



Heating - Air Conditioning

A higher standard of comfort

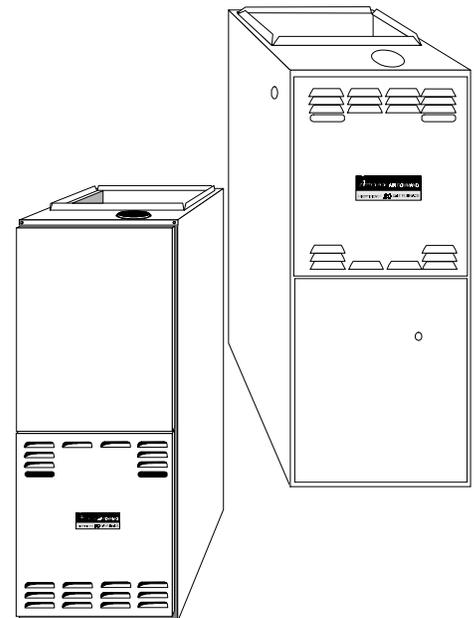
GUI* & GCI*
Gas Fired Warm Air
Furnace

Installation Instructions

Affix this manual, Specification Sheet and Users
Information Manual adjacent to the furnace.

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Amana Forced Air Central Furnace Design Complies With Requirements
Embodied in The American National Standard / National Standard of Canada
Shown Below.

ANSI Z21.47•CAN/CGA-2.3 Central Furnaces



! RECOGNIZE THIS SYMBOL AS A SAFETY PRECAUTION.

ATTENTION INSTALLING PERSONNEL

As a professional installer you have an obligation to
know the product better than the customer. This
includes all safety precautions and related items.

Prior to actual installation, thoroughly familiarize
yourself with this Instruction Manual. Pay special
attention to all safety warnings. Often during installation
or repair it is possible to place yourself in a position
which is more hazardous than when the unit is in
operation.

Remember, it is your responsibility to install the product
safely and to know it well enough to be able to instruct
a customer in its safe use.

Safety is a matter of common sense...a matter of
thinking before acting. Most dealers have a list of
specific good safety practices...follow them.

The precautions listed in this Installation Manual should
not supersede existing practices but should be
considered as supplemental information.



WARNING

If the information in these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.
- What to do if you smell gas:
 - Do not try to light any appliance.
 - Do not touch any electrical switch; do not use any phone in your building.
 - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
 - If you cannot reach your gas supplier, call the fire department.
- Installation and service must be performed by a qualified installer, service agency or the gas supplier.



WARNING

Should overheating occur or the gas supply fail to shut off, turn off the manual gas control valve to the furnace before shutting off the electrical supply.

To The Owner

It is important that you fill out the owner's registration card and mail it today. This will assist Amana in contacting you should any service or warranty information change in the future. When filling in the registration card, be sure to include the Model, Manufacturing and Serial Numbers, plus the installation date.

Your warranty certificate is also supplied with the unit. Read the warranty carefully and note what is covered. Keep the warranty certificate in a safe place, so you can find it, if necessary.

If additional operating instructions are required, call the dealer where the purchase was made.

To The Installer

Before installing this unit, please read this manual to familiarize yourself on the specific items which must be adhered to, such as maximum external static pressure to unit, air temperature rise, minimum or maximum CFM, motor speed connections, and venting. These furnaces are designed for Category I venting only.



WARNING

To prevent possible death or personal injury due to asphyxiation, Amana Non-Condensing Gas Fired Warm Air Furnaces must be Category I vented. Do not vent any of these furnaces using Category III venting.

Keep this literature in a safe place for future reference.

I. Safety and Unit Location



WARNING

To prevent personal injury or death due to improper installation, adjustment, alteration, service, or, maintenance refer to this manual or for additional assistance or information consult a qualified installer, service agency or the gas supplier.



WARNING

This product contains or produces a chemical or chemicals which may cause serious illness or death and which are known to the State of California to cause cancer, birth defects or other reproductive harm.



WARNING

To prevent possible death, personal injury or equipment damage due to fire, the following points must be observed when installing the unit.



WARNING

To prevent possible death, personal injury or property damage due to electrical shock, the furnace must be located to protect the electrical components from water.

NOTE: This unit must not be used as a “construction heater” during the finishing phases of construction on a new structure. This type of use may result in premature failure of the unit due to extremely low return air temperatures and exposure to corrosive or very dirty atmospheres.



WARNING

To prevent possible death, personal injury or property damage, do not install this unit in a mobile home, trailer or recreational vehicle.

ADDITIONAL SAFETY CONSIDERATIONS

- This furnace is approved for Category I Venting only.
- When the furnace is heating, the temperature of the return air entering the furnace must be between 55°F and 100°F.
- Do not install the furnace where the combustion air is exposed to the following substances: permanent wave solutions, chlorinated waxes or cleaners, chlorine based swimming pool chemicals, water softening chemicals, deicing salts or chemicals, carbon tetrachloride, halogen type refrigerants, cleaning solutions (such as perchloroethylene), printing inks, paint removers, varnishes, hydrochloric acid, cements and glues, antistatic fabric softeners for clothes dryers,

and masonry acid washing materials. If the furnace is installed near an area which will be frequently contaminated by these substances, the furnace should be sealed from this area so that little contaminated air can reach the furnace. The furnace must still have an adequate supply of combustion air, either from a nearby uncontaminated room or from outdoors. For details, see “AIR REQUIREMENTS” Section III.

- Provisions must be made for venting combustion products outdoors through a proper venting system. The length of flue pipe could be a limiting factor in locating the furnace.
- When installed horizontally, the furnace must be installed with the access doors vertical so that the burners fire horizontally into the heat exchanger. The unit cannot be installed with the access doors on top or bottom. (See Specification Sheet)
- Allow clearances from the enclosure as shown on Specification Sheet for fire protection, proper operation, and service access. These clearances must be permanently maintained. The combustion and ventilating air openings in the front and top panels of the furnace must never be obstructed.
- This furnace shall not be connected to a chimney flue serving a separate appliance designed to burn solid fuel.
- When the furnace is used in connection with a cooling unit, the furnace must be upstream of, or in parallel with, the cooling unit. For details see Section VIII.
- On Counterflow Installations, the air conditioning coil must be downstream from the heat exchanger of the furnace.
- *Counterflow Installation over a noncombustible floor.* Before setting the furnace over the plenum opening, insure the surface around the opening is smooth and level. A tight seal should be made between the furnace base and floor by using a silicone rubber caulking compound or cement grout.
- *Counterflow Installation over a combustible floor.* If installation over a combustible floor becomes necessary, use an accessory subbase as shown on the Specification Sheet. Follow the instructions with the subbase for proper installation. Do not install the furnace directly on carpeting, tile, or other combustible material other than wood flooring. (Note: The subbase will not be required if an air conditioning coil is installed between the supply air opening on the furnace and the floor.)
- The furnace must be level. If the furnace is to be set on a floor that may become wet or damp at times, the furnace should be supported above the floor on a concrete base sized approximately 1-1/2" larger than the base of the furnace.

ADDITIONAL LOCATION CONSIDERATIONS

- The furnace should be as centralized as is practical with respect to the air distribution system.
- Do not install the furnace directly on carpeting, tile, or combustible material other than wood flooring.
- When suspending the furnace from rafters or joists, use 3/8" threaded rod and 2" x 2" x 3/8" angle as shown on the Specification Sheet. The length of the rod will depend on the application and clearance necessary.

- When installed in a residential garage, the furnace must be positioned so the burners and ignition source are located not less than 18 inches (457 mm) above the floor and protected from physical damage by vehicles.

II. General Information



WARNING

Possible death, personal injury or property damage due to fire, explosion, smoke, soot, condensation, electrical shock or carbon monoxide may result from improper installation, repair, operation, or maintenance on this product.

To ensure the furnace operates safely and efficiently, it must be installed, operated and maintained in accordance with these installation and operating instructions, all local building codes and ordinances, or, in their absence, with the latest edition of the National Fuel Gas Code, ANSI Z223.1*, and/or CAN/CGA B149 Installation Codes.

The rated heating capacity of the furnace should be greater than or equal to the total heat loss of the area to be heated. The total heat loss should be calculated by an approved method or in accordance with "ASHRAE. Guide" or "Manual J-Load Calculations" published by the Air Conditioning Contractors of America.

*Obtain from: American National Standards Institute 1430 Broadway New York, NY 10018

TRANSPORTATION DAMAGE

Check the furnace for any shipping damage. If damage is found, contact the company where the furnace was purchased.

While checking for transportation damage, remove all packaging material and dispose or recycle according to local codes.

THERMOSTAT LOCATION

Locate the thermostat about 5 feet high on a vibration-free inside wall, in an area having good air circulation

Do not install the thermostat where it may be affected by:

- drafts or dead spots behind door, in corners or under cabinets.
- hot or cold air from ducts.
- radiant heat from sun or appliances.
- concealed pipes and chimneys.
- unheated (uncooled) areas behind the thermostat, such as an outside wall.

Consult the instructions packaged with the thermostat for mounting instructions.

III. Air Requirements

COMBUSTION AND VENTILATION AIR



WARNING

Possible death, personal injury or property damage may occur if the furnace and other fuel-burning appliances are not provided with enough fresh air for proper combustion and ventilation of flue gases. Most homes require outside air to be supplied into the furnace area.

Improved construction and additional insulation in buildings has reduced the heat loss, making these buildings much tighter around doors and windows so air infiltration is minimal. This creates a problem supplying combustion and ventilation air for gas fired and other fuel burning appliances. Use of appliances pulling air out of the house (clothes dryers, exhaust fans, fireplaces, etc.) increases this problem causing appliances to starve for air.

This furnace must use indoor air for combustion. It cannot be installed as a direct vent (i.e., sealed combustion) furnace. The burner box is present only to help reduce sound transmission from the burners to the occupied space.

AIR REQUIREMENTS

Most homes will require outside air supplied to the furnace area by means of ventilation grilles or ducts connecting directly to the outdoors or spaces open to the outdoors such as attics or crawl spaces. The following information on air for combustion and ventilation is reproduced from the National Fuel Gas Code NFPA54/ANSI Z223.1 Section 5.3.

5.3.1 General:

(a) The provisions of 5.3 apply to gas utilization equipment installed in buildings and which require air for combustion, ventilation and dilution of flue gases from within the building. They do not apply to (1) direct vent equipment which is constructed and installed so that all air combustion is obtained from the outside atmosphere and all flue gases are discharged to the outside atmosphere, or (2) enclosed furnaces which incorporate an integral total enclosure and use only outside air for combustion and dilution of flue gases.

(b) Equipment shall be installed in a location in which the facilities for ventilation permit satisfactory combustion of gas, proper venting and the maintenance of ambient temperature at safe limits under normal conditions of use. Equipment shall be located so as not to interfere with proper circulation of air. When normal infiltration does not provide the necessary air, outside air shall be introduced.

(c) In addition to air needed for combustion, process air shall be provided as required for: cooling of equipment or material, controlling dew point, heating, drying, oxidation or dilution, safety exhaust, odor control, and air for compressors.

(d) In addition to air needed for combustion, air shall be supplied for ventilation, including all air required for comfort and proper working conditions for personnel.

(e) While all forms of building construction cannot be covered in detail, air for combustion, ventilation and dilution of flue gases for gas utilization equipment vented by natural draft normally may be obtained by application of one of the methods covered in 5.3.3 and 5.3.4.

(f) Air requirements for the operation of exhaust fans, kitchen ventilation systems, clothes dryers, and fireplaces shall be considered in determining the adequacy of a space to provide combustion air requirements.

5.3.2 Equipment Located in Unconfined Spaces: In unconfined spaces (see definition below) in buildings, infiltration may be adequate to provide air for combustion ventilation and dilution of flue gases. However, in buildings of tight construction (for example, weather stripping, heavily insulated, caulked, vapor barrier, etc.), additional air may need to be provided using the methods described in 5.3.3-b or 5.3.4.

Space, Unconfined. For purposes of this Code, a space whose volume is not less than 50 cubic feet per 1,000 BTU per hour of the aggregate input rating of all appliances installed in that space. Rooms communicating directly with the space in which the appliances are installed through openings not furnished with doors, are considered a part of the unconfined space.

5.3.3 Equipment Located in Confined Spaces: (a) All Air from Inside the Building: The confined space shall be provided with two permanent openings communicating directly with an additional room(s) of sufficient volume so that the combined volume of all spaces meets the criteria for an unconfined space. The total input of all gas utilization equipment installed in the combined space shall be considered in making this determination. Each opening shall have a minimum free area of 1 square inch per 1,000 BTU per hour of the total input rating of all gas utilization equipment in the confined space, but not less than 100 square inches. One opening shall be within 12 inches of the top and one within 12 inches of the bottom of the enclosure. (Figure 1)

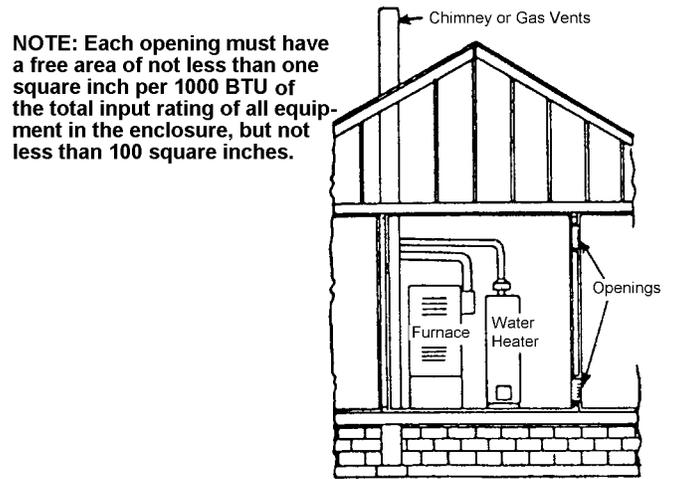


Figure 1
Equipment Located in Confined Spaces; All Air from Inside Building. See 5.3.3-a

(b) *All Air from Outdoors:* The confined space shall be provided with two permanent openings, one commencing within 12 inches of the top and one commencing within 12 inches of the bottom of the enclosure. The openings shall communicate directly, or by ducts, with the outdoors or spaces (crawl or attic) that freely communicate with the outdoors.

