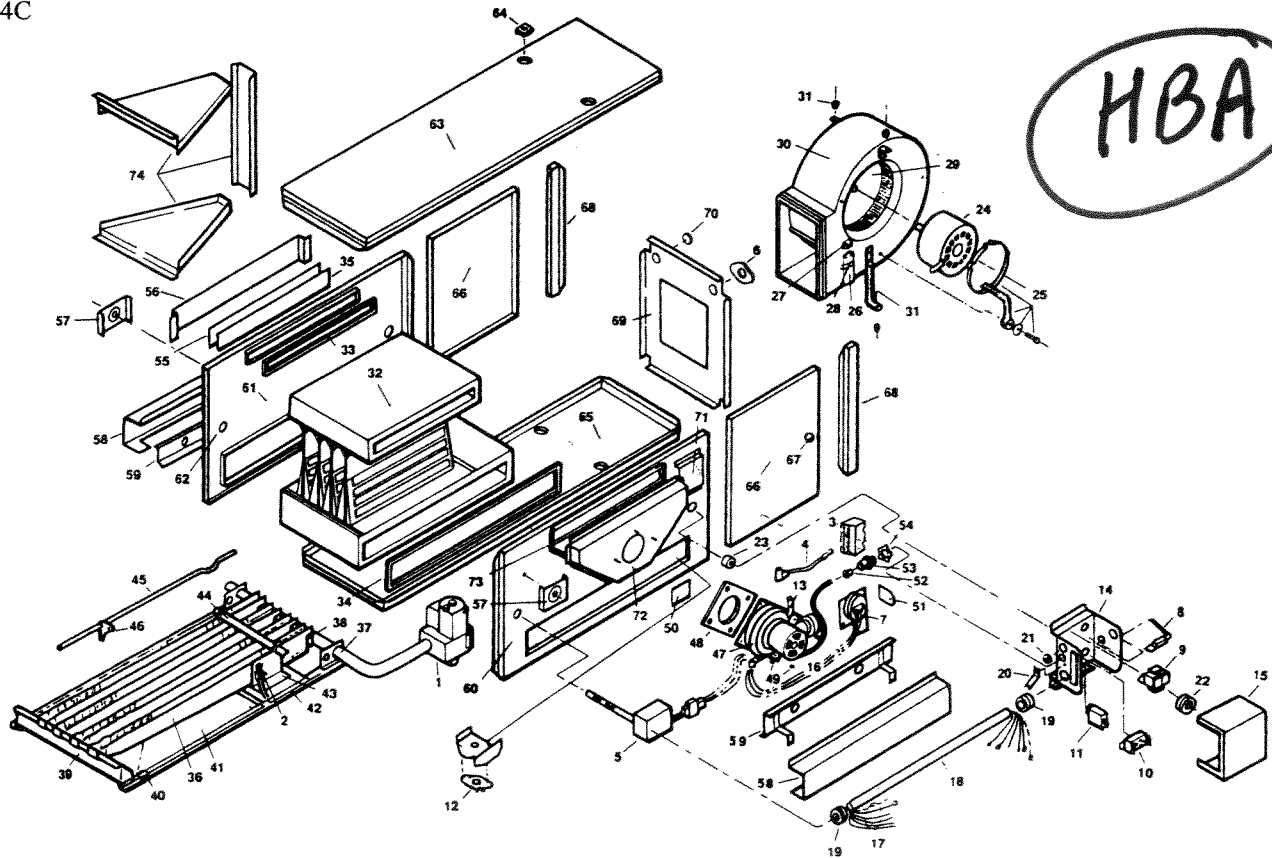


PARTS LIST

207844C



INDUCED DRAFT HORIZONTAL GAS FURNACE

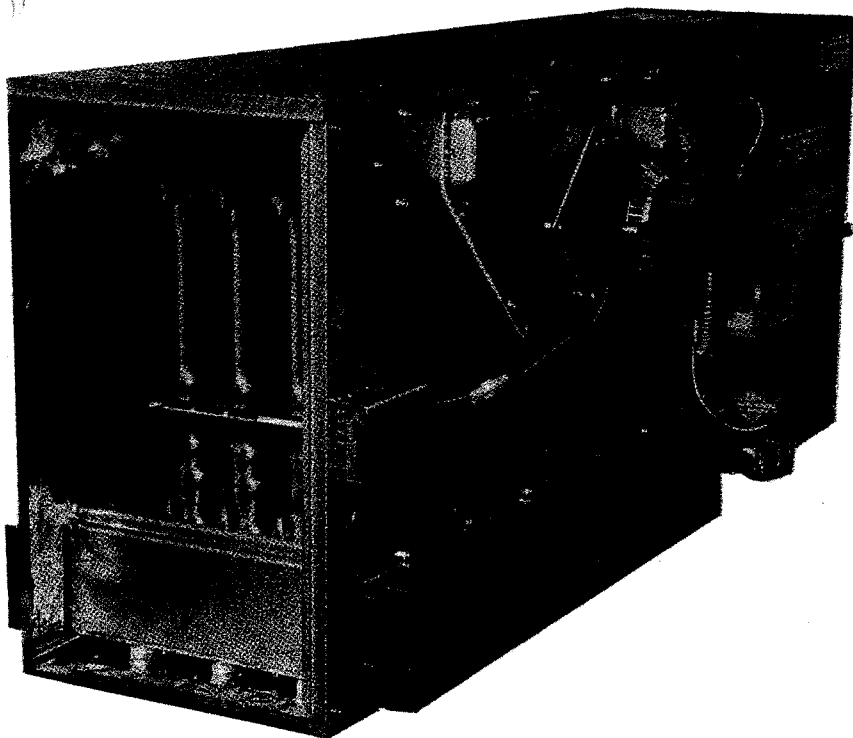
Ill. No.	Part Description	No. Req.	Part Number For Each Furnace Size				
			40,000	60,000	80,000	100,000	120,000
CONTROLS GROUP							
Electronic Ignition							
1	Gas Control - HW Nat VR8204	1	2075011	2075011	2075011	2075011	2075011
2	Pilot/Ignitor Assembly - HW Nat Q345	1	3011931	3011931	3011931	3011931	3011931
3	Lockout Module - S8600H	1	207762	207762	207762	207762	207762
4	Lockout Module Wiring						
	Kit: Ignition Wire and Module	1	2077621	2077621	2077621	2077621	2077621
	Ignition Wire Only	1	207763	207763	207763	207763	207763
ELECTRICAL GROUP							
Controls							
5	Fan/Limit Control Kit - HW	1	300919	300919	300919	300919	300919
6	Auxiliary Limit Switch	1	207030	207030	207030	207030	207030
7	Pressure Switch With Wiring Harness	1	2078051	2078061	2078071	2078081	2078091
8	Blower Door Interlock Switch	1	300229	300229	300229	300229	300229
9	Transformer - 40 VA	1	207023	207023	207023	207023	207023
10	Blower Relay	1	207025	207025	207025	207025	207025
