

Amana® AIR COMMAND 90

Model GCC (Counterflow)

HIGH EFFICIENCY GAS FIRED WARM AIR FURNACE INSTALLATION and OPERATION INSTRUCTIONS

IMPORTANT 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, min. or max. cfm and motor speed connections. Affix these Installation Instructions adjacent to the furnace.

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 if any service or warranty information should 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 through whom the purchase was made.

Keep this literature in a safe place for future reference.



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.



RECOGNIZE THIS SYMBOL
AS A SAFETY PRECAUTION



WARNING: If the information in this manual 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**
 - Extinguish any open flame
 - 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.

THE INSTALLATION AND SERVICING OF THIS EQUIPMENT SHOULD BE PERFORMED ONLY
BY QUALIFIED, EXPERIENCED TECHNICIANS.

Due to policy of continual product improvement, the right is reserved to change specifications and design without notice.

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Amana Refrigeration, Inc.
Amana, IA 52204

I. SAFETY



RECOGNIZE THIS SYMBOL AS A SAFETY PRECAUTION



WARNING

Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage or death. Refer to this manual. For assistance or additional 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.

LOCATING THE FURNACE



WARNING

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



WARNING

This furnace must be located so that the electrical components are protected from water.



CAUTION

This unit should 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.

combustible material other than wood flooring. (Note: The sub-base 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 set on a level floor to enable the condensate produced to drain properly. If the floor may become wet or damp at times, the furnace should be supported above the floor on a concrete base sized approximately 1½" larger than the base of the furnace.



Do not install the furnace where combustion air for the furnace is frequently heavily contaminated with compounds containing chlorine or fluorine. Common sources of such 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.



If the furnace is installed near an area which will be frequently contaminated by chlorine/fluorine compounds, 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 neighboring uncontaminated room or from outdoors. For details, see "AIR REQUIREMENTS" Section IV.



The furnace should be as centralized as is practical with respect to the air distribution system.



Provisions must be made for venting combustion products outdoors through an approved venting system as outlined in this manual. The length of flue pipe could be a limiting factor in locating the furnace. (See FLUE PIPING, Section V.)



Allow clearances from the enclosure as shown in TABLE 1 (page 5) 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.



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



This furnace produces condensate as it operates. Do not locate the furnace or its condensate drainage system in an area which will be subject to below freezing temperatures.



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



The air conditioning coil must be underneath (i.e., downstream from the heat exchanger of) the furnace.



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 IX.



Installation over a non combustible floor. Before setting the furnace over the plenum opening, insure that 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.



Installation over a combustible floor. If installation over a combustible floor becomes necessary, use an accessory sub-base as shown on page 5. Follow the instructions with the sub-base for proper installation. Do not install the furnace directly on carpeting, tile, or other

II. SPECIFICATIONS

Induced Draft Gas Furnace

Counterflow Model	BTUH		Temp. Rise Range, °F	Number of Burners	FLA (4)	Blower D x W	Blower HP	Blower Speeds	Max. CFM @ .5 ESP	Pressure Switch Setting (5)	Net Weight	Approx. Ship Weight
	Input	Output										
GCC045C30C	(1) 45,000 (2) 45,000 (3) 40,500	(1) 43,000 (2) 42,000 (3) 38,000	25-55	2	15.3	10 x 8	1/3	3	1300	-1.20 ±0.10	141	153
GCC070C30C	(1) 70,000 (2) 70,000 (3) 63,000	(1) 65,000 (2) 65,000 (3) 59,000	35-65	3	14.5	10 x 8	1/3	4	1300	-1.20 ±0.10	165	178
GCC070C40C	(1) 70,000 (2) 70,000 (3) 63,000	(1) 66,000 (2) 66,000 (3) 59,000	25-55	3	15.2	11 x 10	1/2	4	1750	-1.20 ±0.10	165	178
GCC090C40C	(1) 90,000 (2) 90,000 (3) 81,000	(1) 84,000 (2) 85,000 (3) 76,000	35-65	4	15.1	11 x 10	1/2	4	1800	-1.20 ±0.10	180	196
GCC090C50C	(1) 90,000 (2) 90,000 (3) 81,000	(1) 84,000 (2) 85,000 (3) 76,000	35-65	4	17.4	11 x 10	3/4	4	2115	-1.20 ±0.10	180	196
GCC115C50C	(1)115,000 (2)115,000 (3)103,000	(1)105,000 (2)108,000 (3) 97,000	40-70	5	17.4	11 x 10	3/4	4	2085	-0.75 ±0.07	192	210

(1) For United States installations

(2) For Canadian installation at 0-2000 ft.

(3) For Canadian installation at 0-4500 ft.

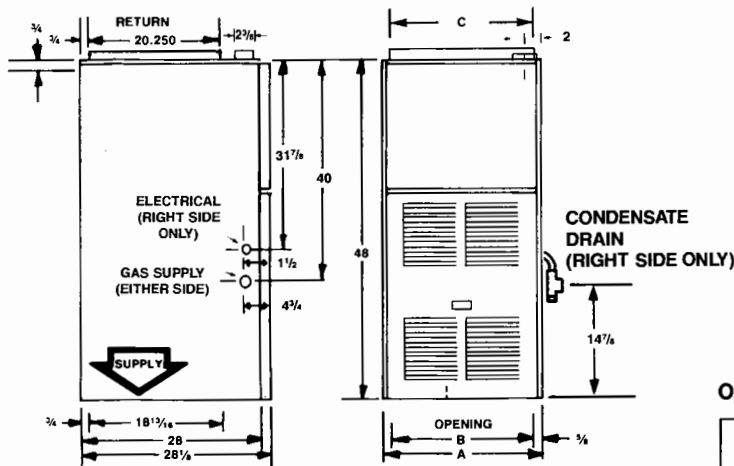
(4) Full Load Amps (FLA) Includes 5 amps drawn by ignitor during 21-second start up cycle.

(5) As shipped for installations below 4000 ft.

NOTE: Canadian output ratings are preliminary.

Flame sensor output is 1 to 4 microamps at 115 volts.

COUNTERFLOW



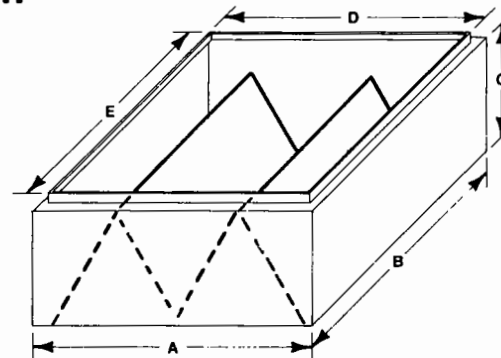
	A	B	C
GCC045	16 1/2	15 1/4	14 15/16
GCC070	20 1/2	19 1/4	18 15/16
GCC090	24 1/2	23 1/4	22 15/16
GCC115	24 1/2	23 1/4	22 15/16

Specifications subject to change without notice.



Amana GCC Series Forced Air Central Furnace Design Complies With Requirements Embodied In The American National Standard Shown Below.

ANSIZ21.47 Central Furnaces



Optional Counterflow Filter Cabinet (See pages 17, 22.)

Filter Kit Part Numbers	Used On Models	Dimensions, Inches				
		A	B	C	D	E
CFC16	GCC045	15 1/8	20 1/2	9 1/2	13 5/8	18 15/16
CFC20	GCC070C30	19 1/8	20 1/2	9 1/2	17 5/8	18 15/16
CFC24	GCC090, 115	23 1/8	20 1/2	9 1/2	21 5/8	18 15/16
CFC20D	GCC070C40	19 1/8	20 1/2	9 1/2	17 5/8	18 15/16

NOTES:

- All furnaces have a redundant gas valve and blower door inter-lock switch.
- All furnaces are manufactured for use on 120V, 60 Hertz and single phase electrical power supply.
- Important:** While the data is presented as a guide, it is very important to electrically connect the unit and properly size fuses and wires, in accordance with the National Electrical Code and/or all Existing Local Codes.
- Performance figures are based on Department of Energy information and requirements under continuous operating conditions. Performance will vary with weather conditions and use.
- Drain connections must conform to local codes.

