

Installation, Start-Up, and Operating Instructions

Sizes 035-110, Series 100

NOTE: Before beginning the installation, READ THESE INSTRUCTIONS CAREFULLY AND COMPLETELY.

SAFETY CONSIDERATIONS

Installation and servicing of heating equipment can be hazardous due to gas and electrical components. Only trained and qualified personnel should install, repair or service heating equipment.

Untrained personnel can perform basic maintenance functions such as cleaning and replacing air filters. All other operations must be performed by trained service personnel. When working on heating equipment, observe precautions in the literature, tags, and labels attached to or shipped with the unit and other safety precautions that may apply.

Follow all safety codes. In the United States, follow all safety codes including the National Fuel Gas Code NFPA No. 54-1988/ANSI Z223.1-1988. In Canada, refer to the current edition of the National Standard of Canada CAN/CGA-B149.1- and .2-M86 Natural Gas and Propane Gas Installation Codes. Wear safety glasses and work gloves. Have fire extinguisher available during startup and adjustment procedures and service calls.

**Table 1—Clearances From Combustible Materials
(In Ins.)**

Sizes	035 and 055	075 thru 110
DOWNFLOW		
Sides—Single-Wall Vent	1	0
Type B-1 Double-Wall Vent	0	0
Back	0	0
Top	1	1
Front—Single-Wall Vent	6	6
Type B-1 Double-Wall Vent	3	3
Vent—Single-Wall Vent	6	6
Type B-1 Double-Wall Vent	1	1
HORIZONTAL (In Alcove/Attic)		
Sides*	1	0
Back	0	0
Top—Single-Wall Vent	1	1
Type B-1 Double-Wall Vent	1	1
Front	18	18
Vent—Single-Wall Vent	6	6
Type B-1 Double-Wall Vent	1	1
HORIZONTAL (In Closet)		
Sides*	1	1
Back	3	3
Top—Single-Wall Vent	2	2
Type B-1 Double-Wall Vent	2	2
Front—Single-Wall Vent	6	6
Type B-1 Double-Wall Vent	3	3
Vent—Single-Wall Vent	6	6
Type B-1 Double-Wall Vent	1	1

*Indicates supply or return sides when furnace is in the horizontal position.



Recognize safety information: This is the safety-alert symbol Δ . When you see this symbol on the furnace and in instructions or manuals, be alert to the potential for personal injury.

Understand the signal word—DANGER, WARNING, or CAUTION. These words are used with the safety-alert symbol. DANGER identifies the most serious hazards which will result in severe personal injury or death. WARNING signifies a hazard that could result in personal injury or death. CAUTION is used to identify unsafe practices, which would result in minor personal injury or product and property damage.

These instructions cover minimum requirements and conform to existing national standards and safety codes. In some instances, these instructions exceed certain local codes and ordinances, especially those that may not have kept up with changing residential construction practices. We require these instructions as a minimum for a safe installation.

INTRODUCTION

The design of the downflow/horizontal gas-fired furnace is A.G.A./CGA certified for natural and propane gas and for installation on noncombustible flooring. The furnace may be installed on combustible flooring when installed with the accessory downflow subbase. This furnace is for installation in alcoves, attics, crawl spaces, basements, closets, or utility rooms. The design of this furnace line is not A.G.A./CGA certified for installation in mobile homes, recreation vehicles, or outdoors.

NOTES:

1. Provide 30-in. front clearance for servicing. An open door in front of the furnace can meet this requirement.
2. A minimum clearance of 3 ins. must be provided in front of the furnace for combustion air and proper operation.
3. Line contact is permitted as shown in Fig. 7.

Before installing the furnace, refer to the current edition of the National Fuel Gas Code NFPA No. 54-1988/ANSI Z223.1-1988. Canadian installations must be installed in accordance with CAN/CGA.B149 Installation Code and all authorities having jurisdiction. For further information, the National Fuel Gas Code is available from National Fire Protection Association Inc. Batterymarch Park, Quincy, MA 02269, American Gas Association, 1515 Wilson Boulevard, Arlington, VA 22209, or from Literature Distribution.

Size	A	D	E	Vent Conn	Ship. Wt
035-EC	14-3/16	12-9/16	12-11/16	4	118
035-GC	14-3/16	12-9/16	12-11/16	4	121
055-EC	14-3/16	12-9/16	12-11/16	4	135
055-GC	14-3/16	12-9/16	12-11/16	4	139
075-GC	17-1/2	15-7/8	16	4	146
075-JC	17-1/2	15-7/8	16	4	146
090-JC	17-1/2	15-7/8	16	4	163
090-LC	21	19-3/8	19-1/2	4	171
110-LC	24-1/2	22-7/8	23	5	182



⚠ CAUTION

⚠ WARNING

When a furnace is installed so that the supply ducts carry

Provisions for adequate combustion and ventilation air must be provided in accordance with Section 5.3, Air for Combustion and Ventilation, of the National Fuel Gas Code, ANSI Z223.1-1988, or applicable provisions of the local building codes.

Canadian installations must be installed in accordance with CAN/CGA.B149 Installation Code, and all authorities having jurisdiction.

⚠ CAUTION

Air for Combustion must not be contaminated by halogen compounds, which include fluoride, chloride, bromide and iodide.

These elements are found in Aerosol sprays, detergents, bleaches, cleaning solvents, salts, air fresheners, and other household products.

All fuel burning equipment must be supplied with air for combustion of the fuel. Sufficient air **MUST** be provided to insure there will not be a negative pressure in the equipment room or space. In addition, a positive seal **MUST** be made between the furnace cabinet and the return-air duct to avoid pulling air from the burner area and draft safeguard opening.

⚠ CAUTION

THE OPERATION OF EXHAUST FANS, KITCHEN VENTILATION FANS, CLOTHES DRYERS, OR FIREPLACES COULD CREATE A NEGATIVE PRESSURE CONDITION AT THE FURNACE. MAKE UP AIR MUST BE PROVIDED FOR THE VENTILATION DEVICES, IN ADDITION TO THAT REQUIRED BY THE FURNACE.

The requirements for combustion and ventilation air depend upon whether the furnace is located in a **confined** or **unconfined** space. A confined space is defined as a space whose volume is less than 50 cu ft/1000 Btuh of the total input ratings of all appliances installed in that space.

A. Unconfined Space

An unconfined space must have at least 50 cubic ft for each 1000 Btuh of input for all the appliances (i.e. furnaces, clothes dryer, water heaters, etc.) in the space.

For Example:

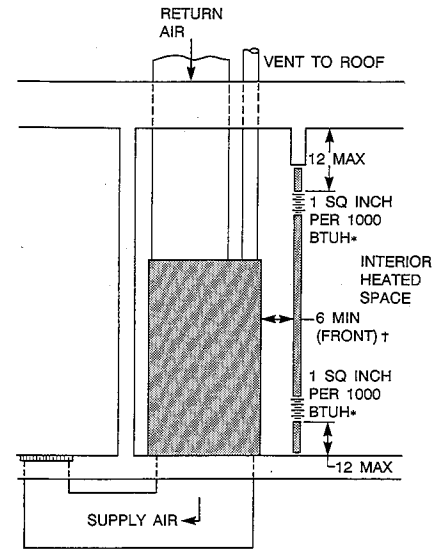
58RAV Furnace Input Btuh	Minimum Sq Ft with 7-1/2 Ft Ceiling
46,000	307
69,000	460
92,000	613
115,000	767
138,000	920

If the unconfined space is of unusually tight construction, air for combustion and ventilation **MUST** come from either the outdoors or spaces freely communicating with the outdoors. Combustion and ventilation openings must be sized the same as for a confined space. A minimum opening having a total of not less than 1 square in. per 5000 Btuh of total input rating for all equipment must be provided. Return air must not be taken from the room, unless an equal or greater amount of air is supplied to the room.

B. Confined Space

A confined space **MUST** have two permanent openings, one within 12 ins. of the ceiling, and the other within 12 ins. of the floor. See Fig. 2.

NOTE: In determining the free area of an opening, the blocking effect of the louvers, grilles and screens must be considered. If the free area of a louver or grille design is unknown, it may be assumed that wood louvers have a 20 percent free area and metal louvers or grilles have a 60 percent free area. Screens, when used, must not be smaller than 1/4-in. mesh. Louvers and grilles must be constructed so they cannot be closed.



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*Minimum opening size is 100 square inches.

†Minimum of 3 inches when type-B vent is used.

Fig. 2

The size of the openings depend upon whether the air comes from inside or outside of the structure.

1. All air from inside the structure:

Each opening **MUST** have at least 1 square in. of free area per 1000 Btuh of the total input for all equipment within the confined space, but not less than 100 square ins. per opening.

For Example:

58RAV Furnace Input Btuh	Free Area per Opening (square ins.)
46,000	100
69,000	100
92,000	100
115,000	115
138,000	138

If the building is of unusually tight construction, a permanent opening directly communicating with the outdoors shall be provided. This opening shall have a minimum free area of 1 square in. per 5000 Btuh of total input rating for all equipment in the enclosure.

If the furnace is installed on a raised platform to provide a return air plenum, and return air is taken directly from the hallway or space adjacent to the furnace, all air for combustion must come from outdoors. See Fig. 3.

2. All air from outdoors:

a. If combustion air is taken from outdoors through vertical ducts, the openings and ducts **MUST** have at least 1 square in. of free area per 4000 Btuh of the total input for all equipment within the confined space.

