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58SXB Deluxe Gas-Fired Electronic Condensing Furnaces

Installation Guidelines—Procedures

INTRODUCTION

→ **NOTE:** Read the entire instruction before starting the installation.

Reference should also be made to 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.

Portions of the following instruction have been adopted in part from the current edition of the National Fuel Gas Code NFPA No. 54, TIA-54-1984-1/ANSI Z223.1-1984, Z223.1a-1987 and American Gas Association. For further details, consult this publication, or the current edition available from National Fire Protection Association, Inc., Batterymarch Park, Quincy, MA 02269, or American Gas Association, 1515 Wilson Boulevard, Arlington, VA 22209.

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 pace with changing residential construction practices. We require these standard procedures as a minimum for a safe installation.

→ **NOTE:** The qualified installer or agency must use only factory authorized kits or accessories when modifying this product.

⚠ 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 degrees F DB or an intermittent operation down to 55 degrees F DB such as when used with a thermostat night setback.

These instructions have the following sections:

- I. Inspection
- II. Location and Air for Ventilation
- III. Gas Piping
- IV. Combustion-Air, Vent, and Condensate Piping
- V. Electrical
- VI. Startup, Adjustment, and Safety Check
- VII. Accessory Hookup
- VIII. Service Diagnostics

⚠ WARNING

Never store anything on, or in contact with, the furnace, such as:

Spray or aerosol cans, rags, brooms, dust mops, vacuum cleaners, or other cleaning tools.

Soap powders, bleaches, waxes or other cleaning compounds, plastic or plastic containers, gasoline, kerosene, cigarette lighter fluid, dry-cleaning fluids, or other volatile fluids.

Paint thinners and other painting compounds, paper bags or other paper products.

A failure to adhere to this warning can cause corrosion of the heat exchanger, fire, personal injury, or death.

I. INSPECTION

Check the available power supply to be sure that it meets the specifications on the furnace rating plate and all motors in the equipment.

Check the available gas supply to see that it conforms to the gas specification on the A.G.A. rating plate.

II. LOCATION AND AIR FOR VENTILATION

Locate the furnace as near the center of the air distribution system as possible.

⚠ CAUTION

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

NOTE: For proper furnace operation, the furnace must be installed within 1/2 in. of level.

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

Provide ample space for servicing and cleaning. Always comply with the minimum fire protection clearances shown on the unit rating plate. This furnace must NOT be installed directly on carpeting, tile, or any combustible material other than wood flooring.

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.

A. 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 means to prevent operation of either unit unless the damper is in the full-heat or full-cool position.

B. Special Locations

When the furnace is installed in a residential garage, it must be installed so that it is protected from physical damage by vehicles.

When a furnace is installed in public garages, airplane hangars, or other buildings having hazardous atmospheres, the unit must be installed in accordance with the requirements of the National Fire Protection Association, Inc.

III. GAS PIPING

Gas piping must be installed in accordance with national and local codes.

The gas supply line should be a separate line running directly from the meter to the furnace, if possible. Refer to Table 1 for the recommended gas pipe sizing. It is best to slope all pipe 1/4 in. in 15 ft to prevent traps. All horizontal runs should slope away from the meter to risers. Risers should be used to connect to the furnace and to the meter.

Joint compounds (pipe dope) should be applied sparingly and only to the male threads of the joints. Consult your local gas supplier for the type of compound to be used. This pipe dope must be resistant to the action of LP (propane) gas.

Install a sediment trap in the riser leading to the furnace. This trap will serve as a trap for dirt and condensate. 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. Then 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. 1.

Where a gum filter is required by local codes, install it in accordance with their requirements.

An accessible manual shut-off valve must be installed upstream 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.

⚠ CAUTION

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

Place a ground joint union between the gas control manifold and the manual gas shut-off valve. See Fig. 1.

⚠ WARNING

Use the proper length of pipes to avoid stress on the gas control manifold. A failure to adhere to this warning can cause a gas leak resulting in a fire, explosion, physical injury, or death.

Protect all segments of the piping system against physical and thermal damage. Support all piping with appropriate straps, hangers, etc. Use a minimum of one hanger every

6 ft. For pipe sizes larger than 1/2 in. follow the recommendations of national codes.

Table 1—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 54-1984

*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).

⚠ CAUTION

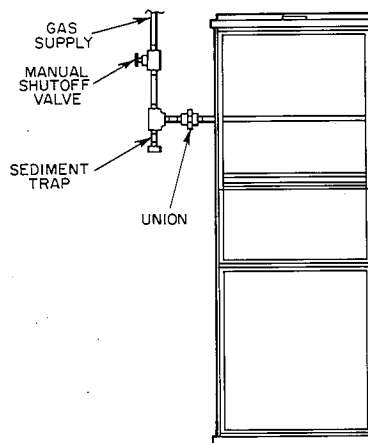
If a flexible connector is required or allowed by the authority having jurisdiction, black iron pipe must be installed at the gas valve and extend a minimum of 2 in. outside the furnace casing.

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 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.

⚠ 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 leaks. A failure to adhere to this warning can cause a fire, explosion, physical injury or death.

After final connection to the furnace has been made, purge the lines and check for leakage with regulated gas supply pressure.



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Fig. 1—Gas Piping Arrangement

IV. COMBUSTION-AIR, VENT, AND CONDENSATE PIPING

Combustion-air and vent pipes for this unit can be of schedule-40 PVC, PVC-DWV, SDR-21 PVC, SDR-26 PVC, or ABS-DWV pipe and terminate through either the roof or a sidewall. Roof termination is preferable. Sidewall terminations must be located to prevent damage to shrubs and siding materials. See Table 2 for clearance requirements.

⚠ 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 and other household products. Vapors from these products are highly corrosive to gas-fired furnaces, even in extremely low concentrations (as low as 0.5 ppm).

