

→ Installation Guidelines — Procedures (150 and 160 Series Furnaces)

INTRODUCTION

Portions of the following instructions have been adopted in part from the National Fuel Gas Code (NFPA 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. *Carrier requires these standard procedures as a minimum for a safe installation.*

Refer also to regulations of the local gas supplier as well as to local building, heating, plumbing, or other codes in effect in area in which installation is made.

⚠ WARNING

Never store items such as the following on, near, or in contact with the furnace:

1. Spray or aerosol cans, rags, brooms, dust mops, vacuum cleaners, or other cleaning tools.
2. Soap powders, bleaches, waxes or other cleaning compounds; plastic items or containers; gasoline, kerosene, cigarette lighter fluid, dry-cleaning fluids, or other volatile fluids.
3. Paint thinners and other painting compounds.
4. Paper bags or other paper products.

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INSPECTION

Available power supply must meet specifications on furnace rating plate and on all motors in the equipment.

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

LOCATION OF FURNACE AND AIR FOR VENTILATION

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

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.

⚠ CAUTION

Do not install furnace in unconditioned space that could experience temperatures of 32 F or lower

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

When furnace supply ducts deliver air to areas outside the space containing the furnace, return air ducts must also be sealed to furnace casing and must terminate outside the space containing the furnace. Otherwise, a negative pressure condition could develop within equipment room or space.

Furnace Location Relative to Cooling Equipment — Install cooling coil in parallel with, or on downstream side of, furnace to reduce potential for condensation in heat exchanger. When a coil is installed in parallel with a furnace, dampers or other means used to control airflow must prevent chilled air from entering furnace. For manual damper operation, equip dampers with a means of preventing operation of either unit unless damper is in the full-heat or full-cool position.

Special Locations — When installing furnace in a residential garage, protect it from physical damage by vehicles. Furnaces installed in public garages, airplane hangars, or other buildings having hazardous atmospheres must comply with requirements of the National Fire Protection Association, Inc.

Ventilation Air — Requirements depend upon whether the furnace is located in an "unconfined" or "confined" space:

Unconfined space — A space whose volume is not less than 50 cu ft/1000 Btuh of the total input rating of all appliances installed in the space. Rooms are considered a part of the unconfined space when they communicate through openings not furnished with doors with the space in which the appliances are installed.

No special ventilating means are required for furnaces installed in unconfined spaces.

Confined space — A space whose volume is less than 50 cu ft/1000 Btuh of the total input ratings of all appliances installed in that space.

For casing ventilation purposes, provide the confined space with 2 permanent openings, one within 12 in. of top and one within 12 in. of bottom of enclosure. Each opening shall have a minimum free area of one sq in./1000 Btuh of total input rating of all equipment in enclosure, but not less than 100 sq inches.

Openings must freely communicate with interior areas whose volume, when combined with the volume of the confined space, meet the criteria for an unconfined space. This can be accomplished through installation of either permanent openings or louvered doors.

LOUVERS AND GRILLES — When calculating the free area, consider the blocking effect of louvers, grilles, or screens protecting openings. Screen mesh size must equal or exceed 1/4 inch. Use the free area through the design of the louver or grille, when known, to calculate the opening size required to provide free area specified. If free area is not known, assume that wood louvers will have a 20 to 25% free area, while metal louvers and grilles will have a 60 to 75% free area. Construct all louvers and grilles providing combustion or dilution air so that they cannot be closed.

GAS PIPING

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

Run a separate gas supply line directly from the meter to the furnace, if possible. Table 1 shows recommended gas pipe sizing. Slope all pipe 1/4 inch in 15 ft to prevent traps. Slope all horizontal runs away from meter and toward risers. Use risers to connect lines to furnace and meter.

Apply joint compounds (pipe dope) sparingly and only to male threads of joints. Consult local gas supplier for compound recommendations

NOTE: Use only compounds resistant to the action of LP (propane) gas.

