



58VCA Deluxe Gas-Fired Variable-Speed Downflow Condensing Furnace

Installation, Start-Up, and Operating Instructions For Sizes 060-100 Series 100

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

SAFETY CONSIDERATIONS

Installing 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 Installation Codes. Wear safety glasses and work gloves. Have fire extinguisher available during start-up and adjustment procedures and service call.

Recognize safety information. This is the safety-alert symbol . When you see this symbol on the unit or in instructions and 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 hazards that could result in personal injury or death. CAUTION is used to identify unsafe practices, which would result in minor personal injury or product and property damage.

INTRODUCTION

Model 58VCA Furnaces are equipped with variable-speed, direct-drive blower and inducer motors. The units feature a microprocessor control center programmed to insure optimum performance in both heating and electrical efficiency.

The output capacity and any representations of efficiency for this furnace are based on standard Department of Energy (DOE) test procedures.

The installed operation may vary—depending on installation, weather, and other factors.

The design of the 58VCA Deluxe Gas-Fired Electronic Condensing Furnace is A.G.A./C.G.A. certified for natural and propane gases and for installation in alcoves, basements, closets, utility rooms, and attics. The 58VCA is A.G.A. approved for manufactured housing (mobile homes) in U.S. installations only. The design of the downflow gas-fired furnace is A.G.A./C.G.A. certified for installation on noncombustible floors. This furnace may be installed on combustible wood flooring when installed with the accessory downflow subbase. The design of this furnace line is not A.G.A./C.G.A. certified for installation in recreation vehicles or outdoors.



Before installing this furnace, refer to the current edition of the National Fuel Gas Code NFPA 54-1988/ANSI Z223.1-1988 which is available from the National Fire Protection Association Inc., Batterymarch Park, Quincy, MA 02269, American Gas Association, 1515 Wilson Boulevard, Arlington, VA 22209, or from Literature Distribution.

Installations must comply with the regulations of the serving gas supplier and the local building, heating, plumbing, or other codes in effect in the area in which the installation is made. In the absence of local codes, the installation must conform with the National Fuel Gas Code, NFPA No. 54-1988/ANSI Z223.1-1988.

Canadian installations must be made in accordance with CAN/CGA-B149 Installation Codes and authorities having jurisdiction.

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

CAUTION

Application of this furnace should be indoors with special attention given to vent sizing and material, gas input rate, air temperature rise, and unit sizing. Improper installation or misapplication of the furnace can require excessive servicing or cause premature component failure.

This furnace is designed for a minimum continuous return-air temperature of 60° F db or intermittent operation down to 55° F db such as when used with a night setback thermostat. Return-air temperature must not exceed a maximum of 85° F db.

WARNING

Improper installation, adjustment, alteration, service, maintenance, or use can cause carbon monoxide poisoning, explosion, fire, electrical shock, or other conditions which may cause personal injury or property damage. Consult a qualified installer, service agency, local gas supplier, your distributor, or your branch for information or assistance. The qualified installer or agency must use only factory-authorized and listed kits or accessories when modifying this product. Failure to follow this warning could result in electrical shock, fire, personal injury, or death.

Manufacturer reserves the right to discontinue, or change at any time, specifications or designs without notice and without incurring obligations.

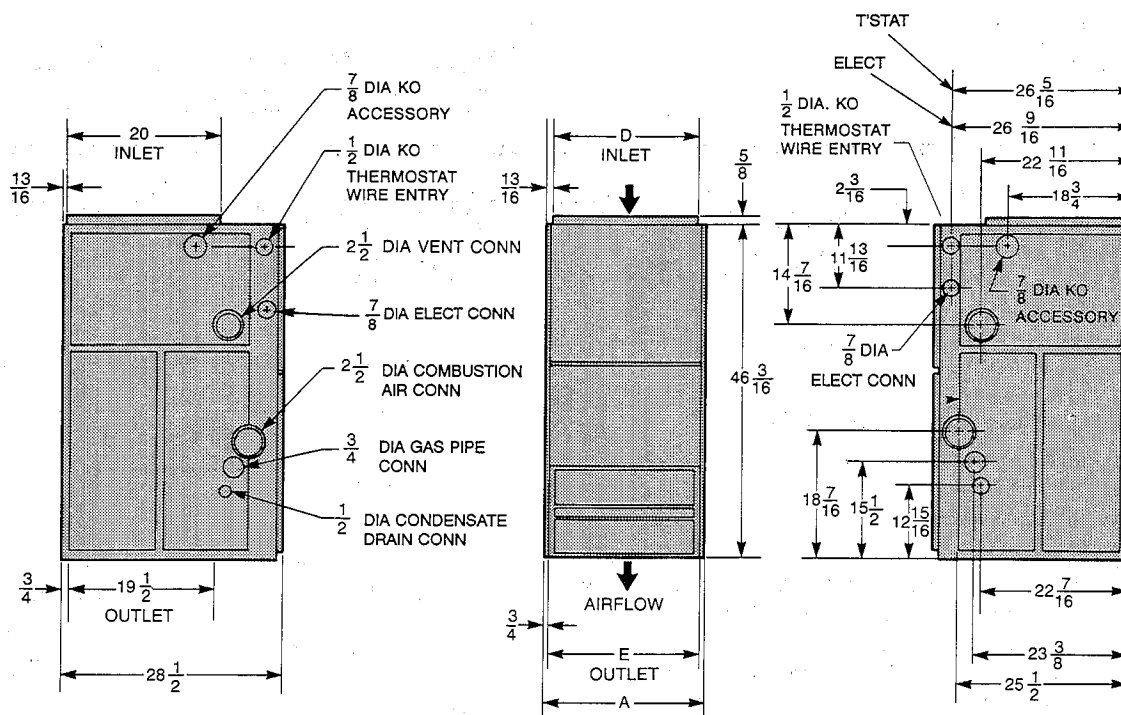


Fig. 1—Dimensional Drawing

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⚠ CAUTION

If this furnace is used during construction when adhesives, sealers, and/or new carpets are being installed, make sure all combustion and circulating air requirements are followed. If operation of the furnace is required during construction, use clean outside air for combustion and ventilation. Compounds of chlorine and fluorine when burned with combustion air form acids which will cause corrosion of the heat exchangers. Some of these compounds are: paneling and dry wall adhesives, paints, thinners, masonry cleaning materials, and many other solvents commonly used in the construction process.

For accessory installation details, refer to the applicable installation literature.

NOTE: Remove all shipping brackets and materials before operating the furnace.

Table 1—Clearances from Combustible Materials (In.)

SIZE	060,080,100,
Sides	0
Back	0
Top of plenum	1
Vent connector	0
Front casing	3
Front service	30

Table 2—Dimensions (In.)

SIZE	A	D	E
060-GG	17-1/2	15-7/8	16
080-HG	21	19-3/8	19-1/2
100-LG	24-1/2	22-7/8	23

Step 1—Location

GENERAL

⚠ WARNING

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

⚠ CAUTION

This furnace must not be installed in an unconditioned space with possible ambient temperatures of 32° F or lower.

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

This furnace may be located in a confined space without special provisions for dilution or ventilation air.

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

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

For proper furnace operation, locate the furnace so that, when installed, it is within 1/2 in. of level; refer to Step 7—Condensate Drainage.

Locate the furnace so that maximum allowable vent and combustion-air pipe lengths are not exceeded; refer to Step 6—Direct Venting.

Provide ample space for servicing and cleaning. Always comply with the minimum fire protection clearances shown on the unit rating plate and in Table 1.

Locate the furnace where available electric power and gas supplies meet the specifications on the furnace rating plate.

LOW-FIRE ONLY INSTALLATION

The 58VCA furnace can be installed to operate in the low-fire only heating mode when sized using the low-fire heating capacity. This is accomplished by placing setup switch SW-2 in the ON or UP position to provide continuous low-fire operation. (See Fig. 11 and Table 9.) When the furnace is set up for continuous low-fire operation, it will start each heating cycle in high fire for 1 minute before switching to low fire for the remainder of the cycle.

⚠ CAUTION

Since the unit will operate in the high-fire mode, the following precautions should be taken:

- (1.) Size gas piping based on the high-fire input. (See Step 4.)
- (2.) Check the high-fire input and adjust it (if necessary) per Step 8. **Never** assume the high-fire rate is unimportant for a low-fire only installation.

When the model number on the unit rating plate is followed by an asterisk (*), the unit has an alternate low-fire only efficiency rating as listed in the GAMA and CEC directories. This alternate rating will be listed as the furnace model number followed by a (-L) suffix.

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

HAZARDOUS LOCATIONS — When the furnace is installed in a residential garage, it must be installed so that the burners and ignition source are located no less than 18 in. above the floor. Also the furnace must be located or protected to avoid physical damage by vehicles.

When the furnace is installed in a public garage, airplane hangar, or another building having a hazardous atmosphere, the unit must be installed in accordance with the requirements of the National Fire Protection Association, Inc.

Step 2—Supply-Air Plenum Installation

INSTALLATION ON A CONCRETE SLAB

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

Table 3—Opening Dimensions

FURNACE WIDTH (IN.)	A	B	
		Furnace	Furnace and Coil*
17-1/2	16-1/8	19-5/8	19-7/16
21	19-5/8	19-5/8	19-7/16
24-1/2	23-1/8	19-5/8	19-7/16

*These dimensions apply when a Model CB5A or CD5A Evaporator Coil casing is to be installed.

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. 4.

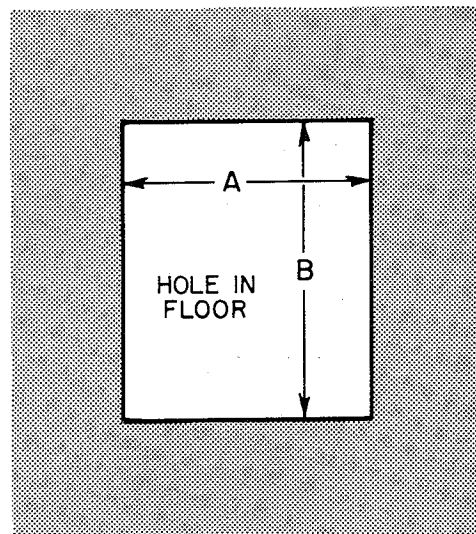


Fig. 2—Floor Opening for Concrete Slab

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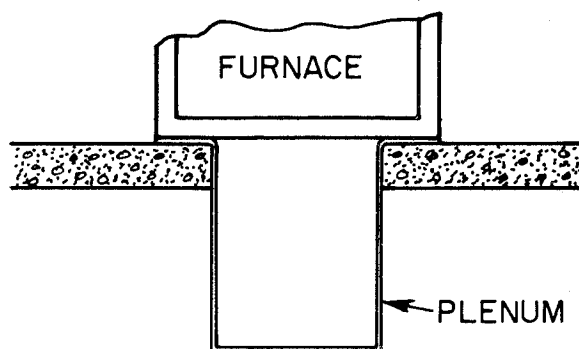


Fig. 3—Furnace on a Concrete Slab

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Step 3—Filter Arrangement

⚠ CAUTION

Never operate the unit without a filter or with the filter access door removed. Failure to follow this caution can result in a fire, personal injury, or death.

The 2 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 with cross-mesh binding facing the blower. (See Fig. 5.)

Step 4—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. Canadian installations must be installed in accordance with CAN/CGA-B149 Installation Codes, and all authorities having jurisdiction.