CFM & Temperature Rise vs. External Static Pressure

Model	Motor Speed	External Static Pressure, Inches Water Column													
		0.2		0.3		0.4		0.5		0.6		0.7		0.8	
		CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise	CFM	Rise
GCC045C30C	LO	970	40	960	41	930	42	900	44	850	46	785	48	690	50
	MED	1265	31	1225	32	1175	33	1125	35	1050	36	960	38	820	40
	HI	1480	26	1425	27	1365	29	1300	30	1210	31	1110	33	955	35
GCC070C30C	LO	770	—	760	—	750	—	700	—	655	—	635	—	495	—
	MED-LO	970	63	960	63	930	—	900	—	850	—	785	—	690	—
	MED	1265	48	1230	50	1175	52	1125	54	1050	56	970	61	825	—
	HI	1480	41	1420	43	1360	45	1300	47	1215	49	1120	53	1000	59
GCC070C40C	LO	1110	—	1080	—	1050	—	1000	—	930	—	845	—	705	—
	MED-LO	1330	46	1290	47	1240	49	1200	51	1130	53	1040	—	905	—
	MED	1570	39	1530	40	1470	41	1410	43	1330	45	1230	48	1090	54
	HI	1975	31	1900	32	1825	33	1750	35	1650	36	1550	38	1480	42
GCC090C40C	LO	1210	—	1190	—	1170	—	1125	—	1070	—	1000	—	890	—
	MED-LO	1450	54	1430	55	1400	56	1350	58	1310	59	1230	63	1115	—
	MED	1690	46	1660	47	1615	49	1575	50	1510	51	1430	54	1310	59
	HI	2000	39	1940	40	1870	42	1800	44	1710	45	1610	48	1465	53
GCC090C50C	LO	1415	47	1390	48	1350	49	1300	51	1260	61	1200	64	1125	—
	MED-LO	1660	40	1625	41	1580	42	1530	44	1470	52	1390	55	1295	59
	MED	1955	—	1915	—	1850	36	1780	37	1700	45	1615	48	1490	52
	HI	2375	—	2300	—	2200	—	2115	—	2010	38	1880	41	1700	45
GCC115C50C	LO	1430	60	1400	61	1370	62	1325	64	1275	65	1200	—	1100	—
	MED-LO	1675	51	1635	52	1600	53	1550	55	1485	65	1390	—	1270	—
	MED	1960	43	1900	45	1830	47	1775	48	1700	57	1590	61	1445	67
	HI	2340	—	2260	—	2180	—	2085	41	1995	49	1860	52	1680	58

NOTE:

1. INSTALLATION IS TO BE ADJUSTED TO OBTAIN A TEMPERATURE RISE WITHIN THE RANGE SPECIFIED ON THE RATING PLATE.
2. The above chart is for information only. For satisfactory operation, external static pressure should not exceed value shown on rating plate. The shaded area indicates ranges in excess of maximum external static pressure allowable when heating.
3. The above chart is for U.S. furnaces installed at 0-2000 feet. At higher altitudes, a properly derated unit will have approximately the same temperature rise at a particular CFM, while the ESP at that CFM will be lower.
4. Filters are not included in the above table.

CLEARANCES to combustible surfaces (inches) TABLE 1

Front	6
Left	1
Right	1
Rear	0
Top	0
Flue	0
Floor	NC*

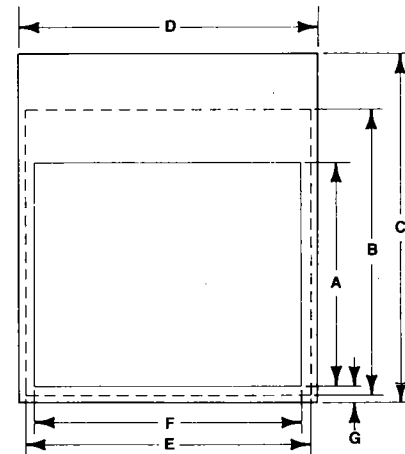
NC = Non-combustible floor

* = May be combustible (wood only) with special subbase no. CFSB 16, 20, or 24

ACCESSIBILITY CLEARANCES (MINIMUM)

36" at front is required for servicing or cleaning.

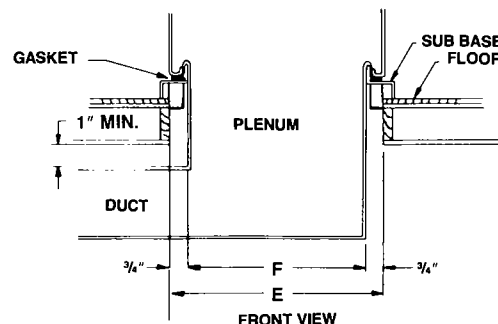
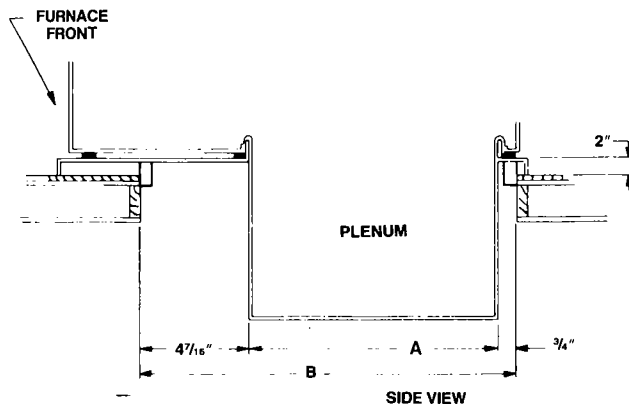
NOTE: In all cases accessibility clearance shall take precedence over clearances from the enclosure where accessibility clearances are greater.



Counterflow Subbases (see page 3.)

Subbase Part Numbers	Used On Models	Dimensions, Inches						
		A	B	C	D	E	F	G
CFSB16	GCC045	18 ⁹ / ₁₆	23 ³ / ₄	29	17 ¹ / ₂	16 ¹ / ₂	15	11 ¹ / ₃₂
CFSB20	GCC070	18 ⁹ / ₁₆	23 ³ / ₄	29	21 ¹ / ₂	20 ¹ / ₂	19	11 ¹ / ₃₂
CFSB24	GCC090, 115	18 ⁹ / ₁₆	23 ³ / ₄	29	25 ¹ / ₂	24 ¹ / ₂	23	11 ¹ / ₃₂

B x E = Floor opening A x F = Plenum size



III. GENERAL INFORMATION



WARNING

Property damage, bodily injury, or death from hazards such as fire, explosion, smoke, soot, condensation, electrical shock, or carbon monoxide may result from improper installation, repair, operation, or maintenance on this product.



WARNING

To avoid fire, property damage, and personal injury, do not install this unit in a mobile home, trailer, or recreational vehicle.

This is a counterflow type furnace for installation in a basement, closet, or utility room. To assure that your unit 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*, in Canada with the CAN/CGA-B149 Installation Codes, local plumbing or waste water codes and other applicable codes.

The nominal 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 "A.S.H.R.A.E. 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

All furnaces are securely packed in shipping containers approved by the National Safe Transit Committee. The carton should be checked upon arrival for external damage. If damage is found, a request for inspection by carrier's agent should be made in writing immediately.

The furnace should be carefully inspected upon arrival for damage and bolts or screws which may have loosened in transit. In the event of damage, the consignee should:

1. Make notation on delivery receipt of any visible damage to shipment or container.
2. Notify carrier promptly and request an inspection.
3. In case of concealed damage, carrier should be notified as soon as possible — preferably within 5 days.
4. File the claim with the following supporting documents within the 9-month statute of limitations:
 - a. Original Bill of Lading, certified copy, or indemnity bond.
 - b. Original paid freight bill or indemnity in lieu thereof.
 - c. Original invoice or certified copy thereof, showing trade and other discounts or reductions.
 - d. Copy of the inspection report issued by carrier's representative at the time damage is reported to the carrier.

The carrier is responsible for making prompt inspection of damage and for a thorough investigation of each claim. The distributor or manufacturer will not accept claims from dealers for transportation damage.

LOCATING THE THERMOSTAT

Thermostat should be mounted 4 to 5 feet above the floor, on inside wall of the living room, dining room, or a hallway that has good air circulation from the other rooms being controlled by the thermostat.

Movement of air should not be obstructed by furniture, door, draperies, etc. The thermostat should not be mounted where it will be affected by drafts, hot or cold water pipes or air ducts in walls, radiant heat from fireplace, lamps, the sun, T.V., etc. or on an outside wall. Consult the Instruction Sheet packaged with thermostat for mounting instructions.

IV. AIR REQUIREMENTS

COMBUSTION AND VENTILATION AIR



WARNING

Property damage, bodily injury or death may occur if the furnace and any 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 homes has reduced the heat loss and made these homes much tighter around doors and windows so that air infiltration is minimal. This creates a problem to supply combustion and ventilation air for gas fired or other fuel burning appliances. Any use of appliances that pull air out of the house (clothes dryers, exhaust fans, fireplaces, etc.) increases this problem and appliances could be starving for air.

In addition, these energy saving measures mean that your home will retain more water vapor and have a higher relative humidity. High humidity, especially during cold weather, may be damaging to buildings because condensation forms on windows and inside walls.

AIR REQUIREMENTS

Most homes will require that outside air be 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 or Canadian Installation Code and CANI-B149.2.

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 for 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 applied 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.

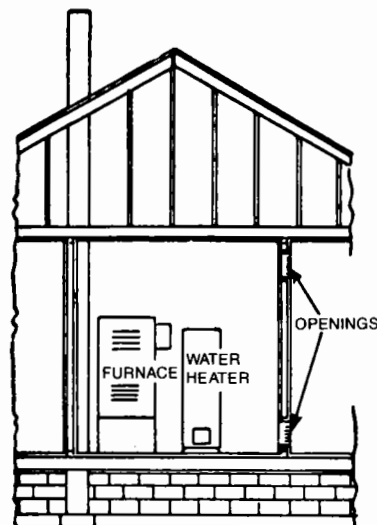
5.3.2 Equipment Located in Unconfined Spaces:

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 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. (See Figure 1.)



Note: Each opening shall have a free area of not less than one square inch per 1,000 Btu per hour of the total input rating of all equipment in the enclosure, but not less than 100 square inches.

Fig. 1 Equipment Located in Confined Spaces; All Air from inside the 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. (See Figure 2.)