1. When directly communicating with the outdoors, each opening shall have a minimum free area of 1 square inch per 4,000 BTU per hour of total input rating of all equipment in the enclosure (Figure 2).

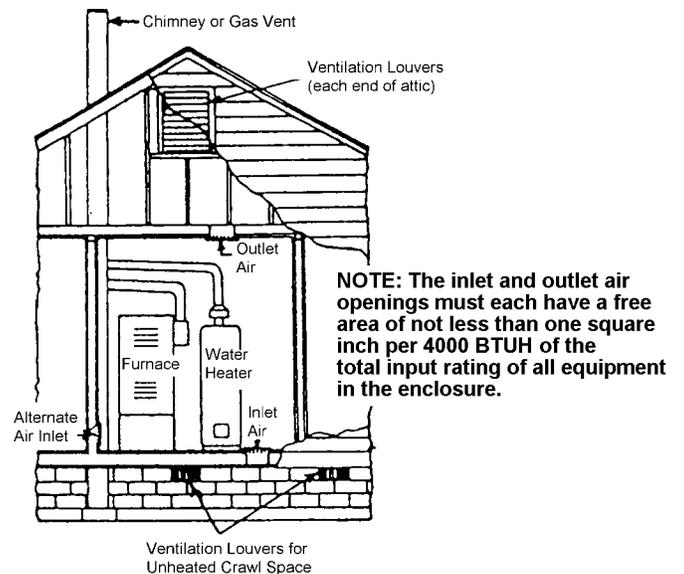
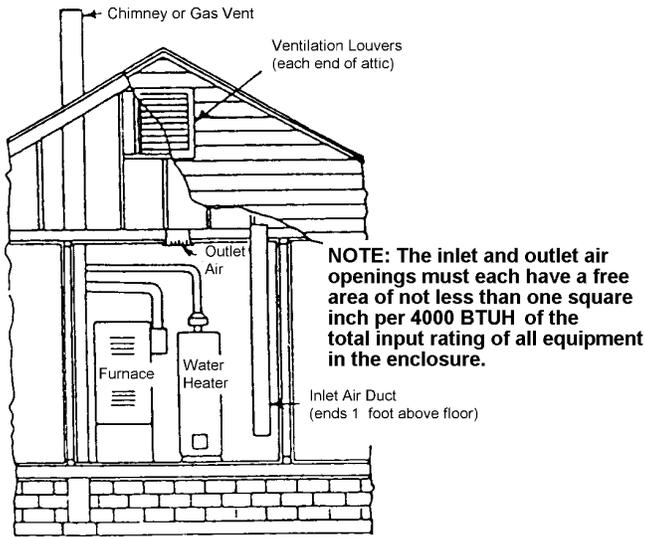


Figure 2
Equipment Located in Confined Spaces; All Air from Outdoors—Inlet Air from Ventilated Crawl Space and Outlet Air to Ventilated Attic. See 5.3.3-b

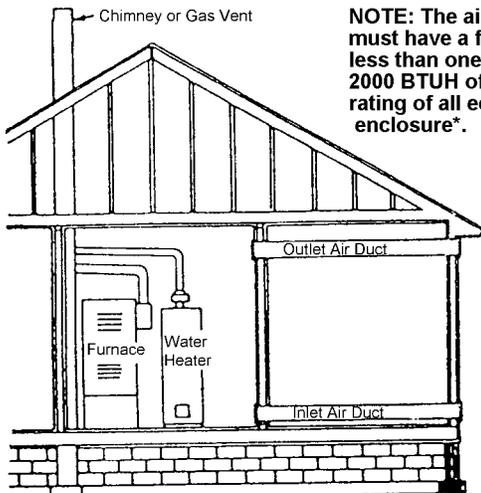
2. When communicating with the outdoors through vertical ducts, each opening shall have a minimum free area of 1 square inch per 4,000 BTU per hour of total input rating of all equipment in the enclosure (See Figure 3).



NOTE: The inlet and outlet air openings must each have a free area of not less than one square inch per 4000 BTUH of the total input rating of all equipment in the enclosure.

Figure 3
Equipment Located in Confined Spaces; All Air from Outdoors Through Ventilated Attic.
 See 5.3.3-b.

3. When communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of 1 square inch per 2,000 BTU per hour of total input rating of all equipment in the enclosure. (Figure 4)



NOTE: The air duct openings must have a free area of not less than one square inch per 2000 BTUH of the total input rating of all equipment in the enclosure*.

*If the appliance room is located against an outside wall and the air openings communicate directly with the outdoors, each opening shall have a free area of not less than one square inch per 4,000 BTU per hour of the total input rating of all appliances in the enclosure.

Figure 4
Equipment Located in Confined Spaces; All Air from Outdoors. See 5.3.3-b.

4. When ducts are used, they shall be of the same cross-sectional area as the free area of the openings to which they connect. The minimum dimension of rectangular air ducts shall not be less than 3 inches.

5.3.4 Specially Engineered Installations:

The requirements of 5.3.3 shall not necessarily govern when special engineering, approved by the authority having jurisdiction, provides an adequate supply of air for combustion, ventilation, and dilution of flue gases.

5.3.5 Louvers and Grilles:

In calculating free area in 5.3.3, consideration shall be given to the blocking effect of louvers, grilles or screens protecting openings. Screens used shall not be smaller than 1/4 inch mesh. If the area through a design of louver or grille is known, it should be used in calculating the size of opening required to provide the free area specified. If the design and free area is not known, it may be assumed that wood louvers will have 20-25 percent free area and metal louvers and grilles will have 60-75 percent free area. Louvers and grilles shall be fixed in the open position or interlocked with the equipment so that they are opened automatically during equipment operation.

5.3.6 Special Conditions Created by Mechanical Exhausting or Fireplaces:

Operation of exhaust fans, ventilation systems, clothes dryers, or fireplaces may create conditions requiring special attention to avoid unsatisfactory operation of installed gas utilization equipment.

IV. Category I Venting (Vertical Venting)

⚠ WARNING

To prevent possible death or personal injury due to asphyxiation, Amana Non-Condensing Gas Fired Warm Air Furnaces must be Category I vented. Do not vent any of these furnaces using Category III venting.

Category I Venting is venting at a non-positive pressure. A furnace vented as Category I is considered a fan-assisted appliance and does not have to be "gas tight." **NOTE:** Single stage gas furnaces with induced draft blowers draw products of combustion through a heat exchanger allowing in some instances common venting with natural draft appliances (i.e. water heaters).

All installations must be vented in accordance with National Fuel Gas Code, NFPA 54/ANSI Z223.1 - latest edition. In Canada, the furnaces must be vented in accordance with the National Standard of Canada, CAN/CGA B149.1 and .2 - latest editions and amendments.

NOTE: The vertical height of the Category I venting system must be at least as great as the horizontal length of the venting system.

⚠ WARNING

To prevent possible death or personal injury due to asphyxiation, common venting with other manufacturer's induced draft appliances is not allowed.

Common venting with specific Amana Category I 80% furnaces is allowed with the addition of a common vent kit (CVK) for each appliance. Contact the local installing dealer, distributor or Amana directly for more information.

The minimum vent diameter for the Category I venting system is as shown below:

MINIMUM VENT DIAMETER		
MODEL	GUI*	GCI*
45	3 Inch	4 Inch
70	4 Inch	4 Inch
90	4 Inch	4 Inch
115	5 Inch	5 Inch
140	5 Inch	5 Inch

Under some conditions, larger vents than those shown above may be required or allowed.

When an existing furnace is removed from a venting system serving other appliances, the venting system may be too large to properly vent the remaining attached appliances.

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.

- Seal any unused openings in the common venting system.
- Visually inspect the venting system for proper size and horizontal pitch as required in the National Fuel Gas Code, ANSI Z223.1, or the CAN/CGA B149 Installation Codes and these instructions. Determine there is no blockage or restriction, leakage, corrosion or other deficiencies which could cause an unsafe condition.
- Where practical, close all building doors, windows, and all doors between the space where the appliances remain connected to the common venting system are located and other spaces of the building. Turn on all gas appliances not connected to the common venting system and operate on high speed all exhaust fans (range hoods and bathroom), except summer exhaust fans. Close fireplace dampers.
- Following the lighting instructions, place the furnace being inspected in operation. Adjust thermostat so appliance will operate continuously.
- 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.
- After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliance to their previous conditions of use.
- If improper venting is observed during any of the above tests, the common venting system must be corrected in accordance with the latest edition of the National Fuel Gas Code, ANSI Z223.1.

When resizing any portion of the common venting system, use the appropriate table in Appendix G in the latest edition of the National Fuel Gas Code, ANSI Z223.1.

Upflow or Horizontal units are shipped with the induced draft blower discharging from the top of the furnace. ("Top" is as viewed for an upflow installation.) The induced draft blower can be rotated 90 degrees counterclockwise for Category I venting, with the airflow horizontal left to right (Figure 5). For horizontal installations, a 4-inch single wall pipe can be used to extend the induced draft blower outlet

1/2" beyond the furnace cabinet. Vent the furnace in accordance with the National Fuel Gas Code, NFPA54/ANSI Z223.1 - latest edition. In Canada, vent the furnace in accordance with the National Standard of Canada, CAN/CGA B149 - latest editions and amendments.

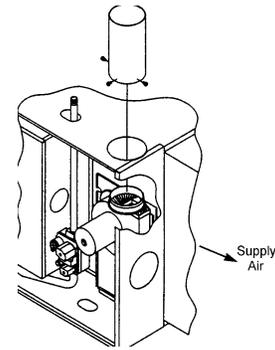


Figure 5
Upflow Rotated Induced Draft Blower

Counterflow units are shipped with the induced draft blower discharging from the top of the furnace. ("Top" as viewed for a counterflow installation.) The induced draft blower can be rotated 90 degrees counterclockwise for Category I venting, with the airflow horizontal right to left (Figure 6). For horizontal installations, a 3-inch B-vent pipe can be used to extend the induced draft blower outlet 1/2" beyond the furnace cabinet. Vent the furnace in accordance with the National Fuel Gas Code, NFPA54/ANSI Z223.1 - latest edition. In Canada, vent the furnace in accordance with the National Standard of Canada, CAN/CGA B149 - latest editions and amendments.

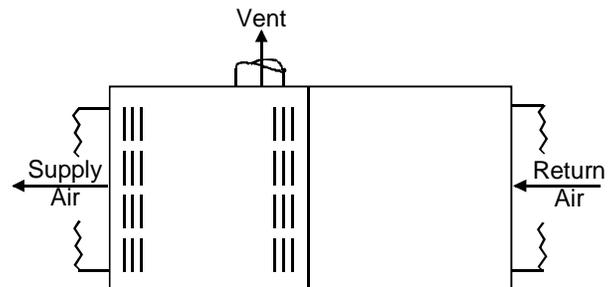


Figure 6
Counterflow Rotated Induced Draft Blower

To rotate the induced draft blower counterclockwise proceed as follows:

- Disconnect electrical power from furnace.



WARNING

To prevent death or personal injury due to electrical shock, disconnect electrical power.

- Remove the round cutout from the side of the furnace.

Note: The assembly, starting from the outside, is induced draft blower, outer gasket, rotation plate, inner gasket, partition panel (See Figure 7).

V. Masonry Chimneys

WARNING

Possibility of property damage, personal injury, or death - Damaging condensation can occur inside masonry chimneys when a single fan assisted Category I appliance (80% AFUE furnace) is vented without adequate dilution air. Do not connect an 80% furnace to a masonry chimney unless the furnace is common vented with a draft hood equipped appliance, or the chimney is lined with a metal liner or Type B metal vent. All installations using Masonry chimneys must be sized in accordance with the appropriate Venting Tables. If an 80% furnace is common vented with a draft hood equipped appliance, the potential for condensation damage may still exist with extremely cold conditions, long vent connectors, exterior chimneys, or any combination of these conditions. The risk of condensation damage is best avoided by using the masonry chimney as a pathway for properly sized metal liner or Type B metal vent.

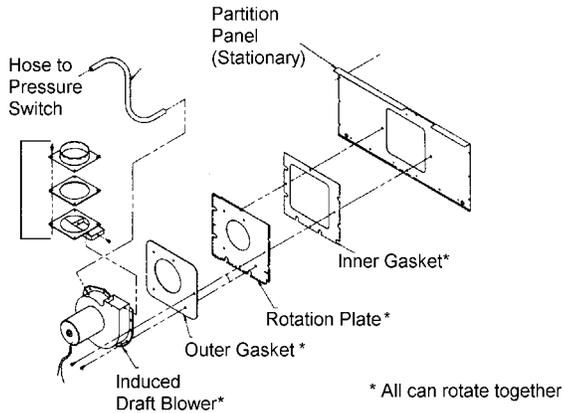


Figure 7
Blower Assembly

3. Remove and save the four screws which hold the rotation plate on the partition panel. Note that one of the screws which hold the induced draft blower on the rotation plate needs to be removed.
4. Turn the rotation plate 90 degrees counterclockwise. The inner gasket must turn with the rotation plate.
5. Reinstall the rotation plate on the partition panel, using the four screws removed in step 3. Tighten screws to provide an airtight seal.
6. Make sure all wires are at least one inch from flue pipe. Relocate junction box to right side of cabinet if necessary. Refer to Section VI for instructions.

WARNING

To prevent death or serious illness to building occupants due to flue products leaking into the building, proper installation of gaskets and screws is essential for providing a gas tight seal between the partition panel and the induced draft blower.