The gas supply line should be a separate line running directly from the meter to the furnace, if possible. Refer to Table 4 for the recommended gas pipe sizing. Risers must be used to connect to the furnace and to the meter.

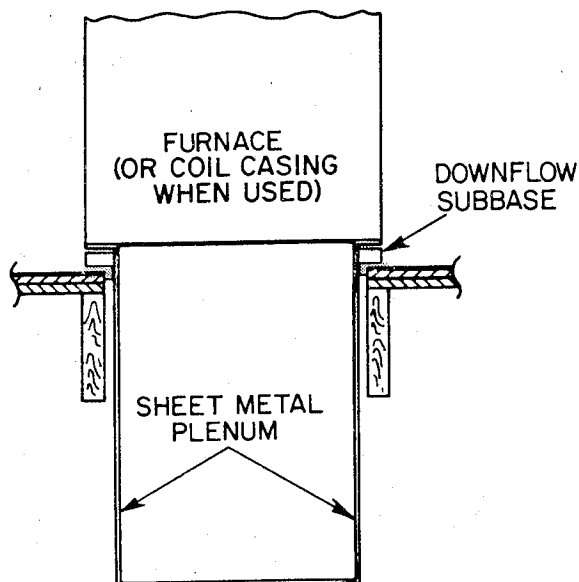


Fig. 4—Furnace, Plenum, and Subbase Installed on a Combustible Floor

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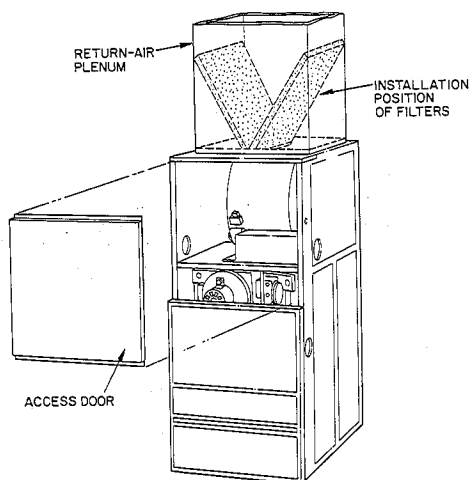


Fig. 5—Position of Filters

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Table 4—Maximum Capacity of Pipe*

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

*Cubic ft of gas per hour, for gas pressures of 0.5 psig (14-in. wc) or less, and a pressure drop of 0.5-in. wc (based on a 0.60 specific gravity gas). Ref: Table C-4 NFPA 54-1988.

Support all gas piping with appropriate straps, hangers, etc. Use a minimum of 1 hanger every 6 ft.

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

Install a sediment trap in the riser leading to the furnace. The trap can be installed by connecting a tee to the riser leading to the furnace, so that the straight-through section of the tee is vertical.

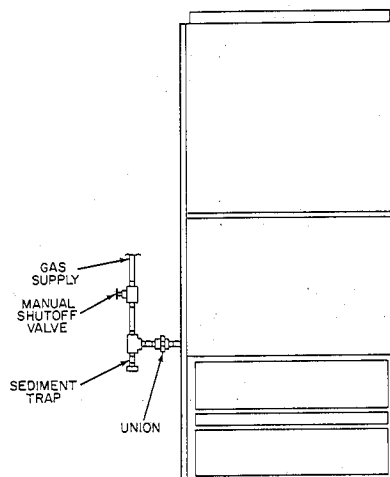


Fig. 6—Typical Gas Pipe Arrangement

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Then connect a capped nipple into the lower end of the tee. The capped nipple should extend below the level of the gas controls. Place a ground joint union between the gas control manifold and the manual gas shutoff valve. (See Fig. 6.)

⚠ 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 in. outside the furnace casing.

⚠ WARNING

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

An accessible manual shutoff valve **MUST** 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 gage connection, **MUST** be installed immediately upstream of the gas supply connection to the furnace and downstream of the manual shutoff valve.

⚠ CAUTION

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

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

⚠ WARNING

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

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), close the manual shutoff valve located on the gas valve before the test. It is recommended that the ground joint union be loosened before pressure testing.

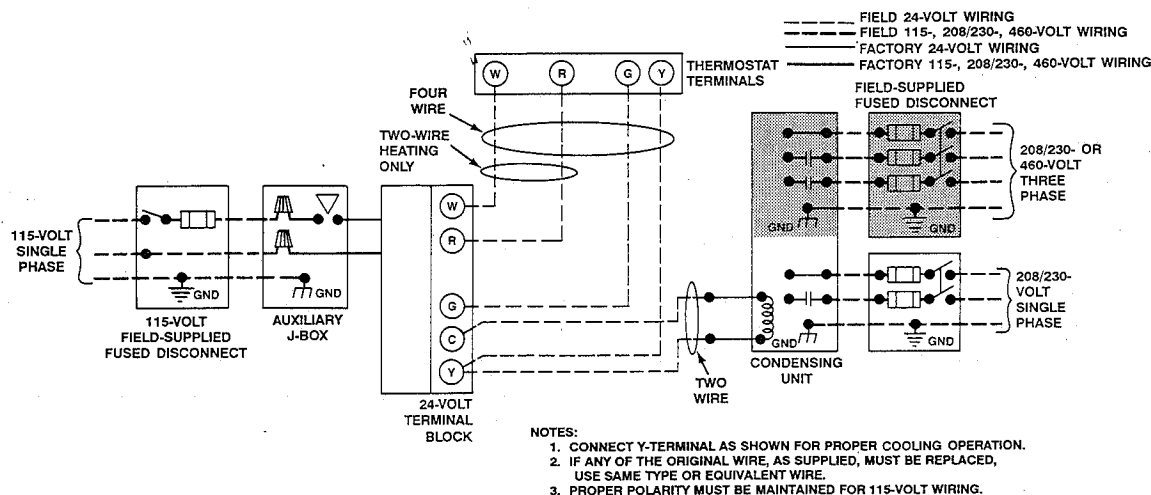


Fig. 7—Heating and Cooling Application Wiring Diagram

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Table 5—Electrical Data

SIZE	VOLTS—HERTZ—PHASE	OPERATING VOLTAGE RANGE		MAX UNIT AMPS	MIN WIRE SIZE	MAX WIRE LENGTH FT†	MAX FUSE‡ OR HACR-TYPE CKT BKR AMPS
		Max*	Min*				
060-GG	115—60—1	127	104	9.0	14	44	15
080-HG	115—60—1	127	104	9.0	14	44	15
100-LG	115—60—1	127	104	13.0	12	44	20

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

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

‡Time-delay fuse is recommended.

Step 5—Electrical Connections

See Fig. 7 for a wiring diagram showing the proper field 115- and 24-v wiring. Check all electrical connections (both factory and field) for tightness.

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

⚠ CAUTION

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

Make all electrical connections in accordance with the National Electrical Code ANSI/NFPA 70-1990 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.

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

NOTE: Operation of unit on improper line voltage constitutes abuse and could affect unit reliability. Do not install unit in system where voltage may fluctuate above or below permissible limits.

The auxiliary J-box can be moved to the left side of the furnace when a left-side power supply is desired.

1. Remove 2 screws holding auxiliary J-box.

2. Mount auxiliary J-box in the same position on opposite side of the casing. Rotate the J-box 180° so that the switch button will still be facing out of the blower enclosure.
3. Plug or cap unused electrical entry holes in right side of casing.

⚠ WARNING

The cabinet **must** have an uninterrupted or unbroken ground according to National Electrical Code, ANSI/NFPA 70-1990 and Canadian Electrical Code, CSA C22.1 or local codes to minimize personal injury if an electrical fault should occur. This may consist of electrical wire or conduit approved for electrical ground when installed in accordance with existing electrical codes. Do not use gas piping as an electrical ground. Failure to follow this warning could result in an electrical shock, fire, or death.

⚠ CAUTION

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

24-V WIRING — Make field 24-v connections at the 24-v terminal block on the control center; connect Y terminal as shown in Fig. 7 for proper cooling operation. The 24-v terminal board is marked for easy connection of field wiring. (See Fig. 11.)

NOTE: Use AWG No. 18 "color coded" copper thermostat wire for lengths up to 100 ft. For wire lengths over 100 ft, use AWG No. 16 wire.

INSTALLATION WITH AIR CONDITIONERS AND HEAT PUMPS

Refer to the following wiring diagrams and instructions for installation of the model 58VCA Furnace with standard and 2-speed air conditioners and heat pumps.

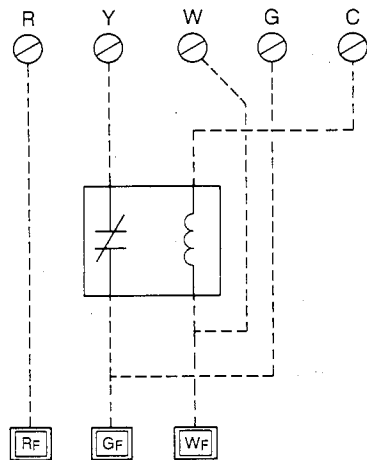
Standard Air Conditioners

Wire the air conditioner control circuit to terminals Y and C. (See Fig. 7 and 11.)

Standard Heat Pumps

When connecting a standard heat pump to this furnace, an Optimizer kit is required. Also, a field-supplied SPST set of normally closed pilot duty contacts needs to be wired into the thermostat circuit. (See Fig. 8.) During the defrost cycle when Y and W are simultaneously energized, this relay will open the Y circuit. If Y and W are allowed to be energized simultaneously, the board will "fault out" on a fault code 24—illegal thermostat input.

FURNACE LOW-VOLTAGE TERMINALS



ENERGY MINDER TERMINALS

Fig. 8—Standard Heat Pump Wiring

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2-Speed Air Conditioners and Heat Pumps

When connecting a 2-speed outdoor unit to this furnace, connect Y1 and Y2. (See Fig. 7, 9 and 11.) Set constant fan speed as directed below.

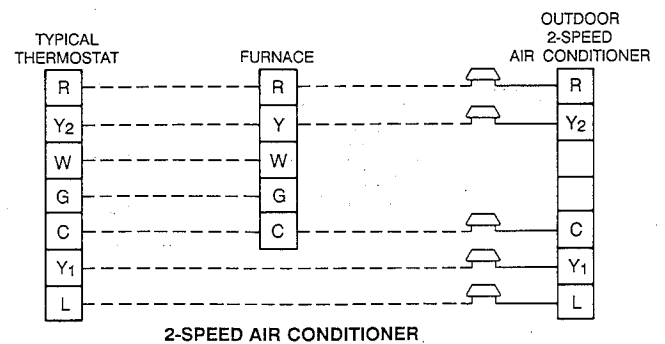
CAUTION

If constant fan speed is not selected properly for a 2-speed unit, the indoor coil may freeze—causing damage to the outdoor unit and/or the furnace as a result of inadequate airflow.