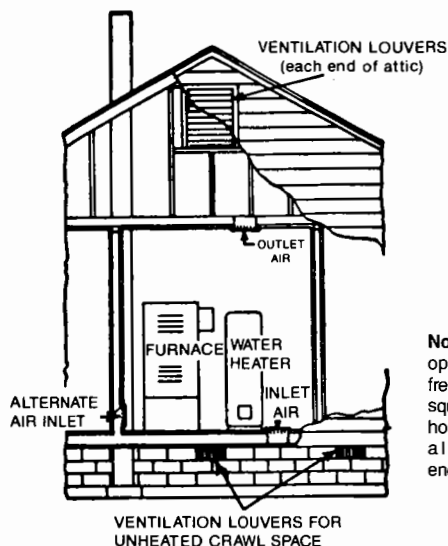


Fig. 2. Equipment Located in Confined Spaces; All Air from Outdoors — Inlet Air from Ventilated Crawl Space and Outlet Air to Ventilated Attic. See 5.3.3-b.

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.)

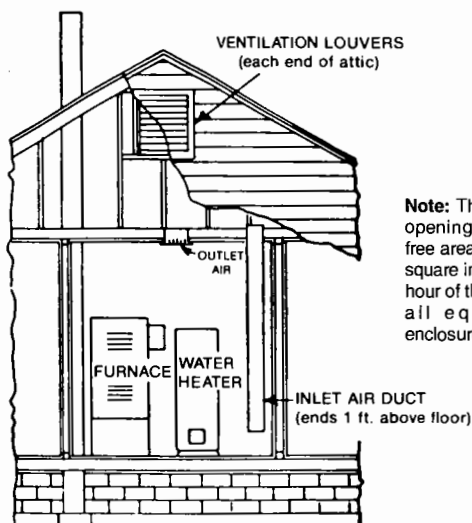
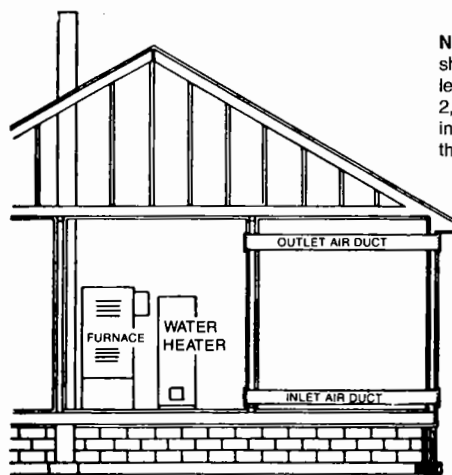


Fig. 3. Equipment Located in Confined Spaces; All Air from Outdoors Through Ventilated Attic. See 5.3.3-b.

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. (See Figure 4.)



Note: Each air duct opening shall have a free area of not less than one square inch per 2,000 Btu per hour 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.

Fig. 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 be not 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 $\frac{1}{4}$ inch mesh. If the free area through a design of louver or grille is known, it should be used in calculating the size 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.

V. FLUE PIPING



WARNING

Failure to follow these instructions can result in bodily injury or death from asphyxiation. Therefore, carefully read and follow all instructions given in this section.

In order to achieve high efficiency, the products of combustion from this furnace are cooled to the point where condensation takes place. Consequently, the venting must be done in a different manner and with different materials than with a conventional system. Two or three inch PVC Schedule 40 pipe meeting ASTM 1785, PVC primer and PVC solvent cement meeting ASTM D2564 specifications must be used. Only DWV type fittings meeting ASTM D2665 for socket dimensions and ASTM D3311 for exterior dimensions can be used.

As an alternate to PVC pipe, primer, solvent cement, and fittings; ABS materials which are in compliance with the following specifications may be used: two or three inch ABS Schedule 40 pipe must meet ASTM D1527 and must be CSA listed. Solvent cement for ABS to ABS joints must meet ASTM D2235 and must be CSA listed. The solvent cement used for the PVC to ABS joint must meet ASTM D3138. Fittings must be DWV type fittings which meet ASTM D2661 and ASTM D3311 (exterior dimensions) and are CSA listed. Carefully follow the manufacturer's instructions in cutting, cleaning and solvent cementing PVC or ABS pipe.



WARNING

Solvent cements are combustible liquids and should be kept away from all ignition sources. (i.e. sparks, open flames and excessive heat). Avoid breathing cement vapors or contact with skin and eyes.

All 90 degree elbows must be medium ($\frac{1}{4}$ bend DWV) or long radius (long sweep $\frac{1}{4}$ bend DWV) types conforming to ASTM D3311. A medium radius ($\frac{1}{4}$ bend) elbow is $3\frac{1}{16}$ " minimum from the plane of one opening to the centerline of the other opening for 2" pipe ($4\frac{9}{16}$ " for 3" pipe). These dimensions are shown in Figure 5.

This furnace must not be connected to any type B, BW, or L vent or vent connector and must not be vented into any portion of a factory built or masonry chimney, except when used as a pathway for PVC pipe as described below.

Flexible couplings for joining PVC pipe (sometimes called "no hub connectors") have been used by some installers to connect the field supplied portion of the vent system to the furnace. Amana Refrigeration, Inc. does not encourage nor recommend using these connectors. However, if you do choose to use "no-hub connectors," the connectors must be gas tight, water tight, and able to withstand continuous exposure to the warm, moist, acidic flue products of the furnace.

It is the responsibility of the installer to follow the manufacturers' recommendations and to verify that all flue pipe connectors used are compatible with the furnace flue products. In addition the connectors must possess adequate structural integrity to prevent flue pipe separations during furnace operation.

IMPORTANT

The length of the vent pipe affects the performance of the furnace and therefore must be carefully sized.

Just as with ductwork, the resistance of the flue pipe is measured in terms of equivalent feet. Equivalent feet is actual length of the pipe plus an additional three feet of pipe for a 90 degree medium radius elbow and $1\frac{1}{2}$ ft. for each 45 degree medium radius elbow. A 90 degree short radius elbow is equal to 10 feet of straight pipe. For this reason, the use of a short radius elbow should usually be avoided. **IN NO CASE SHOULD OVER 40 FT. OF ACTUAL 2" PIPE OR 52 EQUIVALENT FEET OF 2" PIPE BE USED.**

If the equivalent vent length is too long, a portion of the vent may be changed to a 3" pipe. The transition from 2" to 3" must be made in a vertical run.

A sample calculation is as follows (All elbows are medium radius):

SECTION	EQ. FT. OF 2" PIPE
Outdoor 2" elbow	3
Outdoor & through the wall pipe—2" pipe	3
2-45 degree elbows, 2"	3
4-90 degree elbows, 2"	12
36 feet 2" pipe	36
	57

This is greater than the 52 equivalent feet which is allowed. 3" pipe has only $\frac{1}{3}$ the pressure drop of 2" pipe. Changing a portion of the piping to 3" will change the pressure drop as follows:

SECTION	EQ. FT. OF 2" PIPE
Outdoor 3" elbow	1
Outdoor & through the wall pipe—3" pipe	1
2-45 degree elbows, 3"	1
4-90 degree elbows, 3"	4
33 feet of 3" pipe	11
3 feet of 2" pipe	3
	21

This is less than 52 equivalent feet of 2" pipe, so this will be satisfactory.

When the vent pipe goes through an outside wall, the vent must terminate at least one foot outside to keep moist combustion products away from the structure. The vent termination must be at least three feet above any forced air inlet located within ten feet. It must be at least four feet below, four feet horizontally from or one foot above any door, window, or gravity air inlet into any building. The vent must terminate at least one foot above ground level. If heavy snow is expected

locally, this distance may need to be increased. The vent shall not terminate over public walkways, or over an area where condensate or vapor could create a nuisance or hazard or could be detrimental to the operation of regulators, relief valves, or other equipment. Drill a $2\frac{3}{8}$ " diameter hole through the wall. Cut a piece of PVC (ABS) pipe that is the thickness of the wall plus the depth of the sockets of the fittings to be installed on the inside and outside of the walls. To prevent the vent pipe from moving and possibly damaging connections, locate the fitting on the inside wall and a coupling on the outside wall as shown in Fig. 5. To prevent condensate from freezing inside the PVC flue pipe in extremely cold conditions or in long outdoor runs, insulation may be required on the outside of the PVC pipe. Use $\frac{1}{2}$ " thickness closed cell foam insulation such as Armaflex or Insultube.

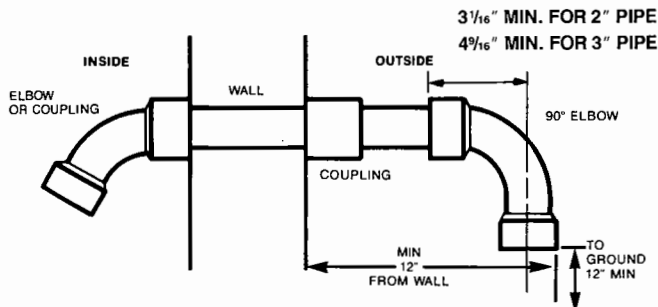


Fig. 5

In a basement installation, the vent pipe may be run between the joist spaces. If the vent must go below the joists, then the pipe must run up into the last joist space to go through the header. Two 45° elbows should be used rather than 90°'s. The horizontal run must not have any sag that can hold condensate and should pitch up at least $\frac{1}{4}$ " per foot so that condensate will run back to the unit to drain. Support the horizontal run at least every three feet. Allow for some expansion and contraction from temperature fluctuations. The normal direction changes usually account for this, but if you have a long run followed by a short offset of less than 40 inches such as going up into the last joist space, the pipe should be tightly clamped to prevent flex loading on the fittings. Seal around the pipe on the outside wall with silicone caulking material.

