

58 Series

Procedures for Downflow Condensing Furnaces

Application Data and Installation Guidelines

INTRODUCTION

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 "National Fuel Gas Code" (NFPA No. 54-1984/ANSI Z223.1-1984) copyrighted by the National Fire Protection Association 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.

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.

These instructions have the following sections:

- I. Inspection
- II. Furnace Location
- III. Gas Piping
- IV. Combustion-Air and Vent Piping
- V. Condensate Piping
- VI. Electrical
- VII. Startup, Adjustment, and Safety Check

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. FURNACE LOCATION

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

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

⚠ 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 inch of level.

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 an optional combustible floor base is required, it can be obtained from your Distributor or branch.

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 I for the recommended gas pipe sizing. It is best to slope all pipe 1/4 inch in 15 feet 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-inch NPT plugged tapping, accessible for test gauge connection, must be installed immediately upstream of the gas supply connection to the furnace and downstream of the manual shut-off valve.

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

⚠ WARNING

Use the proper length of pipes to avoid stress on the gas control manifold. 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 feet. For pipe sizes larger than 1/2 inch, follow the recommendations of national codes.

⚠ 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 inches 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. Failure to adhere to this warning can cause a fire, explosion, physical injury, or death.

TABLE I

Maximum Gas Flow Capacity of Pipe in Cubic Feet of Gas per Hour for Pressures of 0.5 PSIG or Less, and a Pressure Drop of 0.5 Inch WC (Based on a 0.60 Specific Gravity Gas)

Nominal Iron Pipe Size Inches	Internal Diameter Inches	Length of Pipe, Feet				
		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

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

IV. COMBUSTION AIR AND VENT PIPING

The combustion air and vent pipe and 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), D2441 (SDR-21 and SDR-26 PVC) or D2661 (ABS-DWV). Pipe cement and primer must conform to ASTM standards D2564 (PVC) or D2235 (ABS). See Tables II and IV for pipe sizing and Figs. 2 through 7 for exterior piping arrangements. See "High-Altitude Pipe Sizing Procedures" section for high-altitude applications.

The accessory vent terminal kit described below 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 II gives clearance requirements.

TABLE II—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

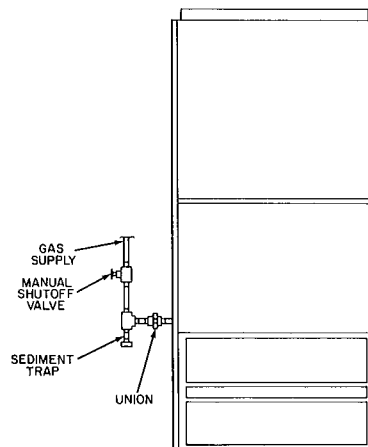


Fig. 1

⚠ 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.

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.

TABLE III—PIPE DIAMETER*

Pipe Length (feet-inch)	Furnace Size	Number of 90-Degree Elbows†‡				
		1	2	3	4	5
0 to 5	040	1-1/2	1-1/2	1-1/2	1-1/2	1-1/2
	060	1-1/2	1-1/2	1-1/2	2	2
	080	2	2	2-1/2	2-1/2	2-1/2
	100	2-1/2	2-1/2	2-1/2	3	3
5-1 to 10	040	1-1/2	1-1/2	1-1/2	1-1/2	2
	060	1-1/2	1-1/2	2	2	2
	080	2	2-1/2	2-1/2	2-1/2	2-1/2
	100	2-1/2	2-1/2	3	3	3
10-1 to 15	040	1-1/2	1-1/2	1-1/2	2	2
	060	1-1/2	2	2	2	2
	080	2-1/2	2-1/2	2-1/2	2-1/2	2-1/2
	100	2-1/2	3	3	3	3
15-1 to 20	040	1-1/2	1-1/2	2	2	2
	060	2	2	2	2	2
	080	2-1/2	2-1/2	2-1/2	2-1/2	2-1/2
	100	3	3	3	3	3
20-1 to 25	040	1-1/2	2	2	2	2
	060	2	2	2	2	2
	080	2-1/2	2-1/2	2-1/2	2-1/2	2-1/2
	100	3	3	3	3	3
25-1 to 30	040	2	2	2	2	2
	060	2	2	2	2	2
	080	2-1/2	2-1/2	2-1/2	2-1/2	2-1/2
	100	3	3	3	3	3
30-1 to 35	040	2	2	2	2	2
	060	2	2	2	2	2
	080	2-1/2	2-1/2	2-1/2	2-1/2	2-1/2
	100	3	3	3	3	3