Maintain a minimum of 36-in. 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.

Table 2—Combustion-Air and Vent Terminal Clearances

Location	Clearance Feet
Dryer vent	3
From plumbing vent stack	3
Gas appliance vent terminal	4
From any opening where vent gases could enter building	1
Above grade and anticipated snow depth	1
Above grade when adjacent to public walkway	7

NOTE: When a previously common-vented system (furnace and water heater) is converted to water heater only, the vent system may be drastically oversized for the water heater. Consult the National Fuel Gas Code for proper sizing of the vent and revise the system if necessary.

⚠ 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 or install thermostat controlled heat tape. When using heat tape, follow the manufacturer's instructions for installation procedures.

⚠ 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.

A. Combustion-Air and Vent Piping

The combustion-air and vent pipes and fittings must conform to American National Standards Institute (ANSI) standards and American Society for Testing and Materials (ASTM) standards D1785, D2661, D2241, or D2665. The pipe cement and primer must conform to ASTM D2235 or

D2564. See Table 3 for maximum allowable pipe lengths and Figs. 2 through 7 for piping arrangements.

⚠ WARNING

Solvent cements are combustible. Keep away from heat, sparks, and open flame. Use only in well ventilated areas. Avoid breathing of the vapor and contact with the skin or eyes. A failure to adhere to this warning can cause a fire, explosion, physical injury, or death.

⚠ WARNING

All combustion-air and vent pipes must be airtight and watertight. The pipes must also terminate exactly as shown in Figs. 2 through 7.

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

1. Determine maximum allowable pipe length (for applications from 0 to 10,000 ft above sea level) using Table 3.

EXAMPLE: An 060-size furnace located in Albuquerque requires 13 ft of vent pipe, two 90-degree elbows and two 45-degree elbows for the vent pipe. Using Table 3, the maximum allowable pipe length at 5250 ft above sea level with three elbows is 26 ft of 2-in. pipe; therefore, this venting arrangement will be okay.

Consult Application Engineering when pipe length of combustion-air or vent pipe needed is longer than allowed in Table 3.

NOTE: Do not count the elbows to which the terminal bracket attaches or any elbow between the bracket and open end of the pipe.

2. Working from furnace to outside, cut pipe to required length(s).

Table 3—Maximum Allowable Length Using 2-in. Diameter Pipe*

Altitude (feet above sea level)	Furnace Size	Number of 90 Degree Elbows†‡				
		1	2	3	4	5
0-2000	060	35	35	35	35	35
	080	35	35	35	35	35
2001-3000	060	35	35	35	32	29
	080	35	35	35	32	29
3001-4000	060	35	35	31	28	24
	080	35	35	31	28	24
4001-5000	060	35	33	29	26	22
	080	35	33	29	26	22
5001-6000	060	34	30	26	22	18
	080	34	30	26	22	18
6001-7000	060	32	28	24	20	16
	080	32	28	24	20	16
7001-8000	060	29	25	20	16	11
	080	29	25	20	16	11
8001-9000	060	27	23	18	14	9
	080	27	23	18	14	9
9001-10,000	060	25	20	15	10	5
	080	25	20	15	10	5

*Pipe length applies to both combustion-air and vent pipes.

†Elbows and pipe section supplied in the vent terminal kit should not be included in the count.

‡Two 45-degree elbows are equal to one 90-degree elbow. Long radius elbows are desirable.

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

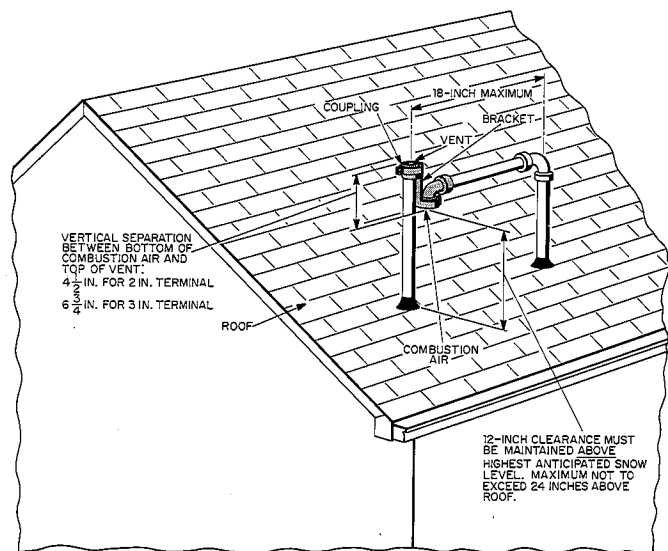
NOTE: It is recommended that all pipes be cut, prepared, and preassembled before permanently cementing any joint.

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 the 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 piping at 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 lineal foot with no sags between hangers.
13. Use appropriate methods to seal openings where vent and combustion-air pipes pass through roof or sidewall.

B. 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 termination kit must be installed as in one of the installations shown in Figs. 2 through 7. Roof termination is preferred. See Fig. 2. Two terminal kits are available. The 2-in. kit is for 1-1/2-in. and 2-in. diameter pipe systems. The 3-in. kit is for 2-1/2-in. and 3-in. diameter pipe systems. Each kit will have extra parts. See Figs. 2 through 7 for the different applications.