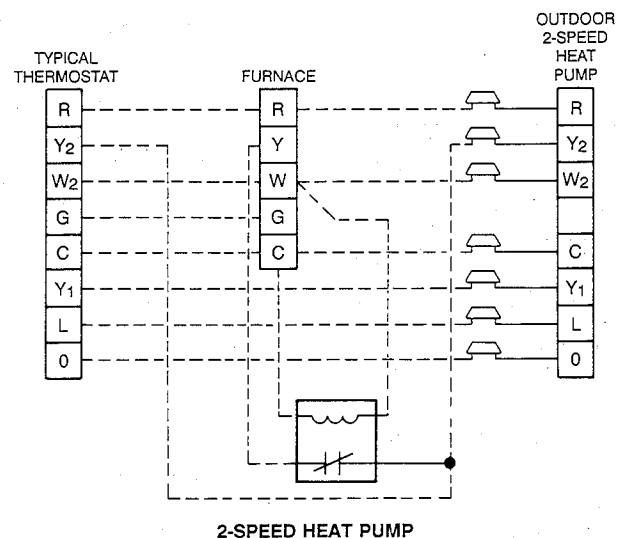
Adjust Constant Fan Airflow

To adjust constant fan to deliver airflow other than low-heat cfm, perform the following:

1. Remove access doors and disconnect all thermostat leads.
2. Tape blower door interlock switch ILK closed. Wait 30 sec.
3. Put setup switches SW-1, SW-2, and SW-3 in ON position.
4. Rotate blower-off delay switch to desired airflow per Table 6 and Fig. 10.



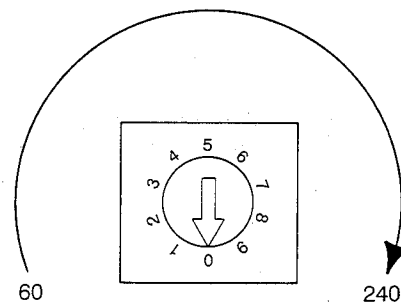
2-SPEED AIR CONDITIONER



2-SPEED HEAT PUMP

Fig. 9—2-Speed Air Conditioner or Heat Pump Wiring

A92161



BLOWER

Fig. 10—Blower-Off Delay RSW1 Dial

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Table 6—Blower-Off Delay and Selectable Constant Fan Air Delivery

BLOWER RSW1 SETTING	BLOWER- OFF DELAY (SECONDS)	SELECTABLE CONSTANT FAN AIR DELIVERY (CFM)	VALID FURNACE SIZES		
			060	080	100
—	—	500* (Low-Heat cfm)	X		
—	—	665* (Low-Heat cfm)		X	
—	—	835* (Low-Heat cfm)			X
0	60	600 (1-1/2 Tons)	X	X	
1	80	800 (2 Tons)	X	X	X
2	100	1000 (2-1/2 Tons)	X	X	X
3	120	1200 (3 Tons)	X	X	X
4	140	1400 (3-1/2 Tons)		X	X
5	160	1600 (4 Tons)			X
6	180	1800 (4-1/2 Tons)			X
7	200	2000 (5 Tons)			X
8	220	*			
9	240	*			

* Default value if constant fan is not selected or improperly selected. See "Adjust Constant Fan Airflow" section in Step 5.

NOTE: If continuous blower cfm is adjusted outside of the furnace's valid range (or is never adjusted) the blower will default to low-heat cfm.

5. Once dial is properly positioned, jumper low-voltage terminals R to G.

NOTE: If R to G is not jumpered within 1 minute after setup switches are placed in the ON position, fault code 22 will flash until they are turned OFF. If this occurs, turn switches OFF and repeat items 3, 4, and 5 above. After the continuous blower cfm is stored in the board's memory, fault code 11 will flash for 1 minute, then fault code 22 will flash.

6. Put setup switches SW-1, SW-2, and SW-3 in the OFF position.

7. Return blower-off delay dial to desired blower-off delay.

8. Reconnect thermostat leads.

ACCESSORIES

NOTE: Do not use accessories with a combined maximum amp draw of more than 1.0 amp.

An isolated set of normally open contacts (not connected to 24 vac or 120 vac) are available to operate any accessory such as an electronic air cleaner (EAC) or humidifier. The relay contacts will close whenever the blower motor is operating. These contacts are accessible by two 1/4-in. quick connects mounted directly on the relay as shown in Fig. 11. Wire leads with quick connects have been supplied as part of the control box wiring to simplify hookup per the 3 possible combinations shown in Fig. 12, 13, or 14.

Accessory Wiring Procedures

The following steps should be performed by a qualified service technician:

1. Turn OFF electrical supply at main disconnect.
2. Remove control and blower access doors.
3. Remove control box cover.
4. Cut wire tie that surrounds accessory hookup leads. (See Fig. 11.)

NOTE: For 120-v accessory hookup, see items 5 through 11 and Fig. 12 or 13.

5. Locate black pigtail lead from 120-v terminal block (TB) and cut off tip of insulator—allowing 1/4-in. quick connect to be used.
6. Attach black pigtail to COM terminal on accessory relay ACCR.

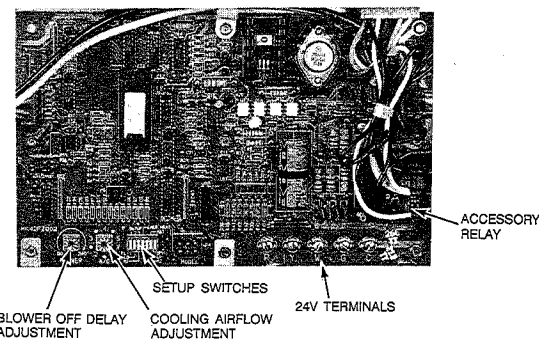


Fig. 11—Microprocessor Control Center A92099

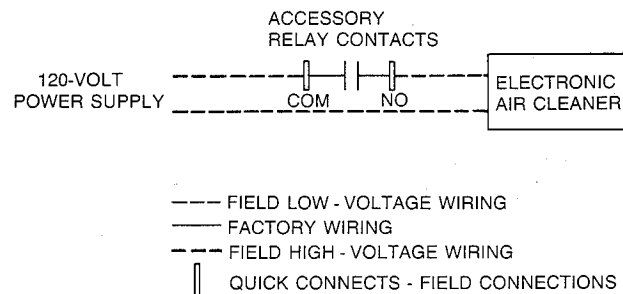


Fig. 12—Electronic Air Cleaner A87330

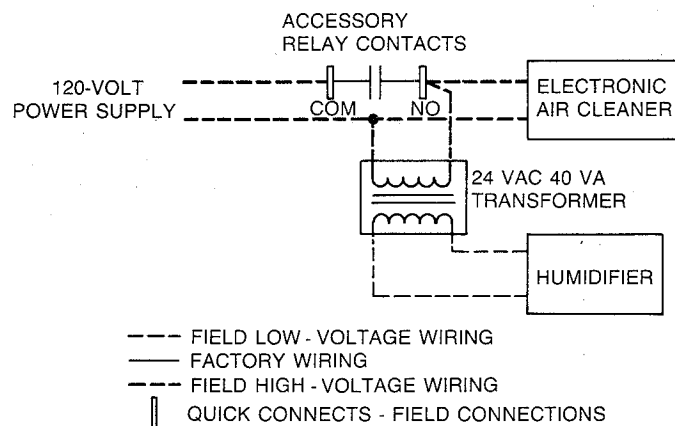


Fig. 13—Electronic Air Cleaner and Humidifier A87328

7. Cut black wire connected to NO terminal on ACCR and discard loose end.
8. Strip loose end of wire connected to NO terminal on ACCR.
9. Using field-supplied wire nut, connect 120-v accessory power lead to black wire connected to NO terminal on ACCR.
10. Connect other 120-v accessory power lead to white pigtail lead from 120-v TB. Use either butt connector supplied on end of pigtail, or cut and strip pigtail end and secure with a wire nut.
11. Route wiring directly out of control box away from microprocessor chip.

NOTE: If accessory has an internally grounded power lead, it must be connected as in item 10.

12. Go to item 18.

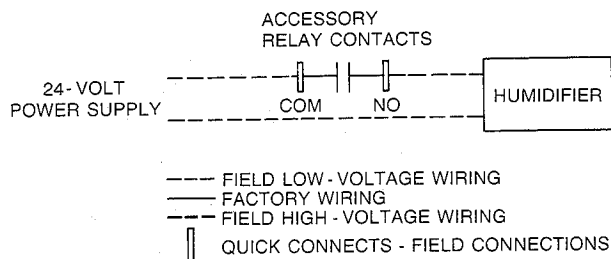


Fig. 14—Humidifier

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NOTE: For 24-v accessory hookup, see items 13 through 18 and Fig. 14.

13. Cut black wire connected to ACCR terminal NO approximately 3 in. from relay.
14. Cut off tip of black insulator (allowing 1/4-in. quick connect to be used) and connect loose wire to ACCR terminal COM.
15. Strip loose ends of both black leads connected to ACCR.
16. Connect lead (connected to COM on ACCR) to control board thermostat terminal R.
17. Using field-supplied wire nut, connect 24-v accessory power lead to short lead on ACCR terminal NO.
18. Connect 24-v accessory lead to control board thermostat terminal C.

NOTE: If accessory has an internally grounded power lead, it must be connected as in item 17.

19. Reinstall control box cover.
20. Reinstall blower access door.
21. Turn ON gas and electrical supplies to unit.
22. Check unit for proper operation through 2 complete cycles.
23. Reinstall control access door.

NOTE: If a bypass-type humidifier is used, the bypass humidifier switch on the microprocessor control board must be placed in the ON position to increase the low-heat blower motor speed. This prevents nuisance limit trips caused by the increase in return-air temperature caused by the bypass from the humidifier. (See Fig. 11 for BPH switch location.)

Modulating Damper System

For proper furnace operation, follow the installation instructions provided by the modulating damper system manufacturer. In addition, the multizone switch (labeled MZ on the microprocessor control board) must be placed in the ON position so the microprocessor can vary the blower speed to compensate for dampers that have modulated closed during heating or cooling cycles. (See Fig. 11 and Table 9 for multizone setup switch MZ location.) A 2-stage thermostat interface kit may be required for multizone applications. Short OFF or long ON cycles may cause furnace to run continuously in high-fire operation. See kit instructions for further details.

Step 6—Direct Venting

The 58VCA Furnace requires a dedicated (one 58VCA Furnace only) direct-vent system. In a direct-vent system all air for combustion is derived directly from the outside atmosphere and all flue gases are discharged to the outside atmosphere.

REMOVAL OF EXISTING FURNACES FROM COMMON VENT SYSTEMS — If a furnace is being replaced which was connected to a common vent system with another appliance(s), 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:

1. Seal any unused openings in the common vent system.
2. 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.
3. 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 vent system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected 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.
4. Follow the lighting instructions and place the appliance in operation. Adjust the thermostat so appliance will operate continuously.
5. Test for flue gas 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, etc.
6. 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.
7. 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. 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 ANSI Z223.1-1988, or Section 5 of CAN/C.G.A.-B149 for Canadian standards.

COMBUSTION-AIR AND VENT PIPING — The combustion-air and vent pipe fittings must conform to American National Standards Institute (ANSI) standards and American Society for Testing and Materials (ASTM) standards D1785 (schedule-40 PVC), D2665 (PVC-DWV), D2241 (SDR-21 and SDR-26 PVC), D2661 (ABS-DWV) or F628 (schedule-40 ABS). Pipe cement and primer must conform to ASTM standards D2564 (PVC) or D2235 (ABS). See Table 7 for maximum pipe lengths and Fig. 15, 16, and 17 for exterior piping arrangements.

In Canada construct all combustion-air and vent pipes for this unit of CSA or ULC certified schedule-40 PVC, PVC-DWV or ABS-DWV pipe and pipe cement. SDR pipe is not approved in Canada.