For Example:

58RAV Furnace Input Btuh	Free Area per Opening (square ins.)	Round Pipe (ins. dia)
46,000	11.5	4
69,000	17.3	5
92,000	23.0	6
115,000	28.8	7
138,000	34.5	7

b. If combustion air is taken from the outdoors through horizontal ducts, the openings and ducts **MUST** have at least 1 square in. of free area per 2000 Btuh of the total input for all equipment within the confined space.

For Example:

58RAV Furnace Input Btuh	Free Area per Opening (square ins.)	Round Pipe (ins. dia)
46,000	23.0	6
69,000	34.3	7
92,000	46.0	8
115,000	57.6	9
138,000	69.6	10

When ducts are used, they must be of the same cross sectional area as the free area of the openings to which they connect. The minimum dimension of rectangular ducts must not be less than 3 ins. See Fig. 3.

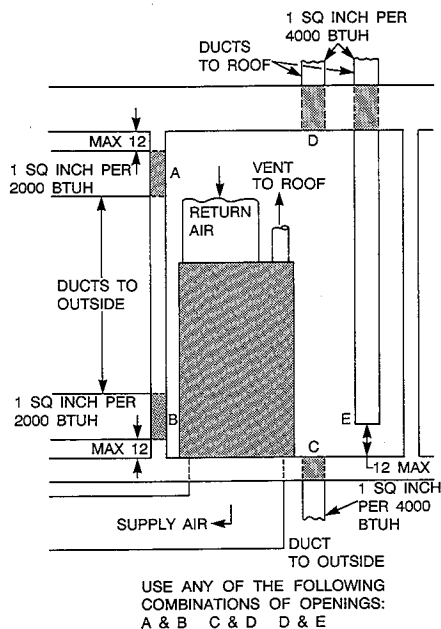


Fig. 3

III. SUPPLY-AIR PLENUM INSTALLATION (DOWNFLOW)

A. Installation On a Concrete Slab

1. Construct hole in floor per dimensions in Fig. 4 and Table 3.
2. Place plenum and furnace as shown in Fig. 5.

B. Installation On a Combustible Floor

1. Cut and frame hole in floor per dimensions in Installation Instructions packaged with downflow subbase.
2. When completed, downflow subbase, plenum, and furnace (or coil casing when used) should be installed as shown in Fig. 6.

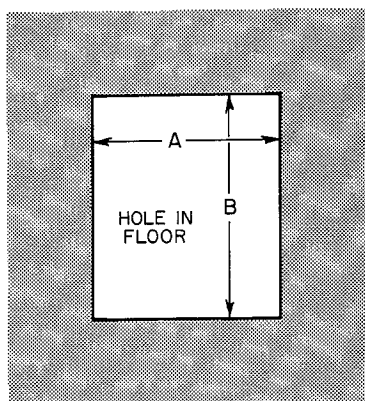


Fig. 4—Floor Opening for Concrete Slab

Table 3—Opening Dimensions

Furnace Casing Width	A	B	
		Heat-Only	Heat/Cool*
14-3/16	13-1/8	19-5/8	19-7/16
17-1/2	16-7/16	19-5/8	19-7/16
21	19-7/8	19-5/8	19-7/16
24-1/2	23-7/16	19-5/8	19-7/16

*These dimensions apply when a Model 28RC or 28RD Evaporator Coil casing is to be installed.

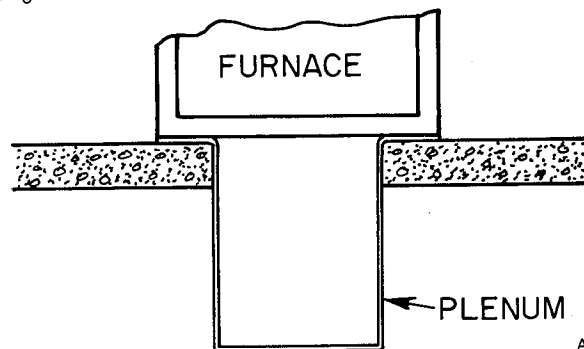


Fig. 5—Furnace on a Concrete Slab (Non-Garage Installation)

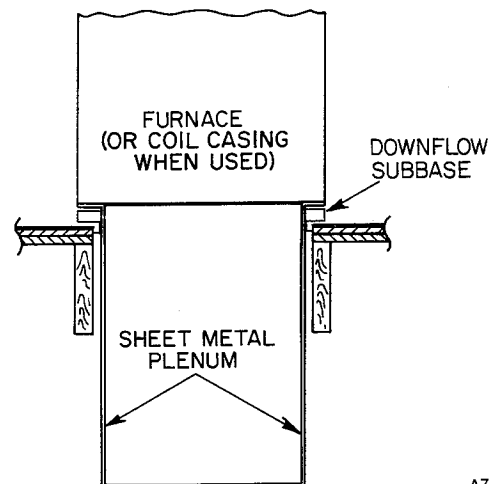


Fig. 6—Furnace, Plenum, and Subbase Installed on a Combustible Floor

IV. HORIZONTAL ATTIC INSTALLATION

⚠ WARNING

Do not install the furnace on its back; safety control operation will be adversely affected. Never connect return-air ducts to the sides or back of the furnace. A failure to follow this warning could result in fire, personal injury, or death.

The furnace can be installed horizontally on either the left-hand (LH) or righthand (RH) side. A typical attic installation is shown in Fig. 7.

A. Construct a Working Platform

1. Construct working platform on location where all required furnace clearances are obtainable. See Table 1 and Fig. 7.

B. Install Furnace

1. Position furnace in desired location.
2. Connect gas supply pipe, see Fig. 7 for typical piping entry.

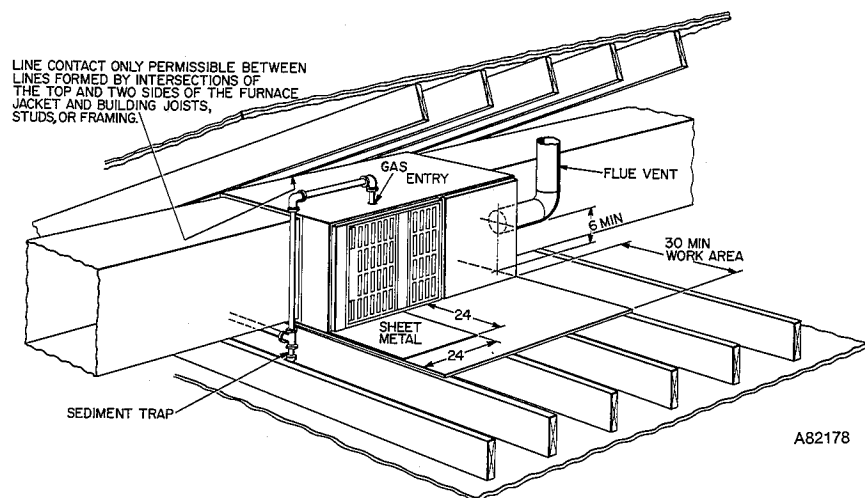


Fig. 7—Typical Attic Installation

3. Connect supply- and return-air ducts.
 - a. Install field-supplied filter retainers as indicated in Fig. 8 and Table 4 before connecting return-air duct to furnace.
4. Install 24- x 24-in. sheet metal shield on platform in front of louvered control panel, as shown in Fig. 7.

V. HORIZONTAL CRAWL SPACE INSTALLATION

The furnace can be installed horizontally with either the LH or RH side up. In a crawl space, the furnace can either be hung from the floor joist or installed on suitable blocks or pad. The furnace can be suspended from each corner by hanger bolts (four each 3/8-in. all-thread rod) cut to desired length, 1 x 3/8 flat washer, 3/8 lockwasher, and 3/8 nut. Dimples are provided for hole locations. See Fig. 1. Cut two 40-in. pieces of angle iron and install on hanger bolts to support the length of the furnace.

The horizontal crawl space installation is very similar to the attic; therefore, refer to Section IV, Subsection B, Steps 1, 2, and 3. The installation of a sheet metal shield in front of the louvered control panel is covered in Step 4. For a crawl space installation, this same sheet metal shield must be installed above the louvered control panel. Extend the sheet metal shield over the furnace top far enough to cover the gas pipe entry hole.

VI. FILTER ARRANGEMENT

The two factory-supplied filters are shipped in the blower compartment. After the return-air duct has been connected

to the furnace, install the filters in a V-formation inside the return-air plenum. See Fig. 8 and Table 4 for horizontal applications. Horizontal filter retainers must be field supplied. See Fig. 9 for downflow applications.

⚠ WARNING

Never operate unit without a filter or with filter access door removed. A failure to follow this warning could result in fire, personal injury, or death.

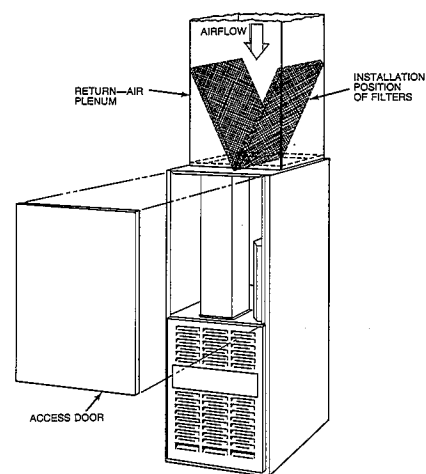


Fig. 9—Position of Filters

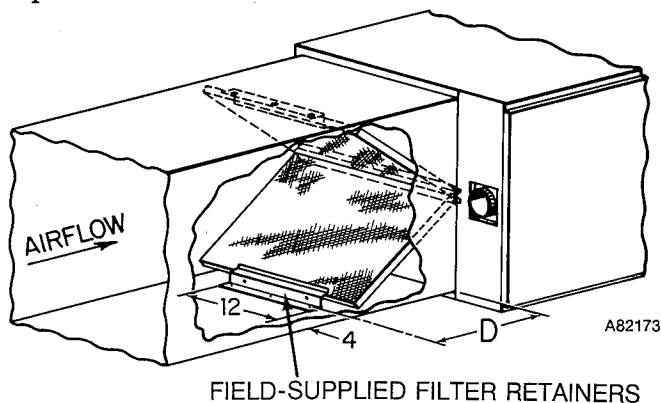


Fig. 8—Horizontal Filter Arrangement
Table 4—Filter Retainer

Furnace Casing Width	Filters	D
14-3/16	(2) 16 x 20 x 1	14-3/8
17-1/2	(2) 16 x 20 x 1	13-3/8
21	(2) 16 x 20 x 1	11-5/8
24-1/2	(2) 16 x 20 x 1	10-1/4

VII. GAS PIPING

Gas piping must be installed in accordance with national and local codes. Refer to the current edition of the National Fuel Gas Code.