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

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

Install a sediment trap in the riser leading to the furnace to trap dirt and condensate. Connect a tee to the riser leading to the furnace, keeping straight-through section of tee vertical. Connect a capped nipple into lower end of tee, so that nipple extends below level of gas controls (Fig. 1).

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

An accessible manual shutoff valve *must* be installed upstream of furnace gas controls and within 6 ft of furnace. A 1/8-in. NPT plugged tapping, accessible for test-gage connection, *must* also be installed immediately upstream of gas supply connection to furnace and downstream of manual shutoff valve.

Install a ground joint union between gas control manifold and manual gas shutoff valve (Fig. 1).

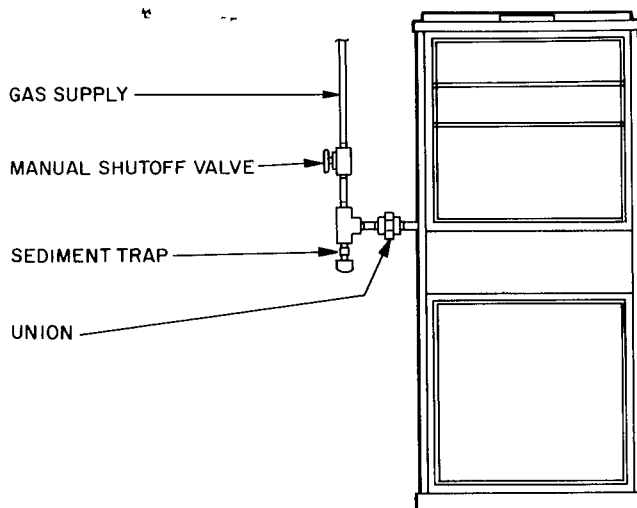


Fig. 1 — Ground Joint Union and Sediment Trap

Protect all segments of the piping system against physical and thermal damage. Support all piping with appropriate straps or hangers (one hanger every 6 ft minimum). For pipe sizes larger than 1/2 in., follow 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 in. outside the furnace casing.

Pressure-test piping in accordance with local and national plumbing and gas codes before attaching furnace. Crack ground joint union before pressure testing. If pressure exceeds 0.5 psig (14 in. wg), disconnect gas supply line from furnace before performing pressure test. If test pressure is equal to or less than 0.5 psig (14 in. wg), close manual shutoff valve located on gas valve before testing.

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

⚠ WARNING

Never purge line into 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.

COMBUSTION-AIR, VENT, AND CONDENSATE PIPING

Construct all combustion-air and vent pipes for this unit of schedule-40 PVC, SDR-21 PVC, SDR-26 PVC, PVC-DWV, or ABS-DWV pipe. The accessory vent terminal kit described below must be used in constructing the vent terminal for this unit. Pipes must terminate through either roof or sidewall; roof termination is preferable. Locate sidewall terminations to prevent damage to shrubs or siding materials. Table 2 gives clearance requirements.

When a previously common-vented system (furnace and water heater) is converted to water heater only, vent

Table 2 — Combustion-Air and Vent Terminal Clearances

LOCATION	CLEARANCE
Dryer vent	3 ft
From plumbing vent stack	3 ft
From any opening where vent gases could enter building	12 in
Above grade and anticipated snow depth	12 in.
Above grade when adjacent to public walkway	7 ft

system may be drastically oversized for water heater. Consult National Fuel Gas Code for proper sizing and revise vent system if necessary.

⚠ WARNING

Do NOT install unit so that indoor air is used for combustion.

⚠ 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 combustion-air inlet as far as possible from swimming pool and swimming pool pump house.

Combustion-Air and Vent Piping — The 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), D2241 (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 3 and 4 for pipe sizing and Fig. 2, 3 and 4 for exterior piping arrangements. See High Altitude Pipe Sizing Procedures section for high altitude applications.