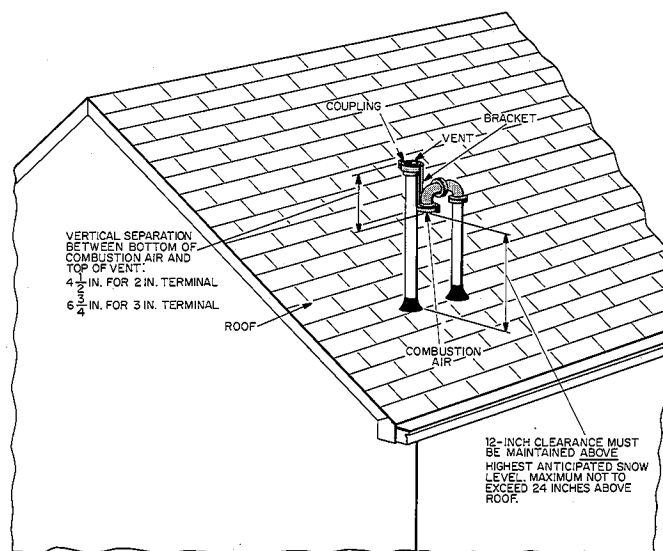


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Fig. 2—Rooftop Termination

The shaded parts in Figs. 2 through 7 are provided in the termination kit; therefore, do not count them when determining the pipe diameter.

1. Rooftop terminal installation. See Figs. 2 and 3.
 - a. Remove one 90-degree elbow from elbow-and-bracket assembly provided in kit and loosen screw so other elbow can turn.
 - b. Loosely install elbow with bracket on combustion-air pipe.
 - c. Loosely install pipe coupling, provided in kit, on properly cut vent pipe. The position of the coupling must be so that the bracket will mount as shown in Fig. 2.
 - d. Disassemble loose pipe fittings. Clean and cement using same procedures as used for system piping.
 - e. Install bracket as shown in Fig. 2.
 - f. For applications using combustion-air pipe option as shown in Fig. 3, install 90-degree street ell into 90-degree elbow, making a U-fitting.
 - g. Install open end of street ell on combustion-air pipe.
2. Sidewall terminal installation when combustion-air and vent pipes exit through sidewall 12 in. or more above highest anticipated snow level or grade. See Figs. 4 and 5.
 - a. Loosely install elbow and bracket assembly on combustion-air and vent pipes.
 - b. Remove and disassemble elbow and bracket assembly.
 - c. Install elbows as shown in Fig. 4 or 5 using same procedures for cementing as used for system piping.
 - d. Install bracket as shown in Fig. 4 or 5.
 - e. Position vent outlet pipe and elbow as to maintain 12-in. separation between vent pipe outlet and combustion-air inlet. Cement vent pipe in elbow as shown in Fig. 4 or 5.
 - f. For applications using vent pipe option as shown in Fig. 5, rotate vent elbow 90 degrees from position shown in Fig. 4.
3. Sidewall terminal installation when combustion-air and vent pipes exit through sidewall below highest anticipated snow level or grade. See Figs. 6 and 7.



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Fig. 3—Rooftop Termination

- Remove one elbow from bracket assembly.
- Install 90-degree street ell into elbow remaining in bracket, making U-fitting.
- Loosely install coupling on end of vent pipe.
- Loosely install U-fitting and bracket as shown in Fig. 6. Position U-fitting so open end is against structure wall.
- Loosely install vent outlet pipe and elbow in coupling as shown in Fig. 6 or 7.
- Check required dimensions as shown in Fig. 6 or 7.
- Disassemble loose pipe fittings. Clean and cement using same procedures as used for system piping.
- Install bracket as shown in Fig. 6 or 7.

C. Condensate Drain

→ **NOTE:** Condensate must be disposed of in a nonfreezing area.

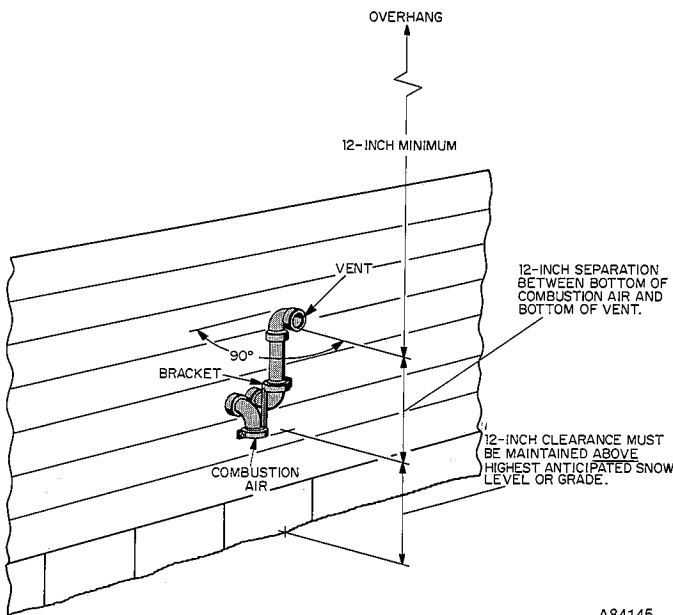


Fig. 4—Sidewall Termination Above Snow Level or Grade

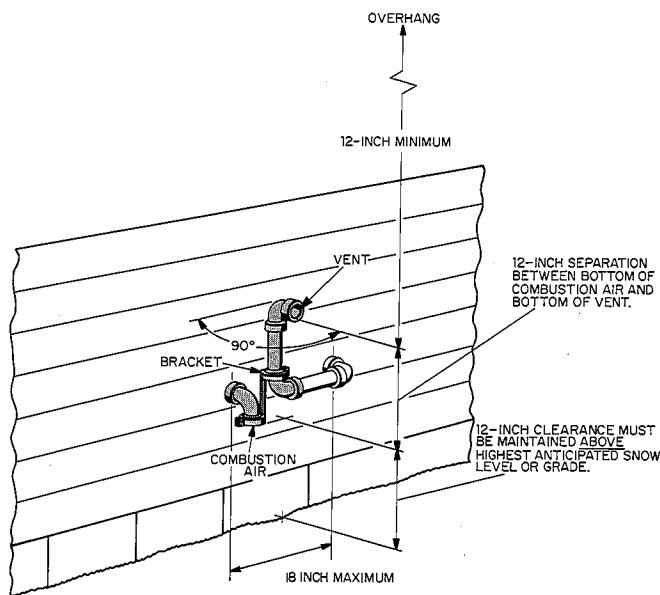


Fig. 5—Sidewall Termination Above Snow Level or Grade

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

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.