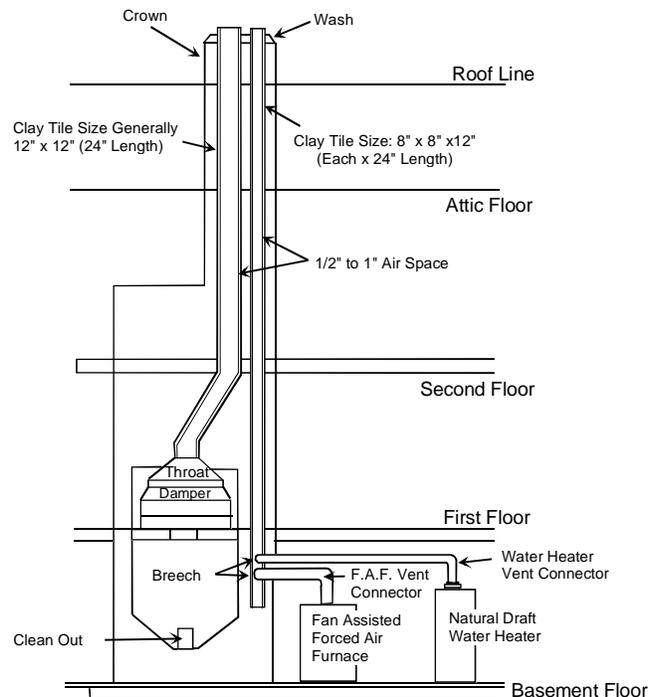


Figure 8
Typical Multiple Flue Clay Tile Chimney

CHECKLIST SUMMARY

This checklist serves as a summary of the items to be checked before venting an Air Command 80 furnace into a masonry chimney. In addition, we recommend that a qualified serviceman use this checklist to perform a yearly inspection of the furnace venting system.

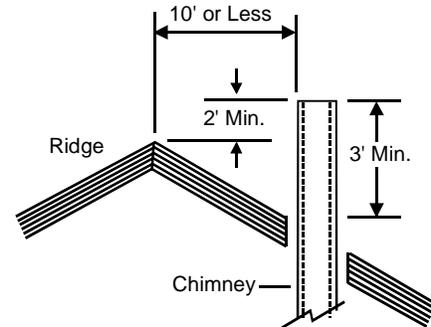
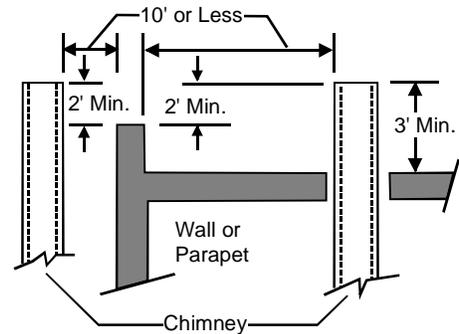
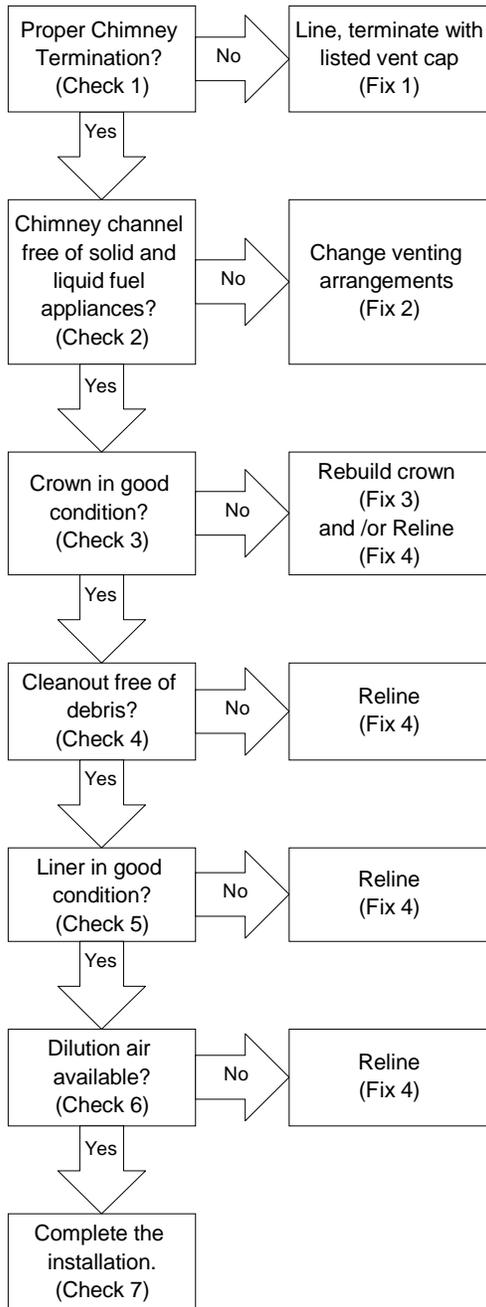
This checklist is only a summary. For detailed information on each of the procedures mentioned, see the paragraph referenced with each item.

This inspection is based upon a draft topical report, "Masonry Chimney Inspection and Relining", issued by the Gas Research Institute. While not yet finalized, we believe this report represents the best information on this subject which is currently available.

CHECK 1 - PROPER CHIMNEY TERMINATION.

A masonry chimney used as a vent for gas fired equipment must extend at least three feet above the highest point where it passes through the roof. It must extend at least two feet higher than any portion of a building within a horizontal distance of 10 feet. In addition, the chimney must terminate at least 3 feet above any forced air inlet located within 10 feet. The chimney must extend at least five feet above the highest connected equipment draft hood outlet or flue collar.

If the chimney does not meet these termination requirements, but all other requirements in the checklist can be met, it may be possible for a mason to extend the chimney. If this will not be practical, see Fix 1, page 12.



**Figure 9
Termination 10 Feet Or Less From Ridge,
Wall or Parapet**

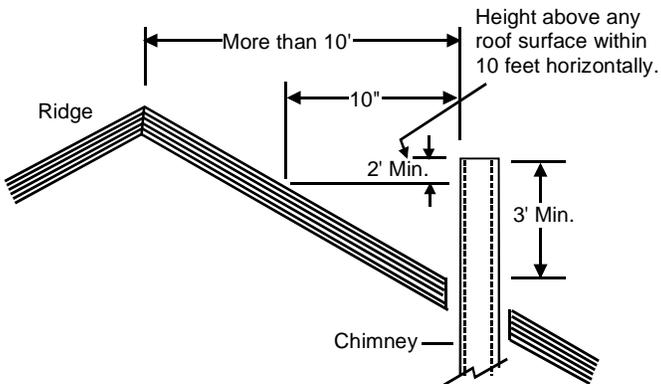
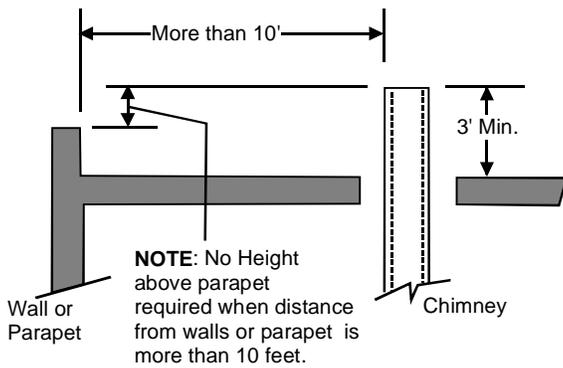


Figure 10
**Termination More Than 10 Feet From Ridge,
 Wall or Parapet**

CHECK 2 - ANY SOLID OR LIQUID FUEL APPLIANCES VENTED INTO THIS CHIMNEY CHANNEL

Solid fuel appliances include fireplaces, wood stoves, coal furnaces, and incinerators.

Liquid fuel appliances include oil furnaces, oil-fired boilers and oil-fired water heaters.

Appliances which burn propane (sometimes referred to as LP (liquefied petroleum)) gas are considered gas-fired appliances.

CHECK 3 - CHIMNEY CROWN CONDITION.

Damage from condensate usually shows up first in the crown. If any of the following trouble signs are present, the condition of the crown is not satisfactory:

- a) Crown leaning
- b) Bricks missing
- c) Mortar missing
- d) Tile liner cracked
- e) No tile liner
- f) Salt staining at mortar joints. (White stains, and mortar becomes sandy and/or erodes.)

For problems a, b, or c, see Fix 3. If problems d, e, or f are present, see Fix 4. **IMPORTANT:** It may be necessary to follow both Fix 3 and Fix 4.

CHECK 4 - DEBRIS IN CLEANOUT

A cleanout (dropleg) must be present such that the upper edge of the cleanout cover is at least 12 inches below the lower edge of the lowest chimney inlet opening.

A chimney without a cleanout could become partially blocked by debris. If no cleanout is present, the chimney must be refined (Fix 4).

Remove the cleanout cover, and examine the cleanout for debris. If significant amounts of any of the following are found:

- Fuel oil residue
- Bricks
- Mortar or sand
- Pieces of the tile liner
- Rusted pieces of the metallic liner

reline the chimney (Fix 4).

CHECK 5 - LINER CONDITION.

If a metal liner is present, it must be checked. It cannot be assumed that all existing metal liners are correctly installed and in good condition.

Remove the lowest existing vent connector, and examine the inside of the elbow or tee at the base of the liner. A small amount of soot may be considered acceptable, provided the installer vacuums it away. If rusted pieces of the liner have collected here, the metal liner must be removed and replaced (Fix 4).

Next, gently tap the inside of the liner with a phillips screwdriver. If the screwdriver perforates the liner, or if the tapping does not sound like metal hitting metal, the liner must be removed and replaced (Fix 4).

Remember that all appliances must be vented inside the liner. Venting one appliance inside the liner and another appliance outside the liner is not acceptable.

Next, use a flashlight and small mirror to sight up the liner. A vent must be supported so as to not come into direct contact with the chimney walls or tile liner. If it is not, it can probably be rehung so as to be acceptable. A thimble or fire stop may be helpful here.

Flexible liners should be hung straight or nearly straight. If it is spiraled in the chimney and in good condition, it should be rehung. To do this, break the top seal; pull up and cut off the excess liner length, and refit the top seal. Use caution when doing this, as the cut edges of flexible liners may be sharp.

The surfaces of the liner must be physically sound. If gaps or holes are present, the metal liner must be removed and replaced (Fix 4).

Finally, confirm that the metallic liner is the correct size for the appliances to be installed. Use the GAMA tables and rules.

If a metal liner is not present, a clay tile liner must be present, or the chimney must be lined (Fix 4).

Use a flashlight and small mirror at the cleanout or vent connector to inspect the clay tile liner. If any of the following problems are present:

- Tile sections misaligned
- Tile sections missing
- Gaps between tile sections
- Signs of condensate drainage at the cleanout or vent connectors
- Mortar protruding from between tile sections
- Use of sewer pipe or drainage pipe rather than an approved fire clay tile

reline the chimney (Fix 4).

Next, measure the size of the liner. It may be possible to do this from the cleanout. The liner must be at least as large as the minimum size established by the tables in National Fuel Gas Code, NFPA 54/ANSI Z223.1 - latest edition and in the National Standard of Canada, CAN/CGA B149.1 and .2 - latest editions and amendments. If the liner is too small or too large, then the chimney must be relined (Fix 4).

CHECK 6 - DILUTION AIR.

If gas-fired appliances are to be vented into a clay tile liner, a source of dilution air is required.

Dilution air cannot be obtained through:

- Induced draft appliances
- Natural draft appliances with vent dampers

Sufficient dilution air can ordinarily be obtained through the draft hood of a natural draft appliance only if the appliance's vent connector does not include a vent damper.

If dilution air will not be available, the chimney must be relined (Fix 4).

CHECK 7 - COMPLETE THE INSTALLATION.

If Checks 1 through 6 have been satisfactory, and the liner is an acceptable size as determined by the tables in National Fuel Gas Code, NFPA 54/ANSI Z223.1 - latest edition and in the National Standard of Canada, CAN/CGA B149.1 and CAN/CGA B149.2 - latest editions and amendments, then the clay tile liner can probably be used as a vent for the gas appliances. However, the installer must keep in mind the following factors which may render the tile liner unsuitable for use as a vent:

- Extremely cold weather
- Long vent connectors
- Masonry chimneys with no air gap between the liner and the bricks. (In practice, this can be difficult to detect.)
- Exterior chimneys (The tables in National Fuel Gas Code, NFPA 54/ANSI Z223.1 - latest edition and in the National Standard of Canada, CAN/CGA B149.1 and CAN/CGA B149.2 - latest editions and amendments assume interior chimneys.)

If, in the judgment of the local gas utility, installer, and/or local codes; one or more of the above factors is likely to present a problem, the chimney must be relined (Fix 4).

FIX 1 - LINER TERMINATION.

Any cap or roof assembly used with a liner must be approved by the liner manufacturer for such use. The liner and cap/roof assembly must then terminate above the roof in accordance with the manufacturer's instructions.

In some cases, a shorter extension above the roof may be possible with a liner than would be required with a masonry chimney.

For further information on relining, see Fix 4.

FIX 2 - CHANGE VENTING ARRANGEMENTS

If the masonry chimney has more than one channel, it may be possible to vent the gas appliances into one channel and vent the solid or liquid fuel appliance(s) into another channel(s). Do not vent an Air Command 80 inside of a metal liner with other appliances vented outside the liner.

Alternatively, the homeowner may agree to discontinue use of the fireplace (solid fuel appliance). If so, the tile liner must be cleaned to remove creosote buildup. The fireplace opening must then be permanently sealed.

If oil-fired appliance(s) are being replaced by gas-fired appliance(s), the tile liner must first be cleaned to remove the fuel oil residue.

If none of the above options is practical, the Air Command 80 may need to be vented vertically with a B Vent.

Under some conditions an Air Command 90 or 95 could be installed rather than an Air Command 80. The Air Command 90 or 95 can be vented horizontally or vertically through PVC pipe.

FIX 3 - REBUILD THE CROWN.

If the chimney crown is damaged, a qualified mason must repair it in accordance with nationally recognized building codes or standards. One such standard which may be referenced is the Standard for Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances, ANSI/NFPA 211.

FIX 4 - RELINING.

Relining options include B vent and flexible liners.

If the chimney has diagonal offsets, B vent probably cannot be used.

If B vent is to be used, it must be supported adequately. Supports (such as fire stops or thimbles) must be used to prevent the B vent from coming into direct contact with the tile liner or chimney walls. Direct contact would result in higher heat loss, with an increased possibility of poor venting system performance.

It is not acceptable to vent one appliance inside the B vent and other appliances outside. The excess space between the B vent and the chimney walls must be covered at the top of the chimney by a weatherproof, corrosion resistant flashing.

The B vent should then be topped with a listed vent cap. The listed vent cap will, when installed per the manufacturer's instructions, prevent problems due to rain, birds, or wind effects.

A B-vent installed as described in this section is considered to be an enclosed vent system, and the sizing tables in National Fuel Gas Code, NFPA 54/ANSI Z223.1 - latest edition and in the National Standard of Canada, CAN/CGA B149.1 and CAN/CGA B149.2 - latest editions and amendments may be used.