⚠ WARNING

Solvent cements are combustible. Keep away from heat, sparks, and open flame. Use only in well ventilated areas. Do NOT breathe vapors. Avoid contact with the skin or eyes

⚠ WARNING

All combustion-air and vent pipes must be airtight and watertight. Pipes must terminate exactly as shown in Fig. 2 through 4.

Furnace is shipped from factory assembled for right-hand vent pipe connection. When left-hand vent connection is desired, remove cap from left-hand side of inducer outlet box and install over hole in right-hand side of box.

Remove plastic plug from left-hand casing side panel and install plug in unused hole in the right-hand casing side panel.

1. To determine pipe diameter.

- Using Table 3, determine preliminary combustion-air pipe diameter. For high-altitude applications, use Tables 3 and 4.
- Using Table 3, determine vent pipe diameter. For high-altitude applications, use Tables 3 and 4.
- Use largest diameter determined in (a) and (b) above for both pipes.

EXAMPLE: A 10-ft combustion-air pipe having two 90 degree elbows would require a 1-1/2 in. diameter pipe according to Table 3. If vent pipe had three 90 degree elbows and were 8 ft long, a 2-in. diameter pipe would be required. Because vent pipe requires a larger diameter pipe, the larger 2-in. diameter pipe must be used for both the vent and combustion-air pipes.

Table 3 — 58SX Vent Diameter Chart (in.)

PIPE LENGTH (ft)	FURNACE SIZE	NUMBER OF 90 DEGREE ELBOWS (See Notes)				
		1	2	3	4	5
5	040	1½	1½	1½	1½	2
	060	1½	1½	1½	2	2
	080	2	2	2	2	2
	100	2	2	2½	2½	2½
	120	3	3	3	3	3
10	040	1½	1½	1½	2	2
	060	1½	1½	2	2	2
	080	2	2	2	2	2½
	100	2	2½	2½	2½	3
	120	3	3	3	3	3
15	040	1½	1½	2	2	2
	060	1½	2	2	2	2
	080	2	2	2	2½	2½
	100	2½	2½	2½	3	3
	120	3	3	3	3	3
20	040	1½	2	2	2	2
	060	2	2	2	2	2
	080	2	2	2½	2½	2½
	100	2½	2½	3	3	3
	120	3	3	3	3	3
25	040	2	2	2	2	2
	060	2	2	2	2	2
	080	2	2½	2½	2½	2½
	100	2½	3	3	3	3
	120	3	3	3	3	3
30	040	2	2	2	2	2
	060	2	2	2	2	2
	080	2½	2½	2½	2½	2½
	100	3	3	3	3	3
	120	3	3	3	3	3
35	040	2	2	2	2	2
	060	2	2	2	2	2
	080	2½	2½	2½	2½	2½
	100	3	3	3	3	3
	120	3	3	3	3	3

NOTES

- Size both the air and vent pipe diameter independently, then use the larger diameter for both pipes.
- Assume two 45 degree elbows equal one 90 degree elbow
- Pipe lengths are up to and including the tabulated values
- Diameters listed are for schedule-40 PVC, PVC-DWV, SDR-21 PVC, SDR-26 PVC or ABS-DWV pipe
- Long radius elbows are desirable
- Elbows and pipe sections supplied in vent terminal kit should not be included in count

- Working from furnace to outside, cut PVC or ABS pipe to required length(s).
- Deburr inside and outside of pipe.
- Chamfer outside edge of pipe for better distribution of primer and cement.
- Clean and dry all surfaces to be joined.
- Check dry fit of pipe and mark insertion depth on pipe.

NOTE: All pipe should be cut, prepared and pre-assembled before any joint is permanently cemented.