⚠ CAUTION

When the condensate drain pipe passes through an unheated area and is exposed to temperatures below freezing, the pipe must be insulated with 1/2-in. thick Armaflex-type insulation or install thermostat controlled heat tape. When using heat tape, follow the manufacturer's instructions for installation procedures.

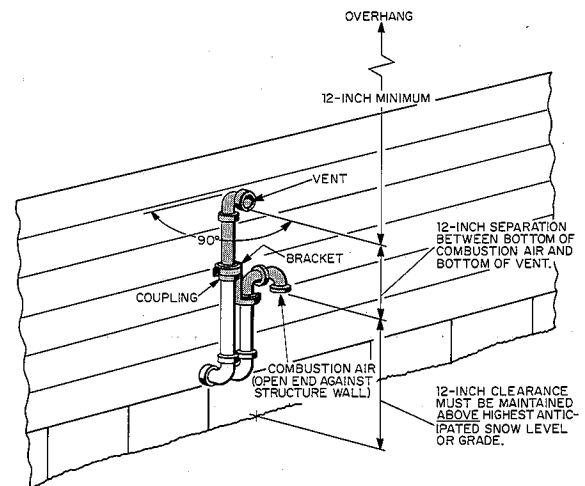


Fig. 6—Sidewall Termination Below Snow Level or Too Close to Grade

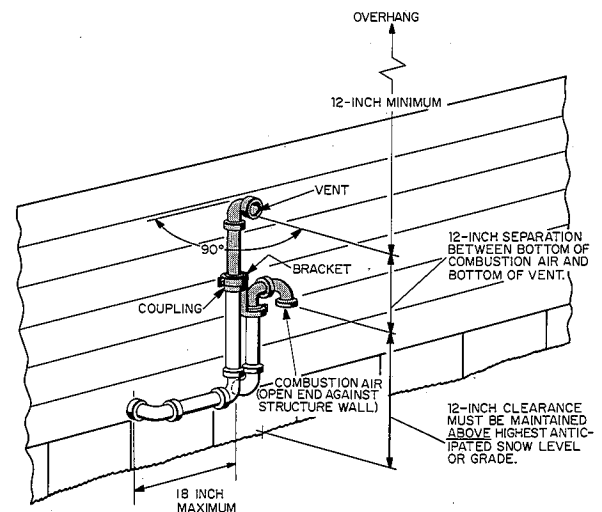


Fig. 7—Sidewall Termination Below Snow Level or Too Close to Grade

When a condensate pump is required to dispose of condensate, use a pump with parts that are resistant to acidic water.

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 Section IV A, "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.

V. ELECTRICAL

IMPORTANT: 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 the unit rating plate for equipment electrical requirements.

The specific furnace Installation Instructions contain wiring diagrams which show the proper field high- and low-voltage wiring. Make all connections in accordance with the National Electrical Code and any local codes and ordinances that might apply.

⚠ WARNING

The cabinet must have an uninterrupted or unbroken ground according to the National Electrical Code, ANSI/NFPA 70-1987, and local codes to minimize personal injury if an electrical fault should occur. The ground may consist of electrical wire or metallic conduit approved to electrical ground when installed in accordance with existing electrical codes. **DO NOT** use gas supply piping as an electrical ground.

⚠ CAUTION

If a 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.

NOTE: Use only copper conductors between the disconnect switch and the furnace.

Check all electrical connections (both factory and field) for tightness. This check should also be done after the unit has reached operating temperatures.

VI. STARTUP, ADJUSTMENT, AND SAFETY CHECK

A. Fill condensate trap with water.

1. Disconnect condensate drain tube from inducer outlet box.
2. Insert funnel into tube and pour one quart of water into tube. This should overfill the trap and flow into an open drain.
3. Reconnect drain tube to inducer outlet box.

B. Ignition System Check

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

Start the furnace using the procedure outlined on the Lighting Instructions attached to the furnace; however, when starting the furnace for the first time, perform the following additional steps:

1. If the gas supply was not purged before connecting the furnace, the line will be full of air. It is recommended that the ground joint union be loosened, and the supply line be allowed to purge until the odor of gas is detected. Never purge gas lines into a combustion chamber. Immediately upon detection of a gas odor, retighten the union. Check gas supply pressure to be sure it is within rating plate limits. Allow 5 minutes to elapse, then start the furnace in accordance with the lighting instructions on the furnace.
2. After the pilot lights, the main burners should light in 25 to 75 seconds. If the main burners do not light within the prescribed time period check; the pilot flame, electrical supply to main gas valve, burner cross-over alignment, gas supply pressure, manifold, and orifice alignment.
3. The pilot flame should be soft blue in color and it must provide good impingement on the pilot switching element. The flame should extend above the burner carry-over port to provide proper burner ignition. When the pilot flame requires adjustment:
 - a. Locate adjustment screw marked "PILOT ADJ" on top of gas valve.

Table 4—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				

- b. Remove cap and turn adjustment screw clockwise to decrease pilot gas flow. Turn screw counter-clockwise to increase pilot gas flow.
- c. When proper adjustment is obtained, replace screw cap.

C. Gas Input

1. Determine natural gas orifice size and manifold pressure for correct input during high- and low-heat operation by using Table 5. Adjust manifold pressure per step 3.

NOTE: Be sure all pressure tubing combustion-air and vent pipes, and burner enclosure front are in place when checking input.

- 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 5 can only be used for Model 58SXB 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 5.
- 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.

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.

- g. Check input rate by clocking meter as manifold pressure using procedure described in step 2.

2. Determine natural gas input rates during high- and low-heat operation by clocking gas meter and adjusting manifold pressure per step 3.