NOTES:

1. Size both the combustion-air and vent pipe independently, then use the larger diameter for both pipes.
2. Assume two 45 degree elbows equals one 90 degree elbow.
3. Pipe lengths are "up to and including" the tabulated values.
4. Diameters listed are for schedule 40 PVC, SDR-21 PVC, SDR-26 PVC, PVC-DWV or ABS-DWV pipe.
5. Long radius elbows are desirable.
6. Elbows and pipe sections within the furnace casing and supplied in the vent terminal kit should not be included in the count.
7. Do not exceed 35 linear feet.

⚠ 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-inch thick Armaflex-type insulation.

⚠ CAUTION

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

A. Combustion Air and Vent Piping

⚠ 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.

⚠ 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, loosen the outlet elbow clamp at the inducer housing. Remove the elbow, rotate it to the left, and reinstall elbow. Be sure the elbow clamp is properly positioned and tight. Reposition vent drain so as to point toward the front of the furnace. Remove the plastic plug from the left-hand casing side panel and install it in the right-hand casing side panel.

⚠ CAUTION

To avoid trapping condensate in the vent pipe system, do not assemble any vent pipe below the level of the furnace vent outlet.

NOTE: The unit is shipped with (2) 2-1/2 x 2-1/2-in. rubber couplings. Optional couplings size 3 x 2-1/2 in. and 2-1/2 x 2 in. are available through the Replacement Parts department. See unit Parts Replacement Guide for the part number.

1. Determine pipe diameter (applications up to 2000 feet above sea level).
 - a. Using Table III, determine preliminary combustion-air pipe diameter.
 - b. Using Table III, determine vent pipe diameter.
 - c. Use largest diameter determined in (a) and (b) above for both pipes.

TABLE IV—COMBUSTION-AIR AND VENT ADJUSTMENT CHART (Feet—Inches)

Altitude (Feet above sea level)	Measured Length of Pipe				Elbow Adder (ft per elbow)
	0 to 5 ft	5-1 to 15 ft	15-1 to 25 ft	25-1 to 35 ft	
0—2000	0	0	0	0	0
2001—3000	0 ft-6 in.	1 ft-6 in.	2 ft-6 in.	3 ft-6 in.	0.5
3001—4000	1 ft-0 in.	2 ft-6 in.	4 ft-0 in.	5 ft-6 in.	1.0
4001—5000	1 ft-0 in.	3 ft-6 in.	5 ft-6 in.	7 ft-6 in.	1.0
5001—6000	1 ft-6 in.	4 ft-6 in.	7 ft-0 in.	9 ft-6 in.	1.5
6001—7000	1 ft-6 in.	5 ft-6 in.	8 ft-6 in.	11 ft-6 in.	1.5
7001—8000	2 ft-0 in.	6 ft-6 in.	10 ft-0 in.	13 ft-6 in.	2.0
8001—9000	2 ft-0 in.	7 ft-6 in.	11 ft-6 in.	15 ft-6 in.	2.0
9001—10,000	2 ft-6 in.	8 ft-6 in.	13 ft-0 in.	17 ft-6 in.	2.5

EXAMPLE: A 080 size furnace with 5 feet of combustion-air pipe having two 90-degree elbows would require a 2-inch diameter pipe according to Table III. If the vent pipe had three 90-degree elbows and were 4 feet long, a 2-1/2-inch diameter pipe would be required. Because the vent pipe requires a larger diameter pipe, the larger 2-1/2-inch diameter pipe must be used for both the vent and combustion-air pipes.

2. Determine pipe diameter (applications more than 2000 feet above sea level).

NOTE: Do not count the elbows to which the terminal bracket attaches or any elbow between the bracket and open end of the pipe. See shaded areas in Figs 2 through 7. Likewise, do not count elbows or pipe sections inside of furnace casing.