If the vent is to be run vertically through the roof, it must extend at least 12 inches above the roof line and shall be at least 12 inches from any vertical wall. If heavy snow is expected to remain on the roof, these distances may need to be increased. The vent must be made tight where it penetrates the roof with a proper flashing such as used with a plastic plumbing vent. The vent may be run through an existing **unused** chimney; however, the pipe must be used all the way through to above the top of the existing chimney. The space between the vent pipe and the chimney must be closed with a weather tight, corrosion resistant flashing. **NEVER VENT WITH AN EXISTING APPLIANCE OR VENT USED BY A SOLID FUEL APPLIANCE.**

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 and determine there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.
- Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
- Follow the lighting instructions. Place the appliance 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.

If 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.



WARNING

Upon completion of the furnace installation, carefully inspect the entire flue system both inside and outside the furnace to assure it is properly sealed. Leaks in the flue system can result in serious personal injury or death due to exposure of flue products, including carbon monoxide.

ADDITIONAL CANADIAN VENTING REQUIREMENTS

In Canada venting shall conform to the requirements of the current CANI-B149 Installation Codes.

Use only C.S.A. listed 2" or 3" nominal diameter PVC or ABS pipe and fittings throughout.

The Minimum vent consists of 3 feet of straight pipe with 2 elbows (9 equivalent feet).

A single wall vent shall not be run vertically through the roof. Although, the vent may be run through an existing *unused* chimney as described in the previous venting section provided the space between the vent pipe and the chimney is insulated and closed with a weather tight, corrosion resistant flashing.

Cut all vent pipe at right angles. Remove inside and outside burr at each cut. Use cleaner to clean pipe and fitting socket. Use CSA listed cement to fasten pipe and fittings.

Follow manufacturers cleaning and cementing instructions carefully to avoid leakage.

NOTE: ALL PIPING EXPOSED OUTDOORS OR IN UNHEATED AREAS MUST BE INSULATED WITH 1/2" THICK CLOSED CELL FOAM INSULATION SUCH AS "ARMAFLEX" OR "INSULTUBE."

The vent terminal shall NOT be located:

1. Less than 12" above the finished grade line.
2. Less than 36" from any building opening or any gas service regulator. (In the Province of Ontario 72")
3. Less than 72" from the combustion air inlet of another appliance.
4. Directly above a gas utility meter or service regulator.
5. Over a walkway unless 84" above grade.

VI. CONDENSATE PIPING

CONDENSATE DRAIN

The Air Command 90 achieves its high efficiency by condensing some of the flue products into a slightly acidic water which must be piped to a drain. A standpipe which is shipped with the furnace must be installed on the right side of the furnace cabinet (Figure 6). The condensate from the recuperative coil and the induced draft blower flows into this standpipe which acts as a trap. No other trap may be used. To install the standpipe and drain line, proceed as follows:

1. Place the condensate drain tubes located on the right side of the furnace into the open top of the standpipe assembly.
2. Slide the metal clamp as far to the top of the standpipe as possible.
3. Attach the standpipe to the furnace, using the screw provided.
4. A 1/2" field-provided PVC (or CPVC) drain line must be attached to the side of the standpipe at the horizontal drain connection. The standpipe can be rotated to match the floor drain location. PVC (or CPVC) pipe is recommended because it is corrosion resistant, rigid, and not easily damaged.
5. The drain line must maintain a horizontal downward slope from the furnace to the floor drain in accordance with good plumbing practice. The drain line must not be routed outdoors or into an area where it could freeze. **DO NOT TRAP THIS LINE.**
6. The top of the standpipe must be left open so that any blockage in the drain line will be released out the top of the standpipe and not back up into the furnace.
7. Pour water into the standpipe assembly. Visually confirm that the condensate is draining properly and that the drain line does not leak.

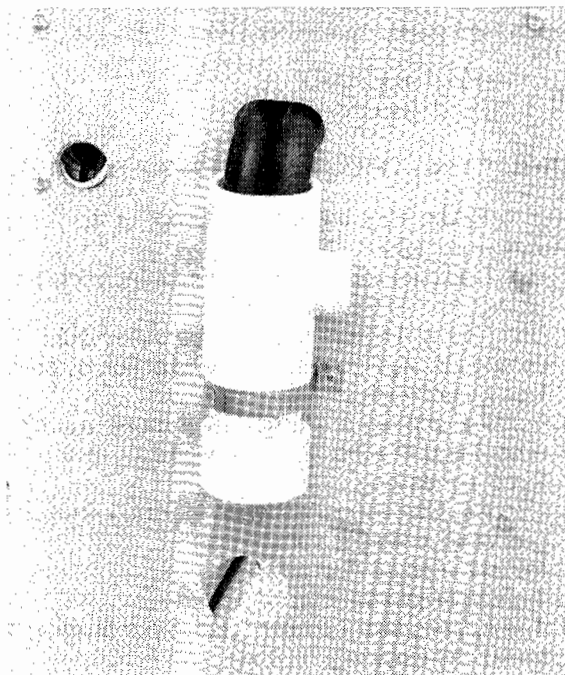


Fig. 6 Standpipe Assembly

VII. 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", MAX. 10.0"
PROPANE	MIN. 11.0", MAX. 14.0"

Inlet Gas Pressure Must Not Exceed the Maximum Value Shown in Table Above.

The minimum supply pressure must not be varied downward because this could decrease the heating capacity of the furnace. In addition, gas input to the burners must not exceed the rated input shown on the rating plate.

HIGH ALTITUDE DERATE (U.S. Installations Only)

When this furnace is installed at altitudes above 2,000 feet the furnace input must be derated 4% for each 1,000 feet above sea level because the density of the air is reduced.

In some areas the gas supplier will derate the gas at a rate of 4% for each 1,000 feet above sea level. If he does not do so, smaller orifices will be required at altitudes above 3,500 feet (non-derated natural gas) or 4,500 feet (non-derated propane).

A different pressure switch is required at altitudes more than 4,000 feet above sea level. This is required regardless of the heat content of the fuel used.

High altitude kits can be purchased depending upon the altitude and the usage of propane or natural gas. Refer to the high altitude instruction manual included with this furnace to determine which high altitude components to use and also for detailed installation instructions.

Adjustment of the manifold pressure to a lower pressure reading than what is specified on the furnace nameplate is not a proper derate procedure. With a lower density of air and a lower manifold pressure at the burner orifice, the orifice will not aspirate the proper amount of air into the burner. This can cause incomplete combustion of the gas, flashback, and possible yellow tipping.

GAS PIPING



CAUTION

To avoid possible unsatisfactory operation or equipment damage due to underfiring of equipment, do not undersize the natural gas/propane piping from the meter/tank to the furnace. When sizing a trunk line per the tables, include all appliances on that line that could be operated simultaneously.

The gas pipe supplying the furnace must be properly sized based on the cubic feet per hour of 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 or CAN/COA B149 Installation Codes.

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	1,050	1,600
20	92	190	350	730	1,100
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

(Press. .5 Psig or less and Pressure Drop of 0.3" W.C.; Based on 0.60 Specific Gravity Gas)

$$CFH = \frac{BTUH \text{ FURNACE INPUT}}{\text{CALORIFIC VALUE OF GAS}}$$

CONNECTING THE GAS PIPING - NATURAL GAS

Refer to Figure 7 for the general layout of 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.
6. Install a manual shut-off valve.
7. Tighten all joints securely.
8. The furnace shall be connected to the building piping by one of the following:
 - a. Rigid metallic pipe and fittings.
 - b. Semirigid metallic tubing and metallic fittings. Aluminum alloy tubing shall not be used in exterior locations.
 - c. Listed gas appliance connectors used in accordance with the terms of their listing that are completely in the same room as the equipment.
 - d. In "b" and "c" above, the connector or tubing shall be installed so as to be protected against physical and thermal damage. Aluminum-alloy tubing and connectors shall be coated to protect against external corrosion where they are in contact with masonry, plaster or insulation or are subject to repeated wettings by such liquids as water (except rain water), detergents or sewage.

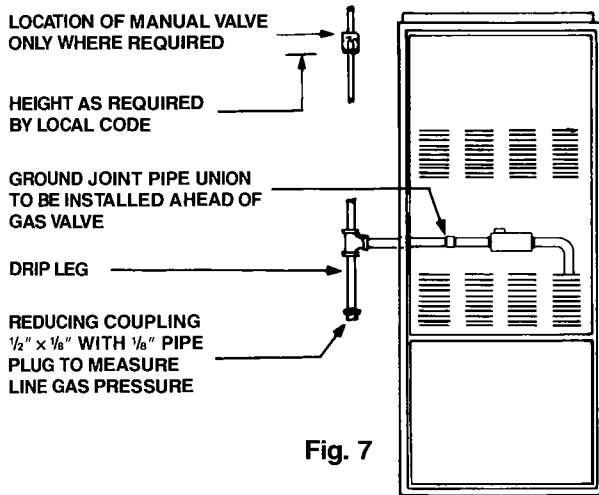


Fig. 7

CHECKING THE GAS PIPING



CAUTION

To avoid the possibility of property damage, personal injury or fire, the following instructions must be performed regarding gas connections, pressure testing, location of shut-off valve and installation of gas piping.



The unit and its gas connections must be leak tested before placing in operation. Because of the danger 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 which may result in heat exchanger failure.



This unit and its individual shut-off valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of $\frac{1}{2}$ psig (3.48 kPa).