NOTE: Be sure all pressure tubing, combustion-air and vent pipes, and burner enclosure front are in place when checking input.

- a. Turn off all other gas appliances and pilots.
- b. Measure time (in seconds) for gas meter test dial to complete one revolution.
- c. Refer to Table 4 for cubic ft of gas per hour.
- d. Multiply gas rate. Obtain heating value from local gas utility (cu ft/hr) x heating value (Btu/cu ft).

→ **Table 5—Model 58SXB Orifice Size and Manifold Pressure for Correct Input Rate***
(Tabulated data based on altitude up to 2000 feet.)

Gas Heat Valve (Btu/cu ft)	SPECIFIC GRAVITY OF NATURAL GAS															
	0.54		0.56		0.58		0.60		0.62		0.64		0.66		0.68	
	Or No.	Heat High/Low	Or No.	Heat High/Low	Or No.	Heat High/Low	Or No.	Heat High/Low	Or No.	Heat High/Low	Or No.	Heat High/Low	Or No.	Heat High/Low	Or No.	Heat High/Low
900	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	3.6/1.7
															41	3.2/1.5
915	44	3.8/1.8	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
	43	3.4/1.6													41	3.2/1.5
930	44	3.7/1.8	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
	43	3.3/1.6													41	3.2/1.5
945	44	3.6/1.7	44	3.7/1.8	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
	43	3.2/1.5	43	3.3/1.6											42	3.4/1.6
960	44	3.5/1.6	44	3.6/1.7	44	3.8/1.8	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
			43	3.2/1.5	43	3.3/1.6									42	3.3/1.6
975	44	3.4/1.6	44	3.5/1.7	44	3.6/1.7	44	3.8/1.8	43	3.4/1.6	43	3.5/1.7	43	3.6/1.7	43	3.7/1.8
			43	3.2/1.5	43	3.3/1.6									42	3.2/1.5
990	44	3.3/1.5	44	3.4/1.6	44	3.5/1.7	44	3.6/1.7	44	3.8/1.8	43	3.4/1.6	43	3.5/1.7	43	3.6/1.7
							43	3.2/1.5	43	3.3/1.6					43	3.7/1.8
1005	44	3.2/1.5	44	3.3/1.6	44	3.4/1.6	44	3.5/1.7	44	3.7/1.7	44	3.8/1.8	43	3.4/1.6	43	3.5/1.7
									43	3.2/1.5	43	3.3/1.6			43	3.6/1.7
1020	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	3.7/1.7	44	3.8/1.8	43	3.4/1.6
											43	3.2/1.5	43	3.3/1.6	43	3.5/1.7
1035	45	3.7/1.7	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	3.7/1.7	43	3.3/1.6
											43	3.2/1.5	43	3.3/1.6	43	3.4/1.6
1050	46	3.7/1.8	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	3.7/1.8
	45	3.5/1.7											43	3.2/1.5	43	3.3/1.6
1065	46	3.6/1.7	46	3.8/1.8	45	3.7/1.8	45	3.8/1.8	44	3.3/1.6	44	3.4/1.6	44	3.5/1.7	44	3.6/1.7
	45	3.4/1.6	45	3.6/1.7			44	3.2/1.5							44	3.7/1.8
1080	46	3.5/1.7	46	3.7/1.7	46	3.8/1.8	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
	45	3.4/1.6	45	3.5/1.7	45	3.6/1.7									43	3.2/1.5
1095	46	3.4/1.6	46	3.6/1.7	46	3.7/1.8	46	3.8/1.8	45	3.7/1.8	44	3.2/1.5	44	3.3/1.6	44	3.4/1.6
	45	3.3/1.6	45	3.4/1.6	45	3.5/1.7	45	3.6/1.7							44	3.5/1.7
1110	46	3.3/1.6	46	3.5/1.6	46	3.6/1.7	46	3.7/1.8	46	3.8/1.8	45	3.8/1.8	44	3.2/1.5	44	3.3/1.6
	45	3.2/1.5	45	3.3/1.6	45	3.4/1.6	45	3.5/1.7	45	3.6/1.7					44	3.4/1.6
1125	47	3.7/1.8	46	3.4/1.6	46	3.5/1.7	46	3.6/1.7	46	3.7/1.8	45	3.7/1.7	45	3.8/1.8	44	3.2/1.5
	46	3.2/1.5	45	3.2/1.5	45	3.3/1.6	45	3.4/1.6	45	3.5/1.7					44	3.3/1.6
1140	47	3.6/1.7	47	3.7/1.8	46	3.4/1.6	46	3.5/1.7	46	3.6/1.7	46	3.7/1.8	45	3.7/1.8	45	3.8/1.8
	46	3.2/1.5	46	3.3/1.6	45	3.2/1.5	45	3.3/1.6	45	3.4/1.6	45	3.5/1.6	45	3.6/1.7	44	3.2/1.5
1155	47	3.5/1.7	47	3.6/1.7	47	3.7/1.8	46	3.4/1.6	46	3.5/1.7	46	3.6/1.7	46	3.7/1.7	45	3.6/1.7
			46	3.2/1.5	46	3.3/1.6	45	3.3/1.6	45	3.4/1.6	45	3.5/1.7	45	3.6/1.7	45	3.7/1.8
1170	47	3.4/1.6	47	3.5/1.7	47	3.6/1.7	46	3.3/1.6	46	3.4/1.6	46	3.5/1.7	46	3.6/1.7	46	3.7/1.7
					46	3.2/1.5	45	3.2/1.5	45	3.3/1.6	45	3.4/1.6	45	3.5/1.7	45	3.6/1.7
1185	48	3.8/1.8	47	3.4/1.6	47	3.6/1.7	47	3.7/1.8	46	3.4/1.6	46	3.5/1.7	46	3.6/1.7	46	3.7/1.8
	47	3.3/1.6					46	3.3/1.6	45	3.2/1.5	45	3.3/1.6	45	3.4/1.6	45	3.5/1.7

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

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

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 sec

Gas rate = 100 cu ft/hr (from Table 5)

Btu heating input = $100 \times 1070 = 107,000$ Btuh

3. To adjust input rate:

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.