Canada installations must be installed in accordance with CAN/CGA.B149 Installation Code, and all authorities having jurisdiction.

The gas supply line should be a separate line directly from the meter to the furnace, if possible. Refer to Table 5 for recommended gas pipe sizing. Risers should be used to connect to the furnace and to the meter.

⚠ CAUTION

If a flexible connector is required or allowed by the authority having jurisdiction, black iron pipe shall be installed at the gas valve and extend a minimum of 2 ins. outside the furnace casing.

Piping should be pressure-tested in accordance with local and national plumbing and gas codes before the furnace has

been attached. If the pressure exceeds 0.5 psig (14 in. wc), the gas supply pipe must be disconnected from the furnace and capped before the pressure test. If the test pressure is equal to or less than 0.5 psig (14 in. wc), close the manual shut-off valve located on the gas valve before the test. It is recommended that the ground joint union be loosened before pressure testing.

After all connections have been made, purge the lines and check for gas leakage.

Install a sediment trap in the riser leading to the furnace. Connect a capped nipple into the lower end of the tee. The capped nipple should extend below the level of the gas controls. See Fig. 10.

Joint compounds (pipe dope) should be applied sparingly and only to the male threads of the joints. This pipe dope must be resistant to the action of propane gas.

Table 5—Maximum Capacity of Pipe*

Nominal Iron Pipe Size (in.)	Internal Diameter (in.)	Length of Pipe (ft)				
		10	20	30	40	50
1/2	0.622	175	120	97	82	73
3/4	0.824	360	250	200	170	151
1	1.049	680	465	375	320	285
1-1/4	1.380	1400	950	770	660	580
1-1/2	1.610	2100	1460	1180	990	900

Ref: Table C-4 NFPA 54/ANSI Z223.1-1988.

*Cubic ft of natural gas per hour, for gas pressures of 0.5 psig (14-ins. wc) or less, and a pressure drop of 0.5-in. wc (based on a 0.60 specific gravity gas).

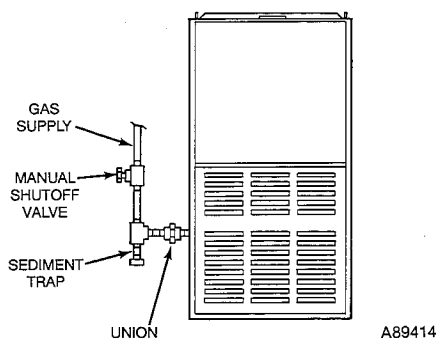


Fig. 10—Typical Gas Pipe Arrangement

⚠ WARNING

Never purge a line into a combustion chamber. Never use matches, candles, flame, or other sources of ignition to check for gas leakage. Use a soap-and-water solution to check for gas leaks. A failure to follow this warning could result in fire, explosion, personal injury, or death.

An accessible manual shut-off valve shall be installed upstream of the furnace gas controls and within 6 ft of the furnace. A 1/8-in. NPT plugged tapping, accessible for test gauge connection, must be installed immediately upstream of the gas supply connection to the furnace and downstream of the manual shut-off valve. Place a ground joint union between the gas control manifold and the manual shut-off.

⚠ WARNING

Use the proper length of pipes to avoid stress on the gas control manifold. A failure to follow this warning could result in a gas leak causing a fire, explosion, personal injury, or death.

⚠ CAUTION

Use a backup wrench when connecting the gas pipe to the furnace to avoid damaging gas controls.

VIII. ELECTRICAL CONNECTIONS

A. 115-Volt Wiring

Refer to the unit rating plate or Table 6 for equipment electrical requirements. The control system requires an earth ground for proper operation.

⚠ CAUTION

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

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

⚠ WARNING

The cabinet **must** have an uninterrupted or unbroken ground according to National Electrical Code, ANSI/NFPA 70 and Canadian Electrical Code, CSA C22.1 or local codes to minimize personal injury if an electrical fault should occur. This may consist of electrical wire or conduit approved for electrical ground when installed in accordance with existing electrical codes. Do not use gas piping as an electrical ground.

Table 6—Electrical Data

Furnace Size	Volts-Hertz-Phase	Operating Voltage Range		Max. Unit Amps	Min. Wire Gauge	Max. Wire Length Ft*	Max. Fuse† or HACR-Type Ckt Bkr Amps
		Max.*	Min.*				
035-EC	115-60-1	127	104	6.6	14	53	15
035-GC	115-60-1	127	104	8.1	14	44	15
055-EC	115-60-1	127	104	6.7	14	53	15
055-GC	115-60-1	127	104	8.4	14	43	15
075-GC	115-60-1	127	104	9.2	14	40	15
075-JC	115-60-1	127	104	10.2	14	35	15
090-JC	115-60-1	127	104	10.0	14	36	15
090-LC	115-60-1	127	104	13.1	12	44	20
110-LC	115-60-1	127	104	14.3	12	40	20

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

†Time-delay fuse is recommended.

‡Length shown is as measured one way along wire path between unit and service panel for maximum 2% voltage drop.

NOTE: Proper polarity must be maintained for 115-volt wiring. If polarity is incorrect, the microprocessor will shut off gas flow shortly after the completion of ignition trial period.

B. 24-Volt Wiring

Make field 24-volt connections at the 24-volt terminal strip. See Fig. 11. Connect terminal Y as shown in Fig. 12 for proper operation in cooling mode. Use AWG no. 18 "color-coded" wire only.

When the furnace is installed in the horizontal position with RH discharge air, 24-volt wire connections can be made easier by removing the two control box mounting screws and letting the control box turn so that the 24-volt screw terminals are visible. Be sure to reinstall the control box after the connections are made.

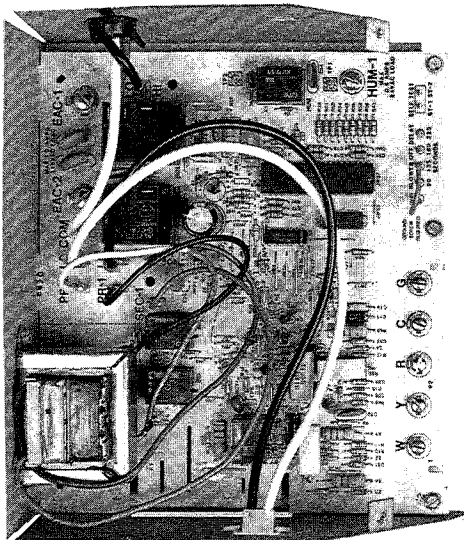
C. Accessory

1. Electronic air cleaner

Two screw terminals (EAC-1 and EAC-2) are provided for electronic air cleaner connection. The terminals are energized with 115-VAC, 1 amp maximum during blower motor operation.

2. Humidifier

Screw terminals (HUM-1 and C) are provided for 24-VAC humidifier connection. The terminals are energized with 24-VAC, 0.5 amp maximum during heating blower motor operation.



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Fig. 11—Control Center

IX. VENTING

These instructions are to be used only for 58RAV Furnace vent systems. These furnaces are equipped with induced-combustion blowers, and are classified as Category I type furnaces in accordance with ANSI/A.G.A. Z21.47 central furnace standards. Category I furnaces use nonpositive, noncondensing vent systems, and may be connected to lined masonry chimneys sized and installed per the National Fuel Gas Code.

However, the venting of this furnace into a lined masonry chimney could result in the formation of flue gas condensate due to cold surfaces and oversizing. If condensate is present in the masonry chimney, a drain must be provided to pre-

vent condensate flow into the vent connector and furnace. Refer to the National Fuel Gas Code Section 7.9 for additional information on condensate drains. Field experience on induced-combustion furnaces has shown that venting through a properly sized Type B-1 vent significantly reduces the occurrence of vent condensation. Any condensate formed is acidic and could cause corrosion of the vent materials.

Therefore, manufacturer suggests (but does not require) that these furnaces be connected to vent systems constructed of Type B-1 vent material.

A. General Instructions

1. This furnace must be installed in accordance with these instructions, the National Fuel Gas Code NFPA No. 54-1988/ANSI Z223.1-1988, Canadian CAN/CGA.B149 requirements, all applicable local codes, and all authorities having jurisdiction.
2. This furnace must not be connected to a chimney flue servicing a separate appliance designed to burn solid fuel.
3. Never connect this furnace to a chimney serving a fireplace, unless the fireplace opening is permanently sealed off.
4. The recommended vent system for this furnace is constructed of Type B-1 double-wall vent pipe (UL or ULC listed). A minimum 1-in. clearance is required between the Type B-1 vent pipe and combustible material.
5. It may be necessary to add insulation to the Type B-1 double-wall vent and single-wall vent connector, if allowed by local codes, in some applications.