The accessory vent terminal kit described in the next section must be used in constructing the vent terminal for this unit. Pipes must terminate through either the roof or the sidewall (roof termination is preferable). Locate sidewall terminations to prevent damage to shrubs, condensing unit and siding materials. Table 8 gives clearance requirements.

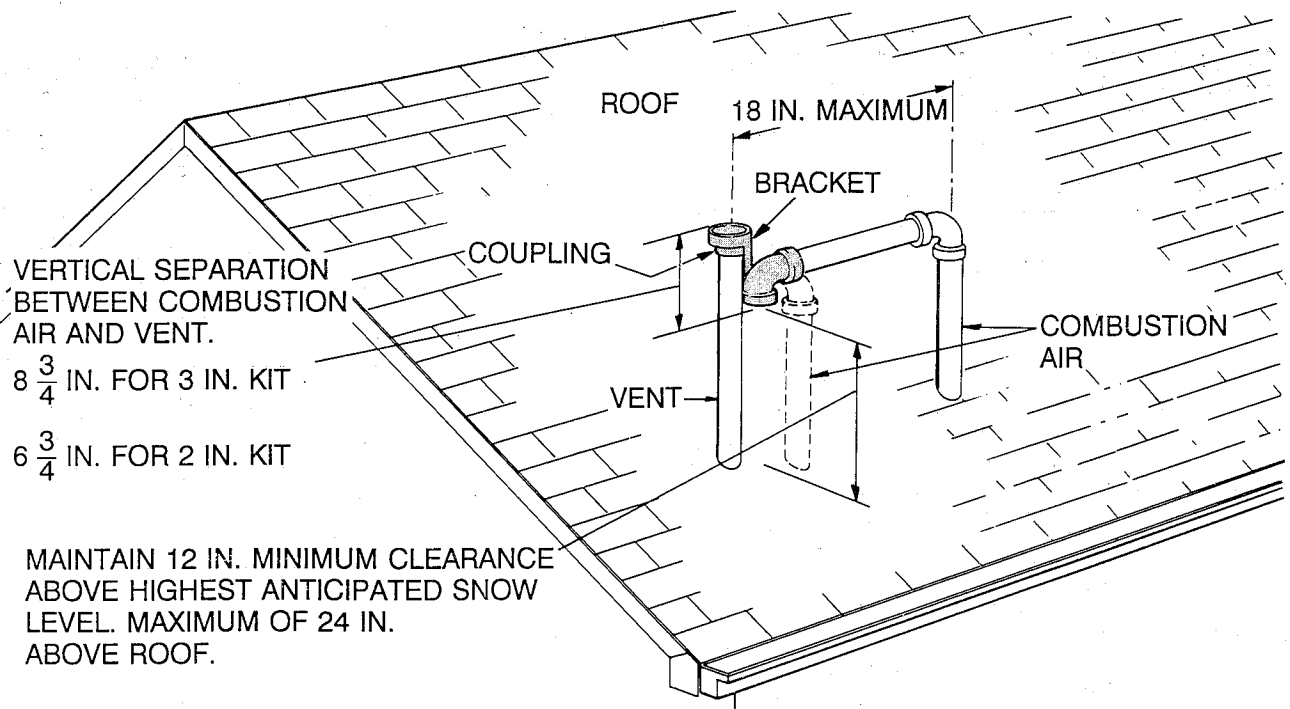


Fig. 15—Roof Termination (Preferred)

A87224

⚠ CAUTION

Combustion air must **not** be taken from inside the structure because that air frequently is contaminated by halogens, which include fluorides, chlorides, bromides, and iodides. These elements are found in aerosols, detergents, bleaches, cleaning solvents, salts, air fresheners, adhesives, paint, and other household products. Maintain a minimum of 36 in. (48 in. in Canada) between combustion-air inlet and clothes dryer vent. Locate the combustion-air inlet as far as possible from the swimming pool and swimming pool pump house.

⚠ CAUTION

When the vent pipe is exposed to temperatures below freezing, i.e. when it passes through an unheated space or when a chimney is used as a raceway, the pipe must be insulated with 1/2-in. thick Armaflex-type insulation.

⚠ CAUTION

When the combustion-air pipe is installed above a suspended ceiling, the pipe must be insulated with 1/2-in. Armaflex-type insulation. The combustion-air pipe should also be insulated when it passes through a warm, humid space.

⚠ WARNING

Solvent cements are combustible. Keep away from heat, sparks, and open flame. Use only in well ventilated areas. Avoid breathing the vapor and contact with the skin or eyes. Failure to follow this warning could result in a fire, property damage, personal injury, or death.

⚠ WARNING

All combustion-air and vent pipes must be airtight and watertight. The pipes must also terminate exactly as shown in Fig. 15 through 20. Failure to follow this warning could result in property damage, personal injury, or death.

The furnace is shipped from the factory assembled for right-side vent pipe connection. When left-side vent connection is desired, interchange the neoprene vent pipe coupling with the neoprene seal cap. Both the vent pipe coupling and seal cap are located on the inducer outlet box. Remove the plastic plug from the left casing side panel and install it in the right casing side panel.

NOTE: The 060- and 080-size units are shipped with 2-1/2 x 2 in. neoprene couplings. The 100-size unit is shipped with 2-1/2 x 2-1/2 in. neoprene couplings. Optional coupling sizes 3 x 2-1/2 in., 2-1/2 x 2-1/2 in., and 2-1/2 x 2 in. are available through your distributor or branch.

1. Determine pipe diameter as follows:

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

NOTE: Do not count the elbows to which the terminal bracket attaches or any elbow between the bracket and the open end of the pipe. See shaded areas in Fig. 15 through 17. Likewise, do not count pipe sections inside furnace casing.

If installing 2 adjacent 58VCA Furnaces, refer to "Multi-Venting and Vent Terminations of 58VCA Furnaces" for proper vent configuration.

EXAMPLE: A 100-LG size furnace located in Indianapolis, elevation 650 ft above sea level, could be installed in an application requiring 3 elbows and 40 ft of pipe.

Table 7 indicates this application would require 3 in. pipe since 2-1/2 in. pipe is good only for lengths up to 35 ft.

Table 7—Maximum Allowable Pipe Length (Ft)

ALTITUDE (FT ABOVE SEA LEVEL)	FURNACE SIZE	PIPE SIZE (IN.)	NUMBER OF 90° ELBOWS					
			1	2	3	4	5	6
0 to 2000	060-GG	2 2-1/2	55 70	55 70	55 70	50 70	45 70	45 70
	080-HG	2 2-1/2	35 70	35 70	30 70	25 70	20 70	15 70
	100-LG	2-1/2 3	45 70	45 70	35 70	30 70	20 70	15 70
2001 to 3000	060-GG	2 2-1/2	49 62	48 61	48 61	42 60	38 60	37 59
	080-HG	2 2-1/2	31 62	30 61	25 61	20 60	15 60	10 59
	100-LG	2-1/2 3	40 62	39 61	30 61	24 60	15 60	10 59
3001 to 4001	060-GG	2 2-1/2	45 57	44 56	43 55	37 54	33 53	32 52
	080-HG	2 2-1/2	28 57	27 56	21 55	17 54	11 53	16 52
	100-LG	2-1/2 3	37 57	36 56	26 55	20 54	11 53	6 52
4001 to 5000	060-GG	2 2-1/2	42 53	41 52	40 51	34 50	30 49	29 48
	080-HG	2 2-1/2	26 53	25 52	19 51	15 50	9 49	0 48
	100-LG	2-1/2 3	34 53	33 52	24 51	18 50	9 49	0 48

ALTITUDE (FT ABOVE SEA LEVEL)	FURNACE SIZE	PIPE SIZE (IN.)	NUMBER OF 90° ELBOWS					
			1	2	3	4	5	6
5001 to 6000	060-GG	2 2-1/2	39 49	37 47	36 46	29 44	25 43	24 41
	080-HG	2 2-1/2	24 49	22 47	16 46	12 44	5 43	0 41
	100-LG	2-1/2 3	31 49	30 47	21 46	14 44	5 43	0 41
6001 to 7000	060-GG	2 2-1/2	36 45	34 43	33 42	26 40	23 39	21 37
	080-HG	2 2-1/2	22 45	20 43	14 42	10 40	0 39	0 37
	100-LG	2-1/2 3	29 45	27 43	19 42	12 40	0 39	0 37
7001 to 8000	060-GG	2 2-1/2	32 41	30 39	28 37	21 35	18 33	16 31
	080-HG	2 2-1/2	19 41	17 39	10 37	7 35	0 33	0 31
	100-LG	2-1/2 3	26 41	24 39	15 37	8 35	0 33	0 31
8001 to 9000	060-GG	2 2-1/2	29 36	27 34	25 32	18 30	15 28	13 26
	080-HG	2 2-1/2	17 36	15 34	10 32	5 30	0 28	0 26
	100-LG	2-1/2 3	23 36	21 34	13 32	6 30	0 28	0 26
9001 to 10,000	060-GG	2 2-1/2	21 32	19 29	16 26	9 23	6 20	0 17
	080-HG	2 2-1/2	10 32	8 29	0 26	0 23	0 20	0 17
	100-LG	2-1/2 3	16 32	13 29	5 26	0 23	0 20	0 17

NOTES:

1. Size both the combustion-air and vent pipe independently, then use the larger diameter for both pipes.
2. Assume two 45° elbows equal one 90° elbow. Long radius elbows are desirable and may be required in some cases.
3. Elbows and pipe sections within the furnace casing and at the vent termination should not be included in vent length or elbow count.
4. The installer may use 1 larger pipe size than what is specified above (up to 4 in. diameter maximum).
5. The minimum pipe length is 5 ft for all applications.
6. Use 3-in. diameter vent termination kit for installations requiring 2-1/2, 3, or 4-in. diameter pipe.

If the same 100-LG size furnace, requiring 3 elbows and 40 ft of pipe, were to be installed in Albuquerque (elevation 5250 ft above sea level), the pipe diameter required would still be 3 in. Table 7 shows 3 in. pipe and 3 elbows can be used up to 46 ft of pipe.

Consult Product Engineering when pipe length of combustion-air or vent pipe needed is longer than allowed in Table 7.

2. Attach factory-supplied neoprene coupling to furnace combustion-air inlet connection and secure with clamp. Ensure that factory-supplied perforated metal disc is installed in flexible coupling.
3. Working from furnace to outside, cut pipe to required length(s).

Table 8—Combustion-Air and Vent Terminal Clearances

LOCATION	CLEARANCE (FT)	
	USA	Canada
Above anticipated snow depth	1	1
Above grade level	1	1
Dryer vent	3	4
From plumbing vent stack	3	3
Gas appliance vent terminal	4	4
From any non-mechanical fresh air opening where vent gases could enter building	1	3
From any mechanical fresh air intake	3*	6
From a gravity combustion-air opening of any appliance with an input capacity greater than 100,000 Btuh	1	3
From a gravity combustion-air opening of any appliance with an input capacity less than 100,000 Btuh	1	1
From service regulator vent, electric and gas meters, and relief equipment	4	6
Above grade when adjacent to public walkway	7	7

*3 ft (vertically) above an intake located within 10 ft.

4. Deburr inside and outside of pipe.
5. Chamfer outside edge of pipe for better distribution of primer and cement.
6. Clean and dry all surfaces to be joined.
7. Check "dry fit" of pipe and mark insertion depth on pipe.

NOTE: It is recommended that all pipes be cut, prepared, and preassembled before permanently cementing any joint.