If a flexible liner is to be used, it must be made of the proper materials:

- For most residential applications, an aluminum liner should be acceptable.
- If the combustion air supplied to the furnace will be contaminated with compounds containing chlorine or fluorine, a liner of AL294C stainless steel should be used. Common sources of chlorine and fluorine compounds include indoor swimming pools and chlorine bleaches, paint strippers, adhesives, paints, varnishes, sealers, waxes (which are not yet dried) and solvents used during construction and remodeling. Various commercial and industrial processes may also be sources of chlorine/fluorine compounds.
- Heavier gauge 300 and 400 series stainless steel liners were developed for use with oil or solid fuel appliances. They are not suitable for use with gas-fired appliances. Flexible liners specifically intended and tested for gas applications are listed in the UL "Gas and Oil Equipment Directory". (UL Standard 1777).

For sizing of flexible liners, see Note 22 and the tables in the National Fuel Gas Code, NFPA 54/ANSI Z223.1 - latest edition and in the National Standard of Canada, CAN/CGA B149.1 and CAN/CGA B149.2 - latest editions and amendments.

To install the liner, read and follow the liner manufacturer's instructions and your local codes. Excess liner length should be pulled out of the chimney and cut off. Use caution when doing this, as the cut edges of flexible liners may be sharp. Do not spiral excess liner inside of the chimney. Support the liner as recommended by the liner manufacturer.

Some manufacturers of flexible liners offer an insulation sleeve designed to be added to the liner before it is installed in the chimney. (Poured insulation, either vermiculite or other materials, is no longer recommended.) Insulation will need to be added to the flexible liner if:

- It is required by the liner manufacturer's instructions.
- The previous liner was properly sized and installed, and suffered from condensation damage.
- It is required by your local building codes.

Even if none of those three conditions exist which require additional liner insulation, the installer may wish to consider it if:

- The local climate is very cold
- The chimney is very tall
- The vent connectors used are very long or have a large number of elbows
- Local experience indicates that flexible liners installed without insulation are likely to have condensation problems.

Insulation must be selected and installed in accordance with the liner manufacturer's instructions.

Finally, cap the chimney and terminate the liner in accordance with the liner manufacturer's instructions.

VI. Gas Piping

The rating plate is stamped with the model number, type of gas and gas input rating. Make sure the furnace is equipped to operate on the type of gas available.

Inlet Gas Pressure	
Natural	Min. 5.0" W.C., Max. 10.0" W.C.
Propane	Min. 11.0" W.C., Max. 14.0" W.C.

Inlet gas pressure must not exceed the maximum value shown in table above.

NOTE: Adjusting the minimum supply pressure below the limits in the above table could lead to unreliable ignition.

Gas input to the burners must not exceed the rated input shown on the rating plate. Overfiring of the furnace could result in premature heat exchanger failure. Gas pressures in excess of 14 inches water column could result in permanent damage to the gas valve.

IMPORTANT NOTE: The furnace will naturally derate itself with altitude. Do not attempt to increase the firing rate by changing orifices or increasing the manifold pressure. This can cause poor combustion and equipment failure.

At all altitudes, the manifold pressure must be within 0.3 inches WC of that listed on the "Specification Sheet" for the fuel used. At all altitudes and with either fuel, the air temperature rise must be within the range listed on the furnace nameplate.

GAS PIPING

IMPORTANT NOTE: To avoid possible unsatisfactory operation or equipment damage due to underfiring of equipment, do not undersize the natural/propane gas piping from the meter/tank to the furnace. Include all appliances which may be operated simultaneously when sizing a trunk line.

The gas pipe supplying the furnace must be properly sized based on gas flow required, specific gravity of the gas and length of the run. The gas line installation must comply with local codes, or in the absence of local codes, with the latest edition of the National Fuel Gas Code ANSI Z223.1.

Natural Gas Capacity of Pipe
In Cubic Feet of Gas Per Hour (CFH)

Length of Pipe in Feet	Nominal Black Pipe Size				
	1/2"	3/4"	1"	1 1/4"	1 1/2"
10	132	278	520	1050	1600
20	92	190	350	730	1100
30	73	152	285	590	980
40	63	130	245	500	760
50	56	115	215	440	670
60	50	105	195	400	610
70	46	96	180	370	560
80	43	90	170	350	530
90	40	84	160	320	490
100	38	79	150	305	460

(Pressure 0.5 psig or less and pressure drop of 0.3" W.C.; Based on 0.60 Specific Gravity Gas)

$$CFH = \frac{BTUH \text{ Furnace Input}}{\text{Heating Value of Gas (BTU/Cubic Foot)}}$$

NATURAL GAS CONNECTION

Refer to Figure 11 for the general layout at the furnace. The following rules apply:

1. Use black iron or steel pipe and fittings for the building piping.
2. Use pipe joint compound on male threads only. Pipe joint compound must be resistant to the action of the fuel used.
3. Use ground joint unions.
4. Install a drip leg to trap dirt and moisture before it can enter the gas valve. The drip leg must be a minimum of three inches long.
5. Use two pipe wrenches when making connection to the gas valve to keep it from turning. *The orientation of the gas valve on the manifold must be the same as shipped from the factory.*
6. Within six feet of the unit, install a manual cutoff valve between the meter and the unit. If a union is installed, the union must be downstream of the manual shutoff valve, between the shutoff valve and the furnace.
7. Tighten all joints securely.
8. The furnace must be connected to the building piping by one of the following:
 - Rigid metallic pipe and fittings.
 - Semirigid metallic tubing and metallic fittings. Aluminum alloy tubing must not be used in exterior locations.
 - Listed gas appliance connectors, used in accordance with the terms of their listing, must be completely in the same room as the furnace.
 - The connectors or semirigid tubing must be protected against physical and thermal damage when installed. Aluminum-alloy tubing and connectors must be coated to protect against external corrosion when in contact with masonry, plaster or insulation or are subject to repeated wettings by such liquids as water (except rain water), detergents or sewage.

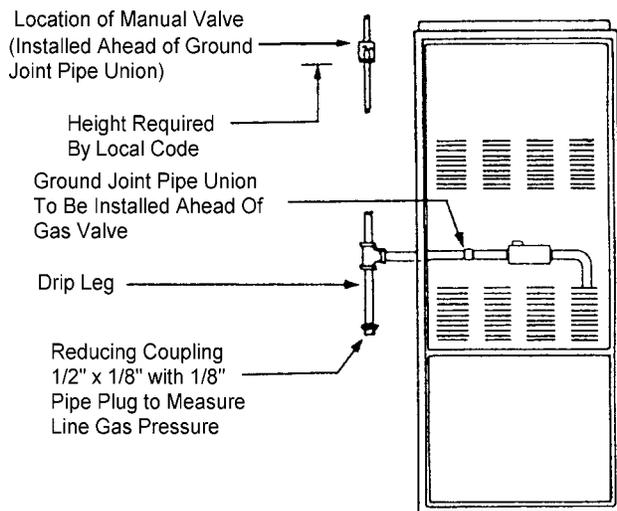


Figure 11
General Furnace Layout

UPFLOW INSTALLATIONS

When the gas piping enters through the right side of the furnace, the installer must supply the following fittings (starting from the gas valve):

- 90 degree elbow
- Close nipple
- 90 degree elbow
- Straight pipe to reach the exterior of the furnace (Figures 12 & 13).

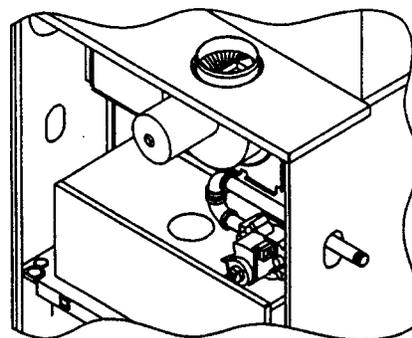


Figure 12
Gas Inlet Through Furnace Right Side

A ground joint union, drip leg, and manual shutoff valve must also be supplied by the installer. In some cases, the installer may also need to supply a transition piece from 1/2" to another pipe size.

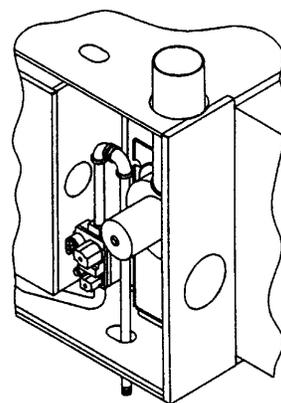


Figure 13
Gas Inlet Through Furnace Bottom Side (Upflow)

When the gas piping enters through the left side of the furnace, the installer must supply the following fittings (starting from the gas valve):

- Straight pipe to reach the exterior of the furnace (Figures 14 & 15).
- A ground joint union, drip leg, and manual shutoff valve must also be supplied by the installer. In some cases, the installer may also need to supply a transition piece from 1/2 inch to another pipe size.

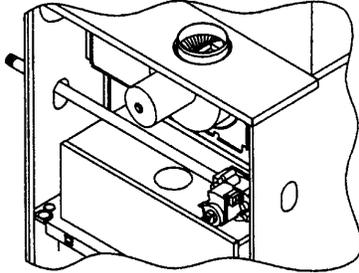


Figure 14
Gas Inlet Through Furnace Left Side
(Upflow)

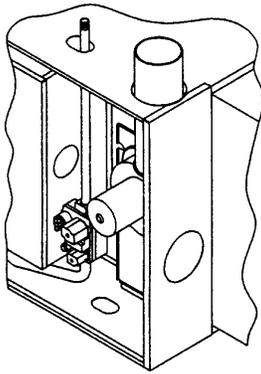


Figure 15
Gas Inlet Through Furnace Top Side
(Upflow)

The gas piping connections shown in Figures 13 and 14 are for a furnace equipped for a right hand discharge. Adaptation for left hand discharge should be self explanatory.

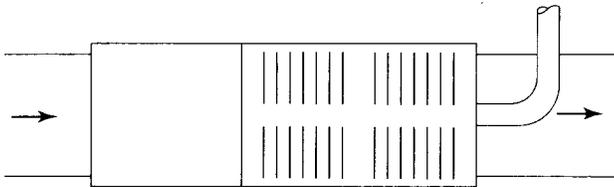


Figure 16
Horizontal Furnace
(Right Hand Discharge)

COUNTERFLOW INSTALLATIONS

When the gas piping enters through the left side of the furnace, the installer must supply a straight pipe to reach the exterior of the furnace (Figure 17).

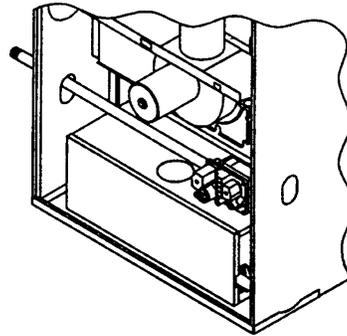


Figure 17
Gas Inlet Through Left Side
(Counterflow)

A ground joint union, drip leg, and manual shutoff valve must also be supplied by the installer. In some cases, the installer may also need to supply a transition piece from 1/2" to another pipe size.

When the gas piping enters through the right side of the furnace, the installer must supply the following fittings (starting at the gas valve):

- 90 degree elbow.
- Close nipple.
- 90 degree elbow.
- Straight pipe to reach exterior of furnace (Figure 18).

A ground joint union, drip leg, and manual shutoff valve must also be supplied by the installer. In some cases, the installer may also need to supply a transition piece from 1/2 inch to another pipe size.

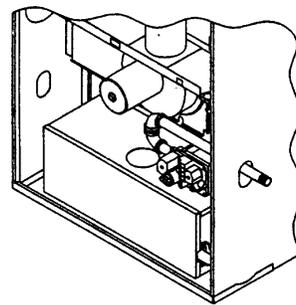


Figure 18
Gas Inlet Through Right Side
(Counterflow)

“Left side” and “right side” above are as viewed for a counterflow installation. Adaptation for horizontal airflow should be self explanatory.

CHECKING GAS PIPING



CAUTION

To prevent personal injury or property damage due to fire, the following instructions must be performed regarding gas connections, pressure testing, location of shutoff valve and installation of gas piping.

Before placing in operation, leak test the unit and gas connections. To avoid the possibility of explosion or fire, never use a match or open flame to test for leaks. Never exceed specified pressures for testing. Higher pressure may damage the gas valve and cause overfiring, resulting in heat exchanger failure.

This unit and shutoff valve must be disconnected from the gas supply piping system before supply piping system pressure testing with test pressures in excess of 1/2 psig (3.48 kPa).

This unit must be isolated from the gas supply system by closing its manual shutoff valve before pressure testing of gas supply piping system with test pressures equal to or less than 1/2 psig (3.48 kPa).

TANKS AND PIPING - PROPANE GAS UNITS



WARNING

To prevent death, personal injury or property damage due to fire or explosion caused by a propane gas leak, install a gas detecting warning device. Since rust can reduce the level of odorant in propane gas, a gas detecting warning device is the only reliable way to detect a propane gas leak. Contact a local propane gas supplier about installing a gas detecting warning device.



WARNING

All metal inserts, screens or turbulators must be removed from the heat exchanger tubes when using propane gas. Failure to comply could cause serious personal injury or death. Failure to comply with this requirement will also void warranty coverage.

All propane gas equipment must conform to the safety standards of the National Board of Fire Underwriters (See NBFU Manual 58).

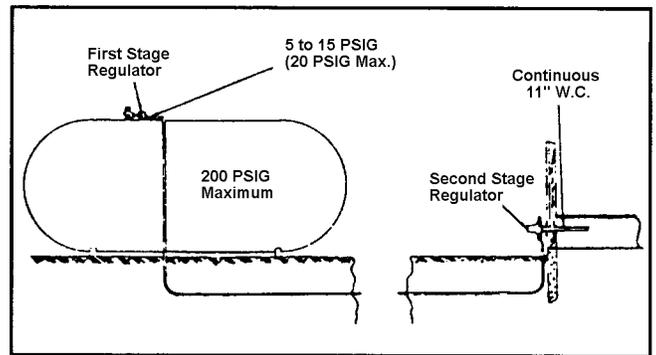
For satisfactory operation, propane gas pressure must be 10 inch WC at the furnace manifold with all gas appliances in operation. Maintaining proper gas pressure depends on three main factors:

1. Vaporization rate, depending on temperature of the liquid, and "wetted surface" area of the container or containers.
2. Proper pressure regulation. (Two-stage regulation is recommended for both cost and efficiency).
3. Pressure drop in lines between regulators, and between second stage regulator and the appliance. Pipe size will depend on length of pipe run and total load of all appliances.