11	Draft Inducer Relay	1	207470	207470	207470	207470	207470
12	Burner Limit Switch	2	3013631	3013631	3013631	3013631	3013631
Hardware							
13	Pressure Switch Tubing	1	207810	207810	207810	207810	207810
14	Junction Box	1	300863	300863	300863	300863	300863
15	Junction Box Cover	1	300219	300219	300219	300219	300219
16	Pressure Switch Wiring Harness	1	207811	207811	207811	207811	207811
17	Fan/Limit Control Wiring Harness	1	302058	302058	302058	302058	302058
18	Fan/Limit Control Conduit	1	300233	300233	300233	300233	300233
19	Fan/Limit Control Conduit Grommet	2	207173	2007173	207173	207173	207173
20	Fan/Limit Control Conduit Grounding Bracket	1	300834	300834	300834	300834	300834
21	Low Voltage Wire Bushing	1	207052	207052	207052	207052	207052
22	Strain Relief	1	207054	207054	207054	207054	207054
23	3/4" Bushing	1	207021	207021	207021	207021	207021
BLOWER GROUP							
24	Blower Assembly	1	300245	300247	300249	300251	300252
	Motor	1	2072212	2070312	2071662	2071022	2071022
25	Motor Mounting Hardware Kit	1	300825	300667	300667	300667	300667
26	Capacitor	1	207071	207071	207071	207769	207769