- After pipes have been cut and preassembled, apply generous layer of PVC or ABS primer to pipe fitting socket and end of pipe to insertion mark. Quickly apply PVC or ABS cement (over primer) to end of pipe and fitting socket. Apply cement in light, uniform coat on inside of socket to prevent buildup of excess cement. Apply second coat of cement to end of pipe.
- 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.
- Wipe excess cement from joint. A continuous bead of cement is visible around perimeter of a properly made joint.
- Handle pipe joints carefully until cement sets.
- Attach factory-supplied flexible coupling to furnace combustion-air inlet connection and secure with stainless steel hose clamp. Ensure that factory-supplied, perforated metal combustion-air disc is installed in the flexible coupling.
- Support piping every 5 ft (minimum) using perforated metal hanging strap (3 ft minimum for SDR-PVC pipe). Slope combustion-air and vent pipes toward furnace a minimum of 1/4 in./lineal ft with no sags between hangers.
- Use appropriate methods to seal openings where vent and combustion-air pipes pass through roof or sidewall.

⚠ CAUTION

When the vent pipe is exposed to temperatures below freezing — that is, 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 insulation

⚠ CAUTION

When the combustion-air pipe is installed above a suspended ceiling, the pipe must be insulated with 1/2-in. Armaflex insulation

The combustion-air pipe should also be insulated in warm, humid spaces such as basements.

High-Altitude Pipe Sizing Procedure

- Measure the length of pipe and number of elbows required for installation of the unit.
- Select appropriate vent length adder from vent adjustment chart (Table 4) for the specific altitude and measured vent length.
- Again using the vent adjustment chart, multiply the number of elbows determined in step 1 by the elbow vent length adder for the altitude specified.
- Add the values determined in steps 2 and 3 to the measured length determined in step 1 to obtain the adjusted vent length.

Table 4 — Vent and Combustion-Air Adjustment Chart

ALTITUDE (ft 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	
Sea Level — 2000	0 ft-0 in				
2001- 3000	0ft-6in	1ft-6in	2ft-6in	3ft-6in	0.5
3001- 4000	1ft-0in	2ft-6in	4ft-0in	5ft-6in	1.0
4001- 5000	1ft-0in	3ft-6in	5ft-6in	7ft-6in	1.0
5001- 6000	1ft-6in	4ft-6in	7ft-0in	9ft-6in	1.5
6001- 7000	1ft-6in	5ft-6in	8ft-6in	11ft-6in	1.5
7001- 8000	2ft-0in	6ft-6in	10ft-0in	13ft-6in	2.0
8001- 9000	2ft-0in	7ft-6in	11ft-6in	15ft-6in	2.0
9001-10000	2ft-6in	8ft-6in	13ft-0in	17ft-6in	2.5

- Select the pipe diameter from the vent sizing chart (Table 3) using the adjusted vent length and measured number of elbows.

EXAMPLE. Assume that a 58SX Model 100, located in Albuquerque, requires 13 ft, two 90 degree elbows and one 45 degree elbow for the flue pipe. At sea level to 1000 ft, this would normally require 2-1/2 in. pipe. The pipe diameter required for Albuquerque, at an altitude of 5250 ft above sea level, is determined as follows:

- The vent length adder for a 13-ft run at an altitude of 5250 ft is 4.5 feet.
- The elbow length adder for the same altitude is 1.5 feet. Multiplying the adder by the number of elbows (1.5 x 2.5) results in a 3.75-ft adder.
- The adjusted vent length is 13 + 4.5 + 3.75 = 21.25 feet.
- From the 58SX Model 100 vent sizing chart, the pipe diameter for this installation is selected using 21.25 ft and 2.5 elbows. The required diameter is now 3 in., compared to the 2-1/2 in. diameter required at sea level.

Vent Terminal Kit Installation

NOTE: If these instructions differ from those in kit, use instructions shipped with kit.

The combustion-air and vent pipes must terminate outside the structure. The Carrier accessory vent termination kit (required) must be installed as shown in Fig. 2-7 Roof termination, shown in Fig. 2, is preferred.

Two termination kits are available. Use the 2-in. kit with 1-1/2 or 2-in. diameter vent pipe. The 3-in. kit can be used with 2-1/2 or 3-in. diameter pipe systems. Each kit contains extra parts.