8. After pipes have been cut and preassembled, apply generous layer of cement primer to pipe fitting socket and end of pipe to insertion mark. Quickly apply approved cement to end of pipe and fitting socket (over primer). Apply cement in light, uniform coat on inside of socket to prevent buildup of excess cement. Apply second coat.
9. While the cement is still wet, insert pipe into socket with a 1/4-turn twist. Be sure pipe is fully inserted into fitting socket.
10. Wipe excess cement from joint. A continuous bead of cement will be visible around the perimeter of a properly made joint.
11. Handle pipe joints carefully until cement sets.
12. Support combustion-air and vent piping a minimum of every 5 ft (3 ft for SDR-21 or -26 PVC) using perforated metal hanging strap. Slope combustion-air and vent pipes toward furnace a minimum of 1/4 in. per linear ft with no sags between hangers.
13. Use appropriate methods to seal openings where vent and combustion-air pipes pass through roof or side wall.

VENT TERMINAL KIT INSTALLATION

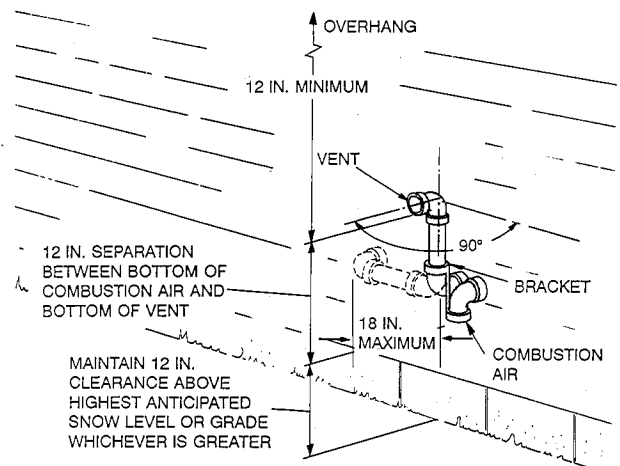
NOTE: If these instructions differ from those packaged with the vent terminal kit, follow the kit instructions.

The combustion-air and vent pipes must terminate outside the structure. A factory-supplied terminal kit must be installed as in 1 of the installations shown in Fig. 15 through 17. Roof termination is preferred. (See Fig. 15.) Two terminal kits are available. The 2-in. kit is for 2-in. diameter pipe systems. The 3-in. kit is for 2-1/2 in., 3-in., and 4-in. diameter pipe systems. (See Fig. 15 through 17 for the different applications.)

The shaded parts in Fig. 15 through 17 are provided in the terminal kit; therefore, do not count them when determining the pipe diameter.

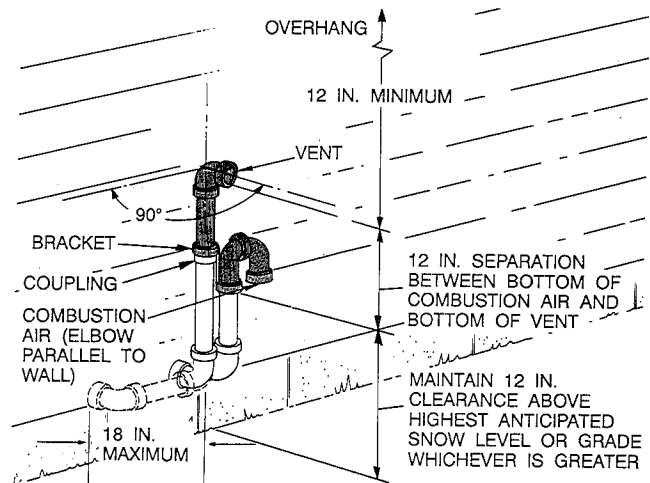
1. Roof termination (preferred). (See Fig. 15.)
 - a. Loosely install elbow in bracket and place assembly on combustion-air pipe.
 - b. Loosely install pipe coupling on properly cut vent pipe. The coupling must be positioned so the bracket will mount as shown in Fig. 15.
 - c. Disassemble loose pipe fittings. Clean and cement using same procedures as used for system piping.
 - d. Install bracket as shown in Fig. 15.
 - e. For applications using combustion-air pipe option, indicated by dashed lines in Fig. 15, install 90° street elbow into 90° elbow, making U-fitting. A 180° U-fitting may be used.
 - f. Install open end of street elbow on combustion-air pipe.
2. Sidewall termination when combustion-air and vent pipes exit through sidewall 12 in. or more above highest anticipated snow level and grade. (See Fig. 16.)
 - a. Install elbows as shown in Fig. 16 using same procedures for cementing as used for system piping.
 - b. Install bracket as shown in Fig. 16.

- c. Position vent pipe and elbow to maintain vertical 12-in. separation between vent pipe outlet and combustion-air inlet. Cement vent pipe in elbow as shown in Fig. 16.
- d. For applications using vent pipe option indicated by dashed lines in Fig. 16, rotate vent elbow 90° from position shown in Fig. 16.



A87225

Fig. 16—Sidewall Termination (12 in. or more above snow level or grade)



A87226

Fig. 17—Sidewall Termination (less than 12 in. above snow level or grade)

3. Sidewall termination when combustion-air and vent pipes exit through sidewall less than 12 in. above highest anticipated snow level or grade. (See Fig. 17.)
 - a. Install 1 elbow in bracket.
 - b. Install 90° street elbow into elbow in bracket, making U-fitting, or use 180° U-fitting.
 - c. Loosely install coupling on end of vent pipe.
 - d. Loosely install U-fitting and bracket as shown in Fig. 17. Position U-fitting so open end is against structure wall.
 - e. Loosely install vent outlet pipe and elbow in coupling as shown in Fig. 17.
 - f. Check required dimensions as shown in Fig. 17.

- g. Disassemble loose pipe fittings. Clean and cement using same procedures as used for system piping.
- h. Install bracket as shown in Fig. 17.

MULTIVENTING AND VENT TERMINATIONS OF 58VCA FURNACES — When 2 or more 58VCA Furnaces are vented near each other, each furnace must be individually vented. NEVER common vent or breach vent 58VCA Furnaces. When 2 or more 58VCA Furnaces are vented near each other, 2 vent terminations may be installed as shown in Fig. 18, 19 or 20, but the next vent termination must be at least 4 ft away from the first 2 terminations. It is important that the vent terminations be made as shown to avoid recirculation of flue gases.

The A dimension in Fig. 18, 19, and 20 represents the center 2 pipes touching or 2-in. maximum separation.

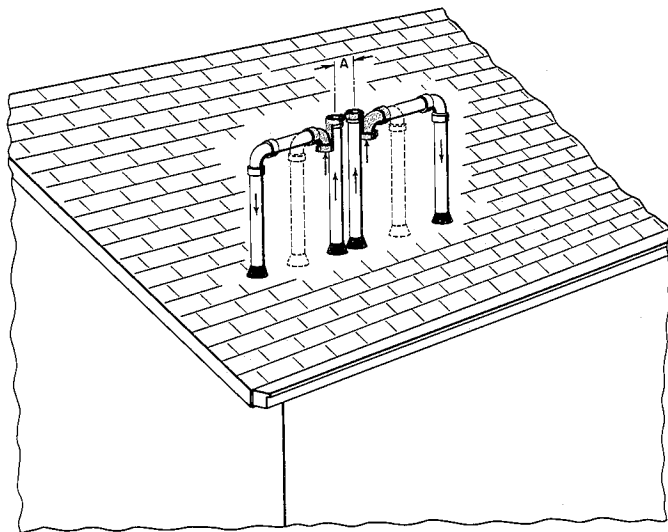


Fig. 18—Rooftop Termination (Preferred) A85182

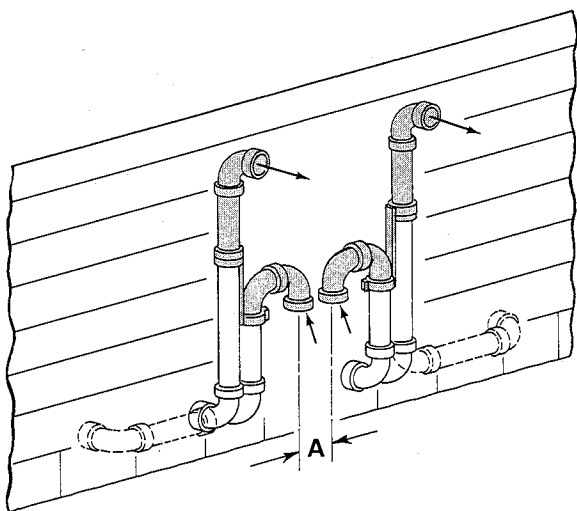


Fig. 19—Sidewall Termination (less than 12 in. above snow level or grade) A85184

Step 7—Condensate Drainage

The 1/2-in. diameter schedule 40 PVC or CPVC condensate drain piping and pipe fittings must conform to ANSI standards and ASTM D1785 or D2846. The schedule 40 PVC or CPVC cement and primer must conform to ASTM D2564 or F493.

In Canada, use CSA or ULC certified schedule 40 PVC or CPVC drain pipe and cement.

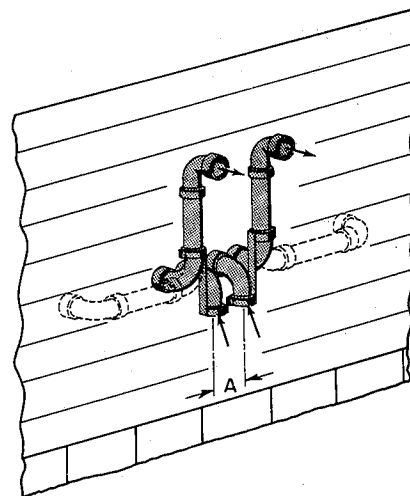


Fig. 20—Sidewall Termination (12 in. or more above snow level or grade) A85183

For proper condensate drainage from the furnace, the furnace must be within 1/2 in. of level. That is, the highest corner of the furnace must not be more than 1/2 in. higher than the lowest corner.

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

NOTE: The furnace contains an internal condensate trap; an external trap must not be installed.

1. Determine which side of furnace drain will exit, then cut and preassemble drain piping (not provided) directly to an open drain. Refer to Step 6—Direct Venting, "Combustion-Air and Vent Piping," for instructions on preparing and cementing plastic pipe.
2. Cement elbow on pipe assembly (provided) to condensate trap mounted on blower housing.
3. Using backup wrench, attach first section of drain pipe to compression coupling (provided).
4. When using schedule 40 PVC drain pipe, connect adapter (provided) to end of pipe installed in compression fitting.
5. Attach schedule 40 PVC adapter (field-supplied) to threaded factory adapter.
6. Cement remaining pipe joints.

Step 8—Start-Up, Adjustment, and Safety Check

GENERAL — The furnace must have a 115-vac power supply properly connected and grounded. Thermostat wire connections at terminals R and W must be made at the 24-v 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) for natural gas.

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

⚠ CAUTION

This furnace is equipped with a manual reset limit switch in the burner enclosure. This switch will open if an overheating condition occurs in the burner enclosure. Correct the inadequate combustion-air supply or improper venting practice condition and reset the switch. **DO NOT** jumper this switch.

⚠ CAUTION

The unit must not be installed, operated, and then turned off and left turned off, in an unoccupied structure during cold weather when the temperature drops to 32° F and below. Freezing condensate left in the furnace will damage the equipment. See Service and Maintenance Instructions for winterizing procedure.

