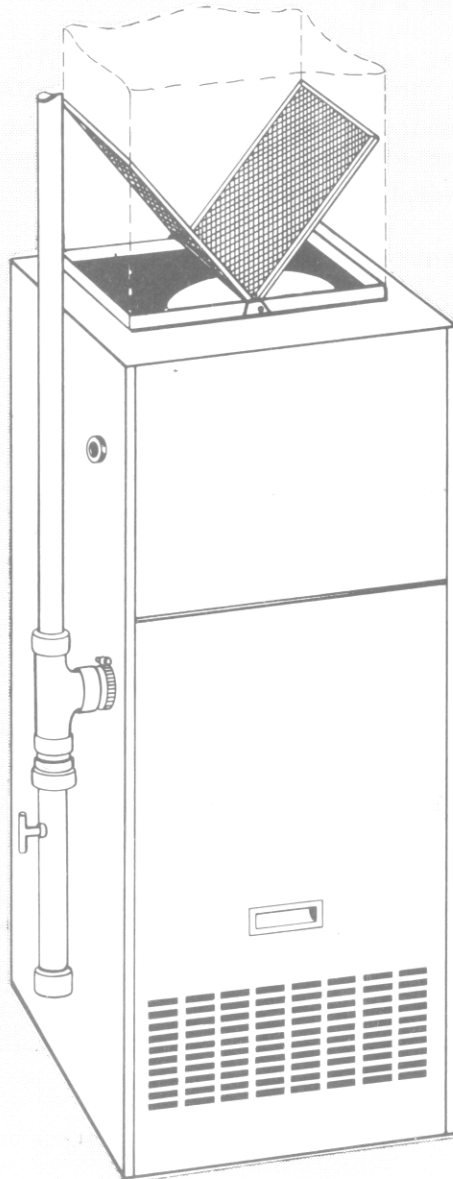


# INSTALLATION INSTRUCTIONS



- Safety Rules
- Installation/Clearances
- Combustion/Ventilation Air
- Vent Pipe
- Gas Supply/Piping
- Wiring
- Ductwork Connections
- Start-Up
- Maintenance

## WARNING

This furnace is not designed for use in mobile homes, trailers or recreational vehicles. Such use could result in property damage, bodily injury and/or death.



Design Certified  
by A.G.A.

## COUNTERFLOW CONDENSING GAS FURNACES

## Contents

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Basic Tools and Materials Needed .....	2	Ductwork and Filter .....	14
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## Safety Rules

### WARNING

READ THESE RULES AND ALL OF THE INSTRUCTIONS IN THIS MANUAL CAREFULLY. FAILURE TO FOLLOW THESE RULES AND INSTRUCTIONS COULD CAUSE A MALFUNCTION OF THE FURNACE, WHICH COULD RESULT IN DEATH, SERIOUS BODILY INJURY, AND/OR PROPERTY DAMAGE.

The information contained in this manual is intended for use by a qualified service technician who is familiar with the safety procedures required and who is equipped with the proper tools and testing instruments.

Installations or repairs made by unqualified persons can result in hazards subjecting that person and others to the risk of injury which can be serious or even fatal.

We will not be responsible for any injury, or property or equipment damage arising from improper installation, service and/or repair procedures.

1. Do not install this furnace in a mobile home, trailer or recreation vehicle.
2. Use only the type of gas approved for this furnace. (See Rating Plate). Overfiring will result in failure of heat exchanger and cause dangerous operation.
3. This furnace must be connected only to an approved vent system to carry combustion products outdoors as described in the Vent Pipe Installation section.
4. Never test for gas leaks with an open flame. Use soap suds to check all connections. This will avoid any possibility of fire or explosion.
5. Provide adequate combustion and ventilation air to the furnace area. Refer to instructions beginning on page 5.
6. Make sure supply and return air ducts are sealed to furnace casing and entirely separate from area supplying combustion and ventilation air.

### NOTE

It is the personal responsibility and obligation of the customer to contact a qualified installer to assure that the installation is adequate and is in conformance with governing codes and ordinances.

## Helpful Information

The following booklets will help you in making the installation. Copies are usually available at the local library or they may be purchased from the following source.

American National Standards Institute  
1430 Broadway  
New York, NY 10018

\*NFPA54/ANSI Z223.1-1988 National Fuel Gas Code

\*ANSI/NFPA No. 70-1987 National Electrical Code

\*or current editions

## Basic Tools and Materials Needed

### TOOLS

Pipe wrenches  
Tin Snips  
Screwdrivers  
Hammer  
Pliers (wire cutting)  
Awl  
Drill and bits (metal) of size required for sheet metal screws used in fastening duct or vent pipe.  
Level  
6 ft. folding rule or tape

### MATERIALS

Sheet Metal duct (plenums) to connect furnace to system.  
Gas Pipe that complies with codes.  
Thermostat and Wire  
Electrical materials to connect furnace and to comply with codes.  
Disconnect switch  
Pipe and duct hangers  
Vent Pipe  
Sheet Metal Screws  
Duct Tape  
Pipe Joint Compound resistant to the action of liquified petroleum gas.  
2 Silicone rubber caulking compound.

# Installation Requirements

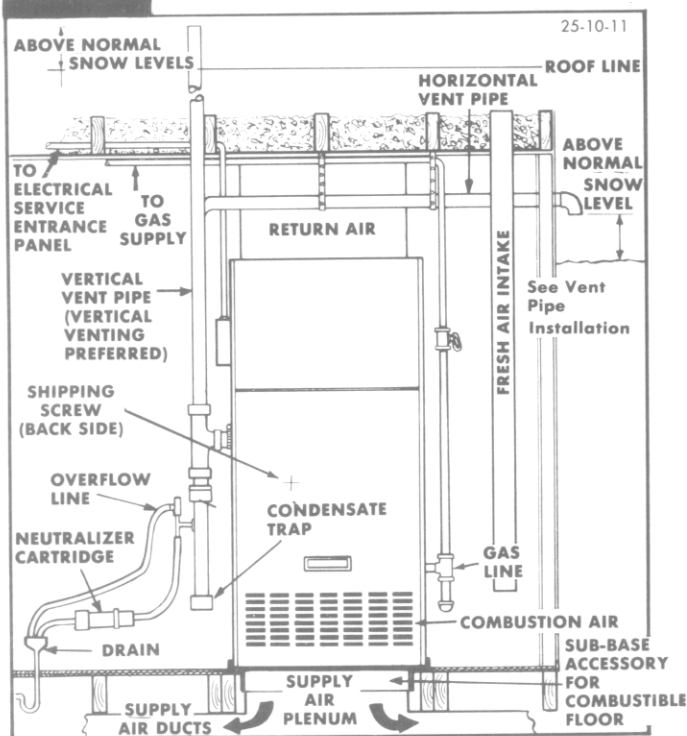
The installation must conform with local building codes or in the absence of local codes, with American National Standards, Z223.1-1988 National Fuel Gas Code and the National Electrical Code, ANSI/NFPA No. 70-1987 or current editions.

A typical installation is shown in Fig. 1. It shows the basic connecting parts needed to install the furnace. In addition supply and return plenums and duct are needed.

## NOTE

If the furnace will be installed where the back side will have limited accessibility remove the shipping screw shown in Fig. 1.

**FIG. 1** TYPICAL INSTALLATION



## BTUH INPUT RATING:

The BTUH input rating of these furnaces can be changed from the standard rating to the alternate input rating as listed on the rating plate. To change the input rating the Main Burner Orifices must be changed. Refer to the Technical Support Manual for proper orifice sizes. Changing of burner orifices must be done by a qualified service technician, reference page 20, preferably before connecting to gas supply.

## LOCATION AND MINIMUM CLEARANCES

If the furnace is a replacement it is usually best to put the new furnace where the old one was. Choose the location or evaluate the existing location based upon the minimum clearances and furnace dimensions. Reference Fig. 2.

## CAUTION

DO NOT locate furnace where temperature may drop below freezing as condensate may freeze during off cycle and cause improper operation or equipment damage.

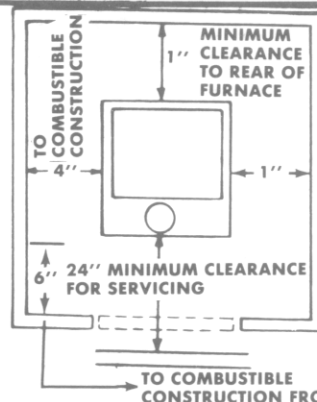
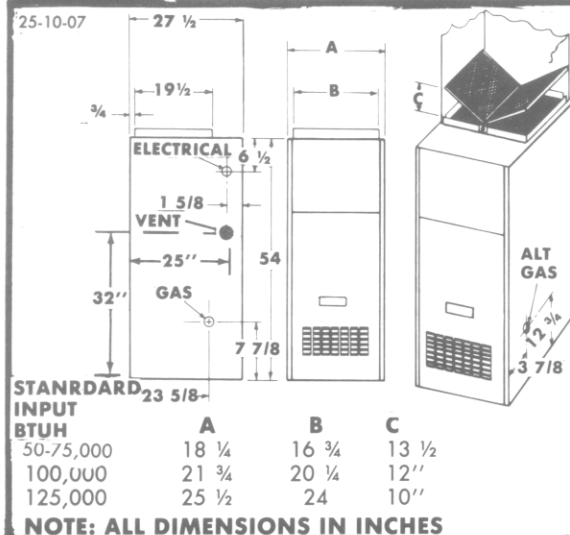
DO NOT operate furnace in a corrosive atmosphere containing chlorine, fluorine or any other damaging chemicals.

The following rules apply:

1. The furnace must be level.
2. FRESH AIR for combustion must be available to the furnace area.
3. The furnace should be as centralized as practical with respect to the heat distribution system.
4. The vent pipe should be as short as practical but must be at least 5' and no more than 60' in total equivalent length to vent combustion products outdoors, (See Vent Pipe Installation).
5. All combustion and ventilation air openings in the furnace must be in the same room and not separated by partitions or other means that would affect the airflow or pressures. These openings must not be obstructed.
6. Maintain clearances for fire safety as well as servicing (Figs. 2-4).
  - a. This appliance must not be installed directly on combustible material. Sub-base, must not be installed directly on carpeting, tile or other combustible material other than wood flooring.
  - b. It must have at least 24 inches clearance at the front door for access to the burner, controls and filter.
7. When the furnace is installed in a residential garage the burners and ignition source must be at least 18 inches above the floor, and it must be located or protected to avoid physical damage by a vehicle.

# Installation Requirements (Cont.)

**FIG. 2 DIMENSIONS & CLEARANCES**



FURNACE INSTALLATION IN UTILITY ROOM OR CLOSET

**NOTE**  
See Fig. 4 for clearance from discharge air plenum or combustible floor installation.

For fire protection clearance, wood and other combustible materials must not be closer than:  
 1" from rear of furnace  
 1" from right side  
 4" from left side  
 0" from top of furnace return air plenum  
 6" from front of furnace

A.G.A. DESIGN CERTIFIED FOR INSTALLATION ON NON-COMBUSTIBLE FLOORING. SUITABLE FOR INSTALLATION ON COMBUSTIBLE FLOORING WHEN INSTALLED ON SPECIAL SUBBASE.

## NON-COMBUSTIBLE FLOOR INSTALLATION

If the unit is installed on a non-combustible floor, the furnace should be set over a plenum opening. The same size as shown in Fig. 3.

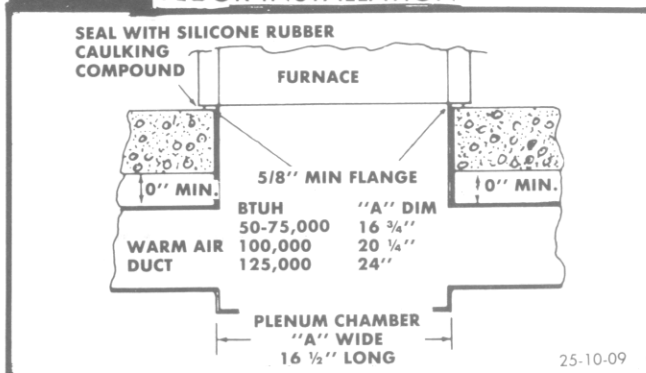
The floor surface around the opening should be smooth and level and a tight seal should be made between it and the furnace base by using silicone rubber caulking compound or cement grout. If the furnace is installed in a confined space such as a closet or utility room where all of the furnace base is not accessible, the sealing material should be placed on the base of the furnace or on the floor before the furnace is moved into position.