- a. Determine length of combustion-air pipe, vent pipe, and number of elbows required for installation.
- b. Using Table IV, determine pipe length adjustment value.
- c. Using Table IV, determine elbow adder (right-hand column of table).
- d. Multiply number of elbows (from step a) by elbow adder (from step c).
- e. Add values determined in steps b and d to length of pipe. This is the adjusted pipe length.
- f. Using adjusted pipe length and number of elbows, determine pipe diameter from Table III.
- g. Using Tables III and IV, determine combustion-air pipe diameter.
- h. Use largest diameter in f and g for both pipes.
- i. **EXAMPLE:** A 100 size furnace located in Albuquerque requires 10 feet of vent pipe, one 90-degree elbow, and one 45-degree elbow for the vent pipe. From sea level to 2000 feet above, the pipe diameter would normally be 2-1/2 inches. However, in Albuquerque (5250 feet above sea level), determine the pipe diameter as follows:

- (1). Using Table IV, determine pipe length adjustment value. Based on 10 feet of pipe and 5250 feet above sea level, the adder is 4 feet 6 inches.

- (2). Using Table IV, determine elbow adder. Based on 5250 feet above sea level, the adder is 1.5. Multiply elbow adder (1.5) by number of elbows (1.5), and the result is 2.25 feet or 2 feet 3 inches.

- (3). Equation: 10 feet + 4 feet 6 inches + 2 feet 3 inches = Adjusted pipe length 16 feet 9 inches.

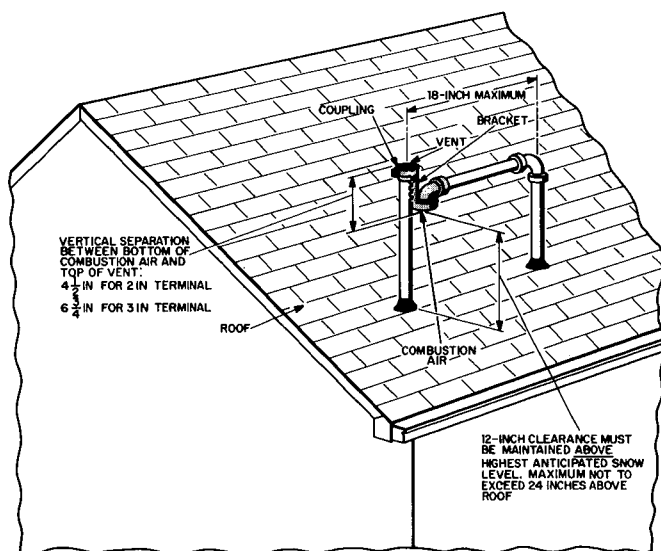
- j. Using Table III, determine pipe diameter for 100 based on adjusted pipe length. (New diameter should be 3 inches instead of 2-1/2 inches).

- k. Using Tables III and IV, determine combustion-air pipe diameter.

1. Use largest diameter determined in j and k for both pipes.
3. Attach PVC pipe, provided with furnace, to vent outlet elbow and clamp. Be sure clamp is tight.
4. Attach rubber coupling to end of PVC pipe outside of furnace casing.
5. Working from furnace to outside, cut pipe to required length(s).
6. Deburr inside and outside of pipe.
7. Chamfer outside edge of pipe for better distribution of primer and cement.
8. Clean and dry all surfaces to be joined.
9. Check "dry fit" of pipe and mark insertion depth on pipe.

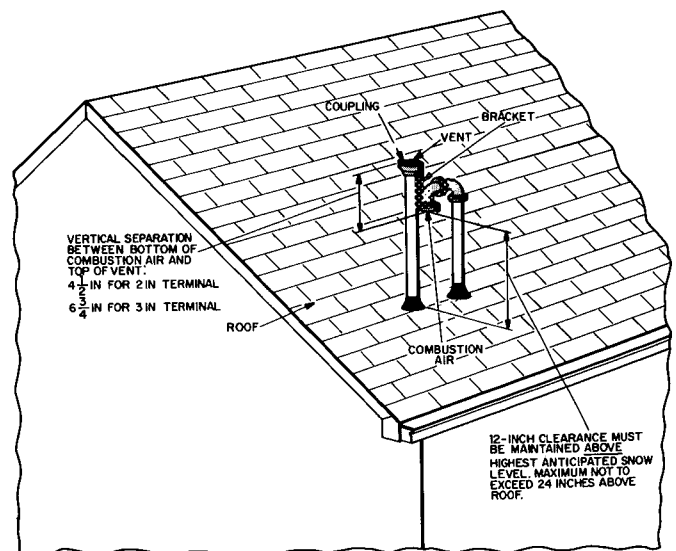
NOTE: It is recommended that all pipes be cut, prepared, and preassembled before permanently cementing any joint.