When insulation is required, it must be fiberglass, and be at least 1 in. thick with a foil backing. Using permanent foil tape, attach insulation to vent pipe. (Both the foil tape and fiberglass insulation must be suitable for temperatures up to 350 degrees F.)

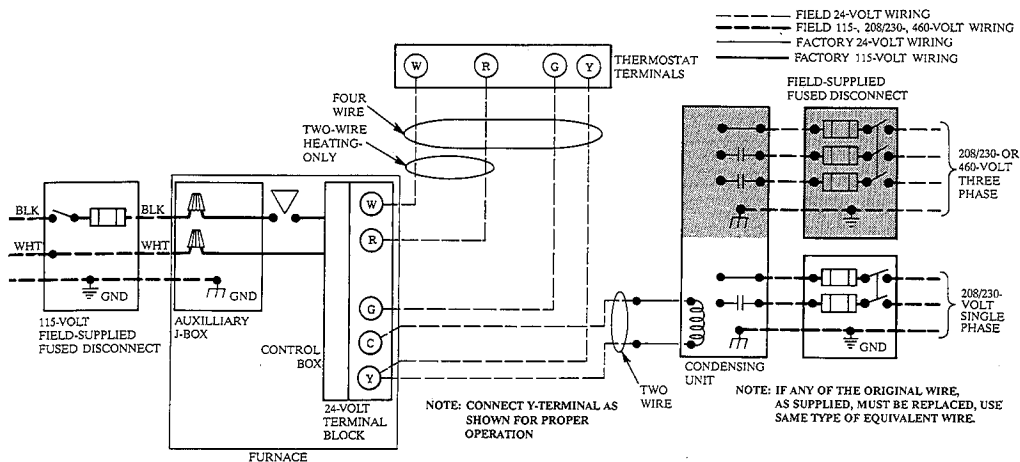
6. Insulation must be added to any vent connector which will be exposed to ambient temperatures of 30 degrees Fahrenheit or less, especially any application using single-wall vent pipe as a vent connector.

Add insulation to Type B-1 vent in applications as indicated in venting tables with an asterisk (*).

Do not insulate vent pipe exposed to outdoor weather conditions (i.e. above roof lines).

7. Do not use a vent size smaller or larger than the size shown in Tables 7 thru 14.

8. If this furnace is connected to a lined, masonry chimney, the chimney must be sized and installed according



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Fig. 12—Heating and Cooling Application Wiring Diagram

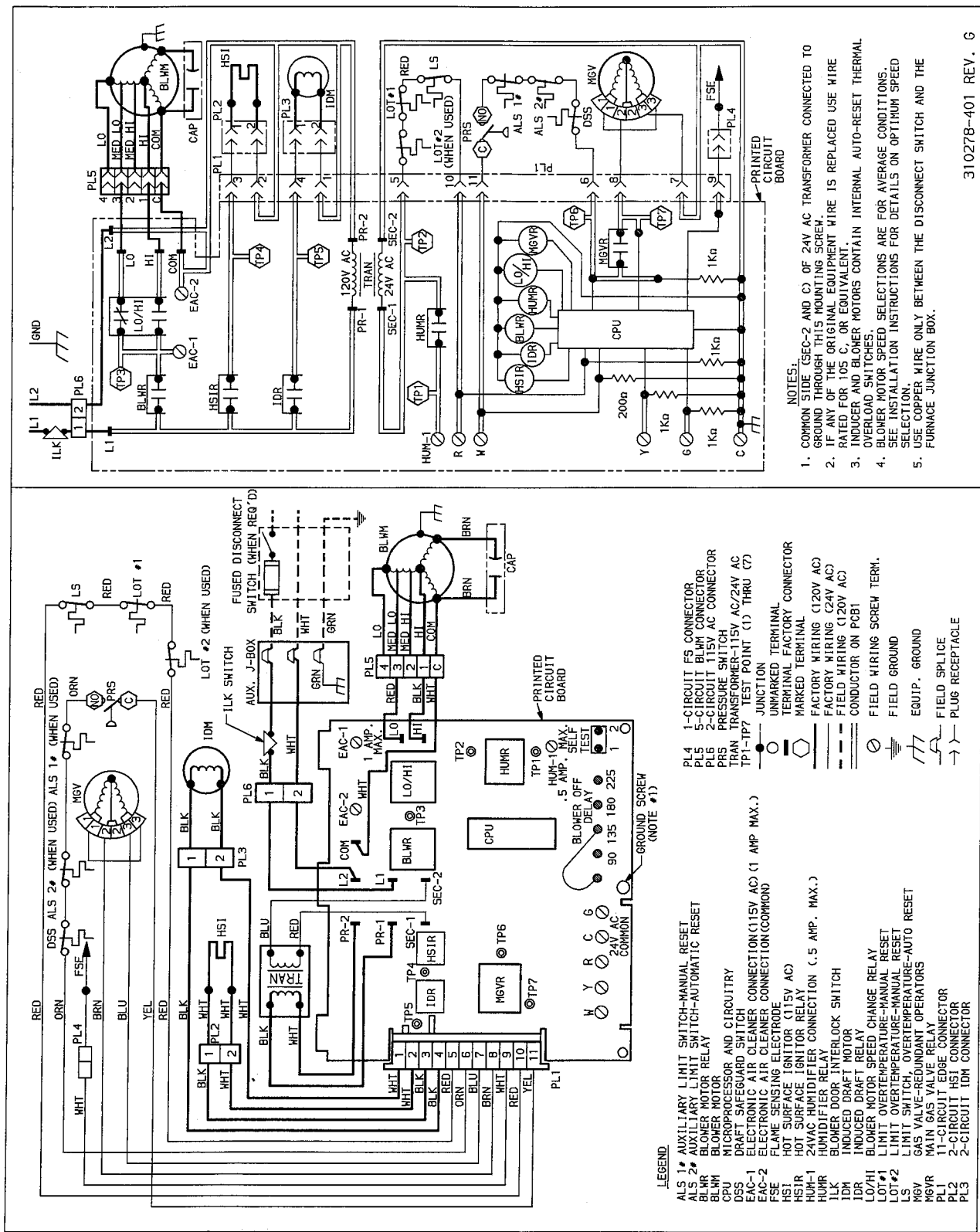


Fig. 13—Unit Wiring Diagram

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to the provisions of the National Fuel Gas Code, or Canadian CAN/CGA.B149 requirements. Vent connectors from the furnace to the chimney should be made with insulated single-wall vent pipe or Type B-1 vent pipe. Insulate per Section A.5 when required.

9. Installation of the vent pipe should be as direct as possible, with a minimum number of turns or elbows.
10. Maintain a minimum of 1/4-in. upward slope per linear ft on all horizontal vent pipe runs.
11. Rigidly support the vent pipe every 5 ft or less with hangers or straps to ensure that there will be no movement after installation.
12. No portion of the vent system shall extend into, or pass through, any circulation air duct or plenum.
13. The Type B-1 vent system shall terminate above the roof surface per the National Fuel Gas Code or CAN/CGA.B149 requirements, and shall include a UL or ULC listed vent cap or roof assembly, unless prohibited by local codes.
14. This furnace may be common vented with another furnace or other listed gas-fired appliances. Total input rates of all appliances will determine the vent size. See Sections C and D for additional information.
15. If a common vent system becomes blocked, the furnace will be shut off by the draft safeguard switch located on the inducer assembly.

⚠ WARNING

Do not bypass the draft safeguard switch, as an unsafe condition exists which must be corrected. Failure to follow this warning could result in a buildup of carbon monoxide and lead to personal injury or death.

16. All vent pipe passing through floors, ceilings, and walls must be installed with the proper clearances from combustible material, and be fire-stopped according to the National Fuel Gas Code requirements and Canadian standards CAN/CGA.B149.
17. In replacement installation, where an existing vent system may be used, the vent system must be inspected for condition, size, type of vent material, and height to meet these instructions. If the existing vent system is larger than shown in Tables 7 thru 14, the vent system will be oversized, and condensation could occur causing corrosion of the vent system. Installation of a replacement vent system may be required.
18. When removing an existing furnace from a common vent system, the vent system is likely to be oversized for the remaining appliances. Refer to Section E for additional information.
19. Vent connectors or vents servicing Category I appliances shall not be connected into any portion of mechanical draft systems operating under positive pressure.
20. For installation of vent systems not covered in Section 9. B, C, or D (or for vent system lengths/heights beyond those shown) refer to the National Fuel Gas Code for information. Following the National Fuel Gas Code requirements will provide for an acceptable vent system and proper operation of the furnace.