Complete information regarding tank sizing for vaporization, recommended regulator settings, and pipe sizing is available from most regulator manufacturers and propane gas suppliers.

Since propane gas will quickly dissolve white lead or most standard commercial compounds, special pipe dope must be used. Shellac base compounds resistant to the actions of liquefied petroleum gases such as Gasolac, Stalactic, Clyde's or John Crane are satisfactory.

Refer to Figure 19 for typical propane gas installations.



**Figure 19
Propane Gas Installation (Typ.)**

PROPANE GAS PIPING CHARTS

Sizing Between First and Second Stage Regulator
Maximum Propane Capacities listed are based on 2 psig pressure drop at 10 psig setting.
Capacities in 1,000 BTU/hour.

Pipe or Tubing Length, Feet	Tubing Size, O.D. Type L					Nominal Pipe Size Schedule 40	
	3/8"	1/2"	5/8"	3/4"	7/8"	1/2"	3/4"
10	730	1,700	3,200	5,300	8,300	3,200	7,500
20	500	1,100	2,200	3,700	5,800	2,200	4,200
30	400	920	2,000	2,900	4,700	1,800	4,000
40	370	850	1,700	2,700	4,100	1,600	3,700
50	330	770	1,500	2,400	3,700	1,500	3,400
60	300	700	1,300	2,200	3,300	1,300	3,100
80	260	610	1,200	1,900	2,900	1,200	2,600
100	220	540	1,000	1,700	2,600	1,000	2,300
125	200	490	900	1,400	2,300	900	2,100
150	190	430	830	1,300	2,100	830	1,900
175	170	400	780	1,200	1,900	770	1,700
200	160	380	730	1,100	1,800	720	1,500

To convert to capacities at 15 psig settings - multiply by 1.130
To convert to capacities at 5 psig settings - multiply by 0.879

Sizing Between Single or Second Stage Regulator and Appliance*
 Maximum Propane Capacities Listed are Based on 1/2" W.C. pressure drop at 11" W.C. setting.
 Capacities in 1,000 BTU/hour.

Pipe or Tubing Length, Feet	Tubing Size, O.D. Type L						Nominal Pipe Size Schedule 40				
	3/8"	1/2"	5/8"	3/4"	7/8"	1-1/8"	1/2"	3/4"	1"	1-1/4"	1-1/2"
10	39	92	199	329	501	935	275	567	1,071	2,205	3,307
20	26	62	131	216	346	630	189	393	732	1,496	2,299
30	21	50	107	181	277	500	152	315	590	1,212	1,858
40	19	41	90	145	233	427	129	267	504	1,039	1,559
50	18	37	79	131	198	376	114	237	448	913	1,417
60	16	35	72	121	187	340	103	217	409	834	1,275
80	13	29	62	104	155	289	89	185	346	724	1,066
100	11	26	55	90	138	255	78	162	307	630	976
125	10	24	48	81	122	224	69	146	275	567	866
150	9	21	43	72	109	202	63	132	252	511	787
200	8	19	39	66	100	187	54	112	209	439	665
250	8	17	36	60	93	172	48	100	185	390	590

*Data in accordance with NFPA pamphlet NO. 54



WARNING

To prevent death, serious personal injury or property damage due to fire or explosion caused by a propane gas leak, install a gas detecting warning device.



WARNING

If the propane gas furnace is installed in a basement, an excavated area or a confined space, a warning device is required due to:

- Propane gas is heavier than air and any leaking gas can settle in any low areas or confined spaces.
- Propane gas odorant may fade, making the gas undetectable except with a warning device.

If the presence of gas is suspected, follow the instructions on Page 2 of this manual.

VII. Electrical Wiring



WARNING

To prevent death or personal injury due to electric shock, disconnect electrical power before changing any electrical wiring.



CAUTION

When servicing controls, label all wires before disconnecting. Wiring errors can cause improper and dangerous operation. After servicing is completed, always verify proper operation.

The unit wiring harness is an integral part of the furnace. Field alteration to comply with electrical codes should not be required.

Power supply to the furnace must be NEC Class 1, and must comply with all applicable codes. The furnace must be electrically grounded in accordance with the local codes or, in their absence, with the latest edition of the National Electrical Code, ANSI NFPA No. 70 and/or the CSA C22. 1 Electrical Code. A fused disconnect must be provided and sized in accordance with the unit maximum overcurrent protection.

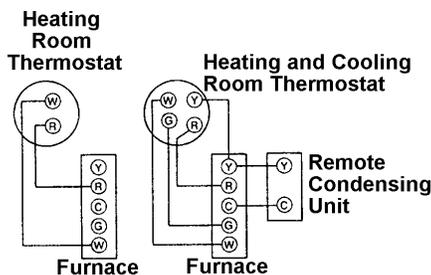


Figure 20
 Typical Field Wiring
 (24 VAC Control Circuit)

A 40 VA transformer and an integrated electronic control are built into the furnace to allow use with most cooling equipment.



CAUTION

To avoid the risk of electrical shock, wiring to the unit must be properly polarized and grounded.

To provide more reliable sensing of flame, the *ground wire* must run to the electrical panel.

Line voltage wiring must enter into the junction box provided with the furnace.

As shipped, the junction box is attached to the left side of the furnace (as viewed for an upflow installation). If this is suitable for your installation, no changes are necessary.

If the line voltage wiring is to enter through the right side of the furnace (as viewed for an upflow installation), relocate the junction box as shown in Figure 21.

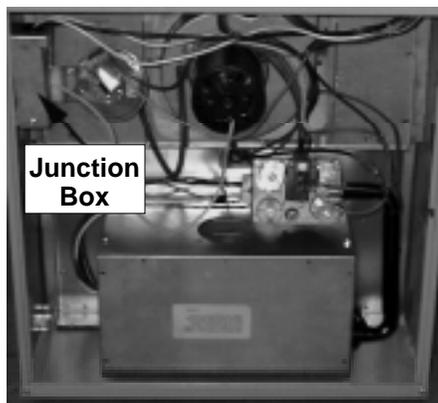


Figure 21
 Junction Box (Left Side)



WARNING

To prevent death or personal injury due to electric shock, disconnect electrical power.

1. Remove both doors from the furnace.
2. Remove and save the screws holding the junction box to the left side of the furnace.
3. Disconnect the hose from the pressure switch. Leave the other end attached to the induced draft blower.
4. Remove five wires entering junction box from split grommet in blower deck.
5. Swap locations of the two bushings in the junction box.
6. Rotate the junction box 180 degrees so the access panel continues to face forward. The open snap bushing should now be at the bottom.
7. Insert five wires into the split grommet on the right side of the blower deck.
8. Insert the five wires through the open bushing in the bottom of the junction box.
9. Attach the junction box to the right side of the furnace, using the screws removed in step 2.
10. Reconnect the hose to the pressure switch.
11. Check the location of the pressure hose and all wiring. Confirm that it will not be damaged by heat from the burners or by the rotation of the fan. Also confirm that wiring location will not interfere with filter removal or other maintenance.

After the junction box is in the desired location, use washers to connect field-supplied conduit to the junction box in accordance with NEC and local codes. Connect hot, neutral, and ground wires as shown in the furnace wiring diagram. The wires and ground screw are located in the furnace junction box.

Low voltage wiring may enter through the right or left side of the furnace (as viewed for an upflow installation - top or bottom for a horizontal installation). See Specification Sheet for hole locations. Run the thermostat wires through either grommet in the blower deck (Figure 21).

Low voltage wires may be connected to the terminal strip as shown in Figure 22.

IMPORTANT NOTE: To avoid possible equipment malfunction, route the low voltage wires to avoid interference with filter removal or other maintenance.

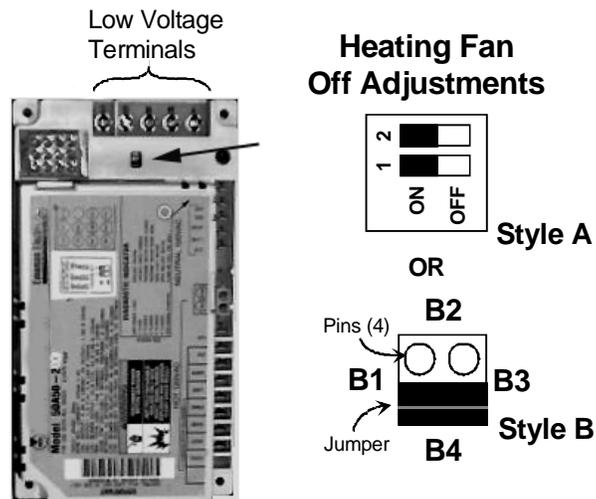


Figure 22
Integrated Ignition Control
(Viewed in an Upflow Installation)

AIR CIRCULATION BLOWER FAN TIMING

All items in this section refer to the air circulation blower fan, not to the induced draft blower. The timing sequence for the induced draft blower is not adjustable.

When a call for cooling occurs, the circulation fan will come on. It will remain on for 45 seconds after the call for cooling ends. This fan timing is not adjustable.

During normal heating operation, the circulation fan will come on 37 seconds after the gas valve opens. This timing is not adjustable.

As shipped, the circulation fan will remain on for 90 seconds after the gas valve closes. If desired, this timing may be adjusted. The adjustment pins or switches are near the low voltage terminal strip (Figure 23).

	Style A	Style B
60 Second Delay		
90 Second Delay		
120 Second Delay		
180 Second Delay		

Switches viewed in an upflow installation.

Figure 23
Heating Fan Off Adjustments

HEAT ANTICIPATOR SETTING

Adjust the heat anticipator in the room to obtain the proper number of heating cycles per hour. The heat anticipator is a wire-wound adjustable heater that prevents the room temperature from “overshooting” the room thermostat setting. The heat anticipator must be set at 0.7 amps. The heat anticipator is part of the thermostat. If the thermostat fails for any reason, replace the thermostat.

LINE VOLTAGE CONNECTION FOR OPTIONAL HUMIDIFIER AND ELECTRONIC AIR CLEANER

The control module is equipped with line voltage accessory terminals used for controlling the power to an optional field-supplied humidifier and/or electronic air cleaner.

Accessory Load Specification

Air Cleaner: 1.0 Amp max. at 120 VAC

Humidifier: 1.0 Amp max. at 120 VAC

Accessory Installation:

Follow the electronic air cleaner and humidifier manufacturers’ instructions for mounting and electrically grounding these accessories. Check that the power supply to the furnace has been disconnected. Wire the accessories to the control module as shown below. All connections to the control module are to be made through 1/4 inch female terminals.

If it is necessary to supply additional line voltage wiring to the interior of the furnace, the wiring must comply with all local codes. This wiring must have a minimum temperature rating of 105°C and must be routed away from the burner compartment. All line voltage wire splices must be made inside the furnace junction box.

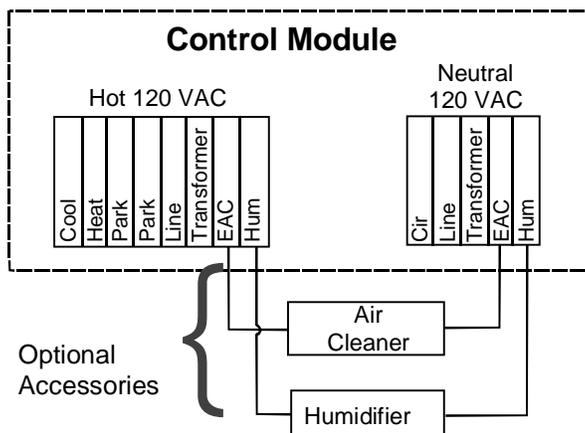


Figure 24
Line Voltage Connection for Accessories

Accessory Operation: The furnace control module energizes the humidifier whenever the induced draft blower is energized (when an air cleaner is installed on the system, the humidifier is not energized until the air cleaner is energized). The control module energizes the air cleaner whenever the air circulation blower is energized.

VIII. Circulating Air and Filters

DUCTWORK - AIR FLOW

Duct systems and register sizes must be properly designed for the CFM and external static pressure rating of the furnace. Ductwork should be designed in accordance with the recommended methods of “Air Conditioning Contractors of America” Manual D.

A duct system must be installed in accordance with Standards of the National Board of Fire Underwriters for the Installation of Air Conditioning, Warm Air Heating and Ventilating Systems. Pamphlets No. 90A and 90B.

A closed return duct system must be used, with the return duct connected to the furnace. Supply and return connections to the furnace may be made with flexible joints to reduce noise transmission. To prevent the blower from interfering with combustion air or draft when a central return is used, a connecting duct must be installed between the unit and the utility room wall. A room, closet, or alcove must not be used as a return air chamber.

When the furnace is used in connection with a cooling unit, the furnace should be installed in parallel with or on the upstream side of the cooling unit to avoid condensation in the heating element. With a parallel flow arrangement, the dampers or other means used to control the flow of air must be adequate to prevent chilled air from entering the furnace 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.

When the furnace is installed without a cooling coil, it is recommended that a removable access panel be provided in the outlet air duct. This opening shall be accessible when the furnace is installed and shall be of such a size that the heat exchanger can be viewed for visual light inspection or such that a sampling probe can be inserted into the airstream. The access panel must be made to prevent air leaks when the furnace is in operation.

When the furnace is heating, the temperature of the return air entering the furnace must be between 55°F and 100°F.

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

Filters - Read This Section Before Installing The Return Air Ductwork

Filters must be used with this furnace. Discuss filter maintenance with the building owner. Filters do not ship with this furnace, but must be provided by the installer. Filter(s) must comply with UL900 or CAN/ULCS111 standards. If the furnace is installed without filters, the warranty will be voided.

The following chart shows recommended minimum filter sizes for each furnace model. Larger sizes are also acceptable.