10. 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.
11. 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.
12. Wipe excess cement from joint. A continuous bead of cement will be visible around the perimeter of a properly made joint.



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Fig. 2—Rooftop Termination (Preferred)



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Fig. 3—Rooftop Termination (Option)

13. Handle pipe joints carefully until cement sets.
14. Support piping at minimum of every 5 feet (3 feet for SDR-21 or -26 PVC) using perforated metal hanging strap. Slope combustion-air and vent pipes toward furnace a minimum of 1/4 inch per lineal foot with no sags between hangers.
15. 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 BDP-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-inch kit is for 1-1/2-inch and 2-inch diameter pipe systems. The 3-inch kit is for 2-1/2-inch and 3-inch diameter pipe systems. Each kit will have extra parts. See Figs. 2 through 7 for the different applications.

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.

NOTE: The arrangement in Fig. 2 is preferred. The arrangement shown in Fig. 3 is an option for the combustion-air pipe.

- 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.

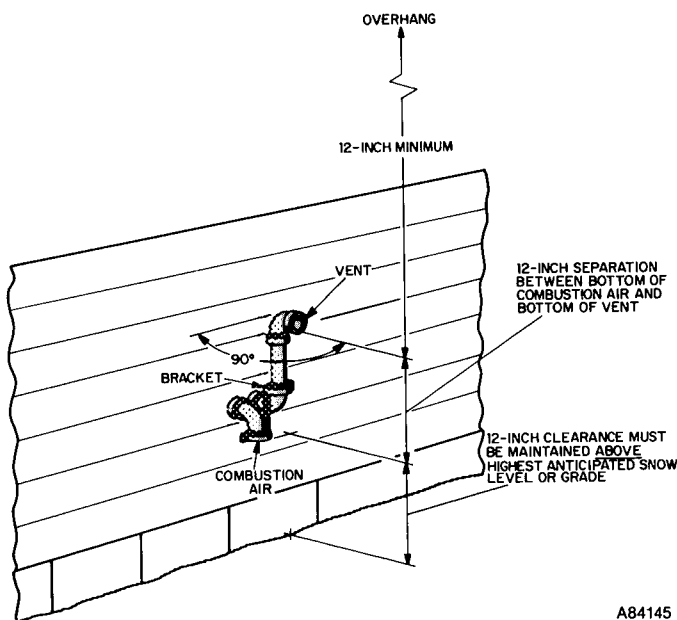


Fig. 4—Sidewall Termination Above Snow Level or Grade (Preferred)

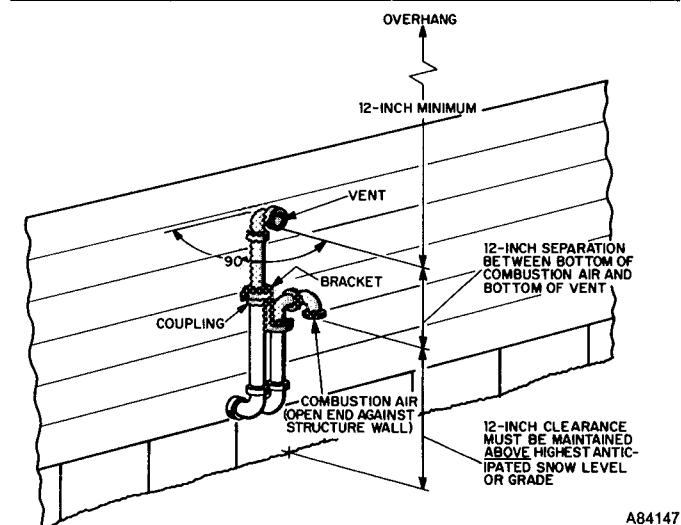


Fig. 6—Sidewall Termination Below Snow Level or Too Close to Grade (Preferred)