## COMBUSTIBLE FLOOR INSTALLATION

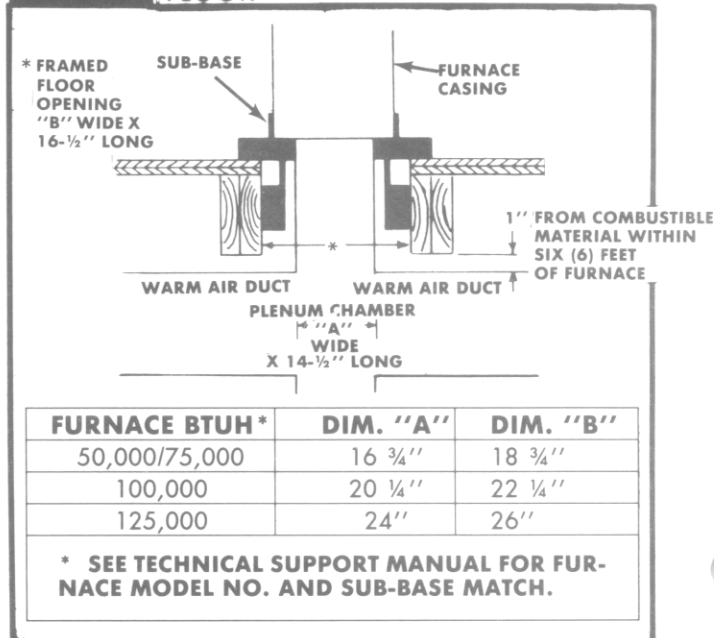
If the furnace is installed on a combustible floor it is necessary to use an accessory sub-base as shown in Fig. 4. To make an installation on a combustible floor proceed as follows:

1. The framed opening in the floor must be sized as shown in Fig. 4.
2. The sub-base should be set on the floor with the locating brackets fitting into the framed opening, to locate and retain the sub-base in its proper position.
3. The plenum chamber must be sized as shown in Fig. 4 with a 5/8" outward flange on all 4 sides of the open end. Drop the plenum through the opening in the sub-base so that the flange supports the plenum on the sub-base.
4. Position the furnace on sub-base. Be careful not to damage gasket on top of sub-base.

**FIG. 3 NON COMBUSTIBLE FLOOR INSTALLATION**



**FIG. 4 INSTALLATION ON COMBUSTIBLE FLOOR**





# Combustion and Ventilation Air

## WARNING

DANGER OF BODILY INJURY OR DEATH  
THE FURNACE AND ANY OTHER FUEL-BURNING APPLIANCE MUST BE PROVIDED WITH ENOUGH FRESH AIR FOR PROPER COMBUSTION AND VENTILATION OF FLUE GASES. MOST HOMES WILL REQUIRE THAT OUTSIDE AIR BE SUPPLIED INTO THE FURNACE AREA.

## AIR REQUIREMENTS

The furnace must be supplied with adequate combustion and ventilation air in accordance with Section 5.3, "Air for Combustion and Ventilation", National Fuel Gas Code NFPA54/ANSI Z223.1, 1988 or applicable provisions of local building codes. Most homes will require that outside air be supplied to the furnace area by means of ventilation grilles or ducts connecting directly to the outside or spaces open to the outdoors such as attic or crawl spaces. The only exception is when the furnace area meets the requirements and definitions for an unconfined space with adequate air infiltration as defined by the National Fuel Gas Code.

**The following instructions are to provide outside air to the furnace.**

## WARNING

DANGER OF BODILY INJURY OR DEATH  
INSTALLATION OF THE FURNACE USING METHODS OTHER THAN DESCRIBED HERE MUST BE IN COMPLIANCE WITH THE NATIONAL FUEL GAS CODE AND LOCAL CODES TO PROVIDE ADEQUATE COMBUSTION AND VENTILATION AIR FOR THE FURNACE.

## ALL AIR OPENINGS AND CONNECTING DUCTS MUST COMPLY WITH THE FOLLOWING:

1. Ducts must have the same cross-sectional area as the free area of the openings to which they connect.
2. The minimum dimension of rectangular air ducts must not be less than 3 inches.
3. If the furnace is installed in an area with another gas appliance(s), the total input rating of all appliances must be considered when determining the free area requirements for combustion and ventilation air openings.
4. If screen is used to cover opening(s) it must not be smaller than 1/4 inch mesh. Use the free area (normally stamped on grille) of a louver or grille to determine the size opening required to provide the free area specified. If the free area is not known, assume a 20% free area for wood and a 60% free area for metal louvers or grilles.

## EXAMPLE 1. FURNACE LOCATED IN UNCONFINED SPACE.\*

\*An unconfined space (such as an open basement) must have a minimum volume of 50 cubic feet per 1000 Btuh

of total of all appliances in area. Adjoining rooms may be counted as one area, only if there are no doors between the rooms.

Fig. 5 shows the required minimum area in square feet to qualify as an unconfined space for different Btuh input ratings. The table is based on a room(s) with 8 foot ceiling heights. The table also shows the required round duct size to provide the necessary outside air and the maximum Btuh input that the duct size will handle.

**FIG. 5** MINIMUM AREA IN SQUARE FEET

4000 Btuh Per Square Inch Round Duct Size	Max. Btuh Input	Unconfined Space Min. Area In Sq. Ft. 8' Ceiling Height
4"	50,000	312
5"	78,500	490
5 1/8"	80,000	500
5 7/8"	105,000	656
6"	114,000	712
7"	155,000	968
8"	200,000	1250

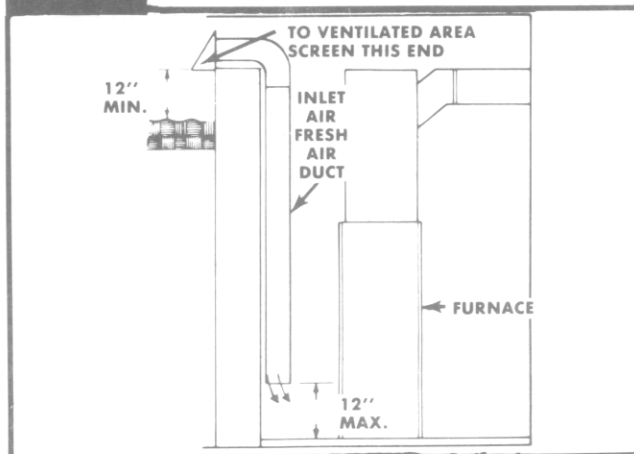
If the area is an unconfined space, provide an opening(s) having a total free area of 1 sq. inch per 4000 Btuh of the total of all appliances. The required duct size is shown in Fig. 5 or refer to required size in square inches in column (4000), Fig. 10.

Fig. 6 shows a typical duct going outdoors. Duct may also go into ventilated crawl space or attic for a ground floor installation.

1. Outside air intake must be at least one foot above ground level and be protected from obstructions.
2. Protect air intake with a screen not less than 1/4 inch mesh.
3. Duct must terminate at a point not more than 1 foot above the floor.

**DO NOT CONNECT AIR INTAKE DUCT TO FURNACE OR TERMINATE NEAR AIR INLET GRILLE AS EXTREME COLD AIR MAY CAUSE CONDENSATE TO FREEZE DURING OFF CYCLE AND DAMAGE FURNACE.**

**FIG. 6** FRESH AIR DUCT (BASEMENT)



# Combustion and Ventilation Air (Cont.)

## EXAMPLE 2. FURNACE LOCATED IN CONFINED SPACE

If furnace is installed in a room or area considered as confined space, it must be provided with free air for proper combustion and ventilation of flue gases.

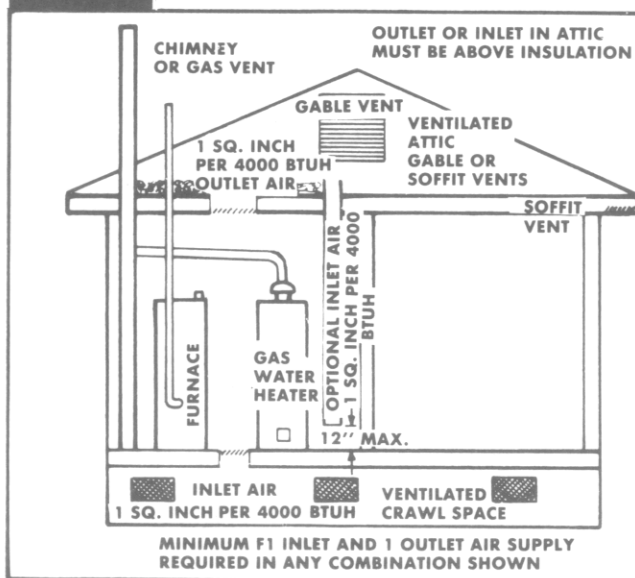
Provide two permanent openings, one within 12" of top, one within 12" of bottom of room connecting directly, or by using ducts, with the outdoors or areas open to outdoors. A minimum of one inlet and one outlet is required using any of the combinations shown in Figs. 7, 8 & 9.

If opening connects directly to, or with vertical ducts, the free area of each opening must be at least 1 square inch per 4000 Btuh combined input of appliances in confined space.

If horizontal ducts are used, the free area of each opening must be at least 1 square inch per 2000 Btuh combined input of appliances in confined space.

FOR EXAMPLE: The furnace is rated at 100,000 Btu per hour. The water heater is rated at 30,000 Btu per hour. The total is 130,000 Btu per hour. Two grilles are needed each with 33 square inches of free opening, unless connected by horizontal ducts which would require each grille or opening to have a free area of 65 square inches.

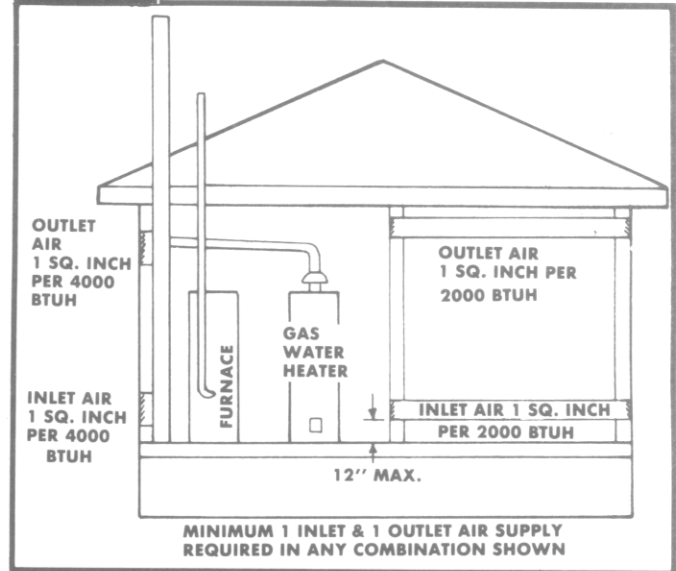
**FIG. 7** AIR FROM ATTIC AND CRAWL SPACE



\*Openings for inlet or outlet air should not be made into attic area if attic is equipped with a thermostat controlled power vent

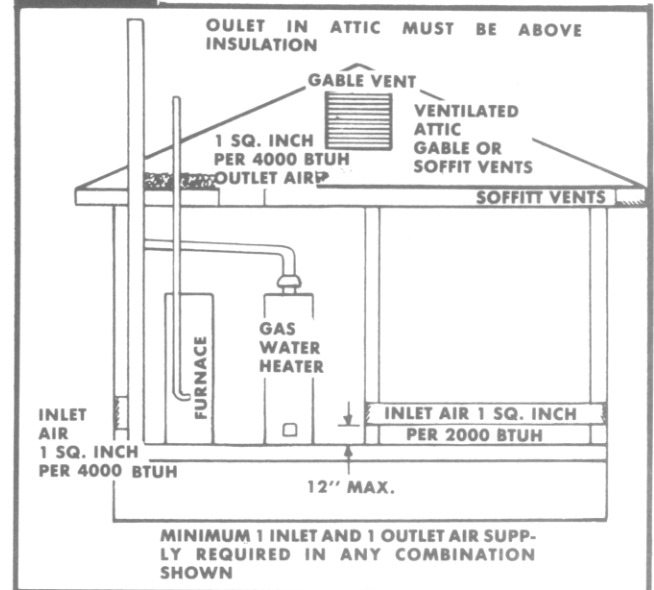
**FIG. 8**

OUTSIDE AIR USING HORIZONTAL INLET & OUTLET



**FIG. 9**

OUTSIDE AIR USING HORIZONTAL INLET/ATTIC OUTLET



**FIG. 10**

FREE AREA IN SQ. INCHES EACH OPENING (FURNACE ONLY)

Furnace Maximum BTUH/INPUT RATING	One Sq. Inch Of Opening For Each (xx) BTU Per Hour Of The Input Rating	
	(2000)	(4000)
Square Inches of Each Opening		
40,000	20	10
50,000	25	13
75,000	38	19
100,000	50	25
125,000	63	32

# Vent Pipe Installation

## WARNING

DANGER OF PROPERTY DAMAGE, BODILY INJURY OR DEATH

PROPER VENT PIPE INSTALLATION IS CRITICAL TO THE SAFE OPERATION OF THE FURNACE, THEREFORE, CAREFULLY READ AND FOLLOW ALL THE INSTRUCTIONS GIVEN IN THIS SECTION.

This Category IV removes both sensible and latent heat from the combustion flue gases. Removal of latent heat results in condensation of flue gas water vapor. This condensed water vapor drains from the secondary heat exchanger into the combustion blower and out of the unit into a PVC drain trap. See Figures 11 & 12.