Minimum Recommended Filter Sizes		
Qty. - Nominal Size, Inches (Sq. In. Surface Area)		
Size_Air Flow	Disposable	Permanent
045_30	1 - 20 X 25 (500)	1 - 15 X 20 (300)
070_30	1 - 20 X 25 (500)	1 - 15 X 20 (300)
070_40	2 - 14 X 25 (350)	1 - 16 X 25 (400)
090_30	1 - 24 X 24 (576)	1 - 16 X 25 (400)
090_50	2 - 18 X 25 (450)	1 - 20 X 25 (500)
115_40	2 - 14 X 25 (350)	1 - 18 X 25 (450)
115_50	2 - 18 X 25 (450)	1 - 20 X 25 (500)
140_50	2 - 18 X 25 (450)	1 - 20 X 25 (500)

**Figure 25
Upflow/Horizontal Furnaces**

UPFLOW INSTALLATIONS

This furnace contains rails for installing 16 x 25 x 1 filters on each side of the interior furnace cabinet. A retainer is also included for bottom return. Refer to the chart below for filter sizes when using bottom return.

Bottom Return Air Filters		
Size	Filter Size, Inches	Type
045, 070	14 X 25 X 1	P
90	16 X 25 X 1	P
115, 140	20 X 25 X 1	P

**Figure 26
Bottom Return
Filter Sizes**

The illustration below shows how the filter is retained over the bottom return air opening.



**Figure 27
Filter Retainer**

One inch throwaway filters should be sized for a face velocity of 300 feet per minute or less (14 x 25 x 1 throwaway = 730 CFM max.; 16 x 25 x 1 throwaway = 830 CFM max.; 18 x 25 x 1 throwaway = 940 CFM max.; 20 x 25 x 1 throwaway = 1040 CFM max.) All other filters should be sized according to their manufacturer's instructions.

For air delivery of less than 1800 CFM; use one side return or bottom return.

For air delivery of 1800 CFM or higher; use two side returns, or one side return plus bottom return.

Guide dimples locate the side and bottom return cutout locations. Use a straight edge to scribe lines connecting the dimples. Cut out the opening on these lines. An undersized opening will cause reduced airflow. For bottom return connection, remove the bottom of the cabinet before setting the furnace on the raised platform or return air duct.

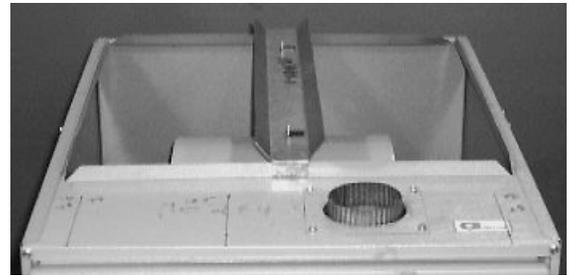
HORIZONTAL INSTALLATIONS

Filter(s) must be installed external to the furnace casing. Using a central return with filters installed in the duct behind the return air grille allows filters to be replaced by just removing the grille. This prevents having to go into the attic or crawl space when a filter has to be changed.

Refer to the preceding chart on Recommended Minimum Filter Sizes. (Figure 25)

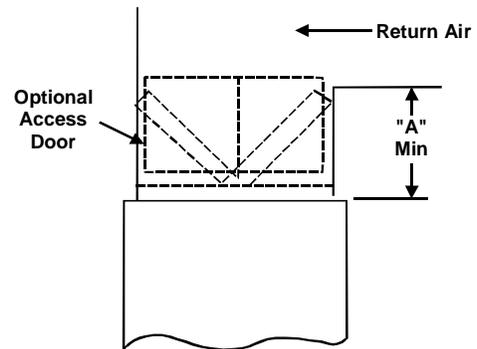
COUNTERFLOW INSTALLATIONS

A filter rack is shipped with the furnace. To use this rack, proceed as follows:



**Figure 28
Furnace Mounted Filter Rack**

1. Center the filter rack over the plenum flange and push down firmly (Figure 28). Since the return air plenum will need to be attached later, do not screw the filter rack down.
2. Install the return air plenum on the furnace. For proper filter performance, the sides of the plenum must be at least as tall as dimension "A" shown in Figures 29 and 30.

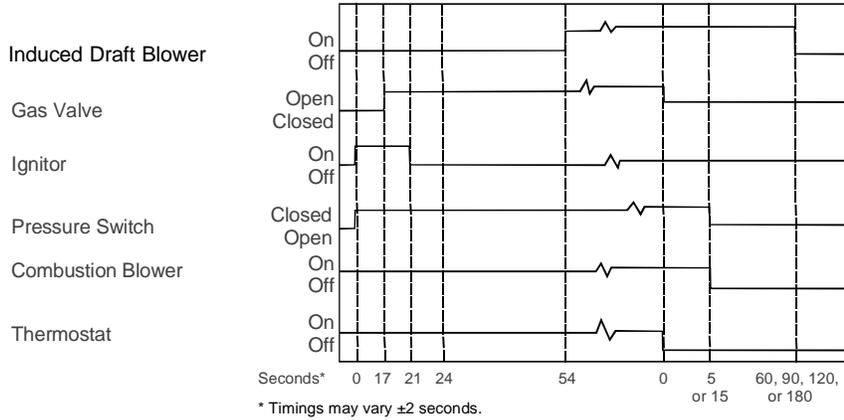


**Figure 29
Return Air Plenum Installation**

NOTE: For easier filter inspection and replacement, the installer may wish to provide a removable panel in the front of the return air plenum.

Heating

Timing Chart for Integrated Ignition Control Normal Heating Operation

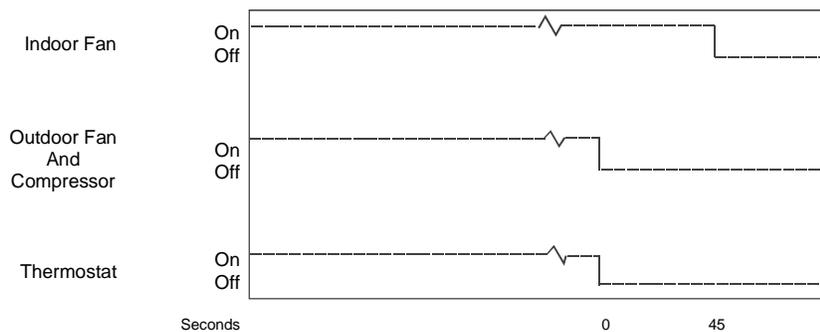


Integrated Ignition Control

Diagnostic Signal Chart

Light Signal	Refer to Abnormal Operation Number
Continuous Light	1 Internal Control Failure
1 Flash	2 System Lockout
2 Flashes	3 Pressure Switch Stuck Closed
3 Flashes	4 Pressure Switch Stuck Open
4 Flashes	5 Open Limit Control
5 Flashes	6 Open Rollout Control
Continuous Flashing	7 Flame Sensed No Call For Heat

Timing Chart for Normal Cooling Operation





CAUTION

To prevent personal injury, use only blunt pointed screws to attach the plenum to the furnace and filter rack. Screws should not be placed where they could interfere with filter replacement.

Size_Air Flow	Dimension "A", Inches		Minimum Recommended Filter Sizes, Inches	
	Throw away	Perm.	Fiberglass Throw away	Permanent
045_30	15-1/2	8	(2) 16x20x1	(2) 10x20x1
070_30	15-1/2	8	(2) 16x20x1	(2) 10x20x1
070_40	19-3/4	8	(2) 20x20x1	(2) 10x20x1
090_30	14-1/4	13	(2) 16x20x1	(2) 15x20x1
090_50	24-1/4	13	(2) 25x20x1	(2) 15x20x1
115_40	17-3/4	11	(2) 20x20x1	(2) 15x20x1
115_50	23-1/2	11	(2) 25x20x1	(2) 15x20x1
140_50	23-1/2	11	(2) 25x20x1	(2) 15x20x1

Figure 30
Counterflow Furnaces

- With the air flow direction arrow pointing toward the furnace, insert the filters from the left side of the blower. Starting with the right filter, push the filter into the plenum so the bottom of the filter fits into the filter rack and the upper edge rests against the side of the plenum. Repeat with the left filter (Figure 29).

OTHER FILTER OPTIONS

External filter grilles can be used instead of the filter rack.

IX. Sequence of Operation (Integrated Ignition Control)

Refer to Timing Charts for sequencing.

NORMAL HEATING SEQUENCE

- Thermostat calls for heat.
- The induced draft blower is energized.
- The ignitor is energized and is allowed to preheat for 17 seconds.
- The gas valve is energized delivering gas to the burners and starting combustion.
- The control checks for a signal from the flame sensor within seven seconds after the gas valve is energized. Gas will only continue to flow if a signal is present.
- The control waits 30 seconds and turns on the air circulation blower to the speed that was selected for heating operation.
- The thermostat is satisfied and opens.
- The control de-energizes the gas valve.

- After a 15 second delay while flue products are purged from the furnace heat exchanger, the induced draft blower motor is de-energized.
- The air circulation blower has an adjustable delay-off timing of 60, 90, 120 or 180 seconds (starting from the time the gas valve closes). This allows more heat from the furnace to be transferred to the conditioned space. After this time has elapsed, the blower will be de-energized.

NORMAL COOLING SEQUENCE - INTEGRATED IGNITION CONTROL

With the room thermostat in the FAN-AUTO position, the indoor air circulation blower and outdoor condensing unit will be energized when a call for cooling occurs. When the call for cooling ends, the outdoor condensing unit will be de-energized. The indoor air circulation blower will continue to run for 45 seconds.

OTHER ITEMS

Constant Fan. During normal operation, the air circulation blower will continually run at "Cooling" speed as long as power is present at terminal G. If a call for heat occurs, the blower will run at heating speed throughout the heating cycle.

If a trip on high/auxiliary/rollout limit occurs, the air circulation blower will run at "Heating" speed. Even if power is present at terminal G, the blower will run at heating speed until the limit closes.

X. Start-Up, Adjustments, and Checks

GENERAL OPERATION

This furnace is equipped with an electronic ignition device to light the burners and an induced draft blower to exhaust combustion products.

An interlock switch prevents furnace operation if the blower door is not in place. Keep the blower access doors in place except for inspection and maintenance.

This furnace is also equipped with a self-diagnosing electronic control module. In the event a furnace component is not operating properly, the control module LED will flash on and off in a factory-programmed sequence, depending on the problem encountered. This light can be viewed through the observation window in the blower access door. Refer to the *Diagnostic Signal Chart* for further explanation of the lighting codes and Section X, *Abnormal Operation - Integrated Ignition Control* for an explanation of the possible problem.

On new installations, or if a functional part such as the gas valve, pressure switch, or limit control has been replaced, verify that the furnace is operating properly after servicing.

Check furnace operation as outlined in the following instructions. If any sparking, odors, or unusual noises are encountered, shut off electrical power and recheck for wiring errors, or obstructions in or near the blower motors. Various shipping materials must be removed before the blower motor is operated.

ROLLOUT PROTECTION DEVICE

If the flames from the burners are not properly drawn into the heat exchanger, a protection device will open causing the gas valve to close. In **GUI(-)** furnaces installed horizontal right-to-left airflow, the device must be relocated.

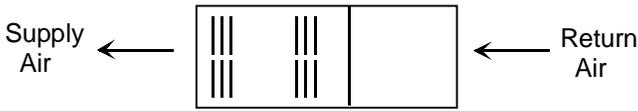


Figure 31
Right To Left Installation

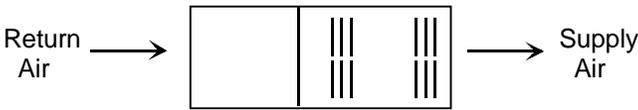


Figure 32
Left To Right Installation

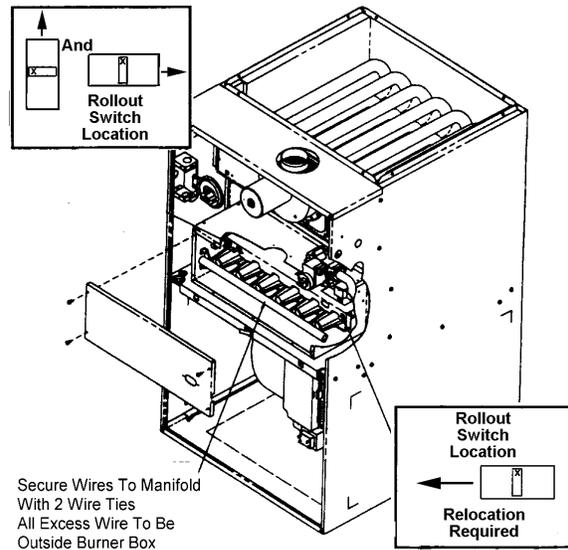


Figure 33
Rollout Switch Relocation (Upflow)

If relocation is required, proceed as follows:

1. Disconnect electrical power.



WARNING

To prevent death or personal injury due to electric shock, disconnect electrical power.

2. See Figures 33 and 34. Remove the cover from the burner box. Save the screws that held it in place. (**Note:** There are several screw holes, but only four screws. This is intentional, and not a manufacturing defect.)
3. As shipped, the rollout protection device is located near the flame sensor end of the manifold assembly. Remove and save the mounting screws.
4. For most installations, it will not be necessary to remove the wires from the rollout protection device.
5. For horizontal-left installations, a hole is provided near the ignitor end of the manifold assembly. Insert the rollout protection device into this hole and attach with screws removed in step 3.
6. Secure rollout wires to manifold and insure no wires can come in contact with burners or other hot surfaces.
7. Push the button to confirm the rollout control is in the closed position.
8. Replace the cover on the burner box, placing the screws from step 2 in their original locations.



WARNING

To prevent death, personal injury or property damage due to fire or explosion, a qualified servicer must determine the reason the rollout protection device opened before the device is reset.