This unit must be isolated from the gas supply system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than $\frac{1}{2}$ psig (3.48 kPa).



The shut off valve should be located in a convenient location (within (6) six feet of unit) between the meter and the unit. Proper sizing of gas piping depends on the cubic feet per hour of gas flow required, specific gravity of the gas and the length of the run. Lay out the piping plan and refer to the National Fuel Gas code manual to obtain the correct pipe sizing for each branch run, etc.

TANKS AND PIPING — PROPANE UNITS



WARNING PERSONAL INJURY HAZARD

Iron oxide (rust) can reduce the level of odorant in propane gas. A gas detecting device is the only reliable method to detect a propane gas leak. Contact your local propane supplier about installing a gas detecting warning device to alert you in the event that a gas leak should develop.

Failure to detect a propane gas leak could result in an **EXPLOSION** or **FIRE** which could cause **SERIOUS PERSONAL INJURY OR DEATH**.

All propane gas equipment must conform to the safety standards of the National Board of Fire Underwriters (See NBFU Manual 58) or Natural Standards of Canada B149.2, Installation Code for Propane Gas Burning Appliances and Equipment.

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

1. Vaporization rate, which depends on (a) temperature of the liquid, and (b) "wetted surface" area of the container or containers.
2. Proper pressure regulation. (Two-stage regulation is recommended from the standpoint of both cost and efficiency.)
3. Pressure drop in lines between regulators, and between second stage regulator and the appliance. Pipe size required 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.

Propane is an excellent solvent, and special pipe dope must be used when assembling piping for this gas as it will quickly dissolve white lead or most standard commercial compounds. Shellac base compounds resistant to the actions of liquified petroleum gases such as Gasolac, Stalactic, Clyde's or John Crane are satisfactory.

Refer to Fig. 8 for typical propane gas installations.



WARNING

If your propane gas furnace is installed in a basement, an excavated area or a confined space, we strongly recommend that you contact your propane supplier about installing a warning device that would alert you to a gas leak.

...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.

An undetected gas leak would create a danger of explosion or fire. If you suspect the presence of gas, follow the instructions on the cover of this manual. Failure to do so could result in **SERIOUS PERSONAL INJURY OR DEATH.**

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/HR

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 1/2"	2"	2 1/2"	3"	3 1/2"	4"
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	1,086	
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

TYPICAL PROPANE PIPING

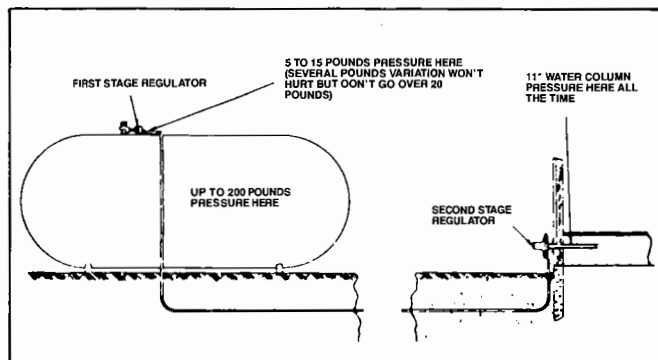


Fig. 8
PROPANE PIPING CHARTS

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/HR

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 1/2"	2"
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

VIII. ELECTRICAL WIRING

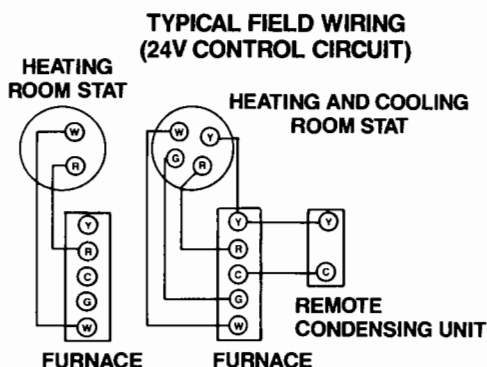


WARNING

To avoid electrical shock, injury or death, disconnect electrical power before changing any electrical wiring.

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

Power supply to the furnace must be N.E.C. 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, or in Canada, Canadian Electrical Code, C22.1 Part I. A fused disconnect should be provided and sized in accordance with the unit minimum circuit ampacity.



A 40VA transformer and auxiliary fan relay are built into the furnace so that it may be used with most cooling equipment.



CAUTION

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

The ground wire should run from the furnace all the way back to the electrical panel. If desired, a qualified servicer can confirm proper grounding as follows: 1) Disconnect the electrical power. 2) Using an ohmmeter, measure the resistance between the neutral (white) connection and one of the burners. 3) Resistance should be 10 ohms or less.

Line voltage wiring must enter through the right side of the furnace. Connect hot, neutral, and ground wires as shown in the wiring diagram located on the blower door of the unit. See Figure 9.

Low voltage wiring may enter through the right or left side of the furnace. The holes for this are near the holes provided for gas piping. Run the thermostat wires through either hole, up through a grommet in the blower deck, and through a hole provided in the ignition control box. (Top or right side.) See Figure 10.

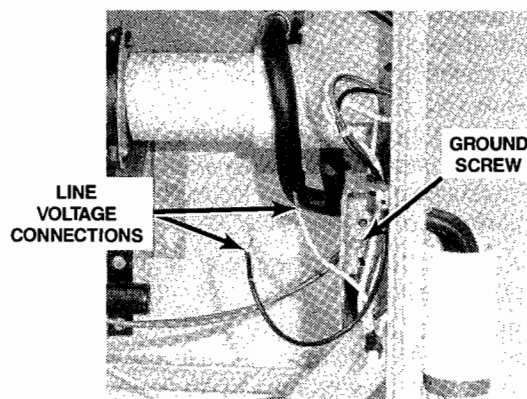


Fig. 9. Field Wiring Connections. (Line Voltage)
(Shown with junction box cover removed for clarity only)

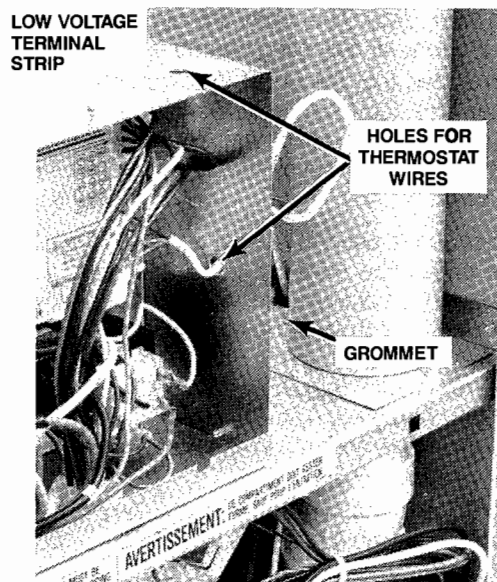


Fig. 10. Field Wiring Connections. (Low Voltage)
(Shown with control box cover removed for clarity only)

A 40VA transformer and auxiliary fan relay are built into the furnace so that it may be used with most cooling equipment.

Consult the wiring diagram for both 115V and 24V wiring details. The diagram is located inside of the blower compartment door and in Section XIV of this manual.

HEAT ANTICIPATOR SETTING

The heat anticipator in the room thermostat must be correctly adjusted to obtain the proper number of heating cycles per hour and to prevent the room temperature from "overshooting" the room thermostat setting. Heat anticipator must be set at 0.7 amps.

IX. CIRCULATING AIR AND FILTERS

DUCTWORK—AIR FLOW

Duct systems and register sizes must be properly designed for the C.F.M. 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 should 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.

The return air duct must be connected to the opening provided on the top of the furnace.

It is a must that a closed return duct system be used, with the return duct connected to the furnace. Supply and return duct connections to the unit may be made with flexible joints to reduce noise transmission. If a central return is used, a connecting duct must be installed between the unit and the utility room wall so that the furnace blower will not interfere with combustion air or draft. The room, closet or alcove must not be used as a return air collecting chamber.

It is recommended that the outlet duct be provided with an access panel. This access should be large enough to inspect the air chamber below the heat exchanger for any smoke or combustion gas leaks. A cover should be attached tightly to prevent air leaks.

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

FILTERS—READ THIS SECTION BEFORE INSTALLING THE RETURN AIR DUCTWORK

Filters must be used with the furnace. If possible, discuss filter maintenance with the building owner before leaving the job.

A filter rack and two filters are shipped with the furnace for field installation. If you desire to use these filters and rack, proceed as follows:

1. Install the filter rack by centering it over the plenum flange and pushing down firmly. (See Figure 11A.) Do not screw into place yet, as the return air plenum will need to be attached.



Fig. 11A
Furnace-mounted Filter Rack

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 below. See Figure 11B.

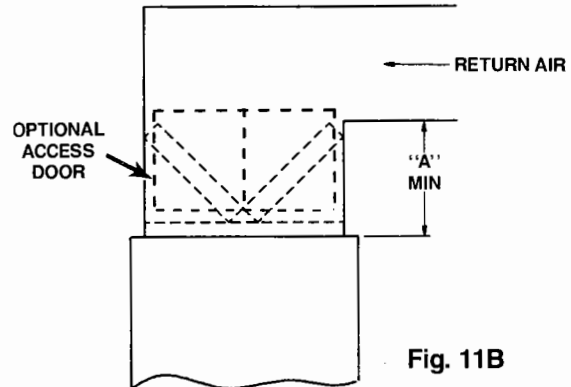


Fig. 11B

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



CAUTION

To avoid personal injury, use only blunt pointed screws to attach the plenum to the furnace and filter rack. Do not locate screws where they could interfere with filter replacement.