B. Venting Tables For Dedicated Vent System (one 58RAV Furnace)

The following tables are used to size a vent system for one 58RAV Furnace when using a dedicated vent system. The tables indicate the maximum horizontal length of vent pipe

Table 7—Dedicated Type B-1 Vent For 58RAV035-EC and GC Maximum Horizontal Length Allowed (Ft)

Height	Number of 90° Elbows						Vent Pipe
	0	1	2	3	4	5	
5	0	5	5	4	NA	NA	4-IN. DIAMETER
10	0	10	10	10	10	10	
15	0	15	14	14	14	14	
20	0	12	12	12	12	12	
20*	0	20*	20*	20*	20*	20*	
25	0	8	6	6	6	6	
25*	0	25*	25*	25*	25*	25*	
30	0	4	3	3	3	3	
30*	0	30*	30*	30*	30*	30*	
5	0	5	5	5	5	5	5-IN. DIAMETER
10	0	10	10	10	10	10	
15	0	6	6	6	6	6	
15*	0	15*	15*	15*	15*	15*	
20	0	2	2	2	2	2	
20*	0	20*	20*	20*	20*	20*	
25	NA	NA	NA	NA	NA	NA	
25*	0	25*	25*	25*	25*	25*	
30	NA	NA	NA	NA	NA	NA	
30*	0	30*	30*	30*	30*	30*	

Table 8—Dedicated Type B-1 Vent For 58RAV055-EC and GC Maximum Horizontal Length Allowed (Ft)

Height	Number of 90° Elbows						Vent Pipe
	0	1	2	3	4	5	
5	0	2	NA	NA	NA	NA	4-IN. DIAMETER
10	0	10	10	8	NA	NA	
15	0	15	15	15	15	15	
20	0	20	20	20	20	20	
25	0	22	20	20	20	20	
25*	0	25*	25*	25*	25*	25*	
30	0	18	16	16	16	16	
30*	0	30*	30*	30*	30*	30*	
5	0	5	5	5	NA	NA	5-IN. DIAMETER
10	0	10	10	10	10	10	
15	0	15	15	15	15	15	
20	0	16	16	16	16	16	
20*	0	20*	20*	20*	20*	20*	
25	0	12	10	10	10	10	
25*	0	25*	25*	25*	26*	25*	
30	0	8	8	8	8	8	
30*	0	30*	30*	30*	30*	30*	

Table 9—Dedicated Type B-1 Vent For 58RAV075-GC and JC Maximum Horizontal Length Allowed (Ft)

Height	Number of 90° Elbows						Vent Pipe
	0	1	2	3	4	5	
5	0	NA	NA	NA	NA	NA	4-IN. DIAMETER
10	0	10	NA	NA	NA	NA	
15	0	15	15	15	NA	NA	
20	0	20	20	20	14	10	
25	0	25	25	24	24	20	
30	0	22	20	20	20	20	
30*	0	30*	30*	30*	30*	30*	
5	0	5	5	2	NA	NA	5-IN. DIAMETER
10	0	10	10	10	10	10	
15	0	15	15	15	15	15	
20	0	20	20	20	20	20	
25	0	16	14	14	14	14	
25*	0	25*	25*	25*	25*	25*	
30	0	8	8	8	8	8	
30*	0	30*	30*	30*	30*	30*	

NA—Not allowed. Condensation or positive pressure in vent system could occur.

*Insulated with 1 in. of foil-backed insulation as per Section A.5.

**Table 10—Dedicated Type B-1 Vent For
58RAV090-JC and LC Maximum
Horizontal Length Allowed (Ft)**

Height	Number of 90° Elbows						Vent Pipe
	0	1	2	3	4	5	
5	NA	NA	NA	NA	NA	NA	4-IN. DIAMETER
10	NA	10	NA	NA	NA	NA	
15	NA	15	NA	NA	NA	NA	
20	0	20	14	8	2	NA	
25	0	25	20	14	8	2	
30	0	30	28	22	16	10	
5	0	5	2	NA	NA	NA	5-IN. DIAMETER
10	0	10	10	10	NA	NA	
15	0	15	15	15	15	15	
20	0	20	20	20	20	20	
25	0	25	25	25	25	25	
30	0	22	22	22	22	22	
30*	0	30*	30*	30*	30*	30*	

NA—Not allowed. Condensation or positive pressure in vent system could occur.

*Insulated with 1 in. of foil-backed insulation as per Section A.5.

**Table 11—Dedicated Type B-1 Vent For
58RAV110-LC Maximum Horizontal
Length Allowed (Ft)**

Height	Number of 90° Elbows						Vent Pipe
	0	1	2	3	4	5	
5	NA	NA	NA	NA	NA	NA	5-IN. DIAMETER
10	0	10	6	NA	NA	NA	
15	0	15	15	15	15	6	
20	0	20	20	20	20	20	
25	0	25	25	25	25	25	
30	0	30	30	30	30	30	
5	0	5	5	4	NA	NA	6-IN. DIAMETER
10	0	10	10	10	10	10	
15	0	15	15	15	15	15	
20	0	20	20	20	20	20	
25	0	25	25	25	25	25	
30	0	30	30	30	30	30	

NA—Not allowed. Condensation or positive pressure in vent system could occur.

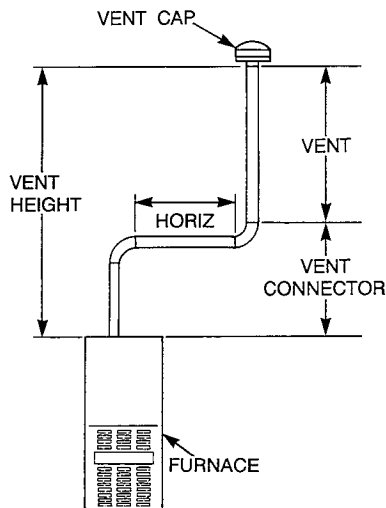


Fig. 14—Dedicated Vent (Typical Installation)

allowed for a vent system of a set height and number of elbows. Some tables also include information for vent lengths allowed when insulation is added to the vent connector or vent. See Tables 7 thru 11 and Fig. 14.

1. If single-wall vent pipe is used for vent connector, it **must** be insulated as indicated in venting table data marked with an asterisk (*). Insulation must be added

as specified in Section A.5 and A.6. Insulation should be added to any single-wall vent pipe used as a vent connector, especially those applications with long (over 5 ft) vent connector runs.

2. Each table is for a specific size of furnace, depending upon the rated furnace input.
3. For all applications, the horizontal length of vent and vent connector must not exceed the vertical height of the vent system.
4. The addition of insulation to the vent and vent connector allows for the use of longer horizontal runs in certain applications marked with an asterisk (*) in the vent tables.
5. If Type B-1 vent pipe is used for the vent connector, it must be insulated as indicated with an asterisk (*) in the vent table.

C. Venting Tables For Common Vented Furnaces (two, three, or four 58RAV Furnaces)

The following information refers to installations where two, three, or four 58RAV Furnaces are common vented into a single vent system. Do **not** connect more than four 58RAV Furnaces into a common vent. Table 12 provides data for vent systems where all furnaces are of the same size. For common vent applications using various sizes of 58RAV Furnaces, contact your Dealer/Distributor for more information.

To determine the proper common vent size, total the heat input of all the appliances to be connected to the vent system. Next, select the smallest vent size which will meet that rated input.

NOTE: A listed single-wall to Type B-1 vent adaptor is required, if single-wall vent pipe is used for the vent connector.

1. Vent connectors should be as short and direct as possible, and should be made of Type B-1 double-wall vent pipe or insulated single-wall vent pipe.
2. Vent connectors shall be sized using dedicated venting tables shown in Section B. The length of horizontal run used in the vent connector and vent must never exceed the height of the common vent.
3. Vent connectors should be spaced at least 1 ft apart when entering the common vent system.

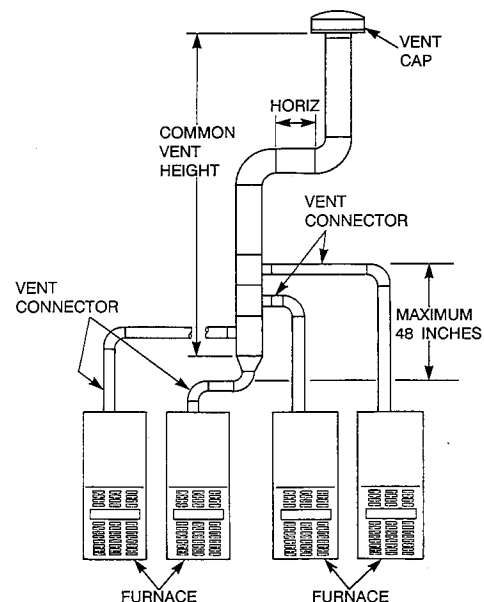


**Fig. 15—Common Vented Furnaces
(Typical Installation)**

- Insulated vent connectors may be required for certain applications. See Sections A.5. and A.6. for additional information.
- For multi-story installation, refer to Appendix G of National Fuel Gas Code or Canadian standards CAN/CGA.B149 for additional information in sizing the common vent. Individual vent connectors should be sized per the dedicated appliance tables shown in Section B.

Table 12—Common Venting Of Multiple Furnaces

58RAV Size	Number of Furnaces	Common Vent Height (Ft)		Vent Dia (Ins.)
		Minimum	Maximum	
035-EC & GC	2	10	40	5
		10	40	6
035-EC & GC	3	24	40	5
		10	40	6
035-EC & GC	4	18	40	6
		10	40	7
055-EC & GC	2	14	40	5
		8	40	6
055-EC & GC	3	14	40	6
		8	40	7
055-EC & GC	4	14	40	7
		10	40	8
075-GC & JC	2	10	40	6
		8	40	7
075-GC & JC	3	14	40	7
		8	40	8
075-GC & JC	4	14	40	8
		10	40	9
090-JC & LC	2	14	40	6
		10	40	7
090-JC & LC	3	10	40	8
		8	40	9
090-JC & LC	4	10	40	9
		10	40	10
110-LC	2	14	40	7
		8	40	8
110-LC	3	10	40	9
		8	40	10
110-LC	4	16	40	9
		10	40	10

D. Venting Tables For Common Vents (one 58RAV Furnace and gas hot water heater)

The information in this section refers to the installation of a common vent serving a 58RAV Furnace and a gas hot water heater. Tables 13 and 14 use typical water heater input rates of 40,000 or 50,000 Btuh. Refer to the water heater rating plate for input ratings of the installed equipment.