NOTE: The shaded portions of Fig. 2-7 are considered part of the vent terminal and are provided in the vent terminal kit. They should not be counted, therefore, in pipe diameter calculations.

ROOFTOP VENT TERMINAL INSTALLATION (Fig. 2)

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

- Remove one 90 degree elbow from elbow and bracket assembly provided in kit. Loosen screw so other elbow can turn.
- Loosely install elbow with bracket on combustion-air pipe.
- Loosely install pipe coupling, provided in kit, on properly cut vent pipe. Position coupling so that bracket will mount as shown in Fig. 2.
- Disassemble loose pipe fittings. Clean them and apply cement using procedures described in Combustion-Air and Vent Piping.



- SIDEWALL VENT TERMINAL INSTALLATION** — Install kit as follows when combustion-air and vent pipes exit through sidewall 12 in. or more above highest anticipated snow level or grade. See Fig. 4 and 5.

1. Loosely install elbow and bracket assembly on combustion-air and vent pipes.
2. Remove and disassemble elbow and bracket assembly.
3. Install elbows as shown in Fig. 4 or 5. Clean them and apply cement using procedures described in Combustion-Air and Vent Piping.
4. Install bracket as shown in Fig. 4 or 5.
5. Position vent-pipe assembly, maintaining a 12-in. separation between vent-pipe outlet and combustion-air inlet. Cement vent pipe in elbow as shown in Fig. 4 or 5.



- Install kit as follows when combustion-air and vent pipes exit through sidewall less than 12 in. above highest anticipated snow level or grade. See Fig. 6 and 7.

1. Remove one elbow from the elbow and bracket assembly. (The elbow remaining will be connected to combustion-air pipe.)
2. Install the 90 degree vent street ell into the 90 degree elbow remaining in elbow and bracket assembly, making a U-fitting.
3. Loosely install coupling on end of vent pipe.
4. Loosely install U-fitting and bracket as shown in Fig. 6. Position U-fitting so that open end is against building wall.

- 5 Loosely install vent-pipe assembly in coupling as shown in Fig. 6 or 7.
6. Check required dimensions as shown in Fig. 6 or 7.
7. Disassemble loose pipe fittings. Clean them and apply cement using procedures described in Combustion-Air and Vent Piping.
8. Install bracket as shown in Fig. 6 or 7.

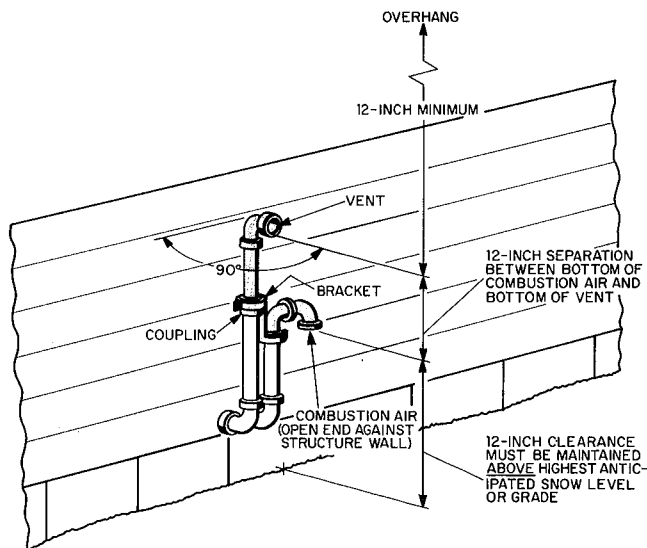


Fig. 6 — Sidewall Termination Below Snow Level or Too Close to Grade (Preferred)