HBA FUNCTIONAL PARTS PRICE LIST

Part Number	List Price	Part Number	List Price	Part Number	List Price
207007	\$ 18.30	300177	\$ 15.00	300849	\$ 23.50
207008	\$ 18.30	300178	\$ 10.00	300850	\$ 26.90
207009	\$ 18.30	300200	\$ 4.10	300851	\$ 28.60
207010	\$ 20.50	3002011	\$ 7.80	300852	\$ 32.50
207011	\$ 21.00	300219	\$ 2.90	300853	\$ 37.20
207019	\$ 1.30	300221	\$ 5.10	300855	\$ 36.20
207020	\$ 1.30	300229	\$ 6.30	300856	\$ 37.30
207021	\$ 0.30	300233	\$ 3.40	300857	\$ 38.90
207022	\$ 0.60	300245	\$168.50	300858	\$ 41.00
207023	\$ 9.30	300247	\$168.50	300859	\$ 4.80
207025	\$ 9.70	300249	\$171.30	300860	\$ 4.80
207030	\$ 5.00	300251	\$217.30	300861	\$ 4.80
2070312	\$ 86.00	300252	\$217.30	300862	\$ 5.60
207038	\$ 0.40	300301	\$ 3.60	300863	\$ 6.00
2070392	\$ 34.30	300309	\$ 1.50	300865	\$ 14.70
2070402	\$ 34.90	300310	\$ 1.60	300866	\$ 19.40
2070422	\$ 36.40	300311	\$ 1.70	300867	\$ 22.10
2070442	\$ 38.60	300312	\$ 1.80	300868	\$ 24.40
207052	\$ 0.40	300313	\$ 2.00	300869	\$ 25.00
207054	\$ 0.40	300370	\$ 4.30	300979	\$ 33.60
207061	\$ 0.40	300371	\$ 4.60	301050	\$ 35.00
207062	\$ 0.50	300372	\$ 4.90	301115	\$ 15.50
207070	\$ 0.50	300373	\$ 5.10	301117	\$ 17.00
207071	\$ 7.30	300374	\$ 5.20	301119	\$ 18.70
207072	\$ 0.90	300385	\$ 0.30	301127	\$ 20.20
207081	\$ 0.40	300387	\$ 1.70	301128	\$ 21.70
207085215	\$ 0.80	300388	\$ 1.80	301167	\$ 44.10
2071022	\$ 93.00	300389	\$ 2.20	301169	\$ 53.70
2071662	\$ 94.50	300390	\$ 2.70	301171	\$ 55.10
207173	\$ 0.50	300391	\$ 4.10	301179	\$ 55.10
2072212	\$ 84.00	300394	\$ 5.40	301180	\$ 57.60
207413	\$ 63.90	300395	\$ 6.60	3011931	\$ 19.60
207457	\$ 1.60	300396	\$ 7.30	3013631	\$ 6.30
207458	\$ 0.40	300397	\$ 9.20	302001	\$ 2.90
207462	\$ 0.90	300398	\$ 9.20	302002	\$ 0.70
207466	\$ 0.40	300455	\$ 6.10	3020381	\$ 6.00
207467	\$ 1.60	300650	\$ 15.80	302054	\$ 1.50
207468	\$ 0.20	300653	\$ 17.20	302058	\$ 3.30
207470	\$ 11.60	300655	\$ 18.90	302066	\$131.30
207496T	\$ 41.50	300657	\$ 21.00	302069	\$ 0.80
207497T	\$ 41.50	300659	\$ 24.20	302070	\$ 0.80
207498T	\$ 41.50	300666	\$ 2.20	302071	\$ 0.80
207499T	\$ 41.50	300667	\$ 5.40	302072	\$ 0.80
207500T	\$ 41.50	300737	\$ 33.80	302073	\$ 0.70
2075011	\$ 61.80	300738	\$ 36.90	302074	\$ 0.70
207762	\$ 63.90	300739	\$ 40.70	302075	\$ 0.70
2077621	\$ 71.90	300740	\$ 44.30	3021001	\$163.20
207763	\$ 7.30	300741	\$ 50.50	3021011	\$212.00
207769	\$ 18.60	300776	\$ 7.30	3021021	\$259.50
3000011	\$ 6.90	300825	\$ 5.40	3021031	\$302.50
300171	\$ 31.40	300834	\$ 0.40	3021041	\$348.60
300175	\$ 32.00	300840	\$ 20.60		