This furnace must be vented to the outdoors using Vent Kit 1000811 (supplied with furnace) and 2 inch round PVC (poly-vinyl chloride) or CPVC (chlorinated poly-vinyl chloride) schedule 40 vent pipe unless local codes do not allow PVC or CPVC. The following substitutes are permitted, only when approved by and installed in accordance with local codes, Polypropylene (PP), Polyethylene (PE), Polybutylene (PB) and Acrylonitrile-Butadiene-Styrene (ABS).

When substitute piping is used it must be connected to the 'Take off Tee (with float stop)' shown in Fig. 11, with a suitable connector for the type of pipe being used. ALL JOINTS, FITTINGS, ETC. MUST BE CEMENTED, SEALED OR MECHANICALLY CONNECTED TO PREVENT LEAKAGE OF FLUE GASES.

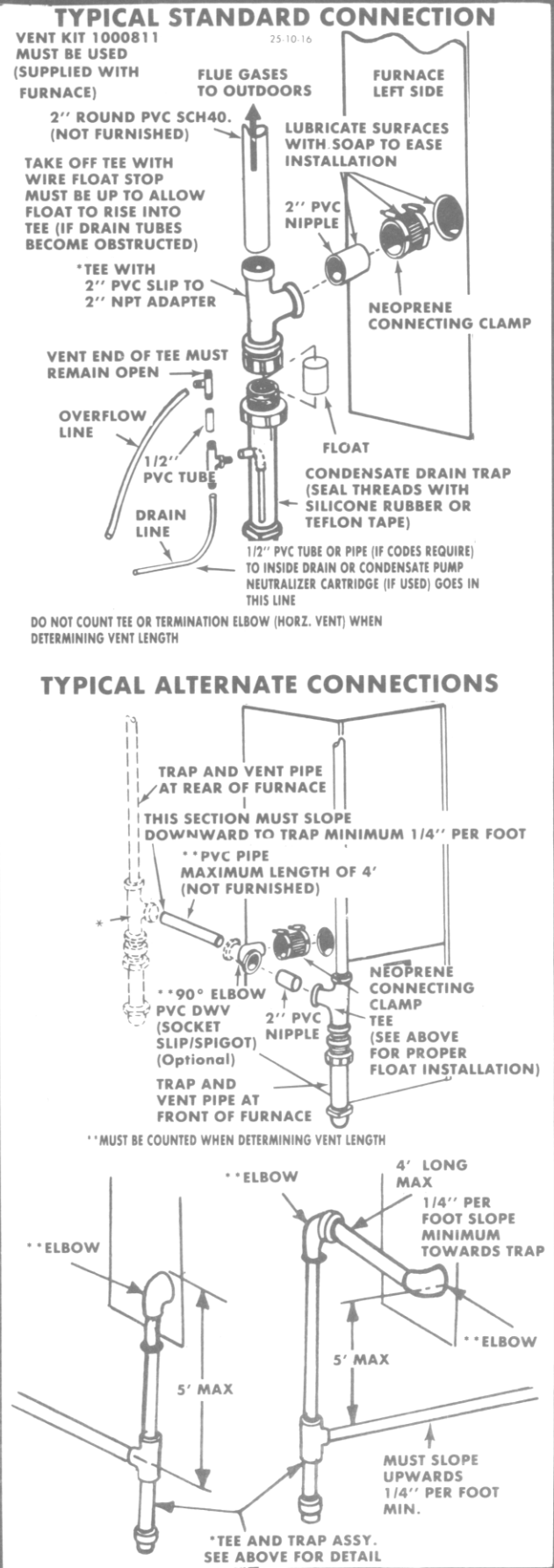
ALL OF THE INSTRUCTIONS, GUIDELINES AND LIMITATIONS OUTLINED IN THIS SECTION FOR PVC PIPING MUST BE FOLLOWED UNLESS IN CONFLICT WITH TYPE OF MATERIAL BEING USED OR LOCAL CODES.

This vent must be installed in compliance with Part 7, "Venting of Equipment", National Fuel Gas Code NFPA54/ANSI Z223.1, 1988 local codes or ordinances, these instructions and good trade practices.

EACH VENT MUST SERVE ONLY ONE FURNACE. DO NOT CONNECT TO EXISTING VENT OR CHIMNEY.

VERTICAL VENTING IS PREFERRED because there will be some moisture in the flue gases that may condense as it leaves the vent pipe (See Special Instructions for Horizontal Vents).

FIG. 11 VENT TRAP AND FURNACE CONNECTION



# Vent Pipe Installation (Cont.)

## INSTRUCTIONS

The vent exits the furnace on the left side. A drain trap assembly to provide the necessary 5" water column against vent pressure must be constructed with the parts provided. Make sure all part fits properly and are correctly oriented before beginning any solvent cementing. Observe the following guidelines and limitations when constructing the vent assembly.

- a. Vent diameter must not be reduced.
- b. Drain Trap Assembly must be installed within 4' horizontally and 5' vertically (lower only) of the furnace vent connector. Some typical examples are shown in Fig. 11. All vent piping from the furnace to the trap must slope downwards a minimum of 1/4" per foot of run. All vent piping from the trap to the vent termination must slope upwards a minimum of 1/4" per foot of run.

Drain Trap Assembly may not be installed in any unconditioned space if there is any chance of condensate freezing inside the trap or drain lines. Drain Trap must be reasonable accessible for homeowners to be able to check.

### NOTE

Elbows used to change from a vertical run to a horizontal run should be the type DWV to provide the correct slope in horizontal run. If other type elbows are used, then 2-45° elbows should be used, in place of one 90°, with elbows slightly misaligned to provide slope in the horizontal runs.

- c. All horizontal vent pipe runs must be supported at least every four feet with metal pipe strapping. No sags or dips are permitted.
- d. All vertical vent pipe runs must be supported every six feet where accessible.
- e. The vent pipe must be insulated if there is any chance of condensate freezing inside the pipe. This can occur if the vent pipe passes through an unconditioned space such as attic, crawl, uninsulated chase or a masonry chimney. It can also occur where the vent terminates above the roof or if an exterior vertical rise (Fig. 12) is used to get above snow levels. Local climatic conditions and vent length must be considered.

If vent height above roof exceeds 30 inches because of snow accumulations it must be insulated.

### INSULATION:

#### For Exterior Or Interior Use:

"Armaflex" or equivalent closed cell foam insulation. Recommended thickness is one inch, or multiple layers if required for extreme climate conditions.

#### For Interior Use Only

Fiberglass or equivalent with a vapor barrier. Recommended "R" value of 7 up to 10 ft, R-11 if exposure exceeds 10 ft.

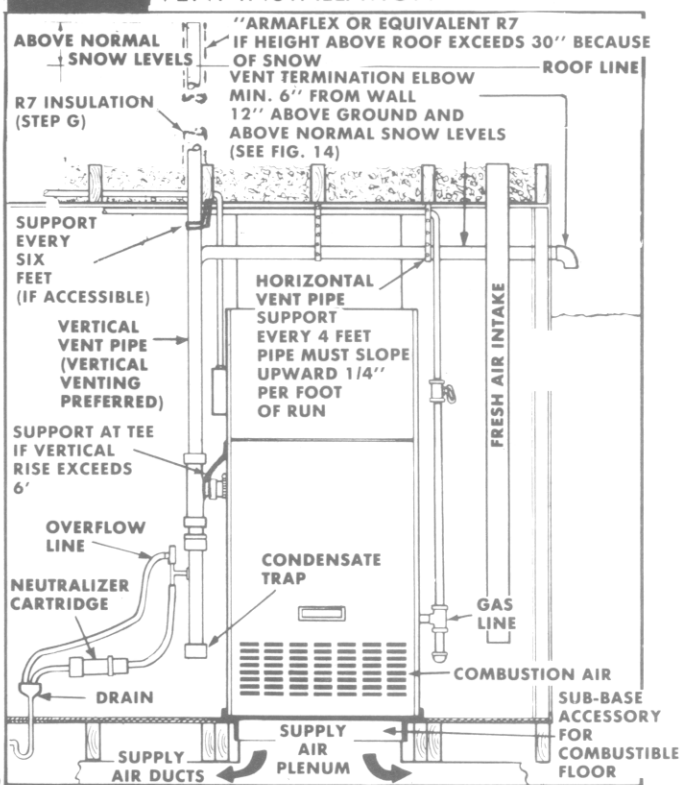
- f. If necessary to insulate vent pipe and a chimney is used as a chase the top of the chimney must be seal-

ed flush, or crowned up, so only the vent pipe protrudes.

- g. When vent height above the roof exceeds 30 inches, or if an exterior vertical riser is used on a horizontal vent to get above snow levels, the exterior portion must be insulated. Use only moisture resistance insulation such as "Armaflex" or other equivalent type insulation.
- h. Maximum vent length is 60 total equivalent feet with each 45° elbow (Max. 8) counting as 2½ feet and each 90° elbow (Max. 4) counting as 5 feet. Do not count the Take Off Tee (Fig. 11) or the Vent Termination Elbow on a horizontal vent. Do not use the termination elbow on a vertical vent through the roof. Example: 40 foot of vent pipe with 4-90° elbows, (20 feet) equals 60 equivalent feet; or 40 foot of vent pipe with 2-45° elbows (5 feet) and 3-90° elbows (15 feet) equals 60 equivalent feet.
- i. The minimum vent length is 5 feet.
- j. DO NOT INSTALL the vent pipe in the same chase with a vent from another gas or other fuel burning appliance.
- k. DO NOT INSTALL the vent pipe within 6 inches of vent pipe from another gas or other fuel burning appliance.
- l. The vent pipe can be run in the same chase or adjacent to supply or vent pipe for water supply or waste plumbing.

The optional 90° elbow (PVC DWV SOCKET X SLIP/SPIGOT) may be fastened to the combustion blower outlet coupling using the 2" x 2" PVC nipple. Refer to Figure 11 for drain trap assembly.

FIG. 12 VENT INSTALLATION



# Vent Pipe Installation (Cont.)

## Joining Pipe and Fittings

All pipe, fittings, solvent cement, primers and procedures must conform to American National Standard Institute and American Society for Testing and Materials (ANSI/ASTM) standards.

Pipe and Fittings - ASTM D1785, D2466 & D2665  
PVC Primer and Solvent Cement - ASTM D2564  
Procedure for Cementing Joints Ref ASTM D2855

### WARNING

DANGER OF FIRE OR BODILY INJURY  
PVC SOLVENT CEMENTS AND PRIMERS ARE HIGHLY FLAMMABLE. PROVIDE ADEQUATE VENTILATION AND DO NOT ASSEMBLE NEAR HEAT SOURCE OR OPEN FLAME. DO NOT SMOKE.  
AVOID SKIN OR EYE CONTACT.  
OBSERVE ALL CAUTIONS AND WARNINGS PRINTED ON MATERIAL CONTAINERS.

All joints in the PVC vent must be properly sealed using the following material and procedure.

### CAUTION

FOR PROPER INSTALLATION:

DO NOT use solvent cement that has become curdled, lumpy or thickened.

DO NOT thin. Observe shelf precautions printed on containers.

For application below 32° F use only low temperature type solvent cement.

PVC CLEANER-PRIMER AND PVC MEDIUM BODY SOLVENT CEMENT.

1. Cut pipe end square, remove ragged edges and burrs. Chamfer end of pipe, then clean fitting socket and pipe joint area of all dirt, grease or moisture.
2. After checking pipe and socket for proper fit, wipe socket and pipe with cleaner-primer. Apply a liberal coat of primer to inside surface of socket and outside of pipe. DO NOT ALLOW PRIMER TO DRY BEFORE APPLYING CEMENT.
3. Apply a thin coat of cement evenly in the socket. Quickly apply a heavy coat of cement to the pipe end and insert pipe into fitting with a slight twisting movement until it bottoms out.

### NOTE

Cement must be fluid, if not, recoat.

4. Hold the pipe in the fitting for 30 seconds to prevent the tapered socket from pushing the pipe out of the fitting.
5. Wipe all excess cement from the joint with a rag. Allow 15 minutes before handling. Cure time varies according to fit, temperature and humidity.

### NOTE

Stir the solvent cement frequently while using. Use a natural bristle brush or the dauber supplied with the can. The proper brush size is one inch.

## CONDENSATE DRAIN/NEUTRALIZER

Drain line and overflow line can be 1/2" PVC flex tube or schedule 40 with a disconnect union so the trap can be removed. Trap assembly provides 5" W.C. so no additional trap is required. Drains must terminate at an inside drain.

### WARNING

DO NOT RUN TO AN OUTSIDE DRAIN AS FREEZING OF CONDENSATE COULD CAUSE PROPERTY DAMAGE.

If a condensate pump or sump pump is used a Condensate Neutralizer Cartridge must also be used unless pump is approved for use with condensing gas furnaces. Use of neutralizer may also be required by local codes.

Install and route main and overflow lines to floor drain or pump, Ref. Fig. 12. If condensate neutralizer is used **install cartridge in horizontal position only.**

Condensate pump must have an auxiliary safety switch to prevent operation of furnace and resulting overflow of condensate in the event of pump failure. The safety switch must be wired through the "R" circuit ONLY (Low Voltage) to provide operation in either heating or cooling modes.