FURNACE MODEL	DIMENSION "A"	FILTER (QTY.), SIZE, TYPE
GCC045C30C	13	2—14 × 20 × 1 — Disposable
GCC070C30C	11¾	2—14 × 20 × 1 — Disposable
GCC070C40C	13	2—15 × 20 × 1 — Permanent
GCC090C40C	11¼	2—15 × 20 × 1 — Permanent
GCC090C50C	11¼	2—15 × 20 × 1 — Permanent
GCC115C50C	11¼	2—15 × 20 × 1 — Permanent

3. To install 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 fits into the filter rack and the upper edge rests against the side of the plenum. Then repeat with the left filter. See Figure 11B.
4. When the GCC045-C or GCC070C30C need replacement filters, use the same size and quantity of disposable filters as listed above, or use permanent filters sized per their manufacturer's recommendations. (**Note:** To properly cover the furnace plenum and fit into the filter rack, filters must be 20 inches long and 1 inch thick.)

OTHER FILTER OPTIONS — If preferred, external filter grilles may be used in place of the filters discussed above. If this is done, refer to the following chart for minimum filter sizes for each furnace which will be operated at high speed, either heating or cooling. Permanent filters should be sized based upon manufacturer's recommendations. Disposable filters should be sized based upon a face velocity of 300 feet per minute or less.

FURNACE MODEL	HIGH-VELOCITY PERMANENT TYPE	DISPOSABLE TYPE
GCC045C30C	1—16 x 25 x 1 or 1—20 x 20 x 1	2—16 x 20 x 1
GCC070C30C	1—16 x 25 x 1 or 1—20 x 20 x 1	2—16 x 20 x 1
GCC070C40C	1—20 x 25 x 1	2—20 x 20 x 1
GCC090C40C	1—20 x 25 x 1	2—20 x 20 x 1
GCC090C50C	1—20 x 25 x 1	2—20 x 25 x 1
GCC115C50C	1—20 x 25 x 1	2—20 x 25 x 1

As another alternative, an optional filter cabinet is available using a semi-permanent filter. This filter cabinet may be installed in the return air duct as shown below. (Fig. 11C) For dimensions and part numbers, see page 4.

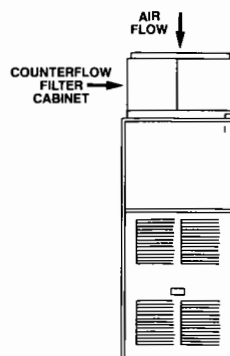


Fig. 11C

X. SEQUENCE OF OPERATION

NORMAL SEQUENCE

1. Thermostat calls for heat.
2. The vent blower is energized.
3. The ignitor is energized and is allowed to preheat for 17 seconds.
4. The gas valve is energized, delivering gas to the burners and starting combustion.
5. Seven seconds after the gas valve is energized, the control starts checking the signal from the flame sensor. Gas will only continue to flow if a signal is present.
6. The control waits 30 seconds and turns on the air circulation blower to the speed that was selected for heating operation.
7. The thermostat is satisfied and opens.
8. The control de-energizes the gas valve.
9. There is a 15 second delay while flue products are purged from the furnace heat exchanger. Following this, the vent blower motor is de-energized.
10. There is another 75 second delay to allow heat in the heat exchanger to be transferred to the conditioned space. Following this, the air circulation blower will stop.

ABNORMAL OPERATION

1. **Internal Control Failure with White-Rodgers Control**
If the control determines it has an internal fault, it enters a locked-out state and the diagnostic light will **light continuously**, with no flashes. The control should be replaced.
2. **System Lockout**
If a flame is not sensed during the first 7 seconds after the gas valve is energized, the control turns off the gas. There will then be a 50 second delay while the combustion blower is energized to purge the heat exchanger. The ignitor will next be energized and preheated for 27 seconds. The gas valve will then be energized. If flame is not sensed in 7 seconds the gas valve will be de-energized and another purge will occur. The control will cycle the gas

valve a total of three tries before it determines it cannot establish measurable combustion and enters a locked out state. If flame is sensed but lost after 10 seconds, the control will recycle this series of three tries four more times before locking out. The diagnostic light will indicate this condition with **one short flash** followed by a longer pause. The control can be reset and brought out of lockout mode by turning the thermostat off and then back on.

3. Pressure Switch Stuck Closed

If the control senses the pressure switch is closed when the vent blower is off, it waits until the fault is corrected. The light code for this problem is **two short flashes** followed by a longer pause. The probable cause is a faulty pressure switch or wiring.

4. Pressure Switch Stuck Open

If, after the vent blower is energized, the pressure switch does not close, 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. The probable cause is either a disconnected hose to the pressure switch, faulty pressure switch or wiring, or restricted flue piping.

5. Open Limit Control

If the limit control opens, the air circulation and vent blower will be turned on until the limit closes. The diagnostic light code for this is **four short flashes** followed by a pause. The probable cause is either: low conditioned air flow due to dirty filter or resistance in duct work, faulty limit, faulty blower, or blower speed set too low.

6. Missing Jumper Wire

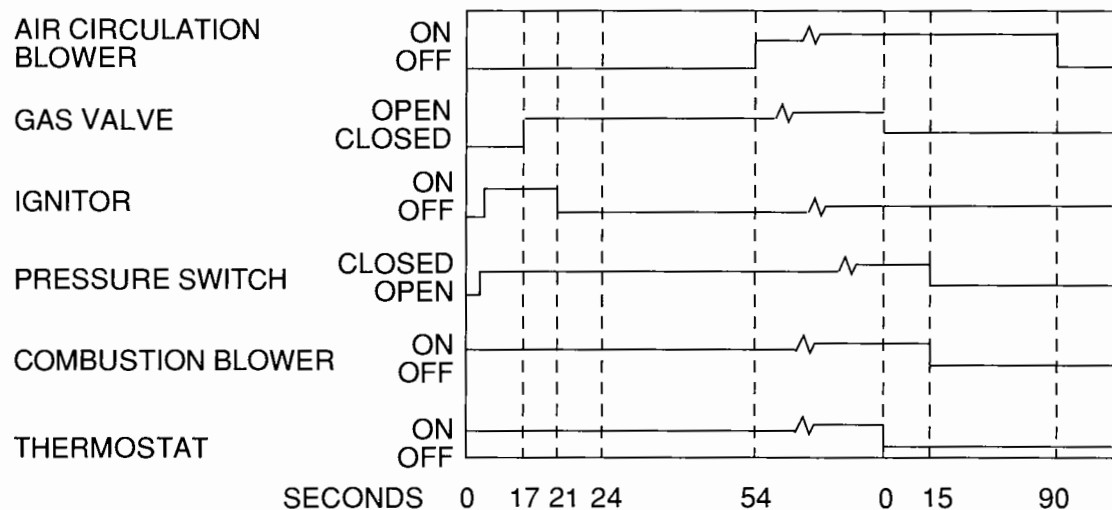
If the jumper between R01 and R02 is not present, the air circulation blower and vent blower will be energized all the time. The diagnostic light code for this is **five flashes** followed by a pause. The probable cause is a missing jumper.

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 vent blower continuously. The diagnostic light code for this is **continuous light flashing**. Probable cause is miswiring.

X. SEQUENCE OF OPERATION (cont.)

TIMING CHART FOR NORMAL WHITE - RODGERS 50A50 OPERATION



WHITE RODGERS 50A50 CONTROL DIAGNOSTIC LIGHT SIGNAL MEANINGS

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. Missing Jumper Wire on control connector
Continuous Flashing	7. Flame Sensed No Call For heat

Thermostat ON

Gas Valve Opens

Ignitor OFF

End of trial for ignition.
Gas valve would close
if flame is not proven.

Air Blower ON

Thermostat OFF

Combustion products
purge ends.

Air Blower OFF

XI. START-UP AND ADJUSTMENT

GENERAL OPERATION

This furnace is equipped with an electronic ignition device which lights the burners. It also has a power vent blower to exhaust combustion products.

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

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

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.

HEAT ANTICIPATOR SETTING

The heat anticipator in the room thermostat must be correctly adjusted to obtain the proper number of heating cycles per hour and to prevent the room temperature from "overshooting" the room thermostat setting. Heat anticipator must be set at 0.7 amps.

ROLL-OUT PROTECTION CONTROL

If the flames from the burners are not properly drawn into the heat exchanger, a protection device will open causing the furnace to shut off. The protection device is located on the manifold assembly. (See Fig. 12)

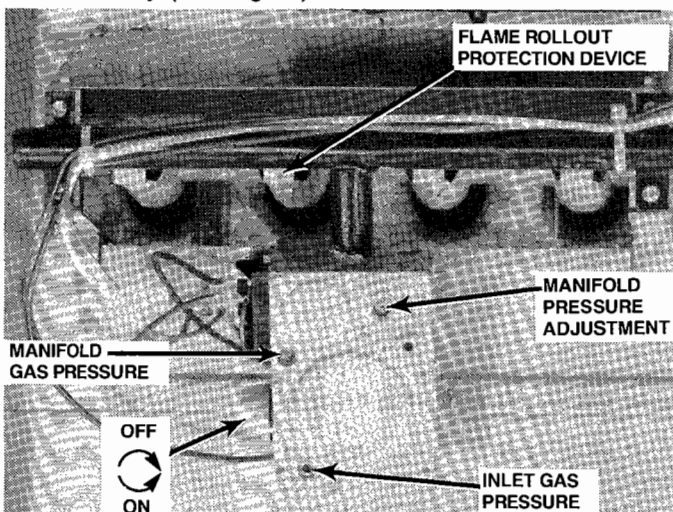


Fig. 12. Gas Valve and Roll-Out Protection Device



CAUTION

The cause must be investigated by a qualified servicer before any attempt is made to engage the manual reset device and turn the furnace back on.