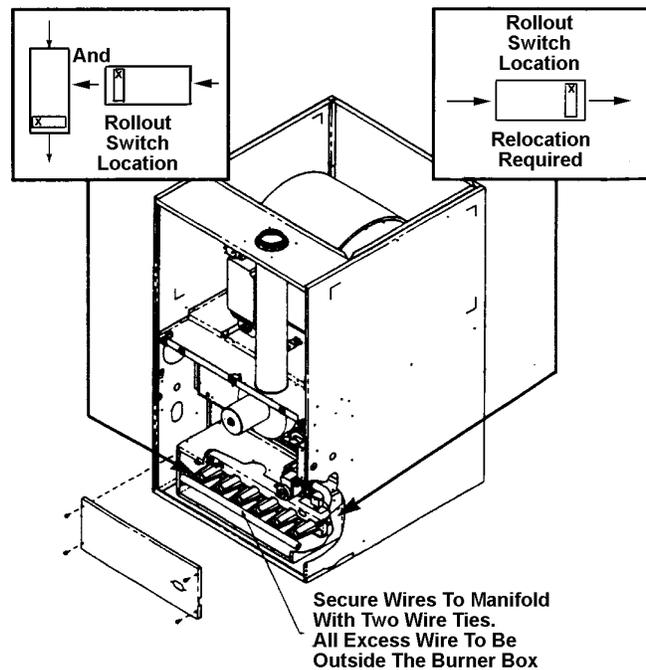


Figure 34
Rollout Switch Relocation
(Counterflow)

BURNER BOX

This furnace must use indoor air for combustion. It is not a direct vent furnace, and it cannot be installed as a direct vent furnace. The burner box (on some models) is present only to reduce the burner sound transmission.

AUXILIARY LIMIT CONTROL (FIGURE 35)

A manual reset limit is located on the blower side of the blower deck, near the center. To access this auxiliary limit, disconnect the electrical power and remove the blower door. If the limit control opens, the air circulation blower will run continuously. The diagnostic light will flash four times. These symptoms are identical to a trip of the primary limit control. See Section X, *Abnormal Operation - Integrated Ignition Control* for diagnosis.

The auxiliary limit control is designed to prevent furnace operation in case of main blower failure on horizontal and counterflow installations. It may also open if the power supply is interrupted while the furnace is firing.

The auxiliary limit control is suitable for both horizontal right and horizontal left installations. Regardless of airflow direction, it does not need to be relocated.



WARNING

To prevent death, personal injury or property damage due to fire, follow these directions for the auxiliary limit control. If the auxiliary limit control opens, it may be reset one time only.

(SERVICER'S NOTE: If it becomes necessary to slide the blower assembly out of the furnace, the auxiliary limit control should be removed first. After the blower assembly is reinstalled, the auxiliary limit must be reinstalled.)

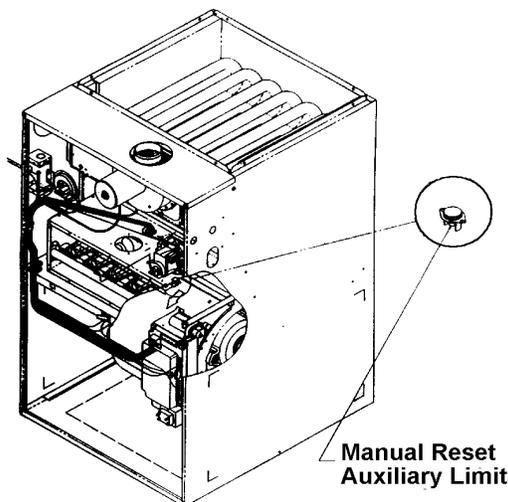


Figure 35
Auxiliary Limit Control

ABNORMAL OPERATION - INTEGRATED IGNITION CONTROL

The following presents the probable causes of questionable furnace operation and how to fix them. Look through

the observation window in the blower access door and make a note of the number of flashes in sequence between pauses. Next, refer to the *Diagnostic Signal Chart* for an interpretation of the signals and to this section for a description.

1. Internal Control Failure with Integrated Ignition Control

An internal control failure occurs when the integrated ignition control senses an internal problem and stops the unit.

To solve this problem, replace the ignition control.

2. System Lockout

A system lockout occurs when the integrated ignition control determines that a measurable combustion cannot be established or maintained after three consecutive tries (four, if flame is established then lost) to turn on the furnace.

If a flame is not sensed during the first six seconds after a gas valve has been energized, the ignition control will internally turn off the gas. After 60 seconds, during which time the induced draft blower purges the heat exchanger, the ignitor will re-energize and preheat for 27 seconds. The gas valve is then re-energized. If a flame is not sensed again in six seconds, the gas valve will de-energize and another purge is performed. The ignition control will cycle the gas valve *three times* before it determines it cannot establish measurable combustion and enter a lockout state. If a flame is sensed but lost after 10 seconds, the control will cycle *four more times* before locking out. A lockout stops ignition attempts and causes the air blower to run continuously. The diagnostic light will indicate either condition with **one short flash** followed by a longer off.

The control can be reset and brought out of lockout mode by turning the thermostat off and then back on. It can also reset by turning off the electrical disconnect switch to the furnace for 30 seconds. The control will reset after one hour.

IMPORTANT: If you have to frequently reset your furnace, it means that a problem exists that should be corrected. Contact a qualified servicer for further information.

3. Pressure Switch Stuck Closed

A sticking pressure switch can be caused by either a faulty pressure switch, faulty wiring, a disconnected hose, or a restricted intake or flue piping. In the case of a pressure switch sticking closed, the probable cause is a faulty pressure switch or wiring.

If the ignition control senses that the pressure switch is closed and the induced draft blower is off, it will shut down the unit until the fault is corrected. The light code for this problem is **two short flashes** followed by a longer pause.

4. Pressure Switch Stuck Open

A sticking open pressure switch can be caused by a faulty pressure switch, a disconnected hose to the pressure switch, a restricted air intake or flue piping, or a faulty wiring.

If the ignition control senses that the induced draft blower is energized but the pressure switch is not closed, the control will keep the blower on and wait for the switch to close. The diagnostic light code for this problem is **three short flashes** followed by a pause.

5. Open Limit Control (Primary or Auxiliary)

An open limit control can be caused by a low conditioned air flow due to dirty filter or resistance in duct work, a faulty blower, a blower speed set too low, or a faulty limit.

When the limit control opens, the induced draft and air circulation blowers are turned on. The induced draft blower will remain on for the first fifteen seconds of this period. The air circulation blower will remain on until the limit control is closed. The diagnostic light code for this is **four short flashes** followed by a pause.

6. Open Rollout Control

An open rollout control can be caused by insufficient combustion air, a restricted flue passage, or a restricted heat exchanger.

The opening of the rollout control signals the air circulation blower and the induced draft blower to turn on. The air circulation blower will remain on until the limit is manually reset. The induced draft blower will remain on for the first fifteen seconds of this period. The diagnostic light code for this is **five short flashes** followed by a pause.

7. Flame Sensed with No Call for Heat

If the control senses a flame when the gas valve is de-energized, it will run the air circulation blower and the induced draft blower continuously. The diagnostic light code for this is **continuous light flashing**. Probable cause is miswiring.

8. Replace the door on the front of the furnace.
9. Open the manual gas valve external to the furnace.
10. Turn on the electrical power supply to the furnace.
11. Set the room thermostat to the desired temperature.

NOTE: There is an approximate 20 second delay between thermostat energizing and burner firing.

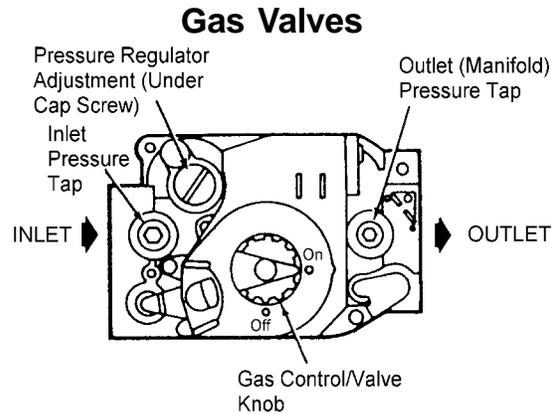


Figure 36
Honeywell Model VR-8205

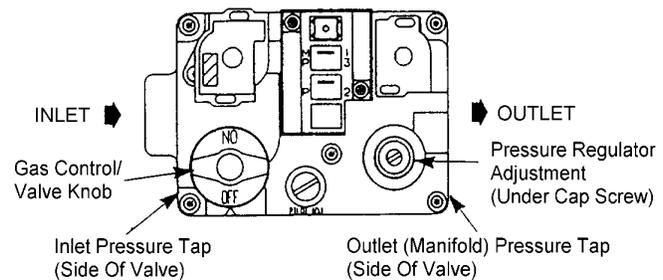


Figure 37
White Rodgers Model 36E36

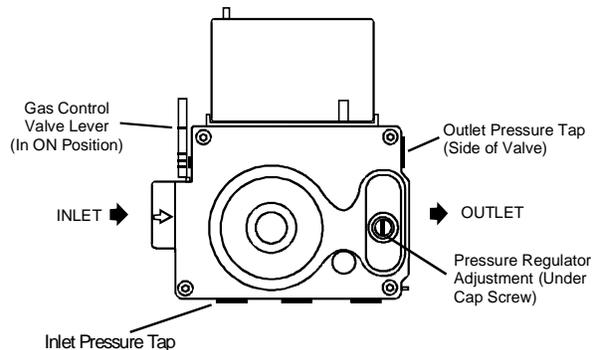


Figure 38
Robertshaw Model 7222

OPERATING INSTRUCTIONS

1. Close the manual gas valve external to the furnace.
2. Turn off the electrical power supply to the furnace.
3. Set room thermostat to lowest possible setting.
4. Remove the door on the front of the furnace.

Note: This furnace is equipped with an ignition device to automatically light the burners. Do not try to light burners by hand.

5. *Honeywell Model VR8205, or White Rodgers Model 36E36, or Robertshaw Model 7222:* Turn the gas control knob clockwise  to the OFF position.

Note: The knob should turn easily. Do not use excessive force.

White Rodgers Model 36E22: Push the switch to the OFF position.

6. Wait five minutes to clear out any gas. Then smell for gas, including near the floor.
7. If gas can be smelled following the five minute waiting period in Step 6, immediately follow the instructions on Page 2 of this manual. If you do not smell gas after five minutes:

Honeywell Model VR8205, or White Rodgers Model 36E36, or Robertshaw Model 7222: Turn the gas control knob counterclockwise  to the ON position. The knob should turn easily. Do not use excessive force.

White Rodgers Model 36E22: Push the switch to the ON position.

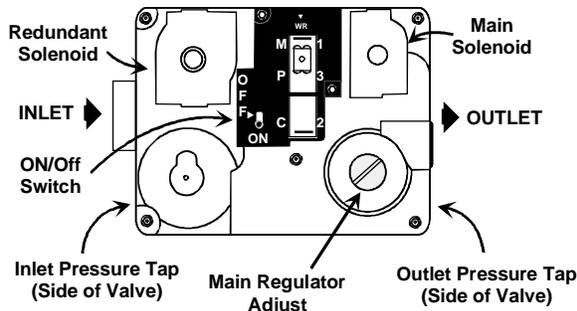


Figure 39
White Rodgers Model 36E22

CHECK GAS INPUT AND PRESSURES

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

CHECKING GAS PRESSURE

Gas inlet pressure should be checked and adjusted in accordance to the type of fuel being consumed.

With Power and Gas Off:

1. Honeywell Model VR8205, or White Rodgers Models 36E36 or 36E22, or Robertshaw Model 7222: Connect a water manometer or adequate gauge to the "inlet pressure tap" of the gas valve.

As an alternative method, inlet gas pressure can also be measured by removing the cap from the drip leg and installing a predrilled cap with a hose fitting (Figure 41).

With Power and Gas On:

2. Put furnace into heating cycle and turn on all other gas consuming appliances.

Inlet Gas Pressure	
Natural	Min. 5.0" W.C., Max. 10.0" W.C.
Propane	Min. 11.0" W.C., Max. 14.0" W.C.

Inlet Gas Pressure Must Not Exceed the Maximum Value Shown.

Figure 40

If operating pressures differ from above, make necessary pressure regulator adjustments, check piping size, etc., and/or consult with local utility.

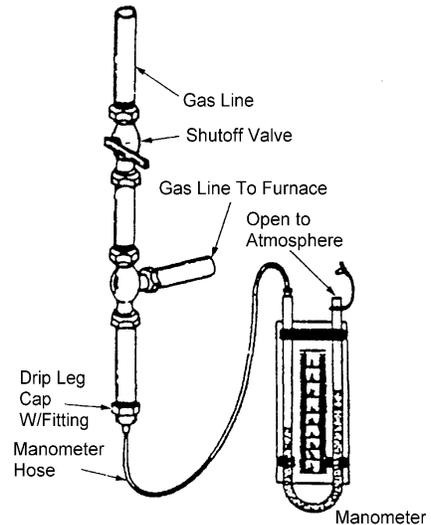


Figure 41
Measuring Inlet Gas Pressure
(Alternate Method)

CHECK MANIFOLD PRESSURE

A tapped opening is provided in the gas valve to facilitate measurement of the manifold pressure. See the "Outlet Pressure Tap" in Figures 36, 37, 38, & 39. 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 burners operating .

To adjust the pressure regulator, remove the adjustment screw or cover on the gas valve. 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 pressure regulator adjustment. For natural gas, the manifold pressure must be between 3.2 and 3.8 inches water column (3.5 nominal). For propane gas, the manifold pressure must be between 9.7 and 10.3 inches water column (10.0 nominal). Any major changes in flow should be made by changing the size of the burner orifice.

CHECK GAS INPUT (NATURAL GAS ONLY)

To measure the gas 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 seconds as is. This gives the seconds per cubic foot of gas being delivered to the furnace.

3. INPUT = GAS HTG VALUE x 3600 SEC. PER CUBIC FOOT (3600 is a conversion factor- 3600 seconds = 1 hour.)

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:

$$\begin{aligned} \text{Input} &= 1000 \times 3600 \times 34 \\ &= 106,000 \text{ BTU per Hour} \end{aligned}$$

NOTE: BTU content of the gas can be obtained from the gas supplier.

This measured input must not be greater than the input indicated in Specification Sheet.

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

CHECK BURNER FLAMES

Flames should be stable, soft and blue, (dust may cause orange tips but they must not be yellow), extending directly outward from the burners without curling, floating or lifting off.

CHECK TEMPERATURE RISE

Check the temperature rise through the unit by placing thermometers in supply and return air registers as close to the furnace as possible. Be sure the thermometers do not "see" the heat exchangers or false readings could be obtained.