## HORIZONTAL VENTS

The furnace may be vented horizontally through an outside wall, using all of the applicable instructions under Vent Pipe Installation with these additional requirements. The requirements and limitations for Horizontal Venting are very strict. ALL HORIZONTAL VENT INSTALLATIONS MUST BE MADE IN ACCORDANCE WITH THESE INSTRUCTIONS.

### Vent Location

The vent location must meet the requirements listed in the following instructions or applicable codes, whichever specifies the most clearance or strictest limitations.

### WARNING

THE COMBUSTION PRODUCTS AND MOISTURE IN THE FLUE GASES MAY CONDENSE AS THEY LEAVE THE TERMINAL ELBOW. THE CONDENSATE MAY FREEZE ON THE EXTERIOR WALL, UNDER THE EAVES AND ON SURROUNDING OBJECTS. SOME DISCOLORATION TO THE EXTERIOR OF THE BUILDING MAY OCCUR.

# Vent Pipe Installation (Cont.)

## Location Requirements

The vent must be installed with the following minimum clearances and requirements. Ref. Fig. 13.

- 12 inches above ground level, above normal snow levels and 6 inches out from wall.

### NOTE

Ice or Snow may cause the furnace to shutdown if the vent becomes obstructed. If required use a vertical riser, Fig. 14 or shield vent to prevent blockage from drifting snow.

- Not above any walkway or area that may create a hazard or nuisance or be detrimental to the operation of other equipment.
- 4 Feet from and not above or below any door, window, gravity inlet or forced air inlet for the building or any electric or gas meter or regulator or reliefs for mechanical equipment.
- At least 4 feet from any soffit or under eave vent.
- Do not vent under any kind of patio or deck.
- Locate vent on the side of the building away from prevailing winter winds when practical but taking into consideration other limitations to determine the best overall location. If installed on a side with prevailing winds consider the possible effects of moisture damage from freezing on walls or overhangs (under eaves) and use protective measures such as shielding (step g) and/or sealing cracks, seams and joints (step i) but extend area of sealing to minimum of six feet:
- On brick or masonry surfaces, use a rust resistant shield (18" sq.) behind vent. If a vertical riser is used the shield must extend 9" above and 9" below as shown in Fig. 14. Shield can be wood, plastic, sheet metal, etc.
- Do not locate vent too close to shrubbery as condensate may stunt or kill them.
- Caulk all cracks, seams, and joints within 3 feet of vent.

## Vent Termination

The vent termination elbow must be installed as shown in Fig. 14.

- Cut a 2½" diameter hole through exterior wall. Do not make the hole oversized, or it will be necessary to add a sheet metal or plywood plate on the outside with the correct size hole in it. Check hole size by making sure it is smaller than the coupling or elbow that will be installed on the outside. The coupling or elbow must prevent the pipe from being pushed back through the wall.
- Extend vent pipe through wall ¾-1" and seal area between pipe and wall.

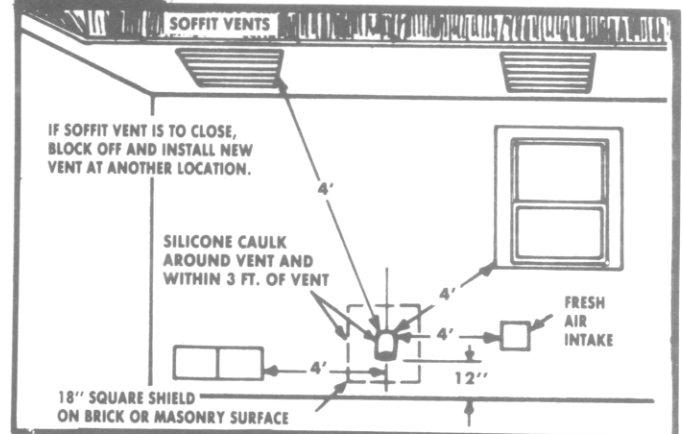
### Straight Through Termination (No Vertical Riser):

- Install the coupling, 2½" long nipple and termination elbow as shown in Fig. 14.

### Termination Using Exterior Riser:

- Install elbows and vent pipe (max. 36" long) to form riser as shown in Fig. 14.

FIG. 13 MINIMUM CLEARANCES

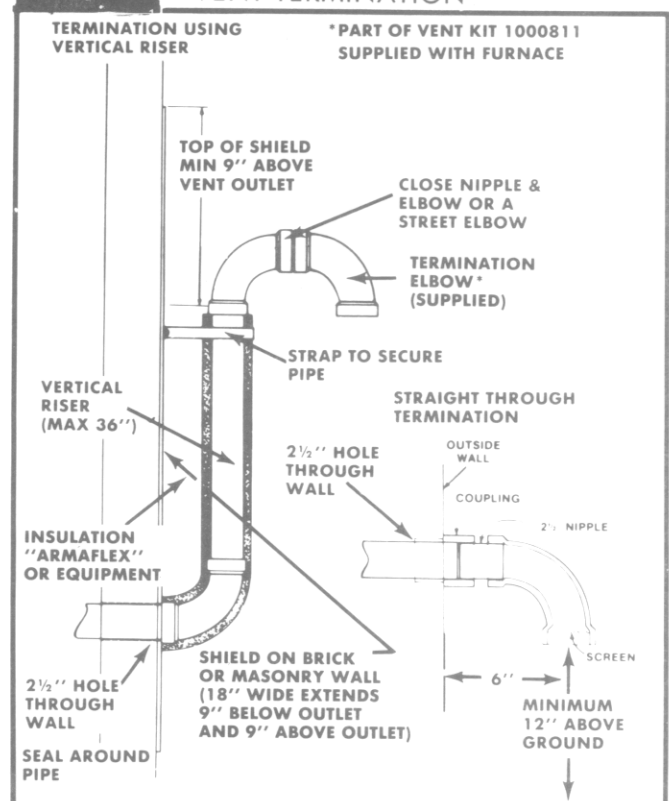


- Insulate pipe with "Armaflex" or equivalent moisture resistance closed cell foam insulation. Reference "E" page 8.
- Secure vent pipe to wall, with galvanized strap or other rust resistance material, to restrain pipe from moving.

### NOTE

If situations require pipe to be run exterior to wall to reach suitable termination location it must be properly insulated. It must be boxed in and sealed against moisture if fiberglass insulation is used.

FIG. 14 VENT TERMINATION





## Existing Common Vent Check

If the installation of the furnace involves removing an existing furnace from a common vent with other appliances the venting system will probably be too large for the remaining appliances and they will not vent properly. The venting system must be checked according to the following procedure.

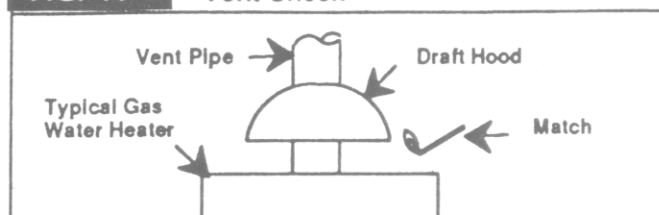
**NOTE:** The following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

1. Seal any unused openings in the common venting system.
2. Visually inspect the venting system for proper size and horizontal pitch to ensure there is no blockage or restriction, leakage, corrosion or other deficiencies which could cause an unsafe condition.
3. Insofar as is practical, close all doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building.
4. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.

5. Follow the lighting instructions. Place the appliance being inspected in operation. Adjust the thermostat so appliance will operate continuously.
6. Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar or pipe. (**Figure 14A**)
7. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined, return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliance to their previous condition of use.
8. If improper venting is observed during any of the above tests, the common venting system must be corrected using the appropriate tables in Appendix G in the National Fuel Gas Code, ANSI Z223.1—1988.

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

**FIG. 14 A** Vent Check



# Gas Supply and Piping

The A.G.A. Rating Plate is stamped with the model number, type of gas and gas input rating.

## WARNING

DANGER OR PROPERTY DAMAGE  
BODILY INJURY OR DEATH

MAKE SURE THE FURNACE IS EQUIPPED TO OPERATE ON THE TYPE OF GAS AVAILABLE. MODELS DESIGNATED AS NATURAL GAS ARE TO BE USED WITH NATURAL GAS ONLY.

FURNACES DESIGNATED FOR USE WITH LIQUIFIED PETROLEUM (L.P.) GAS HAVE ORIFICES SIZED FOR COMMERCIALLY PURE PROPANE GAS. THEY MUST NOT BE USED WITH BUTANE OR A MIXTURE OF BUTANE AND PROPANE UNLESS PROPERLY SIZED ORIFICES ARE INSTALLED BY A LICENSED L.P. INSTALLER.

## GAS SUPPLY

Recommended gas supply pressures are 7" water column pressure for Natural Gas and 11" water column pressure for L.P. Gas. A maximum gas supply pressure of 14" water column should not be exceeded on either gas. A minimum gas supply pressure of 4½" water column for Natural Gas and 11" water column for L.P. is required for purpose of input adjustment and it should not be allowed to vary downward because this will decrease the input to the unit.

Gas input to the burners must not exceed the rated input shown on the rating plate. On Natural Gas the manifold pressure should be 3.5" water column. The manifold pressure should be 10" water column for L.P. Gas. For operation above 2000 feet altitude, Orifice change or manifold pressure adjustment may be required to suit gas supplied. Check with the gas supplier.

For elevations over 2000 feet the furnace should be derated based on the standard input rating. Do not base on the alternate input rating.

## ORIFICE SIZES

Make certain the unit is equipped with the correct main burner and pilot burner orifices.

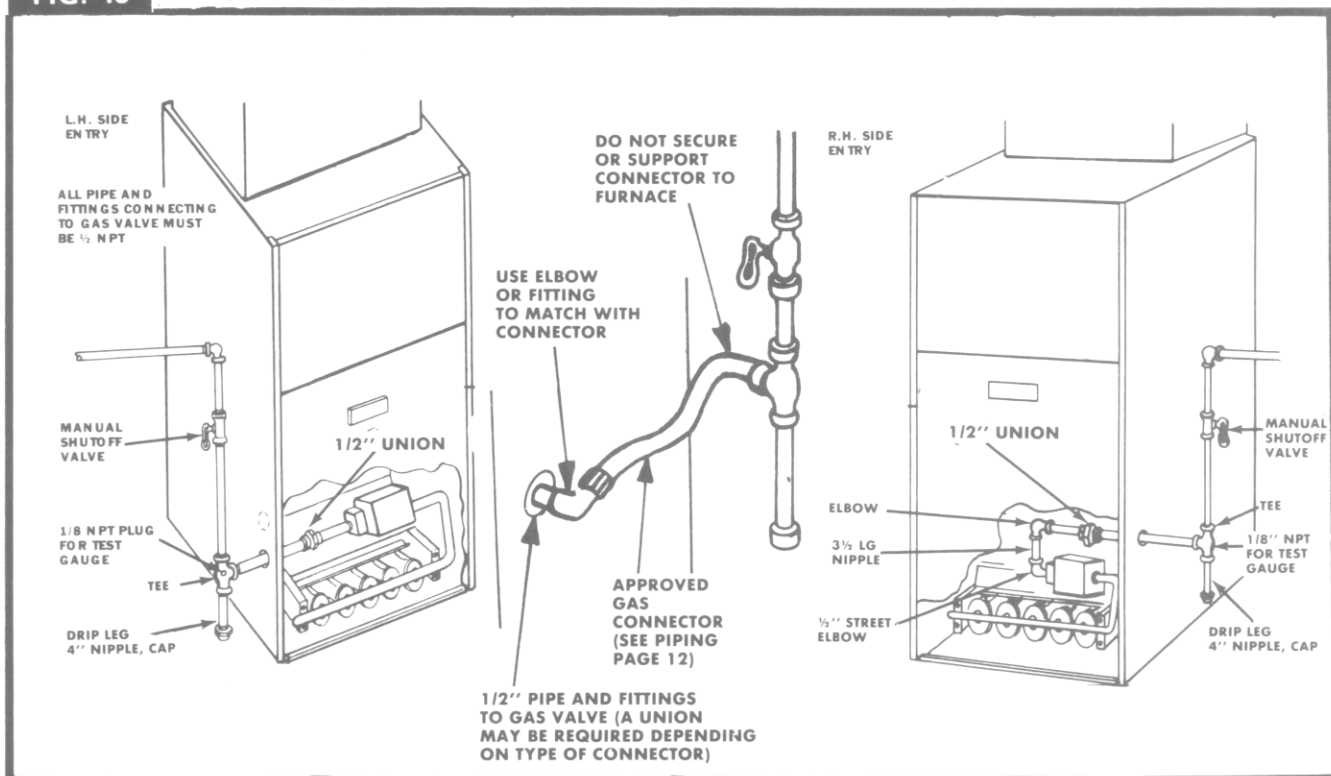
Factory sized orifices for natural gas and LP gas are listed in the Furnace Technical Support Manual.