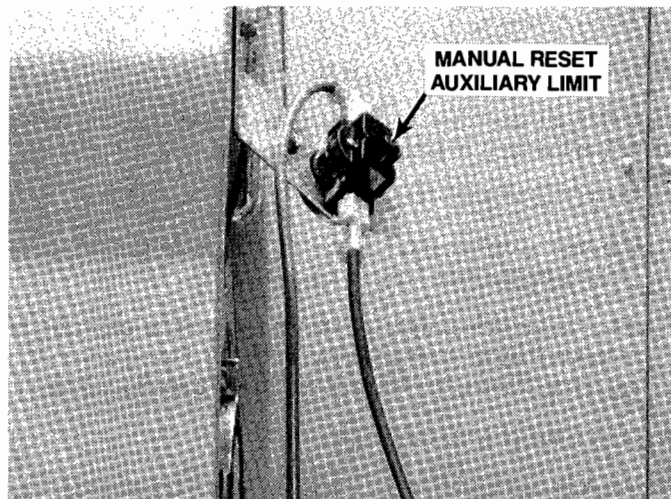


Fig. 13. Auxiliary Limit

AUXILIARY LIMIT CONTROL

On counterflow furnaces, a second limit control is placed on the side of the blower scroll (Remove furnace top door for access). This control is in addition to the main limit control and shuts the furnace off in case of a blower failure. **This is a manual reset limit, reset only once.** If unit goes off on limit again, the reason which caused the control to open must be determined and corrected by a qualified servicer.

RESET AFTER LOCK-OUT

Should ignition not be achieved after three tries for any reason it will be necessary to reset the electronic ignition module. To reset it is only necessary to turn the thermostat below room temperature for thirty seconds and then reset it to the desired temperature. The furnace may also be reset after lockout by disengaging the electric disconnect switch to the furnace for thirty seconds.

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.
5. This furnace is equipped with an ignition device which automatically lights the burner. Do not try to light burner by hand.
6. Turn the gas control valve knob clockwise  to "OFF" position. Do not force. See Fig. 12.
7. Wait five (5) minutes to clear out any gas. Then, smell for gas including near the ground.
8. If you have waited five (5) minutes and smell gas, immediately follow the instructions on the cover of this manual. If you have waited five (5) minutes and do not smell gas, turn the gas valve knob counter clockwise  to the "ON" position. See Fig. 12.
9. Replace the door on the front of the furnace.
10. Open the manual gas valve external to the furnace.
11. Turn on the electrical power supply to the furnace.
12. Set thermostat to desired setting.

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

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. Connect a water manometer or adequate gauge to the "inlet gas pressure" tap of the gas valve. (See Fig. 12.)

As an alternative method, inlet gas pressure can also be measured by removing the cap from the dripleg and installing a predrilled cap with a hose fitting. (See Fig. 13B.)

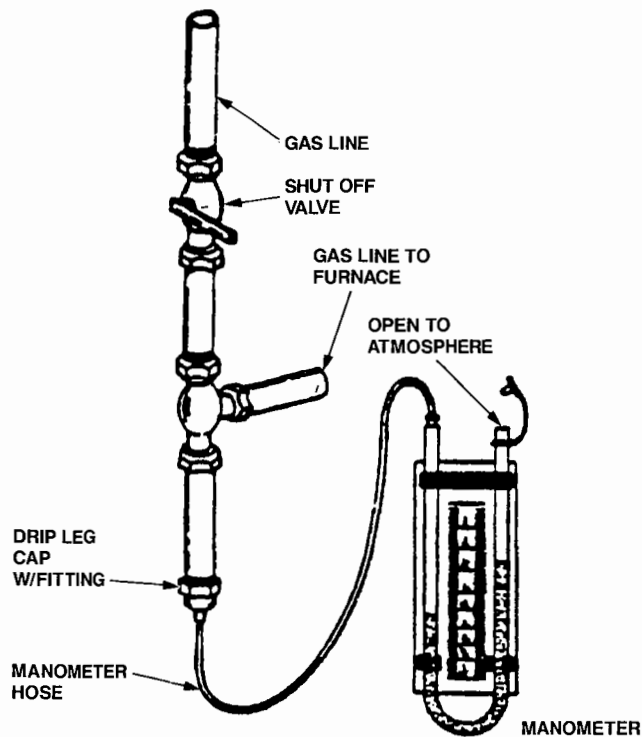
WITH POWER AND GAS ON:

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

INLET GAS PRESSURE	
NATURAL	MIN. 5.0", MAX. 10.0"
PROPANE	MIN. 11.0", MAX. 14.0"

Inlet Gas Pressure Must Not Exceed the Maximum Value Shown in Table Above.

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



**MEASURING INLET GAS PRESSURE
(ALTERNATE METHOD)
Fig. 13B**

CHECK THE MANIFOLD PRESSURE

A tapped opening is provided in the gas valve to facilitate measurement of the manifold pressure. A "U Tube" manometer having a scale range from 0 to 12 inches of water should be used for this measurement. The manifold pressure must be measured with the 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. In no case should the final manifold pressure vary more than plus or minus 0.3 inches water column from the specified pressure. Any major changes in flow should be made by changing the size of the burner orifice.

CHECK THE GAS INPUT

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. $\text{INPUT} = \text{GAS HTG VALUE} \times 3600 \div \text{SEC. PER CUBIC FOOT}$

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:

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

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

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

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

CHECK MAIN BURNER FLAME

Flames should be stable, soft and blue, (dust may cause orange tips but they must not be yellow). They should extend directly outward from the burner without curling, floating or lifting off. (Fig. 14)

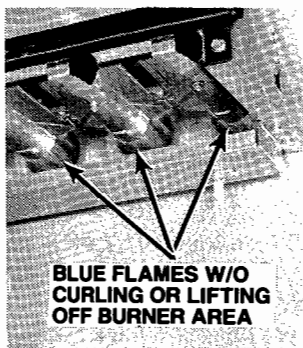


Fig. 14. Burner Flame.

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. Thermometers must not be able to "see" the furnace's 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.

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

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

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

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

CHANGING BLOWER SPEEDS



WARNING

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

A multi-speed motor is used in the furnace blower. It provides easy speed selection for both heating and cooling air flow. Page 5 shows the CFM and E.S.P. relationship for proper selection of heating and cooling speeds.

Refer to the WIRING DIAGRAM on the furnace to connect the correct motor leads to the correct control terminals. All unused motor leads that are not connected to "park" terminals on the control must be taped.

CHECK LIMIT AND FAN CONTROL



WARNING

To avoid premature failure of heat exchanger or possible property damage, injury or fire, do not adjust the limit control, which is factory preset.

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

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

Adjust the thermostat setting below room temperature.

1. Main burners must go off.
2. Circulating Air Blower will continue to run for 90 seconds.



CAUTION

This unit should 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.

TO TURN OFF FURNACE

1. Set the thermostat to its lowest setting.
2. Turn off the electrical power supply to the furnace.
3. Turn the gas control clockwise  to "OFF" position. Do not force. See Fig. 12.
4. Close manual gas shutoff valve external to the furnace.
5. Replace the door on the unit.

XII. MAINTENANCE



WARNING

To avoid electrical shock, injury or death, disconnect electrical power before performing any maintenance.

Have the furnace checked at least once every year, before the heating season begins, to be sure that there is adequate combustion air and that 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 leaking sections of vent pipe.

AIR FILTER



WARNING

Never operate furnace without a filter installed as dust and lint will build up on internal parts resulting in loss of efficiency, equipment damage and possible fire.

In this manual, we will discuss the furnace-mounted filter rack which is shipped with the furnace, and the optional counterflow-filter cabinet.

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 blower door from the furnace by turning the two latches $\frac{1}{4}$ turn, and lifting the door off.
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. See Figure 15A.

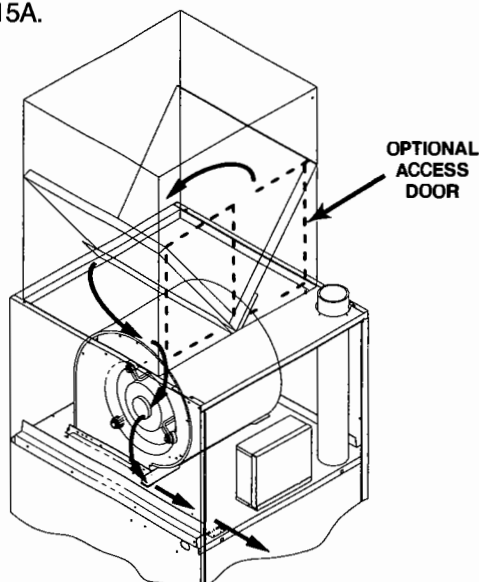


Fig. 15A
Furnace-Mounted Filter Rack

4. The **GCC045C30C** and **GCC070C30C** furnaces include two disposable filters. If dirty, these filters must be thrown away and replaced with two new $14 \times 20 \times 1$ disposable filters.
5. The **GCC070C40C**, **GCC090C40C**, **GCC090C50C**, and **GCC115C50C** furnaces include two permanent filters of $15 \times 20 \times 1$. If dirty but not torn, these 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 $15 \times 20 \times 1$ permanent, high velocity filters. Throwaway filters must not be used. Under normal use, these permanent filters should last for several years.