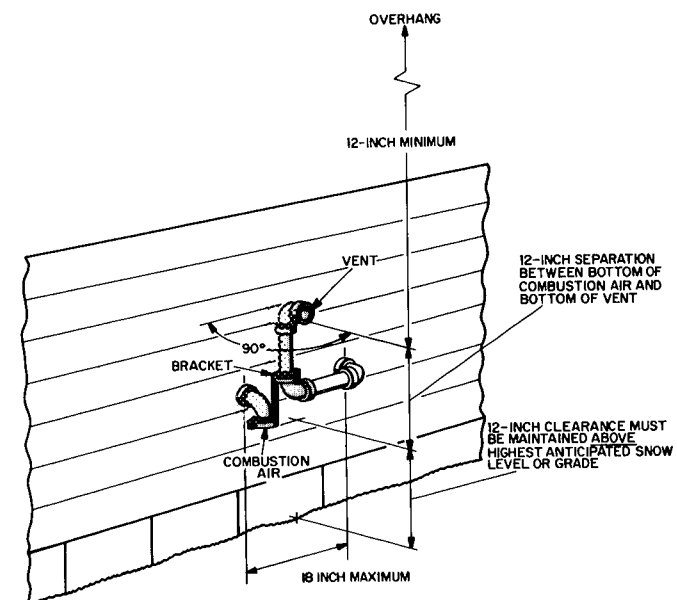


Fig. 5—Sidewall Termination Above Snow Level or Grade (Option)

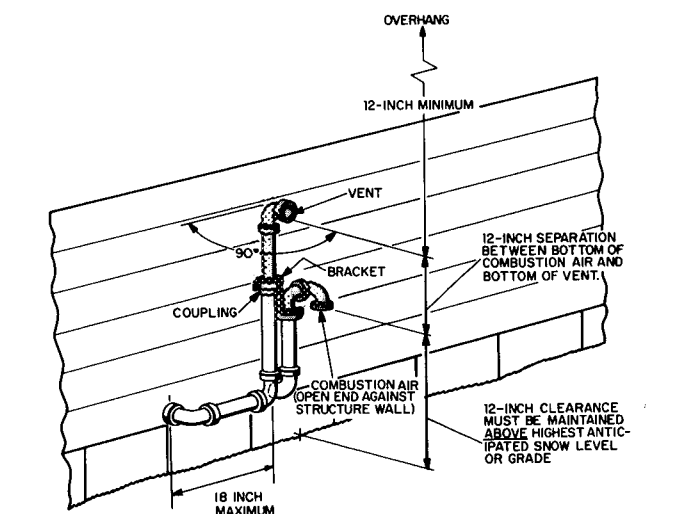


Fig. 7—Sidewall Termination Below Snow Level or Too Close to Grade (Option)

- 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 inches or more above highest anticipated snow level or grade. See Fig.4 and 5.

NOTE: The arrangement in Fig. 4 is preferred. The arrangement in Fig. 5 is an option for the vent pipe only.

- 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 Figs 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 pipe assembly so as to maintain 12-inch 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.

NOTE: The arrangement in Fig. 6 is preferred. The arrangement shown in Fig. 7 is an option for the vent pipe only.

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

V. CONDENSATE DRAIN

The 1/2-inch 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 inch of level. That is, the highest corner of the furnace must not be more than 1/2 inch higher than the lowest corner.

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.

VI. 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.

TABLE V—GAS RATE

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				

⚠ WARNING

The cabinet must have an uninterrupted or unbroken ground according to the National Electrical Code, ANSI/NFPA 70-1984, 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. Failure to adhere to this warning can result in an electrical shock, fire, or death.

⚠ 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.

VII. STARTUP, ADJUSTMENT, AND SAFETY CHECK

A. Fill condensate trap with water.

1. Disconnect condensate drain tube from inducer outlet elbow.
2. Insert funnel into tube and pour one quart of water into tube. This should overflow 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 rating plate 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. Allow 5 minutes to elapse, then start the furnace in accordance with the instructions on the furnace rating plate.

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, adjust the pilot flame, allow the pilot to cool for 5 minutes, and repeat the time check.
3. Locate pilot adjusting screw on top of valve:
 - a. Remove cap screw; turn pilot adjust screw counterclockwise to decrease burner-on time delay, clockwise to increase burner-on time delay.
 - b. Replace cap screw.