## GAS PIPING

The gas pipe supplying the furnace must be properly sized to handle combined appliance loads or it must run directly from gas meter (natural gas) or L.P. gas regulator, and supply only the furnace. It must be the correct size for the length of the run and furnace rating. The length of pipe or tubing should be measured from the gas meter for natural gas or L.P. gas second stage regulator which is usually just outside the building wall.

Determine the minimum pipe size from the table, basing the length of the run from the main line, gas meter or source to the furnace.

FIG. 15 TYPICAL GAS PIPING



# Gas Supply and Piping (Cont.)

## NOTE

Use the correct size pipe. Piping that is too small will not allow enough gas to reach the furnace and will reduce the heat output of the furnace.

Check gas line installation for compliance with local

**FIG. 16** GAS PIPE SIZES/CAPACITY  
NATURAL GAS

Length of Pipe - Ft.	Capacity-Btuh Per Hour Input		
	Pipe Size		
	1/2"	3/4"	1"
20'	92,000	190,000	350,000
40'	63,000	130,000	245,000
60'	50,000	105,000	195,000

**FIG. 17** GAS TUBING AND PIPE SIZES —  
L.P. GAS

Length In Feet	Capacity — Btu Per Hour Input			
	Copper Tubing*		Iron Pipe	
	1/2"***	3/4"***	1/2"	3/4"
20'	62,000	216,000	189,000	393,000
40'	41,000	145,000	129,000	267,000
60'	35,000	121,000	103,000	217,000

\* Copper tubing for gas supply must comply with limitations in National Fuel Gas Code, reference "2.6.3 Metallic Tubing".

\*\* Outside diameter.

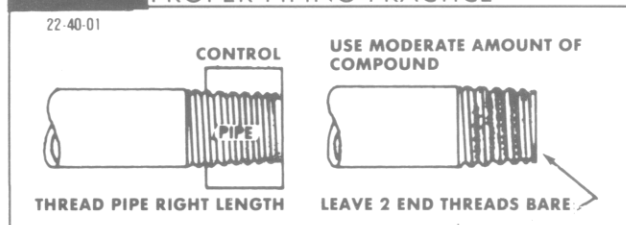
## Connecting The Gas Piping

Refer to Figure 15 for the general layout at the furnace. It shows the basic fittings you will need. The following rules apply:

1. Use black iron or steel pipe and fittings or other approved by local codes.
  - a. If a gas connector is used it must be acceptable to local authority. **Connector may not be used inside the furnace or be secured or supported by the furnace or ductwork.** Connectors should comply with one of the following standards or a superseding standard.
    - ANSI Z21.24a-1983, Metal Connectors for Gas Appliances.
    - ANSI Z21.45b-1983, Flexible Connectors Of Other Than All-Metal Construction For Gas Appliances.
2. Use pipe joint compound on male threads only. Pipe joint compound must be resistant to the action of the LP gases.
3. Use ground joint unions.
4. Install a drip leg to trap dirt and moisture before it can enter the gas valve. Drip leg must be a minimum of 3 inches long.

5. Use two pipe wrenches when making the connection to the valve to keep it from turning.
  6. Provide a 1/8 National Pipe Thread (NPT) plug for test gauge connection immediately upstream of the gas supply connection to the furnace.
  7. Install a manual shut-off valve.
  8. Tighten all joints securely.
- Additional L.P. Gas Requirements:
9. All connections made at the storage tank should be made by a licensed L.P. gas dealer.
  10. L.P. dealer should check all lines and connections from storage tank to heating unit when the unit is connected to the storage tank.
  11. Two-stage regulations should be used by the L.P. installer.
  12. All gas piping should be checked out by the L.P. installer.

**FIG. 18** PROPER PIPING PRACTICE



## CHECKING THE GAS PIPING

Test all piping for leaks. When checking gas piping to the furnace, shut off the manual gas valve for the furnace. Gas pressure must not exceed 1/2 PSIG. If gas piping is to be checked with pressure above 1/2 PSIG, the furnace and manual shut off valve must be disconnected during testing. Apply soap suds (or a liquid detergent) to each joint. Bubbles forming indicates a leak. Correct even the smaller leak at once.

If orifices were changed make sure pilot tube and burner orifices are checked for leakage.

## WARNING

DANGER OF PROPERTY DAMAGE,  
BODILY INJURY OR DEATH

NEVER USE A MATCH OR OPEN FLAME TO TEST FOR LEAKS. NEVER EXCEED SPECIFIED PRESSURES FOR TESTING. HIGHER PRESSURES MAY DAMAGE THE GAS VALVE AND CAUSE OVERFIRING WHICH MAY RESULT IN HEAT EXCHANGER FAILURE. LIQUID PETROLEUM (L.P.) GAS IS HEAVIER THAN AIR AND IT WILL SETTLE IN ANY LOW AREA, INCLUDING OPEN DEPRESSIONS AND IT WILL REMAIN THERE UNLESS AREA IS PROPERLY VENTILATED.

NEVER ATTEMPT STARTUP OF UNIT BEFORE THOROUGHLY VENTILATING AREA.

# Electrical Wiring

## WARNING

DANGER OF BODILY INJURY  
OR DEATH

TURN OFF ELECTRIC POWER AT FUSE BOX  
OR SERVICE PANEL BEFORE MAKING ANY  
ELECTRICAL CONNECTIONS.

GROUND CONNECTION MUST BE COM-  
PLETED BEFORE MAKING LINE VOLTAGE  
CONNECTIONS.

ALL LINE VOLTAGE CONNECTIONS MUST BE  
MADE INSIDE THE FURNACE JUNCTION  
BOX.

All electrical work must conform with the requirements of local codes and ordinances and the National Electrical Code ANSI/NFPA-No. 70-1987.

## GROUNDING

A green wire pigtail connected to a ground lug is installed for the ground connection. Use an insulated copper conductor (#14 AWG) from the unit to a grounded connection in the electric service panel or a properly driven and electrically grounded ground rod.

## ELECTRIC POWER SUPPLY

Line voltage circuit is completely factory wired. It is only necessary to run No. 14 A.W.G. hot, neutral and ground wires from power supply circuit (15 AMP) through a disconnect switch (if required by codes) to furnish power to the unit. Do not connect to existing lighting or other circuits.

Do not complete line voltage connections until unit is permanently grounded. All line voltage connections and the ground connection must be made with copper wire.

## OPTIONAL EQUIPMENT WIRING

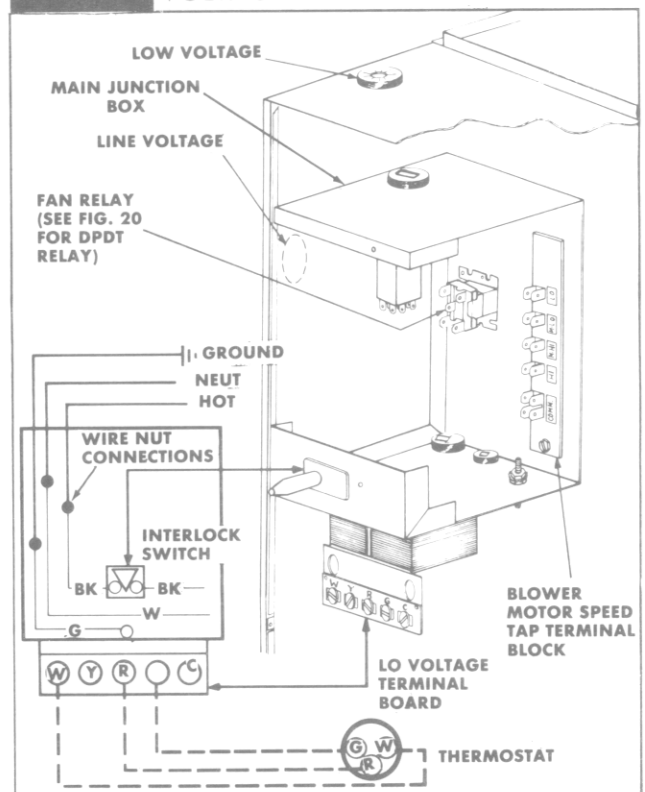
All wiring (except thermostat) from the furnace to optional equipment, such as humidifiers or electronic air cleaners, or between optional equipment, must conform to the temperature, limitations for Type T wire and be installed in accordance with the manufacturers instructions supplied with equipment.

## HUMIDIFIER/ELECTRONIC AIR CLEANING WIRING

The power connections for a humidifier or Electronic Air Cleaner must be made through use of a sail switch, installed in the ductwork, if the furnace has a SPDT Fan Relay with only three terminals.

If manufacturer does not supply sail switch, consult place of purchase.

FIG. 19 LINE AND LOW VOLTAGE CONNECTIONS

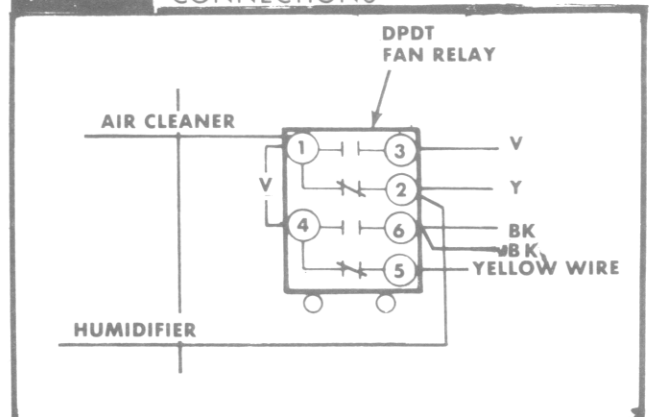


If the furnace has a DPDT Fan Relay, with six terminals the power connections can be made to furnace fan relay as shown in Fig. 20. Make connections for neutral and ground wires with connections to furnace at wire nut shown in Fig. 19. With these connections the humidifier will be powered when the furnace is fired and the circulating air blower comes on. The electronic air cleaner will be powered anytime the circulating air blower is on, whether for heating, cooling, or just fan on for air circulation.

## BLOWER SPEEDS

Refer to Start-Up Procedures, Changing Blower Speeds, page 18.

FIG. 20 HUMIDIFIER AND AIR CLEANER CONNECTIONS



# Electrical Wiring (Cont.)

## Thermostat

The location of the thermostat has an important effect on the operation of the unit. FOLLOW THE INSTRUCTIONS INCLUDED WITH THE THERMOSTAT FOR CORRECT MOUNTING AND WIRING.

### HEAT ANTICIPATOR

Set the thermostat heat anticipator in accordance with thermostat instructions to value shown in Furnace Technical Support Manual.

### THERMOSTAT CONNECTION—HEATING ONLY

Connect the two wires from the thermostat to terminals "R" or "W" on the transformer low voltage terminal board. If thermostat has a fan "ON" switch it will connect to terminal "G", Fig: 19.

## ADDING AIR CONDITIONING

1. Obtain a Heating-Cooling thermostat and 4-wire thermostat cable. Replace the existing thermostat and cable. Connect the wires to "Y", "W", "G" and "R" on the low voltage terminal board to "Y", "W", "G" and "R" on the thermostat.
2. The condensing unit will have a contactor in it. Connect its 24 volt coil to terminals "Y" and "C" on the low voltage terminal board.
3. Follow all instruction with the condensing unit and evaporator coil.

The furnace fan relay will now change fan speeds automatically as you select HEAT and COOL at the thermostat.

## Ductwork and Filter

### WARNING

DANGER OF BODILY INJURY  
OR DEATH

RETURN AIR MUST NOT BE DRAWN FROM INSIDE A CLOSET OR A UTILITY ROOM. RETURN AIR DUCT MUST BE SEALED TO THE FURNACE CASING.

COOL AIR FROM AN EVAPORATOR COIL PASSING OVER THE HEAT EXCHANGER MAY CAUSE CONDENSATE TO FORM INSIDE HEAT EXCHANGER CAUSING FAILURE OF THE HEAT EXCHANGER.

The air distribution system should be designed and installed in conformance with manuals published by the Air Conditioning Contractors of America or other approved methods in conformance with local codes and good accepted trade practices.

When a furnace is installed so that supply ducts carry air circulated by the furnace to areas outside the space containing the furnace, the return air must also be handled by a duct(s) sealed to the furnace casing and terminating outside the space containing the furnace. This is to prevent drawing possibly hazardous combustion products into the circulated air.

When air conditioning is installed with the furnace, the air conditioning cooling coil (evaporator) must be on the outlet side of the furnace or an evaporator and a

blower can be separate from the furnace. This means the same duct system would be used but the air will go around the furnace during cooling. With a separate blower and evaporator there must be good sealing dampers for air flow control. Chilled air going through the furnace could cause condensation and shorten the furnace life. The dampers can either be automatic or manually operated and if manually operated, must be equipped with means to prevent operation of either unit unless the damper is in the full heat or cool position. Purchase them locally.

## DUCTWORK SIZING

Existing or new ductwork must be sized to handle the correct amount of air flow for either heating only or heating and air conditioning.

Refer to the Furnace Technical Support Manual for air flow information.

## DUCTWORK INSULATION

Ductwork installed in attics or other areas exposed to outside temperature should be insulated with a minimum of 2" insulation and have an indoor type vapor barrier. Ductwork in other indoor, unconditioned areas should have a minimum of 1" insulation with indoor type vapor barrier.