Microprocessor Control Center

This control will aid the installer and service technician when installing or servicing the unit. The 24-v connections are provided for easy connection of field wiring. (See Fig. 11.)

The microprocessor control center features state-of-the-art control of combustion, temperature, and airflow to maximize comfort while operating at peak efficiency.

Combustion control is obtained by taking the appropriate inducer motor rpm readings when the low- or high-fire pressure switches make. Using this information, the microprocessor maintains a consistent air-to-fuel ratio independent of vent sizing.

A single-stage thermostat is used to provide 2-stage heating. The first cycle after power is reset will provide 6 minutes of low heat before switching to high heat—unless the room thermostat has been satisfied. Subsequent thermostat cycles will provide anywhere from 0 to 15 minutes of low heat depending on the length of the previous thermostat cycle.

Airflow control is accomplished by using a technique involving the microprocessor and blower motor where the static load on the air delivery system is measured during each heating cycle. The microprocessor then uses this information to deliver correct airflow independent of variations in system restrictions; i.e., dirty filter or zone damper.

Additional features are as follows: (See Fig. 11 and 21.)

1. Adjustable blower off-time from 60 to 240 sec in 20-sec intervals. Adjust by turning blower switch RSW1 in the direction indicated on the printed-circuit board. After a change in blower off-time or cooling airflow, the thermostat must be cycled to set the new values.
2. Variable cooling airflow switch RSW2 for selecting cooling airflow which matches the cooling capacity of the air conditioning system. The microprocessor is programmed to deliver 400 cfm/ton airflow.
3. LED fault code display to aid the installer and service technician while installing or servicing the unit.
4. Accessory connection for easy field wiring.
5. System modification and setup switches are provided for customization and proper operation of the furnace. (See Fig. 11 and Table 9 for location, description, and function of switches.)

Using the schematic diagram (Fig. 21), follow the sequence of operation through the different modes; read and follow the wiring diagram carefully.

Table 9—Setup Switch Description

SWITCH NO.	NORMAL POSITION	DESCRIPTION OF USE
1 (FLT)	Down	Turn switch up for fault history display.
2 (LO)	Down	Turn switch up to lock furnace in the low-heat mode only.
3 (HI)	Down	Turn switch up to lock furnace in the high-heat mode only.
4 (EMER HEAT)*	Down	Turn switch up to bypass microprocessor control. Furnace will operate at high heat only with main blower and inducer motor operating at maximum conditions NO safeties are bypassed.
5 (MZ)	Down	Turn switch up when modulating dampers are used. In this mode the main blower speed is recalculated once every minute while the furnace is in the low-heat or continuous blower mode.
6	NAT	Up for natural gas operation.
	PROP	Down for propane gas operation.
7 (BPH)	Down	Turn switch up when a bypass humidifier is used. This will compensate for the higher return-air temperature.

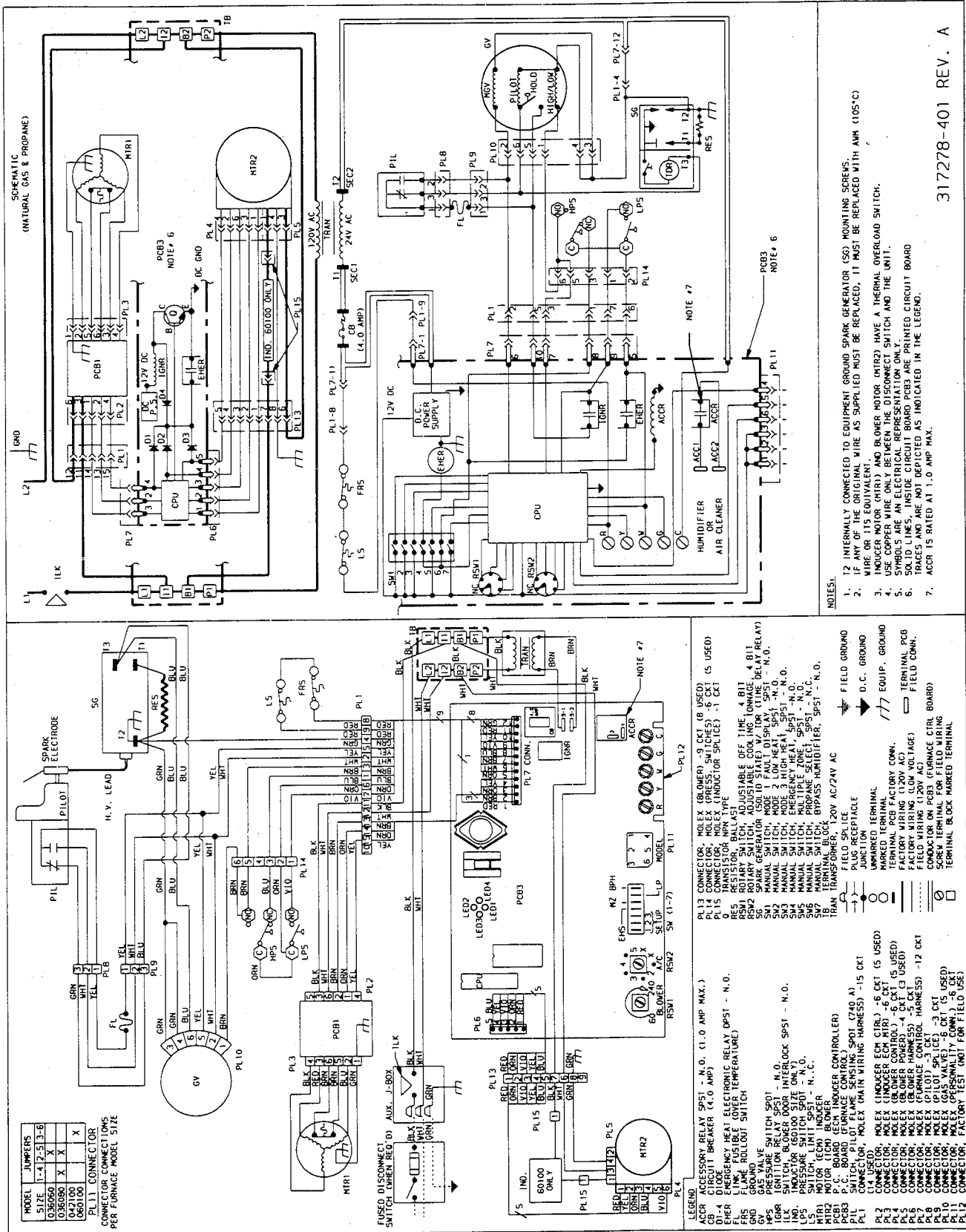
*Function is disabled when propane operation is selected.

SEQUENCE OF OPERATION

1. Self-Test: After electrical supply is reset, the microprocessor (CPU) goes through a self-test sequence. This self-test sequence takes approximately 20 sec to complete. Seven sec after the electrical supply is reset, the green LED fault light comes on for 12 sec, followed by a 1-sec interval where both the green and yellow LED's are lit. If the wall thermostat has a "call for heat" during the self-test sequence, the CPU starts blower motor (MTR2) on low speed (approximately 400-500 rpm) for 20 sec. At this time, the CPU takes a calibration reading and adjusts the blower motor MTR2 speed to deliver low-fire airflow. After the blower motor MTR2 has been on for 1 minute, the motor will be turned off and the following heating or cooling cycle will begin.

The control circuit of the furnace shown in the schematic wiring diagram (Fig. 21) results in the following sequence of operation for the heating, emergency heat, cooling, and continuous blower cycles:

2. Heating cycle:
 - a. When the blower door is in place, 115v are supplied through blower door interlock switch ILK to the inducer controller PCB1 and blower motor MTR2. Transformer TRAN is energized, supplying 24v to the microprocessor control center PCB3 and R thermostat terminal.
 - b. The room thermostat "calls for heat," closing the R-W circuit. This closed circuit supplies power to the 24-v flow-sensing switches LPS and HPS.
 - c. The CPU, upon receiving a thermostat signal, starts inducer motor MTR1 and gradually increases the inducer motor MTR1 speed.
 - d. As inducer motor MTR1 comes up to speed, flow-sensing switches LPS and HPS close, supplying 24v to ignition relay contacts IGNR, the high-fire solenoid in gas valve GV, and the necessary input signals to the CPU—no gas flow will occur at this time.
 - e. Ten sec after flow-sensing switch HPS closes, the CPU activates ignition relay IGNR which then energizes the



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PILOT solenoid coil of gas valve GV and time-delay circuit of spark generator SG through fusible link FL.

- f. When the PILOT solenoid coil of gas valve GV is energized, gas flows to the pilot. The internal pressure switch of gas valve GV senses the pilot gas pressure and closes, completing the *HOLD* circuit. The normally open, time-delay circuit closes after an additional 10-sec purge delay, energizing spark generator SG. The pilot is ignited by a spark produced by spark generator SG.
- g. After a short delay (20 to 70 sec) while the pilot heats up, the normally closed, flame-sensing contacts PIL open. The PILOT solenoid coil remains energized through the *HOLD* circuit. Spark generator SG shuts off when the flame is sensed at the spark electrode. The normally open, flame-sensing switch contacts PIL close 5 to 20 sec later, energizing the main operator MGV of gas valve GV. The MGV opens immediately, increasing the gas pressure approximately 5 sec later, allowing gas flow to the main burners. The pilot flame immediately ignites the gas.
- h. Simultaneously, representative control signals are sent to the CPU which start the blower on-delay timer and make the appropriate inducer motor MTR1 speed adjustments necessary to maximize combustion efficiency. Approximately 35 sec after gas valve GV opens, the CPU starts blower motor MTR2 on low speed (approximately 400-500 RPM) for 20 sec. At this time, the CPU takes a calibration reading and adjusts the blower motor MTR2 speed to deliver the proper airflow for low- or high-fire operation.
- i. Approximately 60 sec after gas valve GV opens, the CPU adjusts the inducer motor MTR1 speed to run the furnace in the low-fire mode for a predetermined time based on the furnace heating load—unless the room thermostat is satisfied. If the thermostat has not been satisfied while in low fire in the allotted time period, the CPU adjusts the inducer motor MTR1 and the blower motor MTR2 speeds. The adjustments allow the furnace to operate in high-fire mode for the remainder of the thermostat cycle.
- j. When the thermostat is satisfied, the R-W circuit is broken, de-energizing gas valve GV, which sends the control signal to the CPU, which stops inducer motor MTR1 after 15 sec. Gas flow to the pilot and main burners stops immediately. The CPU adjusts the blower motor MTR2 speed to deliver low-fire airflow for approximately 60 to 240 sec (depending on the blower off-time adjustment), after which the CPU stops the blower motor MTR2.

NOTE: After a brief interruption of either the electrical or gas supplies, the furnace will not resume operation until the contacts of pilot flame-sensing switch PIL move from the normally open position to the normally closed position.

3. Cooling cycle:

- a. The room thermostat "calls for cooling;" R-G and R-Y circuits are energized. Simultaneously, the R-Y circuit starts the outdoor condensing unit, and the R-Y-G circuit sends the appropriate signal to the CPU which starts blower motor MTR2 on low speed (approximately 400-500 rpm) for 20 sec. At this time, the CPU takes a calibration reading and adjusts the blower motor MTR2 speed to deliver 400 cfm/ton airflow. The airflow will vary depending on the setting of airflow selection switch RSW2.