C. Gas Input

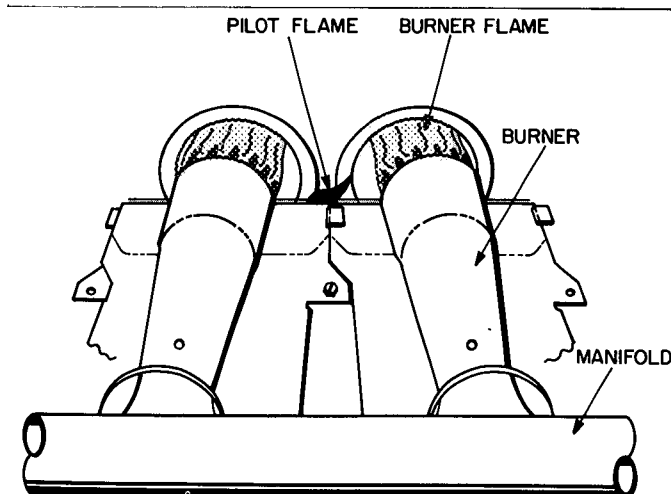
1. Determine gas input.

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

- 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 V for cubic ft of gas per hour.
 - d. Multiply cubic ft/hr (Btu/cubic ft). Obtain heating value from local gas utility.
 - e. Measured gas input must not exceed gas input on unit rating plate.
2. To adjust input rate:
 - a. Remove burner enclosure front and cap that conceals adjustment screw for gas valve regulator.
 - b. Turn adjusting screw either counterclockwise (out) to decrease input rate or clockwise to increase rate. When adjusting input rate, **DO NOT** change manifold pressure more than 0.3 in. wc. Make any major adjustments by changing main burner orifices.

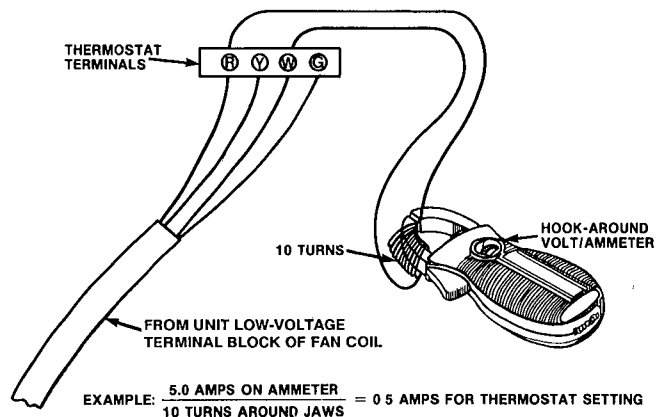
NOTE: Manifold pressure must always be measured with the burner enclosure front removed. The gas meter must always be clocked with the burner enclosure front installed.

- c. Replace burner enclosure front and measure adjusted gas input rate using method outlined in step 1.
- d. Replace cap that conceals gas valve regulator adjustment screw.



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Fig. 8



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Fig. 9—Amp Draw Check With Ammeter

⚠ CAUTION

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

3. 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.

4. High Altitude

Input ratings are for altitudes up to 2000 feet. Ratings for altitudes over 2000 feet must be 4% less for each 1000 feet above sea level.

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.
3. Adjust temperature rise by adjusting blower speed. Increase blower speed to reduce temperature rise. Decrease blower speed to increase temperature rise.

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. Accurate amp draw measurements can be obtained at the thermostat subbase terminals R & W.

Fig. 9 illustrates an easy method of obtaining these mea-

surements. The amp reading should be taken after the blower has started on its heating speed.

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 inducer motor lead wires from inducer printed-circuit board.
3. Turn on 115-volt power to furnace.
4. Close thermostat switch as if making normal furnace start. When the flow-sensing switch is functioning properly, pilot gas flow and sparker operation should not occur. If either gas flow or sparker operation occurs when the inducer motor is disconnected, shut the furnace down immediately. Determine the reason the flow-sensing switch did not function and correct the condition.
5. Turn off 115-volt power to furnace.
6. Reconnect inducer motor leads, reinstall control access panel, and turn on 115-volt power supply.