6. 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. See Figure 15A.
7. Replace the blower door, then reconnect the electrical power.

The **optional counterflow filter cabinet** is designed for heating and/or cooling applications. Filter is of the washable type. After filter is dry it should be sprayed with an adhesive for best efficiency. (Type may be shown on the filter frame.)

The filter should be inspected, cleaned or changed every two months or as required.

Remember that dirty filters are the most common cause of inadequate heating or cooling performance.

Remove filter as follows:

1. Remove two front access doors by turning the two quarter turn plastic fasteners that secure the doors to the filter cabinet. (See Figure 15B.)
2. To remove filter for cleaning, fold the filter sections flat and slide out past flue pipe.
3. Insert filter through the cabinet front with front and back edges resting on filter support channels. Stretch filter out to cover furnace discharge completely to each side.
4. Install two front access panels using plastic quarter turn fasteners to secure doors.

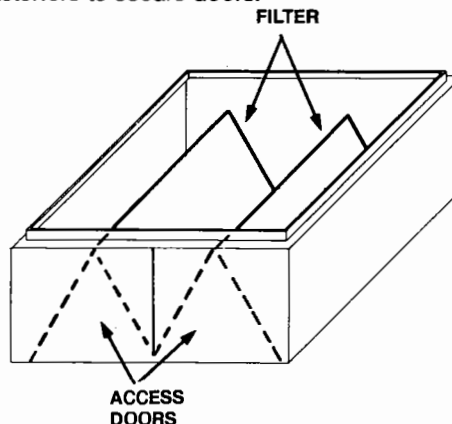


Fig. 15B. Filter Cabinet

BLOWER MOTOR (QUALIFIED SERVICER ONLY)

If desired, the blower motor may be oiled by adding 4 to 6 drops of SAE #20 oil to each oil port, once a year. **TO AVOID PREMATURE MOTOR FAILURE, DO NOT OVER OIL.**

(NOTE: Some blower motors which are permanently lubricated do not have oil ports. Oil cannot be added to these motors.)

VENT BLOWER MOTOR (QUALIFIED SERVICER ONLY)

The vent blower motor may be oiled annually with 6 drops of Anderoil 465 oil. (3 drops in each oil port. See Figure 16.)

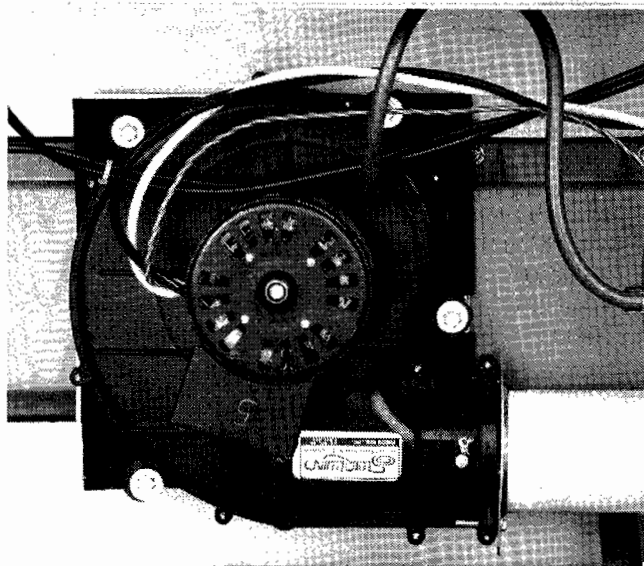


Fig. 16. Vent Blower Motor.



CAUTION

If you must handle the ignitor, handle 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.

CLEANING FLUE PASSAGES (QUALIFIED SERVICER ONLY)

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

1. Turn off electrical power and the gas supply to the furnace.
2. Remove the burner assembly by disconnecting the gas line and removing the manifold brackets from the partition panel.
3. Remove the collector box insulation and then remove the collector box from the partition panel.
4. Disconnect the PVC vent from the induced draft blower so that the blower can be removed from the recuperator coil cover.
5. Remove the recuperator coil cover and remove the turbulators from the recuperator coil tubes.

6. The recuperator coil tubes can now be cleaned using a long handled round wire brush, such as a gun cleaning brush.
7. 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. Repeat for each tube.
8. When all heat exchanger tubes have been cleaned and the residue removed with a vacuum, replace all the parts in the reverse order in which they were removed.
9. To reduce the chances of repeated fouling of the heat exchanger, perform the checks listed in "Start-up and Adjustment," Section XI.

BURNERS



WARNING

Electrical components are contained in both compartments. To avoid electrical shock, injury or death, do not remove any internal compartment covers or attempt any adjustment. Contact a qualified servicer 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. (See Figure 14.)

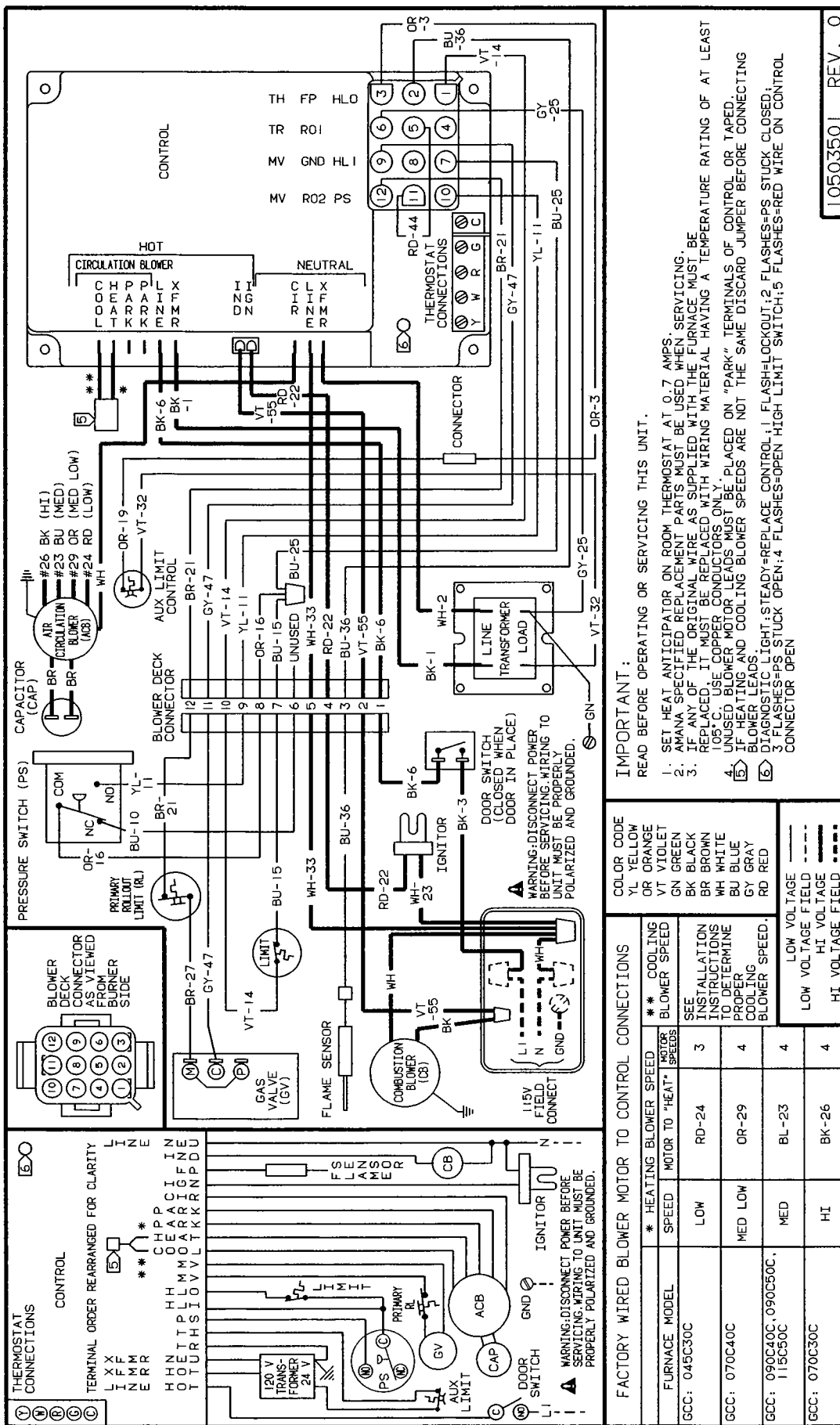
XIII. FUNCTIONAL PARTS LIST

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	Heat Exchanger
Gas Orifice, Propane	Door Switch
Burner	Transformer
Ignitor	Recuperative Coil
Flame Sensor	Terminal Board
Ignitor Clip	Blower Wheel
Gas Manifold	Blower Housing
Ignition Control	Blower Cutoff
Limit Switch	Blower Motor
Pressure Switch	Motor Mount Bracket
Pressure Switch Hose	Capacitor
Induced Draft Blower	Aux. Limit
Collector Box	Flame Roll-out Switch

XIV. WIRING DIAGRAM



Disconnect electrical power before servicing.