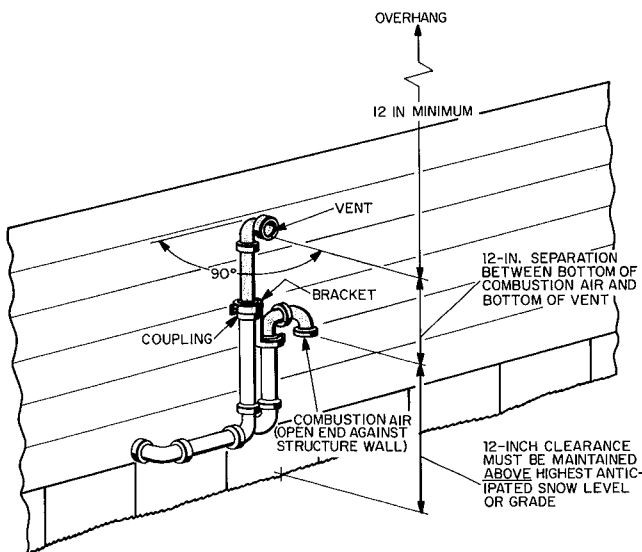


Fig. 7 — Sidewall Termination Below Snow Level or Too Close to Grade (Option)

Condensate Drain — Route the condensate to a nearby floor drain or condensate pump. If a condensate pump is required, it should have a corrosion-resistant impeller and tank.

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

For proper condensate drainage, furnace must be within 1/2 in. of level. Highest corner of furnace must not be more than 1/2 in. above lowest corner.

NOTE: The furnace contains an internal condensate trap; do NOT install external trap.

1. Determine the side of furnace from which drain will exit. Cut and preassemble drain piping (field supplied) directly to an open drain. Refer to Combustion-Air and Vent Piping for instructions on preparing and cementing plastic pipe.
2. Cement elbow on pipe assembly (factory supplied) to condensate trap mounted on blower housing.
3. Using a second wrench to hold assembly, attach first section of field-supplied 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 field-supplied schedule-40 PVC adapter to threaded factory adapter
6. Cement remaining pipe joints.

ELECTRICAL CONNECTIONS

IMPORTANT: Before proceeding with the electrical connections, make certain that voltage, frequency, and phase correspond to those values specified on the unit rating plate. Also, check that service provided by utility is sufficient to handle load imposed by this equipment. Refer to unit rating plate for equipment electrical requirements.

Consult the specific furnace installation instructions for 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 70-1984, and local codes to minimize personal injury if an electrical fault should occur. Ground may consist of electrical wire or metallic conduit approved for electrical ground when installed in accordance with existing electrical codes. Do NOT use gas supply piping as an electrical ground.

⚠ CAUTION

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

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

Check all electrical connections (both factory and field) for tightness. Repeat check after unit has reached operating temperatures.

START-UP, ADJUSTMENT, AND SAFETY CHECK

Ignition System Check — When all connections have been checked, light the furnace using procedure outlined on lighting instruction plate attached to furnace. When lighting the furnace for the first time, however, perform the following additional steps.

1. If gas supply was not purged before connecting furnace, line will be full of air. Loosen ground joint union and allow supply line to purge until gas odor is detected. *Never purge gas lines into a combustion chamber.* Immediately upon detection of gas odor, retighten union. After 5 minutes, light furnace in accordance with instructions on furnace rating plate.

2. Main burners should light 25 to 75 seconds after pilot. If main burners do not light within prescribed time period, adjust pilot flame, allow pilot to cool for 5 minutes, and repeat time check (Fig. 8).
3. Locate pilot adjusting screw on top of valve:
 - a. Remove cap screw; turn pilot adjusting screw counterclockwise to decrease burner-on time delay, or clockwise to increase burner-on time delay.
 - b. Replace cap screw.