## Ductwork and Filter (Cont.)

### FILTER

The furnace is provided with two filters, either the disposable low velocity (nominal 300 FPM) type or the washable high velocity (nominal 500 FPM) type.

The size and type of filter supplied with the furnace will handle the airflow required if central air conditioning is used with the furnace.

If external filter grilles are used, filters which comply with the specifications in Fig. 21 should be used. Filter size and type must be adequate to handle the CFM requirements based on Heating Only or Heating/Cooling applications. See Furnace Technical Support Manual for CFM data.

### CAUTION

If filters provided by installer are suitable for heating applications only, be sure to advise homeowner so they are aware that filter size will have to be increased if air conditioning is added.

### Filter Installation

Install filter rack by centering over plenum flange and pushing down, ref. Fig. 22.

To install filters insert (airflow arrow towards furnace) on right side of blower and push up into plenum so bot-

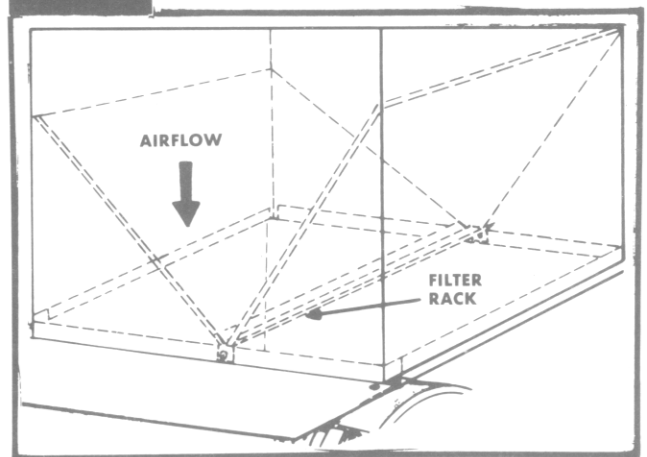
tom of filter rests on filter rack and upper edge rests against side of plenum.

NOTE: Install filter for left side first.

### WARNING

**DANGER OF BODILY INJURY**  
USE BLUNT POINTED SCREWS TO FASTEN RETURN AIR PLENUM TO FURNACE AND DO NOT LOCATE WHERE THEY WILL HINDER FILTER REPLACEMENT.

**FIG. 22** FILTER INSTALLATION



**FIG. 21** REMOTE FILTER SIZES

RECOMMENDED FILTER SIZES MINIMUM SQUARE INCHES/NOMINAL SIZE FILTER				
CFM AIRFLOW	DISPOSABLE TYPE FILTER LOW VELOCITY/300 FPM		CLEANABLE TYPE FILTER HIGH VELOCITY/500 FPM	
	Minimum Surface Area (Sq. In.)	Recommended Nominal Size	Minimum Surface Area (Sq. In.)	Recommended Nominal Size
800	384	20 X 25	231	14 X 20
900	432	20 X 25	260	15 X 20
1000	480	20 X 30	288	14 X 25
1100	528	20 X 30	317	15 X 25
1200	576	14 X 25 (2)	346	16 X 25
1300	624	14 X 25 (2)	375	20 X 25
1400	672	16 X 25 (2)	404	20 X 25
1500	720	16 X 25 (2)	432	20 X 25
1600	768	20 X 25 (2)	461	20 X 25
1700	816	20 X 25 (2)	490	20 X 30
1800	864	20 X 25 (2)	519	20 X 30
1900	912	20 X 30 (2)	548	24 X 25
2000	960	20 X 30 (2)	576	24 X 25

(2) Two Required



# Start-Up Procedure

On a new installation or if a major part such as the gas valve, pressure switch or fan/limit control, has been replaced the operation of the furnace must be checked.

Check the furnace operation as outlined in the following instructions. If any sparking, odors or unusual noises are encountered, shut off electric power immediately. Recheck for wiring errors, or obstructions in or near the blower motors.

## WARNING

DANGER OF EXPLOSION OR FIRE  
LIQUIFIED PETROLEUM (L.P.) GAS IS HEAVIER THAN AIR AND IT WILL SETTLE IN ANY LOW AREA, INCLUDING OPEN DEPRESSIONS AND IT WILL REMAIN THERE UNLESS AREA IS VENTILATED.  
NEVER ATTEMPT STARTUP OF UNIT BEFORE THOROUGHLY VENTILATING AREA.

## START THE FURNACE

Start the furnace using the procedures in section "Operating Your Furnace," in the Owners Information Manual and perform the following checks and adjustments.

## Check Gas Input and Pressures

For furnace located at altitudes between sea level and 2000 feet, the measured input must not be greater than the input shown on the rating plate of the furnace. For elevations above 2000 feet, the measured input must not exceed the input on the rating plate reduced by 4 percent for each 1000 feet that the furnace is above sea level.

Gas supply pressure and manifold pressure with the burners operating must also be as specified on the rating plate.

Type of Gas	Manifold Pressure, In. W.C.
Natural	3.5
L.P.	10.0

Rated input will be obtained on 2500 BTU propane at 10" manifold pressure with factory-sized orifices. If LP gas having a different heating value is supplied, orifices must be changed by a licensed liquified petroleum gas installer before the furnace is operated.

## Check the Manifold Gas Pressure

A tapped opening is provided in the gas valve to facilitate measuring the manifold gas pressure. A "U Tube" manometer having a scale range from 0 to 12 inches of water should be used for this measurement. The manifold pressure must be measured with the burner and pilot operating.

To adjust the pressure regulator, remove adjustment screw or cover on top of Gas Valve (labeled "Hi" on

some valves) turn out (counterclockwise) to decrease pressure, turn in (clockwise) to increase pressure. Only small variations in gas flow should be made by means of the gas pressure regulator adjustment. In no case should the final manifold pressure vary more than plus or minus 0.3 inches water column from the above specified pressures. Any major changes in the flow should be made by changing the size of the burner orifice.

## Check the Gas Input (Natural Gas Only)

To measure the input using the gas meter proceed as follows:

1. Turn off gas supply to all other appliances except the furnace.
2. With the furnace operating, time the smallest dial on the meter for one complete revolution. If this is a 2 cubic foot dial, divide the seconds by 2; if it is a 1 cubic foot dial, use the time in seconds as is. This gives the seconds per cubic foot of gas being delivered to the furnace.
3. Example: Natural gas with a heating value of 1000 Btu per cubic foot and 34 seconds per cubic foot as determined by step (2), then:  
$$\text{Input} = 1000 \times 3600 \div 34$$
$$= 106,000 \text{ Btu Per Hour}$$

### NOTE

BTU content of gas should be obtained from gas supplier.

This measured input must not be greater than the input indicated on the rating plate of the furnace.

4. Relight all other appliances turned off in step 1 above. Be sure all pilot burners are operating.

## PRIMARY AIR ADJUSTMENT

If the burners are not equipped with Air Shutters, NO Adjustment is necessary. Adjustment of the air shutter may be necessary to obtain the correct flame characteristics and/or to minimize resonance heat exchanger noise generated by the burner flame.

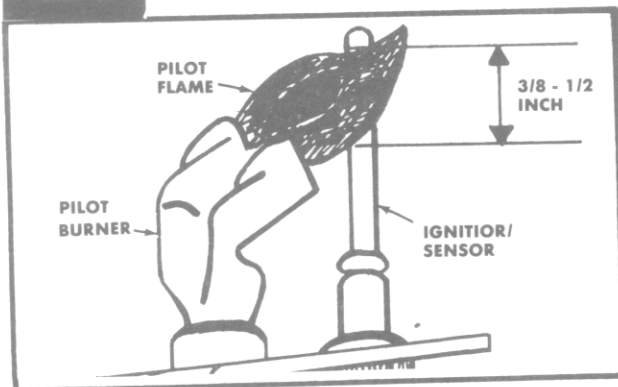
- A. Check air shutter position - should be full open.
- B. Start the furnace; See lighting instructions on furnace or in the Owners Information Manual.
- C. Allow furnace to run for 10 minutes then check flame characteristics; See Check Main Burner Flame.
- D. To Adjust - Loosen shutter locking screw(s) and close shutter until flame has a yellow tip then open just enough to eliminate yellow tip, tighten locking screws.
- E. If resonable noise occurs - close the air shutters just enough to permit the slightest amount possible of yellow tip in the flame, tighten locking screws.

# Start-Up Procedure(Cont.)

## ADJUST PILOT BURNER (Except Hot Surface Ignition)

The furnace has an intermittent pilot. The flame should surround 3/8" to 1/2" of the ignitor/sensor tip. To adjust, remove cap from pilot adjusting screw on gas valve. Turn screw counterclockwise to increase or clockwise to decrease flame as required. Replace cap for adjusting screw. Pilot flame should be inspected monthly.

FIG. 24 PILOT FLAME ADJUSTMENT



## CHECK LIMIT AND FAN CONTROL

Check Limit Control function after 15 minutes of operation by blocking the return air grille(s).

1. After several minutes the main burners must go OFF. Blower will continue to run.
2. Remove air restrictions and main burner will relight after a cool down period of a few minutes.

FIG. 25 FAN/LIMIT CONTROL

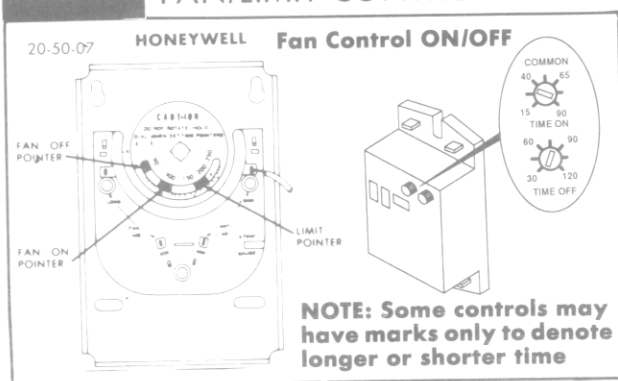
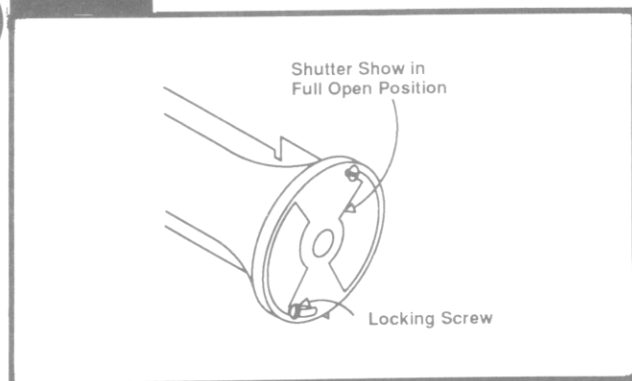


FIG. 23

AIR SHUTTER



Adjust the thermostat setting below room temperature.

1. Main burners must go off.
2. Circulating Air Blower should continue to run briefly until supply air temperature drops to approximately 100° - 90°.

Fan and limits controls are preset at the factory. The control is set for the fan to go off at 100° - 90°.

**NOTE:** On Honeywell Fan/Limit controls the fan off temperature can be adjusted to obtain comfort. On Fan Only controls both the Off and On settings can be set for comfort levels.

## WARNING

### DANGER OF FIRE

THE LIMIT CONTROL IS FACTORY PRESET AND MUST NOT BE ADJUSTED.

## CHECK TEMPERATURE RISE

Check temperature rise through the unit by placing thermometers in supply and return air registers as close to the furnace as possible.

1. All registers and duct dampers must be open and the unit should be operated for 15 minutes before taking readings.
2. It must be within the range specified on the rating plate.

## NOTE

Air temperature rise is the temperature difference between supply and return air.

With a properly designed system, the proper amount of temperature rise will normally be obtained when the unit is operating at rated input with the recommended blower speed.

If the correct amount of temperature rise is not obtained, it may be necessary to change the blower speed. A higher blower speed will lower the temperature rise. A slower blower speed will increase the temperature rise.

## NOTE

Blower speed must be set to give the correct air temperature rise through the furnace as marked on the rating plate.

# Start-Up Procedure (Cont.)

## CHANGING BLOWER SPEEDS

See Technical Support Manual for blower performance chart.

### WARNING

DANGER OF ELECTRICAL SHOCK, BODILY INJURY OR DEATH IF ELECTRIC POWER IS NOT TURNED OFF BEFORE CHANGING SPEED TAPS.

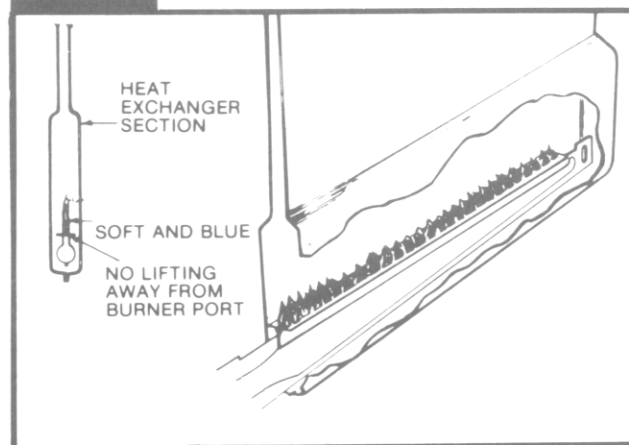
If necessary to change the circulating air blower speed, you can increase the air flow (this will decrease the outlet air temperature) by changing to a higher blower speed tap. The terminal block (Fig. 19) in the furnace junction box makes this a simple operation. The yellow wire is plugged into the MED. Hi speed tap for heating. The violet wire is plugged into the HI speed tap for cooling. Unplug and connect to desired speed tap.