8051
18061
8071
18081
18091

HORIZONTAL GAS FURNACE INSTALLER'S INFORMATION MANUAL



* NRTL *



CATEGORY 1 FORCED AIR FURNACE

ATTENTION, INSTALLER! After installing the furnace, show the user how to turn off gas and electricity to the furnace. Point out control and switch locations for turning off gas and electricity. Go over the User Information Manual and Section 26, "Maintaining Furnace In Good Working Order" in this manual with the user. Make sure the user understands the importance of following all safety precautions, including what could happen if they don't.

Attach the following documents on or adjacent to the furnace. Tell the user where these documents are located:

- User's Information Manual
- Installer's Information Manual
- Parts List
- Warranty Information

While these instructions have been written as accurately and thoroughly as possible, they may not cover every system variation or contingency. Questions of interpretation may arise. For more information, solutions to particular problems or clarification, contact your local distributor or the manufacturer.

ATTENTION, USER! Your furnace installer should give you the important documents listed above. You should immediately read the User's Information Manual for important safety information to keep you and your family safe. Keep these as long as you keep your furnace. Pass them on to future furnace purchasers or users. If any of the documents are missing or illegible, contact your installer or furnace manufacturer for replacement. Throughout this manual, when we use the word "you" we refer to the qualified service technician who is responsible for application, installation and service of your furnace.

– Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

– WHAT TO DO IF YOU SMELL GAS

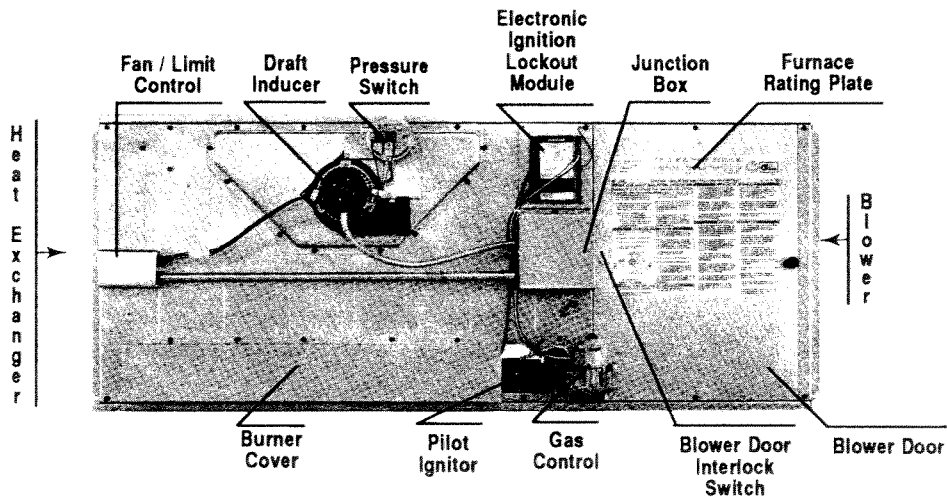
- Do not try to light any appliance.
- Do not touch any electrical switch.
- Do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach gas supplier, call the fire department.



WARNING: Individuals who install this furnace, must have the training and experience necessary to install gas furnaces. They must also have training and experience necessary to install related comfort air conditioning appliances. Improper installation could create a hazard, resulting in the possibility of damage, injury or death.