- a. Remove burner enclosure front and, using Allen key, loosen Allen-head screw that locks high-fire solenoid in place. See Fig. 10.
- b. Put setup switch No. 3 on microprocessor control board in ON position to provide continuous high-fire operation. See Fig. 11.
- c. Turn high-fire solenoid either counterclockwise (out) to decrease high-input rate or clockwise (in) to increase high-input rate, DO NOT set manifold pressure more than 3.2 minimum to 3.8 maximum in. wc for natural gas. Make any major adjustments by changing main burner orifices.

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

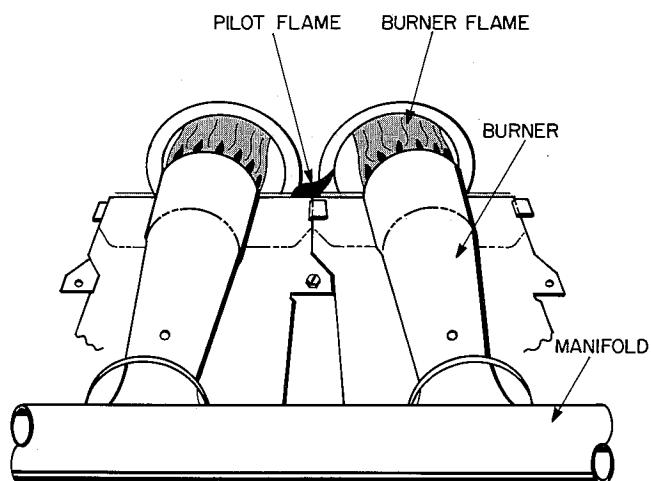


Fig. 8—Pilot and Burner Flame

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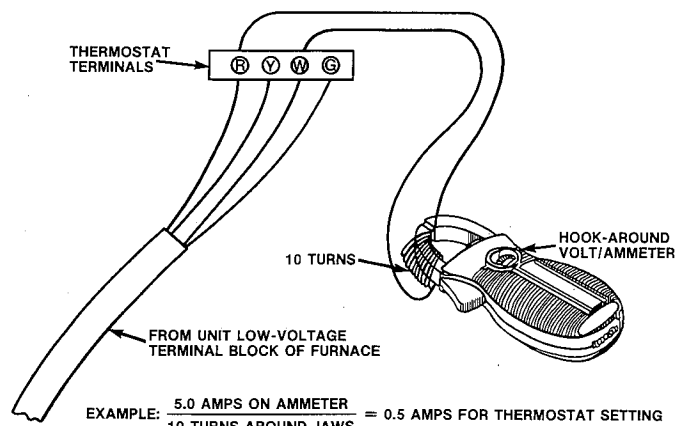


Fig. 9—Amp Draw Check With Ammeter

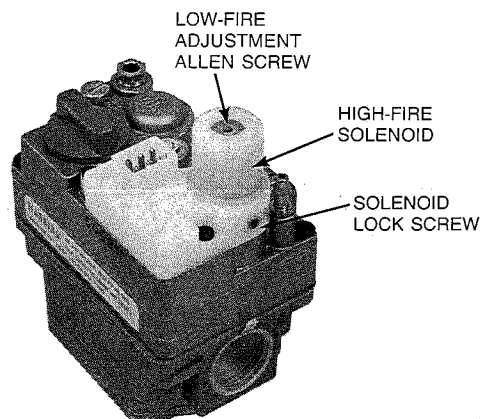
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- d. Tighten Allen-head screw for locking high-fire solenoid in place and return setup switch No. 3 on microprocessor control board to OFF position.
- e. Put setup switch No. 2 on microprocessor control board in ON position to provide continuous low-fire operation.
- f. Locate Allen-head screw in center of high-fire solenoid. See Fig. 10.
- g. Using Allen key turn Allen-head screw either clockwise (in) to increase low-fire input rate or counterclockwise (out) to decrease low-fire input rate. DO NOT set manifold pressure more than 1.4 minimum to 1.8 maximum for natural gas.
- h. Return setup switch No. 2 on microprocessor control board to OFF position.
- i. Replace burner enclosure front and recycle furnace before measuring adjusted gas input using method outlined in step 1 or 2.

CAUTION

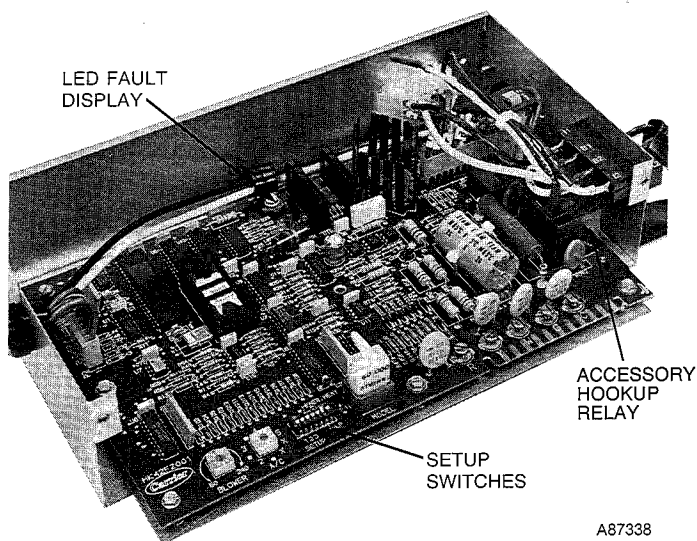
Be sure burner enclosure front is in place after adjustments have been made.