- Size the common vent and vent connector lengths using Tables 13 and 14.
- The vent connectors should be as short and direct as possible.
- The gas water heater vent connector should be sized per the National Fuel Gas Code. The 58RAV Furnace vent connector should be sized using the tables in Section B to determine allowable lengths, number of elbows, and insulation requirements. The allowable vent connector length cannot exceed 15 ft for any common vent installation or application as shown in Tables 13 and 14.
- Insulated vents and vent connectors may be required for certain applications. See Table 14. When insulation is required, it must be installed as indicated in Sections A.5. and A.6.

- If the vent connector is exposed to ambient temperatures of 30 degrees Fahrenheit or less, it must be insulated as indicated in Section A.5 and A.6.
- The vent connectors must be spaced within 3 ft of each other (3-ft rise).

Table 13—Common Vent (No Lateral Run) For Furnace and Water Heater

58RAV Size	Vent Connector Length (Ft)	Common Vent Height (Ft) (No Lateral Runs)		Common Vent Dia (Ins.)
		Minimum	Maximum	
035-EC† & GC†	5	20	30	4
		10	30	5
035-EC† & GC†	10	22	30	4
		10	30	5
035-EC† & GC†	15	NA	NA	4
		10	24*	5
055-EC† & GC†	5	20	30	4
		10	30	5
055-EC† & GC†	10	20	30	4
		10	30	5
055-EC† & GC†	15	20	30	4
		10	30	5
075-GC† & JC†	5	14	30	5
		5	26*	6
075-GC† & JC†	10	14	30	5
		5	20*	6
075-GC† & JC†	15	14	22*	5
		5	14	6
090-JC† & LC†	5	16	30	5
		8	30	6
090-JC† & LC†	10	16	30	5
		8	28*	6
090-JC† & LC†	15	18	30	5
		10	22*	6
110-LC‡	5	10	30	6
		5	30	7
110-LC‡	10	10	30	6
		5	30	7
110-LC‡	15	10	30	6
		5	30	7

NA—Not allowed. Condensation or positive pressure in vent system may occur.

*With insulation added, maximum allowed is 30 ft.

†Installed with a 40,000 Btuh gas-fired water heater (typical size).

‡Installed with a 50,000 Btuh gas-fired water heater (typical size).

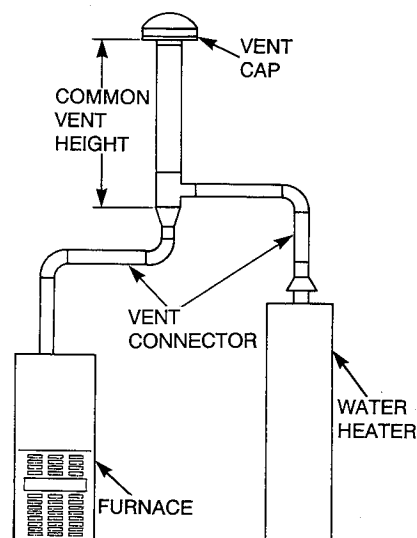


Fig. 16—Common With Water Heater (Typical Installation)

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**Table 14—Common Vent (Up to 10 Ft Lateral Run)
For Furnace and Water Heater**

58RAV Size	Vent Connector Length (Ft)	Vent and Vent Connector Insulation Required	Common Vent Height (Ft) (Maximum 10 Ft Lateral Run)		Common Vent Dia (Ins.)
			Minimum	Maximum	
035-EC* & GC*	5	—	10	28	5
		yes	6	30	
035-EC* & GC*	10	—	10	20	5
		yes	8	30	
035-EC* & GC*	15	—	10	12	5
		yes	8	30	
055-EC* & GC*	5	—	5	28	5
		yes	5	30	
055-EC* & GC*	10	—	5	22	5
		yes	5	30	
055-EC* & GC*	15	—	5	16	5
		yes	5	30	
075-GC* & JC*	5	—	14	30	5
		—	5	26	6
		yes	5	30	
075-GC* & JC*	10	—	14	30	5
		—	5	20	6
		yes	5	30	
075-GC* & JC*	15	—	14	23	5
		yes	14	30	
		—	5	14	6
		yes	5	30	
090-JC* & LC*	5	—	16	30	5
		—	8	30	6
090-JC* & LC*	10	—	16	30	5
		—	8	28	6
		yes	8	30	
090-JC* & LC*	15	—	18	30	5
		yes	16	30	
		—	10	22	6
		yes	8	30	
110-LC†	5	—	10	30	6
		—	5	30	7
110-LC†	10	—	10	30	6
		—	5	30	7
110-LC†	15	—	10	30	6
		—	5	30	7

*Installed with a 40,000 Btuh gas-fired water heater (typical size).

†Installed with a 50,000 Btuh gas-fired water heater (typical size).

- Where possible, locate the vent closer to or directly over the smaller appliance connector.
- For multi-story installation, refer to Appendix G of National Fuel Gas Code or Canadian standards CAN/CGA.B149 for additional information to size the common vent. Individual vent connector for the furnace should be sized per single appliance tables found in Section B. The water heater vent connector must be sized per the National Fuel Gas Code.

E. Removal of Existing Furnaces From Common Vent Systems

- These steps shall be followed with each appliance remaining connected to the common vent system placed in operation, while the other appliances remaining connected to the common vent system are not in operation.
- Seal any unused openings in the common vent system.
- Visually inspect the vent system for proper size and horizontal pitch, and determine there is no blockage or restriction, leakage, corrosion, and other deficiencies which could cause an unsafe condition.
- Insofar as practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common vent system are located and other spaces of the building. Turn on clothes dryers and any appliance not con-

nected to the common vent system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.

- Follow the lighting instructions and place the appliance in operation. Adjust the thermostat so appliance will operate continuously.
- Test for flue gas spillage at the drafthood relief opening (or draft safeguard tube opening) after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, etc.
- After it has been determined that each appliance remaining connected to the common vent system properly vents when tested as above, return doors, windows, exhaust fans, fireplace dampers, any other gas-burning appliances to their previous condition of use.
- If improper venting is observed during any of the above tests, the common vent system must be corrected. The vent system or vent connectors may need to be resized. Resize any 58RAV Furnace vent system according to these instructions. For any other appliances when resizing vent systems or vent connectors, the system or connector must be sized to approach the minimum size as determined using the appropriate table found in Appendix G of the National Fuel Gas Code, or Section 5 of CAN/CGA.B149 for Canadian standards.

X. STARTUP, ADJUSTMENT, AND SAFETY CHECK

A. General

The furnace must have a 115-volt power supply properly connected and grounded. Proper polarity must be maintained for proper operation. Thermostat wire connections at R, W, C, and Y must be made at the 24-volt terminal block on the control board. The gas service pressure must not exceed 0.5 psig (14 in. wc), but must be no less than 0.16 psig (4.5 in. wc).

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

⚠ CAUTION

This furnace is equipped with two manual reset limit switches in the gas control area. The switches will open and shutoff power to the gas valve if a flame roll-out or an overheating condition occurs in the gas control area. Do not bypass the switches. Correct inadequate combustion air supply problem and reset the switches.

The blower compartment door must be in place to complete the 115-VAC circuit to the furnace.

B. Sequence of Operation

Using the schematic diagram, Fig. 13, follow the sequence of operation through the different modes. This furnace has a new and unique control system, therefore, read and follow the wiring diagram very carefully.

1. Heating mode

The wall thermostat "calls for heat," closing the R and W circuit. The furnace control performs a selfcheck, verifies the pressure switch contacts are open, and starts the inducer motor.

a. Prepurge period—As the inducer motor comes up to speed, the pressure switch contacts close to begin a 15 second prepurge period.

b. Ignitor warm up—At the end of the prepurge

period, the ignitor is energized for a 17 second ignitor warm-up period. If ignition is not established during the first cycle, the next warm-up period is increased to 45 seconds. All subsequent ignition cycles will be 45 seconds, or until the 115-VAC power supply is interrupted. By interrupting the 115-VAC power supply, the warm-up period is automatically reset to 17 seconds.

- c. Ignition sequence—When the ignitor warm-up period is completed the gas valve opens, permitting gas flow to the burners where it is ignited. After 5 seconds, the ignitor is deenergized and a 2 second flame sensing period begins.
- d. Flame sensing—When burner flame is sensed, the control begins the blower “on” delay period and continues holding the gas valve open. If burner flame is not sensed, the control will close the gas valve and repeat the ignition cycle.
- e. Blower on delay—60 seconds after burner flame is proven, the blower motor is energized on heating speed. Simultaneously, the humidifier and electronic air cleaner terminals (HUM-1 and C for humidifier, EAC-1 and EAC-2 for electronic air cleaner) are energized.
- f. Blower off delay—When the thermostat is satisfied, the circuit between R and W is broken, deenergizing the gas valve stopping gas flow to the burners. The blower motor, humidifier, and air cleaner will remain energized 90, 135, 180, or 225 seconds (depending on the blower off-time selection). The furnace is factory-set for a 135-second blower off delay.
- g. Post purge—The inducer motor will remain energized 5 seconds after the burners are extinguished.

2. Cooling mode

The thermostat “calls for cooling” closing R-G and R-Y circuits. The R-Y circuit starts the outdoor condensing unit, and the combined R-Y and R-G circuit starts the furnace blower motor on cooling speed. The electronic air cleaner EAC terminals are energized with 115-VAC whenever the blower is operating on cooling speed.

When the thermostat is satisfied, R-G and R-Y circuits are broken. The furnace blower will continue operating on cooling speed for an additional 90 seconds.