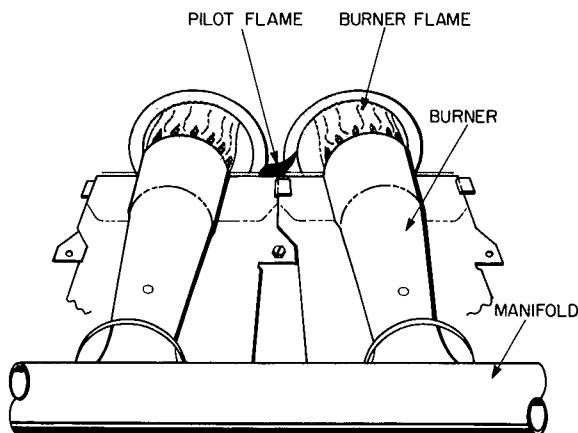


Fig. 8 — Proper Pilot and Burner Flames

Gas Input

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

1. Determine gas 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 5 for cu ft of gas per hour.
 - d. Multiply cu ft/hr by heating value of gas (Btu/cu ft) obtained from local gas utility.
 - 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 = 1070 x 100 = 107,000 Btuh

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. wg. Make any major adjustments by changing main burner orifices (Fig. 8).

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

⚠ 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 apply for altitudes up to 2000 feet. Ratings for altitudes above 2000 ft must be 4% less for each 1000 ft above sea level.

Table 5 — Gas Rate in cu ft/hr

SECONDS FOR ONE REVOLU- TION	SIZE OF TEST DIAL			SECONDS FOR ONE REVOLU- TION	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				

Temperature Rise — Do NOT operate furnace outside range of temperature rise specified on unit rating plate. Determine air temperature rise as follows:

1. Place thermometers in return and supply ducts as near furnace as possible. Thermometers must not "see" heating element or radiant heat may 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.

Thermostat Heat Anticipator Adjustment —

Thermostat heat anticipator must be set to match amp draw of components in R-W circuit. Accurate amp draw measurements can be obtained at thermostat subbase terminals R and W. Figure 9 illustrates an easy method of obtaining these measurements. Amp reading should be taken after blower has started on its heating speed.

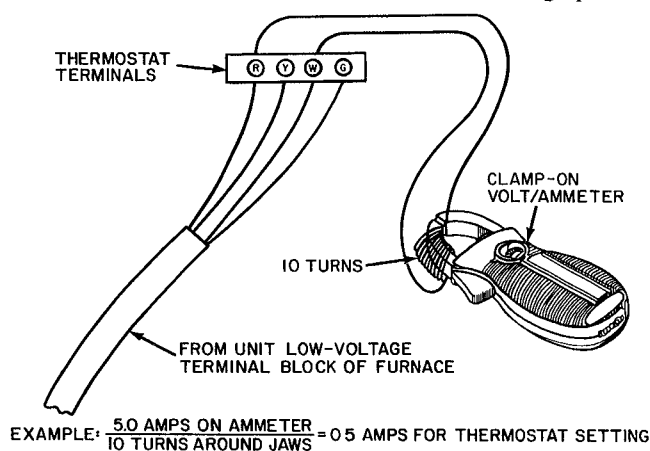


Fig. 9 — Amp Draw Measurements

Safety Check of Limit Control — Control shuts off combustion gas supply and energizes circulating-air blower motor if furnace overheats.

Recommended method of checking this limit control is to gradually block off return air after furnace has been operating for at least 5 minutes. As soon as limit control functions, return-air opening should be unblocked to permit normal air circulation. By using this method to check limit control, proper functioning can be determined and furnace will fail-safe if circulating air supply is restricted or motor fails. If limit control does not function during this test, identify and correct cause of malfunction.

Safety Check of Flow-Sensing Switch — This control proves operation of draft inducer. Check switch operation as follows:

1. Turn off 115-v power to furnace.
2. Remove control access panel and disconnect inducer-motor lead wires from inducer printed-circuit board.
3. Turn on 115-v power to furnace.
4. Close thermostat switch as if making normal furnace start. When flow-sensing switch is functioning properly, gas should not flow to pilot and igniter should not operate. If either pilot gas flow or igniter operation occurs when inducer motor is disconnected, shut furnace down immediately. Determine cause of malfunction and correct condition.
5. Turn off 115-v power to furnace.
6. Reconnect inducer-motor leads, reinstall control access panel, and turn on 115-v power supply.