4. Look through sight glass in burner enclosure and check burner and pilot flame. The main burner flame should be clear blue, almost transparent. The pilot flame should be well defined. See Fig. 8.



A87339

Fig. 10—Gas Valve



A87338

→ **Fig. 11—Microprocessor Control Center**

5. High Altitude

Input ratings are for altitudes up to 2000 ft. Ratings for altitudes over 2000 ft must be 4% 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.

D. Temperature Rise

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:

1. Place thermometers in return and supply ducts as near furnace as possible. Be sure thermometers do not "see" heating element so that radiant heat does not affect readings. This practice is particularly important with straight-run ducts.
2. 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. See Fig. 11.

3. 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 do the following:
 - a. Check gas input for low- and high-fire operation.
 - b. Check derate for altitude if applicable.
 - c. Check all return and supply ducts for excessive restrictions causing static pressure greater than 0.5 in. wc.
 - d. Check to make sure bypass humidifier switch (marked BPH) on microprocessor control board is in ON position when a bypass humidifier has been installed. See Fig. 11.
 - e. Check "Troubleshooting Guide for Deluxe Gas-Fired Condensing Furnace."

E. Thermostat Heat Anticipator Adjustment

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 & W.

Fig. 9 illustrates an easy method of obtaining these measurements. The amp reading should be taken while the furnace is operating in the low-heat mode.

F. Safety Check of Limit Control

The control shuts off the combustion gas supply and energizes the circulating-air blower motor if the furnace overheats.

The recommended method of checking this 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 control functions, the return-air opening 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.

G. Safety Check of Flow-Sensing Switch

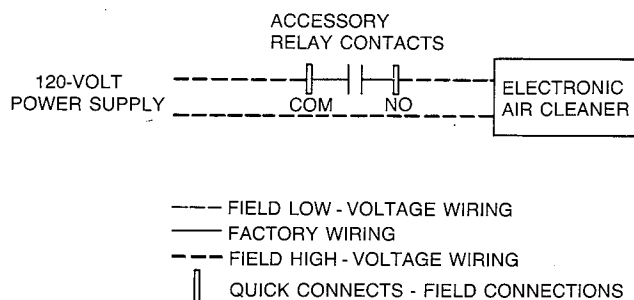
This control proves operation of the draft inducer.

Check switch operation as follows:

1. Turn off 115-volt power to furnace.
2. Remove control access panel and disconnect ECM inducer motor leads at 6-circuit connector on ECM inducer control box.
3. Turn on 115-volt power to furnace.
4. Set thermostat to "call for heat." When the flow-sensing switches are functioning properly, fault 42 will flash on the LED fault display 10 seconds after the thermostat switch is closed. If either fault 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 and correct the condition.
5. Turn off 115-volt power to furnace.
6. Reconnect inducer motor leads, reinstall control access panel, turn on 115-volt power supply, and reset thermostat to desired temperature.

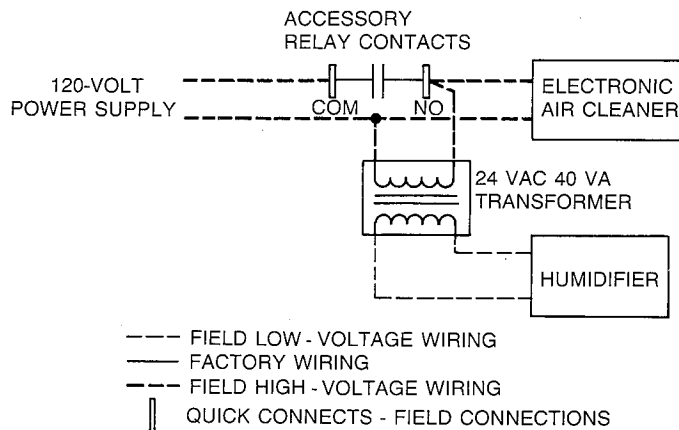
→ VII. ACCESSORY HOOKUP (Electronic Air Cleaner and/or Humidifier)

An isolated set of normally open contacts (not connected to 24VAC or 120VAC) are available to operate any accessory such as an electronic air cleaner or humidifier. The relay contact 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 three possible combinations shown in Fig. 12, 13, or 14.



A87330

Fig. 12—Electronic Air Cleaner



A87328

Fig. 13—Electronic Air Cleaner and Humidifier

A. Wiring Procedure

The following steps should be performed by a qualified service person.

1. Turn off power at main disconnect.
2. Remove control and blower access panels.
3. Remove control box cover from control box.
4. Snip wire tie that surrounds accessory hookup leads shown in Fig. 11.

NOTE: For 120-volt accessory hookup, see steps 5 thru 11 and Fig. 12 or 13.

5. Locate black pigtail lead from 120-volt 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.
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 wirenut, connect 120-volt accessory power lead to black wire connected to NO terminal of ACCR.
10. Connect other 120-volt accessory power lead to white pigtail lead from 120-volt TB. Use either butt connector supplied on end of pigtail or cut and strip pigtail end and wirenut, together.

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

11. Go to step 18 for remaining 120-volt procedures.

NOTE: For 24-volt accessory hookup, see steps 12 thru 17 and Fig. 14.

12. Cut black wire connected to ACCR NO terminal approximately 3 in. from relay end.
13. Connect loose wire to ACCR COM terminal.
14. Strip loose ends of both black leads connected to ACCR.
15. Connect longer lead to control board thermostat R terminal.
16. Using field-supplied wirenut, connect 24-volt accessory power lead to short lead connected to ACCR NO terminal.
17. Connect 24-volt accessory lead to control board thermostat C terminal.

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

18. Reinstall control box cover.
19. Reinstall blower access panel.
20. Turn on gas and electrical supplies to unit.
21. Check unit for proper operation through two complete cycles.