3. Continuous blower mode

When the R-G circuit is made, the blower motor will operate on heating speed. During a call for heat, the blower will stop allowing the furnace heat exchangers to heat up more quickly.

The blower will revert to continuous operation after the heating cycle is completed.

When the thermostat “calls for cooling,” the blower will operate on cooling speed. When the thermostat is satisfied, the blower will operate an additional 90 seconds before reverting back to continuous operation on heating speed.

4. Heat pump mode

When installed with a heat pump, the furnace control automatically changes the timing sequence to avoid long blower off time during demand defrost cycles. When the W-Y or W-Y-G thermostat inputs are received together, the control will change the blower to heating speed or start the blower if it was off, and begin a heating cycle. The blower will remain on until the end of the purge period, then shut off until the end of the ignition warm up and trial for ignition periods (a total of 24 seconds). The blower will then come back on at heating speed.

When the W input signal disappears, the control will begin the normal inducer post-purge period and the blower will change to cooling speed after a one second delay. If the W-Y-G signals should disappear together, the blower will remain on for the selected heating blower off delay period, and the inducer will go through its normal post-purge period. If the W-Y inputs should disappear, leaving the G signal input, the control will go into continuous blower and the inducer will remain on for the normal post-purge period.

While in heat pump mode, the control will use only the 17 second ignition warm-up period, and will not use the 45 second period at all. The control will initiate a 90 second blower only on delay before starting another heat pump cycle, if there is a power interruption. Any time the control senses false flame, the control will lock out of the heating mode. This occurs because the control cannot sense the W input due to the false flame signal, and as a result sees only the Y input and goes into cooling mode blower off delay. All other control functions remain in standard format.

C. Startup Procedures

1. Self test—The furnace features a self-test system to help diagnose a system problem in the case of a component failure. Two test pins (ST-1 and ST-2) are located in the upper right-hand corner of the control board as shown in Fig. 10. To initiate the self-test procedure, momentarily short across the two pins.

NOTE: The self-test feature will not operate if the control board is receiving any thermostat signals.

The self-test sequence is as follows:

- a. The furnace control will check itself and then operate the inducer motor for 10 seconds, then off.
 - b. The hot surface ignitor is then energized for 15 seconds, then off.
 - c. The humidifier relay is then energized for 10 seconds, then off.
 - d. The blower motor will operate on cooling speed for 10 seconds, then off.
 - e. The blower motor will operate on heating speed for 10 seconds, then off.
2. Purge gas lines—After all connections have been made, purge the lines and check for leaks.

⚠ WARNING

Never purge a line into a combustion chamber. Never use matches, candles, flame or other sources of ignition to check for gas leakage. Use a soap-and-water solution to check for gas leaks. A failure to follow this warning could result in fire, explosion, personal injury, or death.

3. To operate furnace, follow procedures on operating instruction label attached to furnace.
4. With furnace operating, set thermostat below room temperature and observe that furnace goes off. Set thermostat above room temperature and observe that furnace restarts.

D. Adjustments

1. Set gas input rate.

There are two methods of adjusting the gas input rate. The preferred method is by using Table 15 and Step a. The second method is by clocking the gas meter and Step b.

The gas valve regulator has been nominally-set at 3.5 ins. wc for natural gas. When adjusting input rate, do not set manifold pressure above 3.8 or below 3.2 ins. wc.

Table 15—Model 58RAV Orifice Size and Manifold Pressure For Correct Input Rate
(Tabulated data based on altitude up to 2000 feet and 23,000 Btuh per burner.)

Gas Heat Value (Btuh/cu ft)	SPECIFIC GRAVITY OF NATURAL GAS																	
	0.56		0.58		0.60		0.62		0.64		0.66		0.68		0.70		0.72	
	Orf No.	Mnfl Press	Orf No.	Mnfl Press	Orf No.	Mnfl Press	Orf No.	Mnfl Press	Orf No.	Mnfl Press	Orf No.	Mnfl Press	Orf No.	Mnfl Press	Orf No.	Mnfl Press	Orf No.	Mnfl Press
860	40	3.2	40	3.3	40	3.4	40	3.5	40	3.7	40	3.8	—	—	37	3.2	37	3.2
	41	3.5	41	3.6	41	3.7	41	3.8	38	3.2	38	3.3	38	3.4	38	3.5	38	3.6
	—	—	39	—	39	3.2	39	3.3	39	3.4	39	3.5	39	3.6	39	3.8	—	—
875	—	—	40	3.2	40	3.3	40	3.4	40	3.5	40	3.6	40	3.8	—	—	—	—
	41	3.3	41	3.5	41	3.6	41	3.7	41	3.8	38	3.2	38	3.3	38	3.4	38	3.4
	42	3.7	—	—	—	—	39	3.2	39	3.3	39	3.4	39	3.5	39	3.6	39	3.7
890	41	3.2	41	3.4	40	3.2	40	3.3	40	3.4	40	3.5	40	3.6	40	3.7	40	3.8
	42	3.6	42	3.7	41	3.5	41	3.6	41	3.7	41	3.8	—	—	38	3.2	38	3.3
	—	—	—	—	—	—	—	—	39	3.2	39	3.3	39	3.4	39	3.5	39	3.6
905	—	—	41	3.2	41	3.4	40	3.2	40	3.3	40	3.4	40	3.5	40	3.6	40	3.7
	42	3.5	42	3.6	41	3.7	41	3.5	41	3.6	41	3.7	41	3.8	—	—	38	3.2
	—	—	—	—	42	—	—	—	—	—	39	3.2	39	3.3	39	3.4	39	3.5
920	—	—	—	—	41	3.2	41	3.4	40	3.2	40	3.3	40	3.4	40	3.5	40	3.6
	42	3.4	42	3.5	42	3.6	42	3.7	41	3.5	41	3.6	41	3.7	41	3.8	—	—
	—	—	—	—	—	—	—	—	42	3.8	—	—	39	3.2	39	3.3	39	3.4
935	42	3.3	42	3.4	42	3.5	42	3.6	42	3.7	42	3.8	—	—	39	3.2	39	3.3
	—	—	—	—	—	—	—	—	—	—	40	3.2	40	3.3	40	3.4	40	3.5
	—	—	—	—	—	—	41	3.2	41	3.4	41	3.5	41	3.6	41	3.7	41	3.8
950	42	3.2	42	3.3	42	3.4	42	3.5	42	3.6	42	3.7	42	3.8	—	—	39	3.2
	—	—	—	—	—	—	—	—	—	—	—	—	40	3.2	40	3.3	40	3.4
	—	—	—	—	—	—	—	—	41	3.2	41	3.3	41	3.5	41	3.6	41	3.7
965	—	—	42	3.2	42	3.3	42	3.4	42	3.5	42	3.6	42	3.7	42	3.8	—	—
	43	3.7	—	—	—	—	—	—	—	—	41	3.2	41	3.3	41	3.4	40	3.3
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	41	3.5
980	—	—	—	—	42	3.2	42	3.3	42	3.4	42	3.5	42	3.6	42	3.7	42	3.8
	43	3.6	43	3.7	—	—	—	—	—	—	—	—	—	—	—	—	40	3.2
	—	—	—	—	—	—	—	—	—	—	—	—	41	3.2	41	3.3	41	3.4
995	—	—	—	—	42	3.2	42	3.3	42	3.3	42	3.4	42	3.5	42	3.6	42	3.7
	43	3.5	43	3.6	43	3.8	—	—	—	—	—	—	—	—	—	—	—	—
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	41	3.2	41	3.3
1010	—	—	—	—	—	—	—	—	42	3.2	42	3.3	42	3.4	42	3.5	42	3.6
	43	3.4	43	3.5	43	3.6	43	3.6	—	—	—	—	—	—	—	—	41	3.2
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1025	—	—	—	—	—	—	—	—	—	—	42	3.2	42	3.3	42	3.4	42	3.5
	43	3.3	43	3.4	43	3.5	43	3.7	43	3.8	—	—	—	—	—	—	—	—
	44	3.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1035	—	—	—	—	—	—	—	—	—	—	—	—	42	3.2	42	3.3	42	3.4
	43	3.2	43	3.3	43	3.4	43	3.6	43	3.7	43	3.8	—	—	—	—	—	—
	44	3.7	44	3.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1055	—	—	—	—	—	—	—	—	—	—	—	—	—	—	42	3.2	42	3.3
	44	3.6	44	3.7	44	3.8	43	3.5	43	3.6	43	3.7	43	3.8	—	—	—	—
	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1070	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	42	3.2
	44	3.5	44	3.6	43	3.3	43	3.4	43	3.5	43	3.6	43	3.7	43	3.8	—	—
	—	—	—	—	44	3.7	44	3.8	—	—	—	—	—	—	—	—	—	—
1085	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	44	3.4	44	3.5	43	3.2	43	3.3	43	3.4	43	3.5	43	3.6	43	3.7	43	3.8
	—	—	—	—	44	3.6	44	3.7	—	—	—	—	—	—	—	—	—	—
1100	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	44	3.3	44	3.4	44	3.5	43	3.2	43	3.3	43	3.4	43	3.5	43	3.6	43	3.7
	—	—	—	—	—	—	44	3.6	44	3.7	—	—	—	—	—	—	—	—

- a. Check gas input rate using Table 15.
 - (1.) Obtain average yearly heat value for local gas supply.
 - (2.) Obtain average yearly specific gravity for local gas supply.
 - (3.) Verify furnace model. Table 15 can only be used for Model 58RAV Furnaces.
 - (4.) Check and verify orifice size in furnace. NEVER ASSUME THE ORIFICE SIZE, ALWAYS CHECK AND VERIFY.