NOTE: If the Y thermostat lead is not connected to the indoor microprocessor control board and a "call for cooling" occurs, the blower motor MTR2 will run at continuous blower speed. Indoor coil freeze-up can occur if the Y lead is not properly connected.

- b. When the thermostat is satisfied, the R-G and R-Y circuits are broken, de-energizing the outdoor condensing unit and sending a control signal to the CPU which stops blower motor MTR2 after an additional 90 sec.

4. Emergency heat cycle (setup switch SW4 ON, See Fig. 11 and Table 9):

In the event of CPU failure, the furnace will deliver heat in the emergency heat mode until service may be obtained. Setup switch SW4 **must** be ON. The furnace should be serviced as soon as possible.

NOTE: The furnace should not be run in emergency heat for extended periods of time. Operate the furnace in emergency heat only as long as required to obtain a non-functioning component replacement. In this mode, the CPU is bypassed and the motors run at full speed which can over stress the electronics and reduce the life of the primary heat exchanger.

- a. When the blower door is in place, 115v are supplied through blower door interlock switch ILK to the inducer controller PCB1 and blower motor MTR2. Transformer TRAN is energized, supplying 24v to the microprocessor control center PCB3 and R thermostat terminal.
- b. The room thermostat "calls for heat," closing the R-W circuit. This closed circuit supplies power to the flow-sensing switches LPS and HPS.
- c. Simultaneously, the emergency heat electronic relay EHER is energized. EHER relay contacts close, starting inducer motor MTR1, blower motor MTR2, and activates ignition relay IGNR which then energizes the PILOT solenoid coil of gas valve GV and time-delay circuit of spark generator SG through fusible link FL. Another set of contacts in EHER relay close in the 24-v circuit, locking in the EHER relay. The EHER relay is locked in until the R-W circuit, limit switch LS, flame roll-out switch FRS, or auxiliary limit switch ALS (when used) opens.
- d. When the PILOT solenoid coil of gas valve GV is energized, gas flows to the pilot. The internal pressure switch of gas valve GV senses the pilot gas pressure and closes, completing the *HOLD* circuit. The normally open, time-delay circuit closes after a 10-sec purge delay, energizing spark generator SG. The pilot is ignited by a spark produced by spark generator SG.
- e. As the inducer motor MTR1 comes up to speed, flow-sensing switch HPS closes, energizing the high-fire solenoid of gas valve GV—no gas flow will occur at this time. After a short delay (20 to 70 sec) while the pilot heats up, the normally closed flame-sensing contacts PIL open. The PILOT solenoid coil remains energized through the *HOLD* circuit. Spark generator SG shuts off when flame is sensed at the spark electrode. The normally open, flame-sensing switch contacts PIL close 5 to 20 sec later, energizing the main operator MGV of gas valve GV. The MGV opens immediately, increasing the gas pressure approximately 5 sec later, allowing gas flow to the main burners. The pilot flame immediately ignites the gas.
- f. When the thermostat is satisfied, the R-W circuit is broken, de-energizing gas valve GV, inducer motor MTR1, and blower motor MTR2. The gas flow to the pilot and main burners stops immediately.

5. Continuous blower cycle:

- a. When the room thermostat is set for continuous blower, the R-G circuit is energized. The R-G circuit sends the appropriate signal to the CPU which starts blower motor MTR2

on low speed (approximately 400-500 rpm) for 20 sec. At this time, the CPU takes a calibration reading and adjusts the blower motor MTR2 speed to run at continuous blower speed.

- b. During a "call for heat", the blower motor MTR2 will stop when the main operator MGV of gas valve GV is energized. This allows the furnace heat exchangers to heat up more quickly. Approximately 35 sec after the gas valve GV opens, the CPU starts blower motor MTR2 on low speed (approximately 400-500 rpm) for 20 sec. At this time, the CPU takes a calibration reading and adjusts the blower motor MTR2 speed to deliver the proper airflow for low- or high-fire operation.

START-UP PROCEDURES

1. Fill condensate trap with water.
 - c. Disconnect condensate drain tube from inducer outlet box.
 - d. Insert funnel into tube and pour 1 quart of water into tube. This should overfill the trap and flow into an open drain.
 - e. Reconnect drain tube to inducer outlet box.
2. Purge gas lines. If not previously done, purge the lines after all connections have been made and check for leaks.

⚠ WARNING

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

3. Ignition system check.

Check to be sure all connections have been properly made, then proceed as follows:

- a. Start the furnace using the procedure outlined on the operating instructions attached to the furnace.
- b. After the pilot lights, the main burners should light in 25 to 75 sec. If the main burners do not light within this time period, check the pilot flame, electrical supply to main gas valve, burner crossover alignment, gas supply pressure, and manifold and orifice alignment.

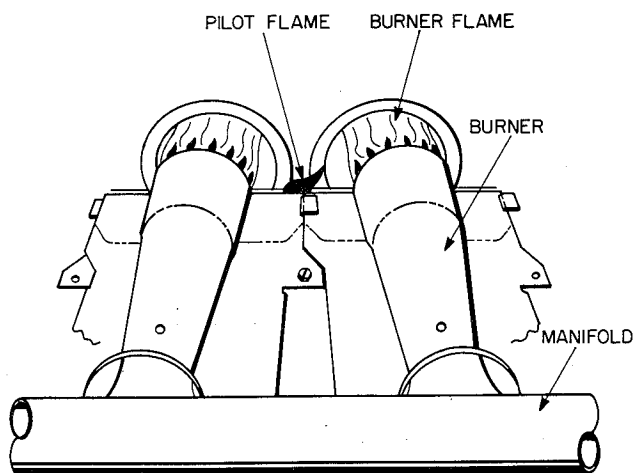


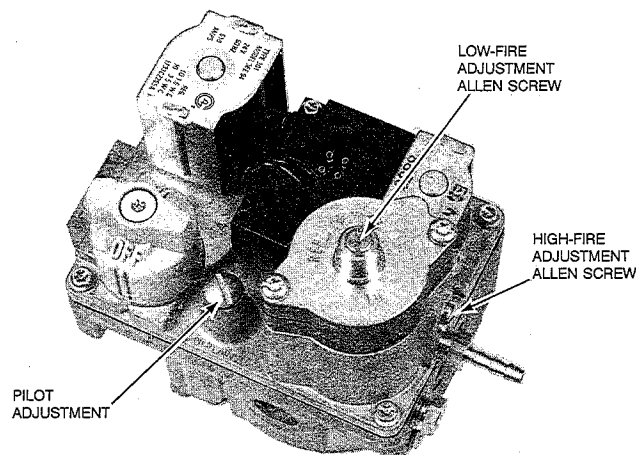
Fig. 22—Burner Flame

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- c. The main burner flames should be clear blue, almost transparent. The pilot flame should be soft blue in color, well defined, and must provide good impingement on the pilot-sensing element. Pilot flame should extend above burner carryover port to provide proper burner ignition. (See Fig. 22.)

- d. When the pilot flame requires adjustment:

NOTE: For easy pilot flame adjustment, disconnect the pilot lead connector and jumper the yellow and green wires. This will prevent main burner ignition and allow time to adjust the pilot. Reconnect the pilot lead connector after adjustment. Check the flame characteristics after replacing the burner enclosure front.



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Fig. 23—Redundant Automatic Gas Valve

- (1.) Locate adjustment screw marked "PILOT ADJ" on top of gas valve. (See Fig. 23.)
- (2.) Remove seal cap and turn adjustment screw clockwise (in) to decrease pilot gas flow or counterclockwise (out) to increase pilot gas flow.
- (3.) When proper adjustment is obtained, replace seal cap.

ADJUSTMENTS

Gas Input

1. Reset thermostat below room temperature.
2. Set thermostat to "call for heat."
3. Determine natural gas orifice size and manifold pressure for correct input during high- and low-heat operation by using Table 10.
 - a. Obtain average yearly heat value for local gas supply.
 - b. Obtain average yearly specific gravity for local gas supply.
 - c. Verify the furnace model. Table 10 can only be used for model 58VCA Furnaces.
 - d. Check and verify orifice size in furnace. **NEVER ASSUME THE ORIFICE SIZE. ALWAYS CHECK AND VERIFY.**
 - e. Find natural gas heat value and specific gravity in Table 10.
 - f. Follow heat value line and specific gravity line to point of intersection to find orifice size and manifold pressure settings for proper operation at given natural gas condition. Adjust manifold pressure per item 5.

Table 10—Model 58VCA Orifice Size and Manifold Pressure for Correct Input Rate*
(Tabulated data based on altitude up to 2000 ft)†

GAS HEAT VALUE (BTUH/CU FT)	0.56		0.58		0.60		0.62		0.64		0.66		0.68		0.70		0.72	
	Orf No.	Heat High/Low	Orf No.	Heat High/Low	Orf No.	Heat High/Low	Orf No.	Heat High/Low	Orf No.	Heat High/Low	Orf No.	Heat High/Low	Orf No.	Heat High/Low	Orf No.	Heat High/Low	Orf No.	Heat High/Low
900	43	3.6/1.7	43	3.7/1.8	42	3.2/1.5	42	3.3/1.6	42	3.4/1.6	42	3.5/1.7	42 41	3.6/1.7 3.2/1.5	42 41	3.7/1.8 3.3/1.6	42 41	3.8/1.8 3.4/1.6
915	43	3.5/1.7	43	3.6/1.7	43	3.7/1.8	42	3.2/1.5	42	3.3/1.6	42	3.4/1.6	42	3.5/1.7	42 41	3.6/1.7 3.2/1.5	42 41	3.7/1.8 3.3/1.6
930	43	3.4/1.6	43	3.5/1.7	43	3.6/1.7	43	3.7/1.8	42	3.2/1.5	42	3.3/1.6	42	3.4/1.6	42	3.5/1.7	42 41	3.6/1.7 3.2/1.5
945	44 43	3.7/1.8 3.3/1.6	43	3.4/1.6	43	3.5/1.7	43	3.6/1.7	43	3.7/1.8	42	3.2/1.5	42	3.3/1.6	42	3.4/1.6	42	3.4/1.6
960	44 43	3.6/1.7 3.2/1.5	44 43	3.8/1.8 3.3/1.6	43	3.4/1.6	43	3.5/1.7	43	3.6/1.7	43	3.7/1.8	42	3.2/1.5	42	3.3/1.5	42	3.3/1.6
975	44	3.5/1.7	44 43	3.6/1.7 3.2/1.5	44 43	3.8/1.8 3.3/1.6	43	3.4/1.6	43	3.5/1.7	43	3.6/1.7	43	3.7/1.8	43	3.8/1.8	43	3.2/1.5
990	44	3.4/1.6	44 43	3.5/1.7 3.2/1.5	44 43	3.6/1.7 3.2/1.5	44 43	3.8/1.8 3.3/1.6	43	3.4/1.6	43	3.5/1.7	43	3.6/1.7	43	3.7/1.8	43	3.8/1.8
1005	44	3.3/1.6	44	3.4/1.6	44	3.5/1.7	44 43	3.7/1.7 3.2/1.5	44 43	3.8/1.8 3.3/1.6	43	3.4/1.6	43	3.5/1.7	43	3.6/1.7	43	3.7/1.8
1020	44	3.2/1.5	44	3.3/1.6	44	3.4/1.6	44	3.6/1.7	44 43	3.7/1.7 3.2/1.5	44 43	3.8/1.8 3.3/1.6	43	3.4/1.6	43	3.5/1.7	43	3.6/1.7
1035	45	3.8/1.8	44	3.2/1.5	44	3.3/1.6	44	3.4/1.6	44	3.6/1.7	44 43	3.7/1.7 3.2/1.5	44 43	3.8/1.8 3.3/1.6	43	3.4/1.6	43	3.5/1.7
1050	45	3.7/1.8	45	3.8/1.8	44	3.2/1.5	44	3.4/1.6	44	3.5/1.6	44	3.6/1.7	44 43	3.7/1.8 3.2/1.5	44 43	3.8/1.8 3.3/1.6	43	3.4/1.6
1065	46 45	3.8/1.8 3.6/1.7	45	3.7/1.8	45 44	3.8/1.8 3.2/1.5	44	3.3/1.6	44	3.4/1.6	44	3.5/1.7	44	3.6/1.7	44 43	3.7/1.8 3.2/1.5	44 43	3.8/1.8 3.3/1.6
1080	46 45	3.7/1.7 3.5/1.7	46 45	3.8/1.8 3.6/1.7	45	3.7/1.8	44	3.2/1.5	44	3.3/1.6	44	3.4/1.6	44	3.5/1.7	44	3.6/1.7	44 43	3.7/1.8 3.2/1.5
1095	46 45	3.6/1.7 3.4/1.6	46 45	3.7/1.8 3.5/1.7	46 45	3.8/1.8 3.6/1.7	45	3.7/1.8	44	3.2/1.5	44	3.3/1.6	44	3.4/1.6	44	3.5/1.7	44	3.6/1.7
1110	46 45	3.5/1.6 3.3/1.6	46 45	3.6/1.7 3.4/1.6	46 45	3.7/1.8 3.5/1.7	46 45	3.8/1.8 3.6/1.7	45	3.8/1.8	44	3.2/1.5	44	3.3/1.6	44	3.4/1.6	44	3.5/1.7