If you must use the same speed tap for both heating and cooling, install a duplex spade terminal adaptor on the motor speed tap to connect both yellow and violet wires or strip the yellow lead to expose bare wire about 1 1/2 inches back from the terminal. Remove the terminal from the violet lead and strip 3/4 inch from end. Twist this wire around exposed yellow wire several times. Solder and tape. Plug into the speed tap desired.

## CHECK MAIN BURNER FLAME

Flames should be stable, soft and blue, (dust may cause orange tips or they may have wisps of yellow, but they must not have solid yellow tips). They should extend directly upward from burner without curling, floating or lifting off. They must not touch the sides of the heat exchanger. Main burner flame should be inspected monthly.

FIG. 26 MAIN BURNER FLAME



## FURNACE MAINTENANCE

The furnace should be inspected and serviced on an annual basis (before the heating season) by a qualified service technician.

If you perform maintenance on the furnace yourself, remember that certain mechanical and electrical skills and tools are required to properly perform maintenance on the furnace. Personal injury or death may result if you are not properly trained. You should call your installing dealer or place of purchase if you are uncertain about your ability to perform maintenance.

### WARNING

TURN OFF ELECTRIC POWER TO FURNACE BEFORE PERFORMING ANY MAINTENANCE OR REMOVING PANELS, BECAUSE OF THE DANGER OF ELECTRICAL SHOCK.

### AIR FILTERS — Monthly

The air filter(s) should be inspected at least monthly and cleaned or replaced as required. There are two types of filters most commonly used. The most widely used is the fiberglass disposable type which should be replaced before it becomes clogged. The other type commonly in use is the washable type constructed of aluminum mesh, foam, or reinforced fibers. Washable filters may be cleaned by soaking in mild detergent and rinsing with water.

### NOTE

Some filters are marked with an arrow to indicate the proper direction of air flow through the filter. When installing the arrow must point in the direction of the air flow. Remember that dirty filters are the most common cause of inadequate heating or cooling performance.

The table Figure 21 lists recommended sizes and types of filters that may be used with your furnace, based on air flow.

However, the furnace installer may have used a larger filter for additional air volume or if the furnace was installed for Heating Only with a remote filter cabinet or central return he may have installed a smaller filter. If air conditioning has been added since your furnace was installed, make sure the filter size is adequate.

Replacement filters should be of the same type and size to ensure adequate air flow and filtering, unless a disposable low velocity filter is replaced with a washable high velocity type.

## Furnace Maintenance (Cont.)

### FILTER REPLACEMENT (FIG. 27)

The filter will normally be found inside the furnace return plenum, but alternate location may be a remote filter grille.

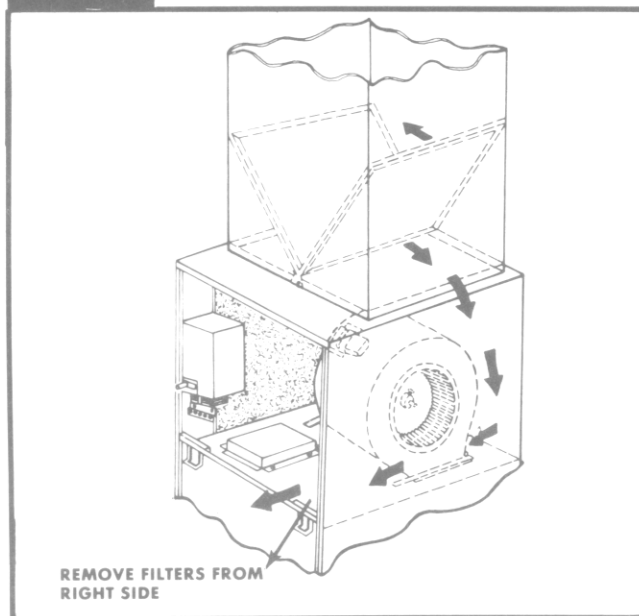
Use only the same size filter. The type must be the same unless replacing a disposable low velocity type, with a washable high velocity type.

#### WARNING

NEVER OPERATE FURNACE WITHOUT A FILTER INSTALLED AS DUST AND LINT WILL BUILD UP ON INTERNAL PARTS RESULTING IN LOSS OF EFFICIENCY, EQUIPMENT DAMAGE AND POSSIBLE FIRE.

1. Turn off electric power for furnace at circuit breaker or disconnect switch.
2. Remove blower compartment door.
3. Reach up through right side and lift upward and swing top of filter towards center of furnace then pull filter down and remove being careful not to dislodge dirt and debris from filter.
4. Inspect filter and replace or clean washable type. If filter is aluminum mesh it should be recoated with filter coating spray.

**FIG. 27** COUNTERFLOW FILTER REPLACEMENT



5. Reinstall left filter first. If filter is marked for air flow direction make sure it's installed correctly.
6. Replace blower compartment door making sure that it's tightly closed.
7. Turn on electric power for the furnace.

### BLOWER MOTOR

Motor will require lubrication every five (5) years of normal operation. Add 1/2 teaspoon (2 cc) of SAE #10W30 motor oil to each motor bearing through oil tubes or by removing cap plugs in motor end bells.

#### CAUTION

**DO NOT** over oil or use 3 in 1 oil, penetrating oil, WD40 or similar oils or oil motor bearings. Use of these may damage these motors.

### CONDENSATE DISPOSAL Monthly/Annually

Your furnace has a condensate trap as part of the vent system. The moisture in the flue gases will condense and collect in the trap to go to an inside drain or be pumped to a sewer line using a condensate pump.

The Condensate Trap and Condensate Neutralizer Cartridge (if used) in the drain line leading from the trap will require some maintenance. Disassemble and clean trap and cartridge prior to each heating season or if drain line becomes plugged.

Inspect the drain line and overflow line at least monthly. If the Condensate Neutralizer Cartridge becomes plugged the condensate will flow through the overflow line. If this happens clean both cartridge and trap.

**TO CLEAN:** Disconnect the drain line cartridge and unscrew end cap from cartridge. Pour the neutralizer out and thoroughly flush neutralizer and inside of cartridge with water. Pour neutralizer back into cartridge, adding neutralizer if cartridge is less than 3/4 full. Unscrew trap from Vent Connecting Tee and flush thoroughly with water, use soap if necessary to clean, **DO NOT USE** any kind of solvents. Make sure float is reinstalled in trap, Ref. Fig. 28.

Reassemble and seal threaded connections with silicone rubber (bathtub caulk) or pipe dope approved for plastic pipe.

See repair parts section in the Furnace Technical Support Manual, to order replacement neutralizer.

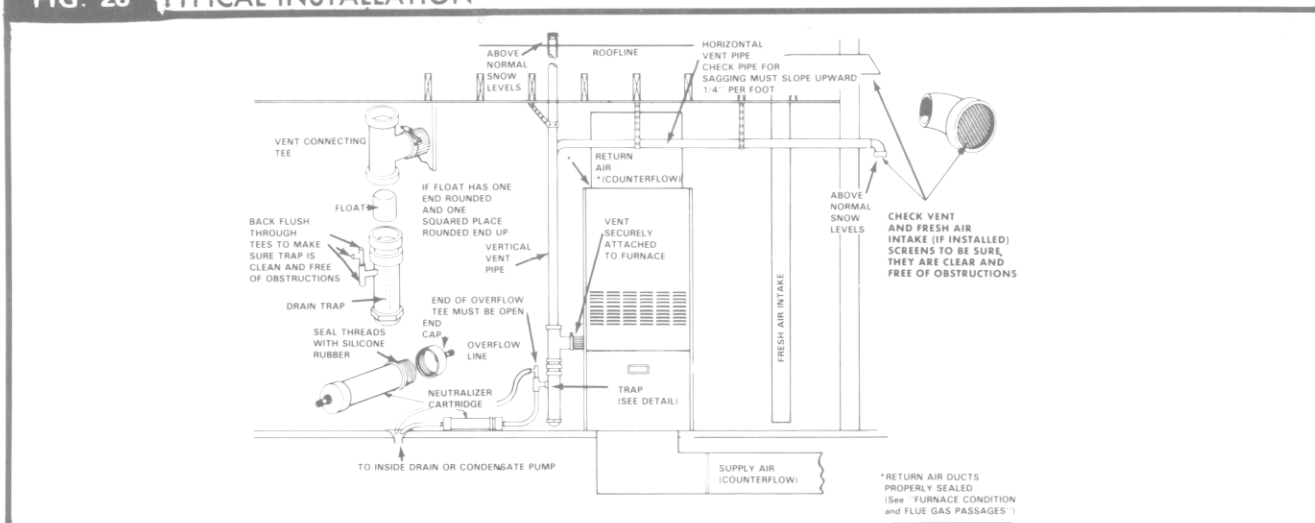
Do not use Condensate for any reason as it is acidic.

### FURNACE CONDITION AND FLUE GAS PASSAGES/Monthly

A properly adjusted gas furnace should not require cleaning at frequent intervals, but it should be inspected regularly to ensure safe and efficient operation. A brief monthly inspection is recommended that does not require disassembly. In addition you should have the furnace inspected, and cleaned (only if required), by a qualified service technician annually.

# Furnace Maintenance (Cont.)

FIG. 28 TYPICAL INSTALLATION



During the monthly inspection check the vent pipe and fresh air intake (if installed), to be sure they are clear and free of obstructions. Check vent pipe for evidence of condensate leakage, tight joints, secure attachment to furnace and sagging pipe.

Horizontal sections of pipe must slope upward 1/4" per foot except section between furnace and drain trap when trap is not mounted directly on furnace. That section (Max 4' Long) should slope down 1/4" per foot (Max 1") to trap.

Check return air ducts to make sure it is sealed to furnace casing and that it is in good physical condition. It must terminate outside the space containing the furnace with no holes or inlets in furnace space.

The floor or furnace base must be in good physical condition.

Remove the front panel and use a flashlight to inspect the visible part of the heat exchanger, burners and ignitor. Check for loose soot and give particular attention to obvious deterioration from corrosion or other sources. Check for any signs of condensate leakage inside furnace cabinet.

If soot or deterioration is found or if there is evidence of condensate leakage inside furnace **DO NOT OPERATE FURNACE.**

Call a qualified service technician.

## MAIN BURNER & PILOT FLAMES/Monthly

Allow furnace to run approximately 10 minutes then inspect the main burner flames and pilot flame (except Hot Surface Ignition).

**MAIN BURNER FLAMES** should be stable, soft and blue, (dust may cause orange tips or they may have wisps of yellow but they must not have solid yellow tips). They should extend directly upward from burner without curling, floating or lifting off. They must not touch the sides of the heat exchanger.

Contact a qualified service agency at once if an abnormal flame appearance should develop. See Figure 26.

**PILOT FLAME** should surround 3/8" to 1/2" of the ignitor/sensor tip. See Figure 24.

## CHANGING MAIN BURNER ORIFICES

### Qualified Service Technician Only

Main Burner Orifices can be changed to operate furnace at alternate input rating or if required for high altitudes. **Note:** Hot Surface Ignition furnaces do not have a pilot tube, Ref. Step 2 & 5.

### WARNING

DANGER OF PROPERTY DAMAGE, BODILY INJURY OR DEATH IF ELECTRIC POWER (AT DISCONNECT) AND GAS SUPPLY (AT MANUAL SHUTOFF VALVE IN GAS LINE) ARE NOT SHUT OFF.

1. Disconnect gas line from gas valve. Wiring to valve can be disconnected if desired.

2. Disconnect pilot tube at gas valve, Fig. 29.
3. Remove the four (4) screws holding the Manifold to the manifold brackets and remove, Fig. 29.
4. Remove the orifices from the manifold and replace them with properly sized orifices.
  - a. Tighten orifices so there is 9/16" from the face of the orifice to the face of the manifold brackets. To check, place a straight edge across manifold brackets and measure to face of orifice as shown in Fig. 29. Make sure orifice goes in straight so that it forms a right angle (90°) to the manifold brackets.
5. Reinstall manifold and other parts. Use caution when installing pilot line to avoid cross threading or stripping of threads. Make sure burners do not bind on new orifices.