- (6.) Follow heat value and specific gravity lines to point of intersection. Find orifice size and manifold pressure settings for proper operation at given natural gas conditions.

EXAMPLE:

Heat value 1070 Btu/cu ft

Specific gravity 0.58

Therefore; Orifice No. 44*

Manifold pressure 3.6 ins. wc

*The furnace is shipped with No. 43 orifices. Therefore, in this example all main burner orifices must be changed and the manifold pressure must be adjusted.

- (7.) Proceed to Step c. to adjust manifold pressure.

- b. Check gas input rate by clocking gas meter.

- (1.) Obtain average yearly heat value for local gas supply.
- (2.) Check and verify orifice size in furnace. NEVER ASSUME THE ORIFICE SIZE, ALWAYS CHECK AND VERIFY.

⚠ CAUTION

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

- (5.) Find natural gas heat value and specific gravity in Table 15.

Table 16—Gas Rate Cu Ft/Hr

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

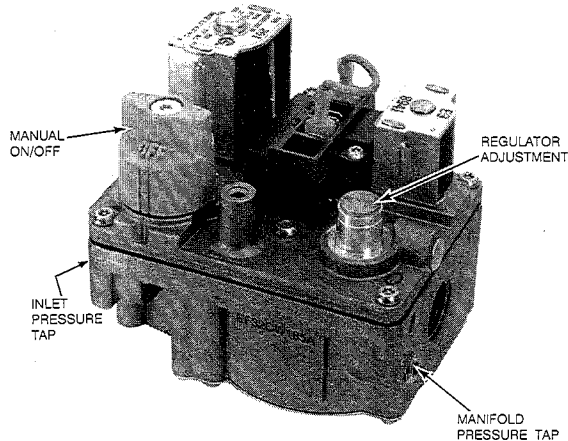


Fig. 17—Redundant Automatic Gas Valve

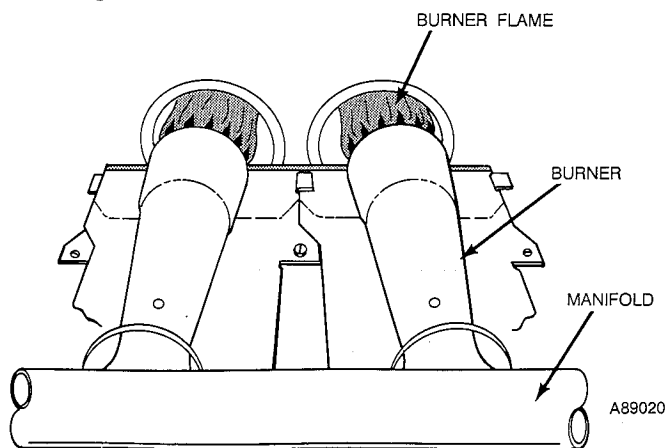


Fig. 18—Burner Flame

- (3.) Turn off all gas appliances and pilots.
- (4.) Start furnace and let run for 3 minutes.
- (5.) Measure time (in seconds) for gas meter to complete one revolution.
- (6.) Refer to Table 16 for cubic ft of gas per hour.
- (7.) Multiply gas rate cu ft/hr × heating value (Btu/cu ft).

EXAMPLE:

Btu heating input = Btu/cu ft times cu ft/hr

Heating value of gas = 1070 Btu/cu ft

Time for one revolution of 2-cu/ft dial = 72 seconds

Gas rate = $100 \times 1070 = 107,000$ Btuh

- (8.) Measured gas input should not exceed gas input on unit rating plate.
- (9.) Proceed to Step c. to adjust manifold pressure.
- c. Adjust gas input.
 - (1.) Remove regulator adjustment seal cap. See Fig. 17.
 - (2.) Turn adjusting screw counterclockwise to decrease input. Turn screw clockwise to increase input. DO NOT set manifold pressure less than 3.2 or more than 3.8 maximum ins. wc for natural gas. Make any major adjustments by changing main burner orifices.
 - (3.) When correct input is obtained, replace regulator seal cap. Main burner flame should be clear blue, almost transparent. See Fig. 18.
- d. Approved input ratings.

The USA ratings are approved for altitudes up to 2000 ft for natural and propane gases. Refer to National Fuel Gas Code Appendix F, Table F-4 for proper orifice sizing at high altitudes.
- e. Canadian installations only.

The Canadian ratings are approved for altitudes up to 2000 ft for natural and propane gases. High altitude ratings are from 2000 ft to 4500 ft above sea level. See Table 17 for nominal burner orifice size. High altitude input ratings include a 10% derate as required by Canadian Standards.

Table 17—Canadian Orifice Size

Gas	Sea Level 0—2000 ft	High Altitude 2000—4500 ft
Natural	43	44
Propane	54	55

2. Set temperature rise.

Do not exceed the temperature rise range specified on the unit rating plate. Determine the air temperature rise as follows:

- a. Place duct thermometers in return and supply ducts as near furnace as possible. Be sure thermometers do not "see" heat exchangers so that radiant heat will not affect thermometer readings. This is particularly important with straight-run ducts.
- b. When thermometer readings stabilize, subtract return-air temperature from supply-air temperature to determine temperature rise.
- c. Adjust air temperature rise by adjusting blower speed. Increase blower speed to reduce temperature rise. Decrease blower speed to increase temperature rise.

⚠ WARNING

Disconnect the electrical power before changing the speed tap. A failure to follow this warning could result in personal injury.

- d. To change motor speed taps, remove the motor tap lead (see Table 18) and relocate it on the desired terminal on the plug-in terminal block/speed selector located on the blower housing.

Table 18—Speed Selector

Speed	Tap No.*
Common	C
Hi	1
Med-Hi	2
Med-Low	3
Low	4

*White wire from control box to common; black wire from control box to cooling speed selection; red wire from control box to heating and constant fan speed selection.

⚠ CAUTION

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

3. Set thermostat heat anticipator

The thermostat heat anticipation must be set to match the amp draw of the electrical components in the R-W circuit. Accurate amp draw readings can be obtained at thermostat subbase terminals R & W. Fig. 19 illustrates an easy method of obtaining the actual amp draw. The amp reading should be taken after the blower motor has started. See the thermostat manufacturer's instructions for adjusting the heat anticipator and for varying the heating cycle length.

NOTE: When using an electronic thermostat, set cycle rate for three cycles per hour.

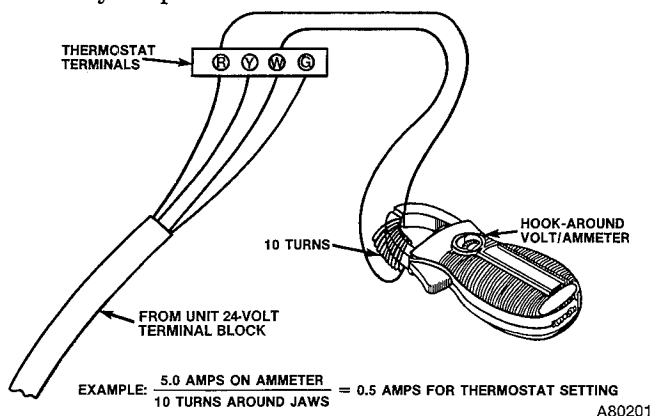


Fig. 19—Amp Draw Check With Ammeter

E. Check Safety Controls

The flame sensor, gas valve, and pressure switch were all checked in the Startup Section as part of normal operation.

1. Check Primary limit control.

This control shuts off the combustion control system and energizes the circulating-air blower motor if the furnace overheats.

The preferred method of checking the limit control is to gradually block off the return air after the furnace has been operating for a period of at least 5 minutes. As

soon as the limit has shutdown the burners the return-air opening should be unblocked. By using this method to check the limit control, it can be established that the limit is functioning properly and will "operate" if there is a motor failure.

2. Check draft safeguard switch.

The purpose of this control is to permit the safe shutdown of the furnace during certain blocked vent conditions.

- a. Disconnect power to furnace and remove vent connector from furnace outlet collar. Be sure to allow time for vent pipe to cool down before removing.
- b. Set room thermostat above room temperature and restore power to furnace.
- c. After normal startup, allow furnace to operate for 2 minutes, then block (100%) flue outlet. Furnace should cycle off within 2 minutes.
- d. Remove blockage and reconnect vent pipe to furnace outlet collar.
- e. Wait 5 minutes and then reset draft safeguard switch.

3. Check flow-sensing switch.

This control proves operation of draft inducer blower.

- a. Turn off 115-volt power to furnace.
- b. Remove control door and disconnect inducer motor lead wires from wire harness.
- c. Turn on 115-volt power to furnace.
- d. Close thermostat switch as if making normal furnace start. If the hot surface ignitor does not glow, then the flow-sensing switch is functioning properly.
- e. Turn off 115-volt power to furnace.
- f. Reconnect inducer motor wires, replace control door, and turn on 115-volt power.

4. Check auxiliary limits.

- a. Turn off 115-volt power to furnace.
- b. Remove blower access door.
- c. Disconnect red motor lead at blower speed selector. Mark terminal for proper reconnection.
- d. Replace blower access door.
- e. Turn on 115-volt power to furnace. Be sure room thermostat is calling for heat.
- f. Allow furnace to operate until auxiliary limit activates, but DO NOT operate furnace longer than 4 minutes.
- g. If furnace operates for 4 minutes, check/replace limit switch(s).
- h. Turn off 115-volt power to furnace.
- i. Remove blower access door.
- j. Reconnect red motor lead and replace door.
- k. Turn on 115-volt power to furnace.

F. Check List

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