*The correct input rate per burner is 21,000 Btu/h for high heat, and 14,500 Btu/h for low heat.

†Gas input ratings are certified for altitudes to 2000 ft. For elevations above 2000 ft, reduce ratings 4 percent for each 1000 ft above sea level. In Canada, from 2000 to 4500 ft above sea level, derate the unit 10 percent.

EXAMPLE:

Heat value 1050 Btu/cu ft

Specific gravity 0.58

Orifice No. 45*

High-heat manifold pressure 3.8-in. wc

Low-heat manifold pressure 1.8-in. wc

*The furnace is shipped with No. 44 orifices. Therefore, in this example all main burner orifices must be changed to No. 45 orifices to allow the furnace to operate at 100 percent of the rated input.

NOTE: Ensure all pressure tubing, combustion-air and vent pipes, and burner enclosure front are in place when clocking the meter.

- g. Check input rate by clocking meter as described in item 4.
4. Determine natural gas input rates during high- and low-heat operation by clocking gas meter as follows and adjusting manifold pressure per item 5.
 - a. Turn off all other gas appliances and pilots.
 - b. Measure time (in sec) for gas meter test dial to complete 1 revolution.
 - c. Refer to Table 11 for cubic ft of gas per hour.
 - d. Multiply gas rate (cu ft/hr) x heating value (Btu/cu ft) to get heating input in Btu/h. Obtain heating value from local gas utility.

e. Measured gas input must not exceed gas input on unit rating plate.

NOTE: High altitude—Gas input on rating plate is for altitudes up to 2000 ft. Ratings for altitudes over 2000 ft must be 4 percent less for each 1000 ft above sea level. To obtain the altitude adjusted rating, adjust the manifold pressure and replace the main burner orifices as needed. Refer to National Fuel Gas Code Appendix F, Table F-4 for proper orifice sizing at high altitudes. Consult local gas utility for altitude adjustment (if any) of gas heating value.

In Canada, from 2000 to 4500 ft above sea level, derate the unit 10 percent.

EXAMPLE:

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

Heating value of gas = 1070 Btu/cu ft

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

Gas rate = 100 cu ft/hr (from Table 11)

Btu heating input = 100 x 1070 = 107,000 Btu/h

5. Adjust input rate as follows:

NOTE: Wait 1 minute after main burners have ignited for unit to switch from high fire "preheat" to low fire. Only 6 minutes are available to complete this next adjustment before the unit switches to high fire. Setup switch No. 2 on the microprocessor control board may be placed in the ON (up) position to provide continuous low-fire operation if desired. (See Fig. 11.)

Table 11—Gas Rate Cu Ft/Hr

SECONDS FOR 1 REVOLUTION	SIZE OF TEST DIAL			SECONDS FOR 1 REVOLUTION	SIZE OF TEST DIAL		
	1 cu ft/hr	2 cu ft/hr	5 cu ft/hr		1 cu ft/hr	2 cu ft/hr	5 cu ft/hr
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				

NOTE: Manifold pressure must always be measured with the burner enclosure front removed. The gas meter must always be clocked with the burner enclosure front installed. The gas valve regulator has been nominally set at 1.6 in. wc for low-fire and 3.5 in. wc for high-fire operation with natural gas.

- Remove burner enclosure front and low-fire regulator adjustment seal cap. (See Fig. 23.)
- Set low-fire manifold pressure:** Turn adjustment screw clockwise (in) to increase manifold pressure or counter-clockwise (out) to decrease pressure. **DO NOT** set manifold pressure less than 1.4- or more than 1.8-in. wc for natural gas. If input rate cannot be obtained within these manifold pressure settings, replace the main burner orifices with orifices within 1 size of that presently installed.

⚠ CAUTION

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

NOTE: If orifice hole appears damaged or it is suspected to have been redrilled, check the orifice hole with a numbered drill bit of the correct size. Never redrill an orifice. A burr-free and squarely aligned orifice hole is essential for proper flame characteristics.

- Reinstall low-fire regulator adjustment seal cap. Return setup switch No. 2 to the OFF (down) position if it was changed previously. (See Fig. 11.)

d. After unit switches to high fire, remove high-fire regulator adjustment seal cap. (See Fig. 23.) Setup switch No. 3 on the microprocessor control board may be placed in the ON (up) position to provide continuous high-fire operation if desired. (See Fig. 11.)

e. **Set high-fire manifold pressure:** Turn adjustment screw clockwise (in) to increase manifold pressure or counter-clockwise (out) to decrease pressure. **DO NOT** set manifold pressure less than 3.2- or more than 3.8-in. wc for natural gas. If input rate cannot be obtained within these manifold pressure settings, replace the main burner orifices with orifices within 1 size of that presently installed.

f. Replace high-fire regulator adjustment seal cap. Return setup switch No. 3 to the OFF (down) position if it was changed previously. (See Fig. 11.)

g. Replace burner enclosure front and recycle furnace before measuring adjusted gas input using method outlined in item 3 or 4.

⚠ CAUTION

Ensure burner enclosure front is in place after adjustment has been made.

- Turn furnace gas valve control knob OFF.
- Remove manometer, apply pipe dope sparingly to manifold pressure tap plug, and replace plug.
- Turn furnace gas valve control knob ON.
- Allow unit to recycle; when main burners ignite, check pressure tap plug for gas-leaks. (See Fig. 22 for proper burner and flame orientation.)

Set temperature rise.

1. The furnace must not be operated outside the range of temperature rise specified on the unit rating plate. Determine the air temperature rise as follows:

- Place thermometers in return and supply ducts as near furnace as possible. Be sure thermometers do not "see" heat exchanger so that radiant heat does not affect readings. This practice is particularly important with straight-run ducts.
- When thermometer readings stabilize, subtract return-air temperature from supply-air temperature to determine air temperature rise.

NOTE: Temperature rise can be determined for low-fire operation by placing setup switch No. 2 on microprocessor control board in the ON position. For high-fire operation, return setup switch No. 2 to the OFF position and place setup switch No. 3 in the ON position. **DO NOT** forget to return setup switches to OFF position upon completion of testing. (See Fig. 11 for switch location.)

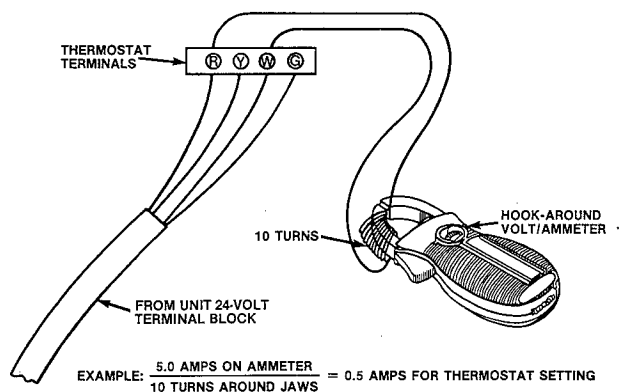
c. This furnace is capable of automatically providing the proper airflow to maintain the temperature rise within the range specified on the unit rating plate. If the temperature rise is outside this range, proceed as follows:

- (1.) Check gas input for low- and high-fire operation.
- (2.) Check derate for altitude if applicable.
- (3.) Check all return and supply ducts for excessive restrictions causing static pressure greater than 0.5 in. wc.
- (4.) Ensure bypass humidifier switch (BPH) on microprocessor control board is in ON position when a bypass humidifier is used. (See Fig. 11 for switch location.)
- (5.) Check "Troubleshooting Guide for Deluxe Gas-Fired Condensing Furnaces."

Set thermostat heat anticipator.

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

Fig. 24 illustrates an easy method of obtaining these measurements. The amp reading should be while the furnace is operating in the low-heat mode. To operate the furnace in low heat, reset the electrical supply and reset the thermostat to "call for heat." The unit will start in low heat, operating in this mode for 6 minutes before switching to high heat. This should be sufficient time to obtain the amp draw readings.



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Fig. 24—Amp Draw Check with Ammeter

NOTE: When using an electronic thermostat, set the cycle rate for 3 cycles per hour.

CHECK SAFETY CONTROLS

1. Safety check of limit control.

This control shuts off the combustion gas supply and energizes the blower motor if the furnace overheats.

The recommended method of checking this limit control is to gradually block off the return-air duct after the furnace has been operating for a period of at least 5 minutes. As soon as the limit control functions, the return-air duct should be unblocked to permit normal air circulation. By using this method to check the limit control, it can be established that the limit is functioning properly and the furnace will "fail safe" if there is a restricted circulating air supply or motor failure. If the limit control does not function during this test, the cause must be determined and corrected.

2. Safety check of flow-sensing switch.

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

- Turn OFF 115-v electrical supply to furnace.
- Remove control access door and disconnect ECM inducer motor leads at 6-circuit connector on ECM inducer control box.
- Turn ON 115-v electrical supply to furnace. Set thermostat to "call for heat." When the flow-sensing switches are functioning properly, fault code 42 will flash on the LED fault display approximately 10 sec after the thermostat switch is closed. If either fault code 31 or 32 is flashed when the ECM inducer motor is disconnected, the furnace will shut itself down immediately. Determine the reason the flow-sensing switches did not function properly and correct the condition.
- Turn OFF 115-v electrical supply to furnace.
- Reconnect inducer motor leads, reinstall control access door, turn ON 115-v electrical supply, and reset thermostat to desired temperature.

CHECK LIST

- Put away tools and instruments; clean up debris.
- Verify that blower and control access doors are properly installed.
- Cycle-test furnace with room thermostat.
- Check operation of accessories per manufacturer's instructions.
- Review User's Manual with owner.
- Leave literature packet near furnace.