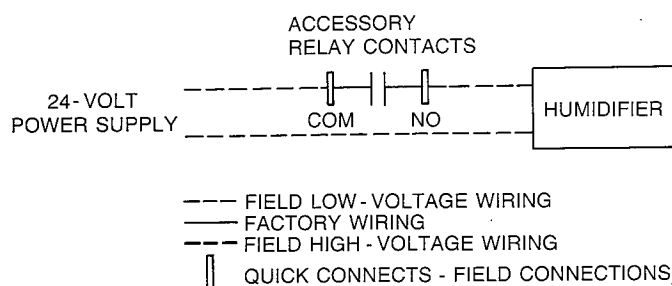


Fig. 14—Humidifier

22. Reinstall control access panel.

NOTE: If a bypass humidifier is used, bypass humidifier switch on the microprocessor control board must be put in 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 location of BPH setup switch.

B. MODULATING Damper System

For proper furnace operation, follow the installation, startup, and adjustment instructions provided by the modulating damper system manufacturer. In addition, the multi-zone switch (labeled MZ on the microprocessor control board) must be put in the ON position so that the microprocessor can vary the blower speed to compensate for dampers that may have modulated closed during any given heating or cooling cycle. See Fig. 11 for location of multi-zone switch setup MZ.

C. Electrical Noise and Interference

This equipment generates and uses radio frequency energy and, if not installed and used properly (that is, in strict accordance with the manufacturer's instructions), may cause interference to radio and television reception. It has been tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in an installation. If this equipment does cause interference to radio or television reception (which can be determined by turning the equipment off and on), the user is encouraged to try to correct the interference by one or more of the following measures:

1. Reorient receiving antenna.
2. Relocate receiver with respect to equipment.
3. Move receiver away from equipment.
4. Plug receiver into different outlet so that equipment and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The following booklet prepared by the Federal Communications Commission may be helpful: "How to Identify and Resolve Radio-TV Interference Problems." This booklet is available from the U.S. Government Printing Office, Washington, DC 20402, Stock No. 004-000-00345-4.

VIII. SERVICE DIAGNOSTICS

This furnace has an LED display to aid the homeowner or service technician, while observing the furnace. See Fig. 11. The display can be seen through the view port provided in the blower door. To decipher the meaning of the display, refer to Fig. 15 or the fault code label on the inside of the control access door.

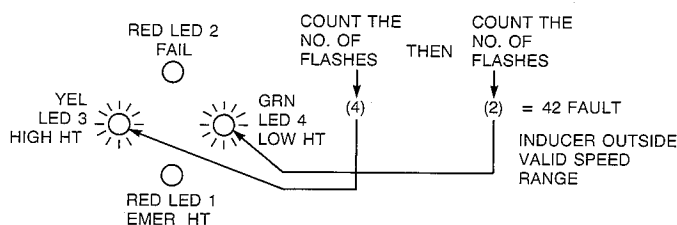
View the display through the port provided in the blower door. If YEL LED 3 is "ON" solid the furnace is operating in the High-Heat mode. If GRN LED 4 is "ON" solid the furnace is operating in the Low-Heat mode. If the lower RED LED 1 is "ON" solid the furnace is operating in the Emergency-Heat mode. If the upper RED LED 2 is "ON" solid the microprocessor board has failed. Alternate flashing of the YEL and GRN LED's indicate a fault has occurred during operation. Count the number of times the YEL LED flashes and then count the number of times the GRN LED flashes. Once the fault code has been determined refer to Fig. 15 or the fault code label on the inside of the control access door to decipher the meaning of the display.

FAULT CODE

Code	Description
11	No Faults in History Display
12	Blower Calibration Lockout
13	High Limit Lockout
14	Pilot Proving Lockout
21	Invalid Model Selection
22	Setup Error
23	Cooling Capacity Error
24	Illegal Thermostat Input
31	High Pressure Switch Fault
32	Low Pressure Switch Fault
33	High Limit Fault
34	Pilot Proving Fault
41	Blower Outside Valid Speed Range
42	Inducer Outside Valid Speed Range
43	RPM Ratio Out Of Range
44	Blower Calibration Fault

Using this fault code, the owner may save the expense of a service call by following the procedure's set forth in the User's Manual. A service technician can follow the steps set forth in the appropriate section of the trouble-shooting guide when correcting the problem.

An additional feature for the service technician to use is the fault history display. To recall the fault history, the follow-



A87341

Fig. 15—Fault Code LED

ing steps should be performed by a qualified service technician.

1. Record status of LED's 1 through 4. **DO NOT REMOVE THE BLOWER DOOR!**
2. Turn off power at main disconnect.
3. Remove control and blower access panels.
4. Locate setup switches as shown in Fig. 11. Put setup switch 1 in "ON" position. Get pad and pencil and be prepared to write the fault codes down as they flash. Depress blower door switch. The fault history codes will be in the sequence of the lowest number first. Once the fault codes have been flashed the sequence will be repeated. If a fault has occurred more than once it will only be flashed once throughout the sequence.
5. Turn power on at main disconnect. A microprocessor self-test sequence will take approximately 20 seconds to complete. During this period the GRN LED will appear for 12 seconds, followed by 1 second where both the YEL and GRN LED's will appear. After this period is completed the fault codes will begin to flash.
6. After faults have been recorded, service technician should clear fault history memory. To do this refer to **CLEANUP AND STARTUP INSTRUCTIONS** in the **TROUBLE-SHOOTING GUIDE**.
7. Return setup switch 1 to "OFF" position. Failure to do this will cause a fault code 22 to flash when a call for heat occurs.
8. Turn off power at main disconnect.
9. Reinstall blower and control access panels.
10. Turn power on at main disconnect.

NOTE: If the fault history is not cleared during servicing the microprocessor will clear it internally after five heating cycles have been successfully completed without a fault occurring. This is done to prevent the buildup of fault codes in the service history which are useless to the trouble-shooter.