1. All registers must be open, all duct dampers must be in their final (fully or partially open) position, and the unit operated for 15 minutes before taking readings.
2. The temperature rise must be within the range specified on the rating plate or Specification Sheet.

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 operated at rated input with the "as shipped" blower speed.

If the correct amount of temperature rise is not obtained, it may be necessary to change the blower speed. A faster 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.

CHANGING BLOWER SPEEDS



WARNING

To avoid death or personal injury due to electrical shock, turn off power to the furnace before changing speed taps.

All furnaces ship at high speed for cooling and the speed listed in Specification Sheet for heating. These speeds should be adjusted by the installer to match the job requirements. See Specification Sheet for details.

Connect the correct motor leads to the COOL, HEAT, and PARK terminals. If heating speed will equal cooling speed, use the jumper wire provided. All unused motor leads that are not connected to "PARK" terminals on the control must be taped to prevent shorts.

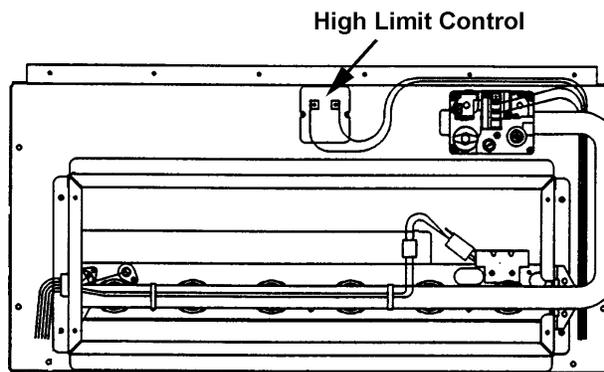


Figure 42
High Limit Control

CHECK HIGH LIMIT CONTROL



WARNING

To prevent death, personal injury, property damage or premature failure of heat exchanger, do not adjust the limit control (factory preset).

Check limit control operation after 15 minutes of operation by blocking the return air grille(s).

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

Adjust the thermostat setting below room temperature

1. Burners must go off.
2. Circulating air blower will continue to run for 60, 90, 120 or 180 seconds as set.

IMPORTANT NOTE: This unit must not be used as a construction heater during the finishing phases of construction of a new structure. This type of use may result in premature failure due to extremely low return air temperatures and exposure to corrosive or very dirty atmospheres.

TO TURN OFF FURNACE

1. Set the thermostat to lowest setting.
2. Turn off the electrical power supply to the furnace.
3. *Honeywell Model VR-8205, or White Rodgers Model 36E36, or Robertshaw Model 7222:* Turn the gas control knob clockwise  to the OFF position. The knob should turn easily. Do not use excessive force.
White Rodgers Model 36E22: Push switch to the OFF position.
4. Close manual gas shutoff valve external to the furnace.
5. Replace the door on the unit.

XI. Maintenance



WARNING

To prevent death or personal injury due to electric shock, disconnect electrical power before performing any maintenance.

IMPORTANT NOTE: Handle the ignitor with care. Touching the ignitor body with bare fingers, rough handling, or vibration could result in early ignitor failure. Only a qualified servicer should ever handle the ignitor.

Have the furnace checked at least once a year, before the heating season begins, to be sure there is adequate combustion air and the vent system is working properly.

Have vent pipe checked to be sure it is not blocked by debris which could permit fumes to enter the house. Replace any rusted or leaking sections of vent pipe.

AIR FILTER



WARNING

To prevent death, personal injury or property damage due to fire, never operate furnace without a filter installed. Dust and lint will build up on internal parts resulting in loss of efficiency, equipment damage and possible fire.

A return air filter is not supplied with this furnace; however, there must be a means of filtering all of the return air. The installer will supply filter(s) at the time of installation.

Filters should be inspected, cleaned or changed every two months or as required. It is the owner's personal responsibility to keep air filters clean. Remember - dirty filters are the most common cause of inadequate heating or cooling performance.



WARNING

To prevent death, personal injury or property damage due to electrical shock, disconnect electrical power to furnace before removing filter or performing any other maintenance.

Become familiar with filter location and procedures for removal, cleaning and replacing them. If help is needed, contact the installer of the furnace or a qualified servicer.

AIR FILTER - UPFLOW FURNACES

If the filter is in the furnace retaining rails, remove it as follows: Pull off the non-louvered door. The blower motor will automatically stop through the interlock switch.

Grasp the lower portion of the filter, lift up to disengage it from the lower railing, move towards blower, drop filter down. Pull filter outward (Figure 43).

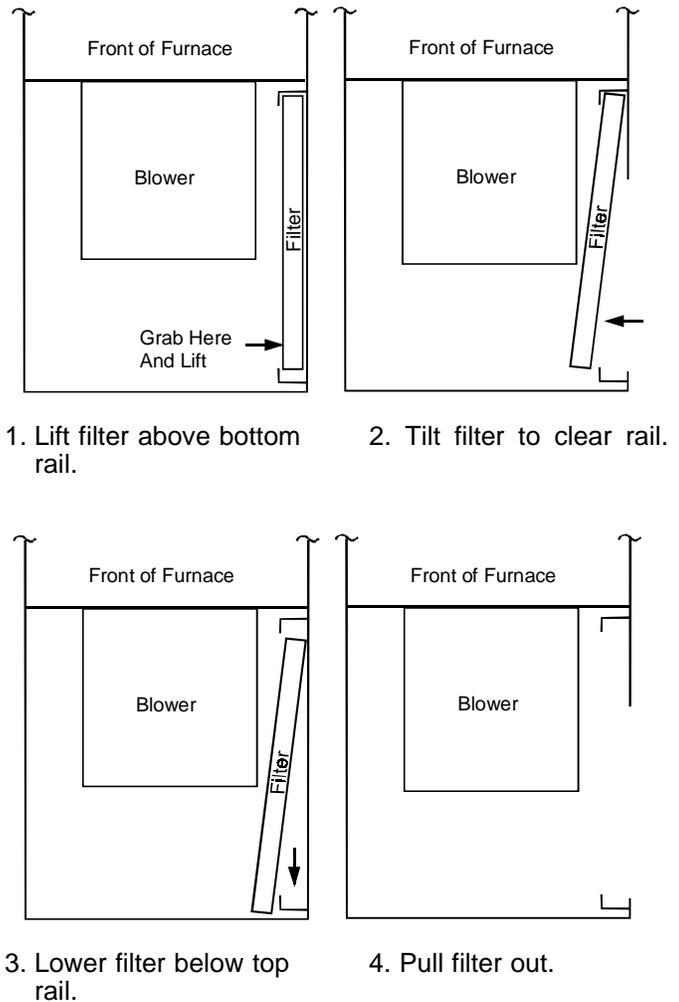


Figure 43
Filter Removal

Replace the filter with the same type and size filter when needed.

Use a vacuum cleaner to clean out the blower area and the adjacent area of the return air duct.

Clean, wash and dry a permanent filter. When using a metal filter, both sides should be sprayed with a dust adhesive as recommended on adhesive container. Spray adhesives for use with permanent metal filters can be found at some hardware stores. Reinstall filter by placing it into the furnace along the side of the blower. Engage filter in top rail, move toward side of furnace and drop it into the bottom rail. BE SURE AIRFLOW DIRECTION ARROW POINTS TOWARDS THE BLOWER.

When the filter is located in the bottom of the furnace on a bottom return system the filter is held in place by a sheet metal retainer strap. To change and clean the filter slide one end of the retainer towards the front and remove filter.

AIR FILTER - COUNTERFLOW FURNACES

A furnace mounted filter rack, shipped with the furnace, can be used in counterflow installation.

The furnace-mounted filter rack includes a rack mounted on the top of the furnace. Two filters fit into the rack and rest against the sides of the return air plenum, forming a "V" above the furnace.

The filters should be inspected frequently and cleaned or replaced when necessary. In some installations, the filters can be inspected after disconnecting the electrical power and removing the optional access door in the return air plenum. If this access panel is not present, proceed as follows:

1. Disconnect the electrical power.
2. Remove the non-louvered door from the furnace.
3. Remove the left filter by reaching to the left side of the blower, pushing the filter up slightly to remove it from the filter rack, and pulling it down to the left of the blower and out the blower door. Repeat with the right filter.
- 4a. Dirty throwaway filters must be replaced with the same filter type and size.
- 4b. Dirty, permanent metal filters must be cleaned as follows:

Wash, rinse, and dry the permanent filters. Both sides should then be sprayed with a filter adhesive as is recommended on the adhesive container. Many hardware stores stock spray adhesives for use with permanent filters.

If badly torn or uncleanable, these filters must be replaced by equal size permanent, high velocity filters. Throwaway filters must not be used as replacement for permanent filters. Under normal use, permanent filters should last for several years.
5. To reinstall the filters, first **MAKE CERTAIN THE AIRFLOW DIRECTION ARROW POINTS TOWARDS THE FURNACE**. Then insert the filters from the left side of the blower. Starting with the right filter, push the filter into the plenum so that the bottom of the filter rests in the filter rack and the upper edge rests against the side of the plenum. Repeat with the left filter (Figure 44).
6. Replace the blower door, then reconnect the electrical power.

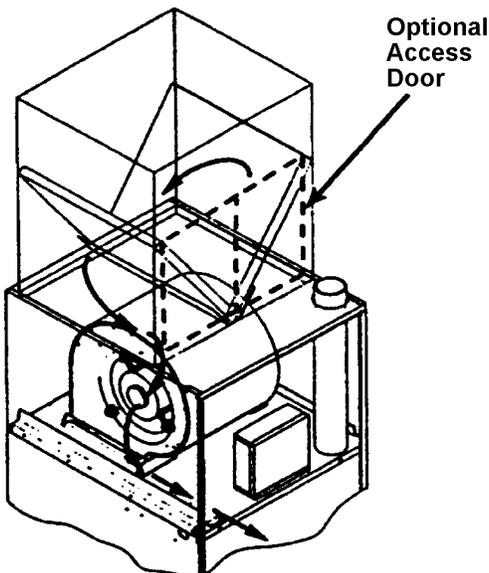


Figure 44
Furnace mounted Filter Rack
(Counterflow)

BLOWER MOTOR

The air circulating blower motor bearings are permanently lubricated. No further lubrication is required.

INDUCED DRAFT BLOWER MOTOR

The induced draft blower motor is permanently lubricated. No further lubrication is required.

FLAME SENSOR (INTEGRATED IGNITION CONTROL) (QUALIFIED SERVICER ONLY)

The fuel or combustion air supply can create a nearly invisible coating on the flame sensor. This coating acts as an insulator, causing a drop in the flame sensing signal. To remove this coating, a qualified servicer should carefully clean the flame sensor with emery cloth or steel wool. After cleaning, the microamp signal should be in the range listed in Specification Sheet.

IGNITOR (QUALIFIED SERVICER ONLY)

If the ignitor and the surrounding air are at about 70°F and the ignitor wires are not connected to any other electrical components, the resistance of the ignitor should not exceed 200 ohms. If it does, the ignitor should be replaced.

FLUE PASSAGES (QUALIFIED SERVICER ONLY)

At the start of each heating season, inspect and if necessary, clean the furnace flue passages.

CLEANING FLUE PASSAGES (QUALIFIED SERVICER ONLY)

1. Shut off electric power and gas supply to the furnace.
2. Remove burner assembly by disconnecting the gas line and removing the manifold brackets from the partition panel.
3. Remove the flue from the induced draft blower and the collector box from the partition panel.
4. The primary heat exchanger tubes can be cleaned using a round wire brush attached to a length of high grade stainless steel cable, such as drain cleanout cable. Attach a variable speed reversible drill to the other end of the spring cable. Slowly rotate the cable with the drill and insert it into one of the primary heat exchanger tubes. While reversing the drill, work the cable in and out several times to obtain sufficient cleaning. Use a large cable for the large tube, and then repeat the operation with a small cable for the smaller tube. Repeat for each tube.
5. When all heat exchanger tubes have been cleaned, replace the parts in the reverse order in which they were removed.
6. To reduce the chances of repeated fouling of the heat exchanger, perform the steps listed in Section X, *Start-up, Adjustments, and Checks*.

BURNERS



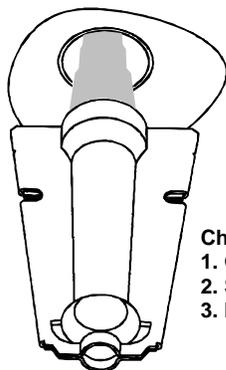
WARNING

To prevent personal injury or death, do not remove any internal compartment covers or attempt any adjustment. Electrical components are contained in both compartments. Contact a qualified service agent at once if an abnormal flame appearance should develop.

Periodically during the heating season make a visual check of the burner flames. Turn the furnace on at the thermostat. Wait a few minutes, since any dislodged dust will alter the normal flame appearance. Flames should be stable, quiet, soft and blue with slightly orange tips. They should not be yellow. They should extend directly outward from the burner ports without curling downward, floating or lifting off the ports.

CLEANING OF BURNERS (QUALIFIED SERVICER ONLY)

1. Shut off electric power and gas supply to the furnace.
2. Remove the burner box front cover.
3. Remove the burner retention bracket.
4. Remove the burners.
5. Use bottle brush to clean burner insert and inside of burner.
6. Replace burners and burner retention bracket, inspect the burner assembly for proper seating of burners in retention slots.
7. Reinstall the burner box front cover.



Check the burner flames for:
1. Good adjustment
2. Stable, soft and blue
3. Not curling, floating, or lifting off.

**Figure 45
Burner Flame**

GENERAL INFORMATION

1. When ordering any of the listed functional parts, be sure to provide the furnace model, manufacturing, and serial numbers with the order.
2. Although only functional parts are shown in the parts list, all sheet metal parts, doors, etc. may be ordered by description.
3. Parts are available from your Amana distributor

Gas Valve	Blower/Box Gasket
Gas Orifice, Natural	Flame Roll-out Switch
Gas Orifice, Propane	Auxiliary Limit
Burner	Heat Exchanger
Ignitor	Door Switch
Flame Sensor	Transformer
Gas Manifold	Blower Wheel
Ignition Control	Blower Housing
Limit Switch	Blower Cutoff
Pressure Switch	Blower Motor
Pressure Switch Hose	Motor Mount Bracket
Induced Draft Blower	Capacitor
Collector Box	