# CLEANING HEAT EXCHANGERS

## Qualified Service Technician Only

**Furnaces that are properly installed and maintained will normally not require cleaning of the heat exchangers.**

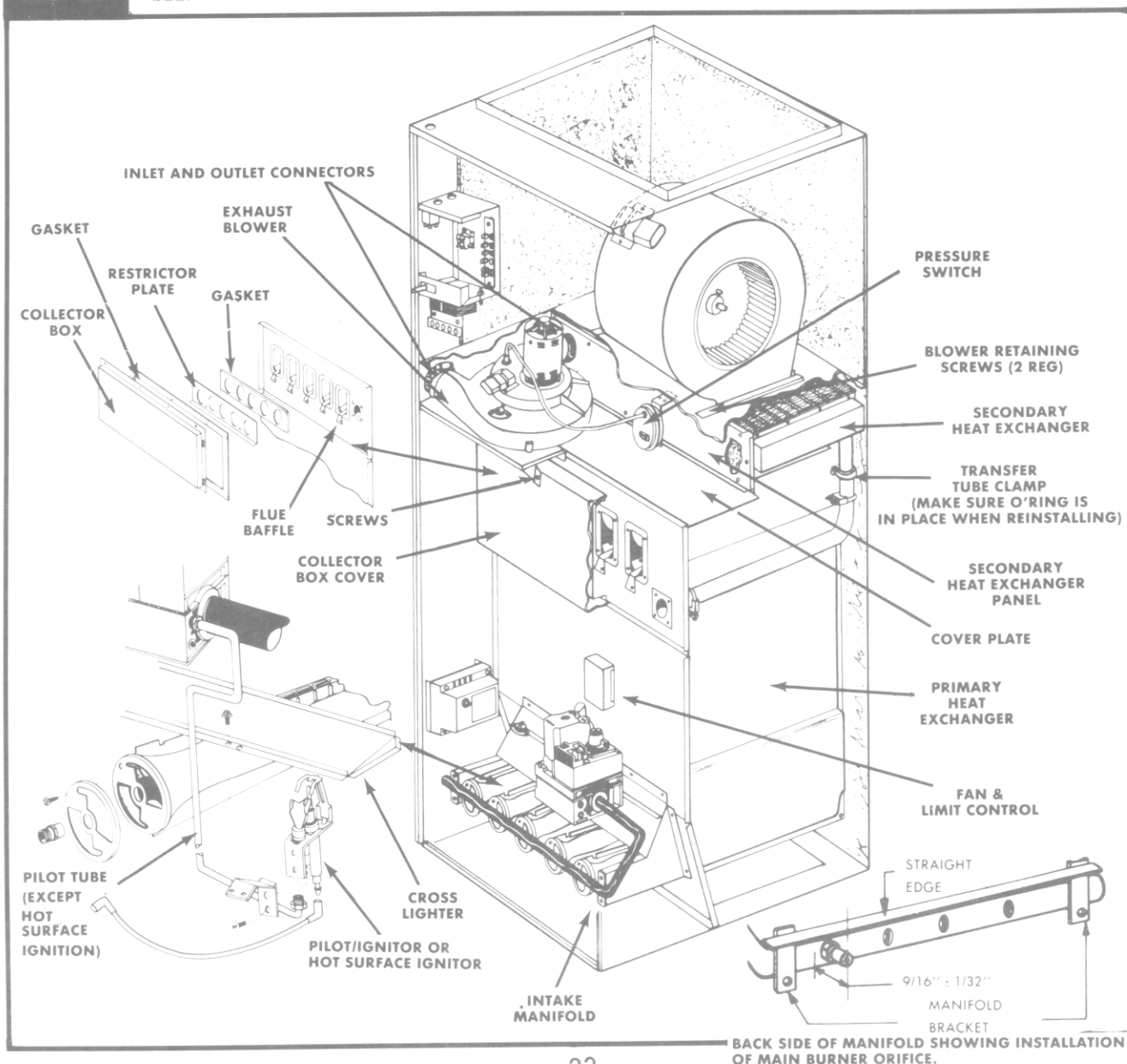
If filters are inadequate or not maintained it may be necessary to clean the exterior surface of the Secondary Heat Exchanger to obtain proper airflow. If the Primary Heat Exchanger requires cleaning it can be completed without removing or cleaning of the Secondary Heat Exchanger.

THE ONLY TIME it should be necessary to disassemble and clean the interior of both the Primary and Secondary Heat Exchangers would be due to a sooting condition caused by abnormal combustion.

### WARNING

DANGER OF PROPERTY DAMAGE, BODILY INJURY OR DEATH IF ELECTRIC POWER (AT DISCONNECT) AND GAS SUPPLY (AT MANUAL SHUTOFF VALVE IN GAS LINE) ARE NOT SHUT OFF.

**FIG. 29** CLEANING HEAT EXCHANGERS





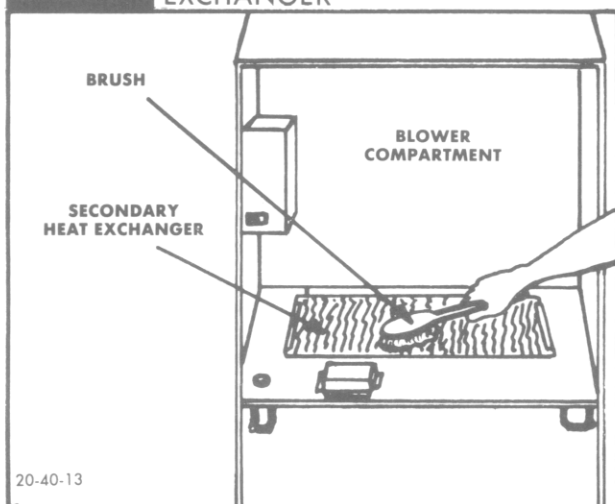
# CLEANING HEAT EXCHANGERS CON'T

## Secondary Heat Exchanger (Exterior Cleaning)

1. Remove the two retaining screws holding blower in position in the slide rails, Fig. 29.
2. Blower can now be removed by pulling assembly from furnace. Support blower next to furnace to avoid having to disconnect wiring.
3. Using a stiff bristle brush and a vacuum cleaner, clean dirt and lint build-up from upper side of Secondary Heat Exchanger. Brush strokes must be with the fin surface to avoid damage to the fins. Use a fin comb to straighten fins.
5. Remove screws that hold flue baffles in position and carefully pull baffles out.
6. Disconnect gas supply line at union and at gas valve if necessary for removal from furnace.
7. Disconnect electrical leads at gas valve, ignitor/sensor and ground wire from pilot assembly.
8. Disconnect pilot tube from gas valve (except Hot Surface Ignition).
9. Remove retaining screws for manifold and remove gas valve/manifold assembly.
10. Pull burners and crosslighter from the heat exchanger.
11. Remove crosslighter from burners by sliding crosslighter toward the orifice end of burner.

FIG. 30

CLEANING SECONDARY HEAT EXCHANGER



### NOTE

If equipped with Hot Surface Ignitor, exercise extreme care in handling crosslighter as ignitor will break easily.

### CLEANING:

1. Clean interior of heat exchangers using a long flexible handle brush and vacuum cleaner.
2. Clean burners by gently striking orifice end on a block of wood. This should remove any dirt or lint buildup in the tube.
  - a. Replace burners if extremely rusted, crushed, or if burner ports have collapsed.
3. Use a brush and stiff wire to clean the crosslighter.
  - a. Crosslighter must not be bent, crushed, or have blocked passages.
4. Reassemble in reverse order, see Reassembly Instructions.

## Primary Heat Exchanger

### DISASSEMBLY:

The following parts and assemblies must be removed before the heat exchanger can be cleaned.

1. Loosen clamps on the inlet and outlet connectors on the Combustion Air Blower.
2. Remove five screws holding Combustion Air Blower Bracket to Collector Box Cover and division panel.
3. Gently wiggle and pull blower outward to disengage from inlet and outlet connectors. It is not necessary to completely remove blower or disconnect wiring or tubing to pressure switch unless Secondary Heat Exchanger requires cleaning.
4. Remove screws for the collector box cover, collector box and restrictor plate. Handle collector box gasket with care to avoid damage.

## Secondary Heat Exchanger (Interior Cleaning)

### DISASSEMBLY:

The following parts and assemblies must be removed before the heat exchanger can be cleaned.

1. Remove two screws that attach the pressure switch to bottom of blower deck, but do not disconnect tubing or wiring going to switch.
2. Loosen clamps on the inlet and outlet connectors on the Combustion Air Blower.

### CAUTION

Use care to avoid spillage of condensate from blower or vent unto the ignition module or other controls.

3. Remove five screws holding Combustion Air Blower Blower Bracket to Collector Box Cover and division panel.

# CLEANING HEAT EXCHANGERS CON'T

4. Gently wiggle and pull blower outward to disengage from inlet and outlet connectors.
  - a. Blower can be pulled out so it just clears the furnace casing on the left side without disconnecting any wiring. Support blower so it does not hang by the wiring.
5. Remove screws attaching the Secondary Heat Exchanger Panel and remove panel.
6. Remove screws holding cover plate and remove.
7. Loosen the screw on the Secondary Heat Exchanger inlet clamp by reaching in on the right side.

## WARNING

DANGER OF BODILY INJURY  
COIL HAS SHARP FINS, COVER WITH RAGS  
AND HANDLE WITH CARE TO AVOID CUTS.

8. Remove Secondary Heat Exchanger by pulling straight out.

## CLEANING:

1. Use a 1 5/8" plastic cap plug or the palm of your hand to plug either the inlet or outlet port and fill heat exchanger coil with approx. 1 1/2 quarts of hot soapy water.
2. Plug other port and shake coil vigorously. Drain and flush with a hard stream of water from a garden hose. Repeat Step 1 & 2 if required.
3. Thoroughly wash exterior. DO NOT use a hard stream of water on the exterior as it will bend coil fins.

## REASSEMBLY

Reassemble all parts in reverse order as removed, with the following instructions.

**Crosslighter** - Install burner into slots of crosslighter and press into position. Back of crosslighter must be seated firmly against the burner ports.

**Burners** - Insert burners into heat exchanger. Burners must be inserted into the slots at the back of the heat exchanger and level.

Check and adjust Spark Gap for Pilot Ignitor, if equipped.

Flue baffles are to be installed into position as illustrated, Fig. 32. Baffle must be located below dimple in heat exchanger and firm against bottom of flue outlet.

FIG. 31 PILOT AND IGNITOR

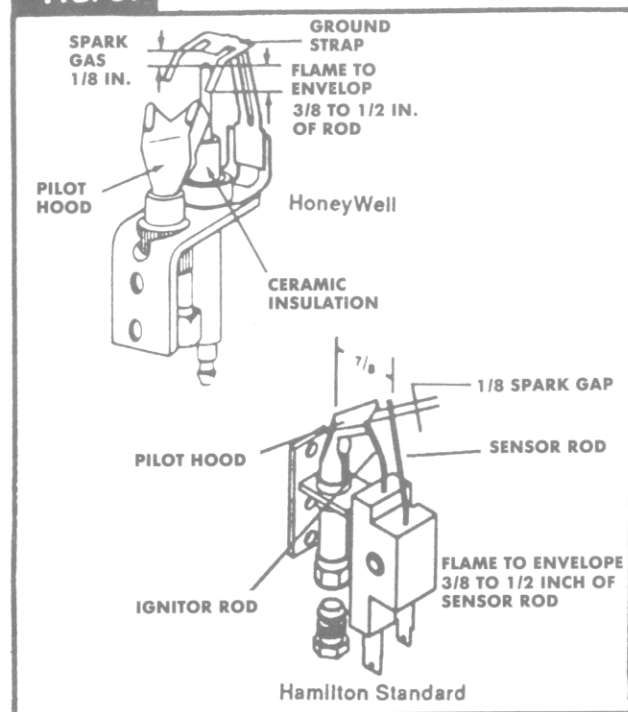
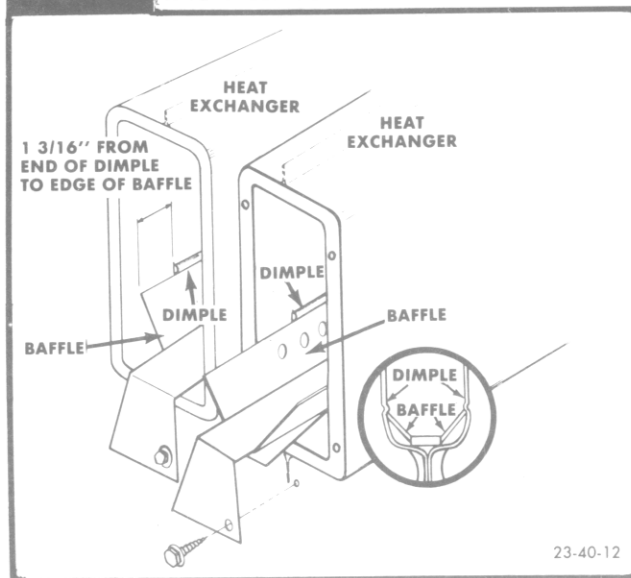


FIG. 32 INSTALLING FLUE BAFFLES



Any insulation that is torn or defective must be repaired or replaced as necessary.

Replace all gaskets and parts that are broken or deteriorated.

**Testing for leaks** - After reassembly turn the gas on and check all joints for gas leaks using a soapy solution. All leaks must be repaired immediately. Perform an operational check of the furnace.