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SECTION 1. IMPORTANT SAFETY RULES

To alert you to potential hazards, we use the signal words "WARNING" and "CAUTION" throughout this manual. "WARNING" alerts you to situations that could cause or result in serious injury or death. "CAUTION" alerts you to situations that could cause or result in minor or moderate injury or property damage. For a safe and reliable installation be sure to read and follow all warnings and cautions.

We also use the words "must" and "should" in this manual. "Must" is mandatory. "Should" is advisory.



WARNING: Read and follow the safety rules in this section and throughout this manual. Failure to do so could cause improper furnace operation, resulting in damage, injury or death.

Use only gas approved for use in this furnace, as indicated on the furnace rating plate. Use only natural gas in furnaces designed for natural gas. Use only propane (LP) gas in furnaces designed for propane (LP) gas. Make sure the furnace will operate properly on the gas type available to the user. Do not use butane gas in this furnace.



WARNING: Use of a non-approved gas in this furnace could cause sooting or overheating of heat exchanger.

Rule 1. Do not install this furnace outdoors or in a mobile home, trailer or recreational vehicle. It is not design certified for these installations. This furnace is suitable for a home built on site or a manufactured home completed at the final site.

Rule 2. Do not install the furnace in a corrosive or contaminated atmosphere. Make sure all combustion and ventilation air requirements are adhered to in addition to local codes and ordinances.

Rule 3. This furnace is not to be used for temporary heating of buildings or structures under construction.

Rule 4. Provide adequate combustion and ventilation air to space where the furnace is being installed. Connect this furnace to an approved vent system, venting combustion products outdoors.

Rule 5. Check for gas leaks anytime work is done on the gas supply line, the furnace gas control, the pilot and pilot line or the main burner manifold.

Rule 6. Never test for gas leaks with an open flame. Use a commercial soap solution made specifically for leak detection to check all connections.

Rule 7. Completely seal supply and return air ducts to furnace casing. Duct work must run to an area outside furnace air space. Seal duct work wherever it runs through

walls, ceilings or floors. See Section 13 for more information.

SECTION 2. MEETING CODES

- This furnace complies with American National Standard for Gas Fired Central Furnaces, ANSI Z21.47-1993 •CAN/CGA-2.3-M93. It is certified for operation with either natural gas or propane (LP) gas for indoor installation in a building constructed on site. It meets the requirement for a 100% shut-off gas control system.
- Before installing this furnace, make sure you know all applicable codes. Be sure to consult local authorities having jurisdiction over furnaces for information on electrical wiring, gas piping and vent pipe. The installation of this furnace must conform with local building codes or in the absence of local codes, with the latest ANSI Z223.1, National Fuel Gas Code.
- Electrical wiring must conform with local building codes or in the absence of local codes, with the current National Electrical Code, ANSI/NFPA 70.

SECTION 3. DETERMINING BEST FURNACE LOCATION

You may install this furnace in an alcove, attic, basement, garage or crawl space.

Select a location which meets all requirements described in this manual for:

- Safety
- Minimum Clearances
- Combustion and Ventilation Air
- Venting
- Duct System
- Gas Piping
- Electrical Wiring

Locate the furnace as close to the chimney or vent and as near to the center of the air distribution system as possible.

To permit easy access for cleaning of all heating surfaces, these clearances are desirable (but not required):

Allow 48" between front of furnace (the side containing controls) and an adjacent wall or other appliances.

Allow 24" between rear of furnace (the opposite side from the controls) and an adjacent wall or other appliances.

You may install on wood flooring.

- Install the furnace so all electrical components are protected from water.
- Install the furnace level.

- When the furnace is in a repair garage or inside the heated space, exhaust fans can adversely affect its operation. Exhaust fans in kitchen, bathrooms, clothes dryers or anywhere within heated space increase combustion and ventilation air requirements. This is because exhaust fans reduce the amount of combustion and ventilation air available to the furnace. A fireplace also reduces amount of combustion and ventilation air.

WARNING: You must allow for these reductions or there could be inadequate combustion and ventilation air. This could cause nausea, asphyxiation, or fire.

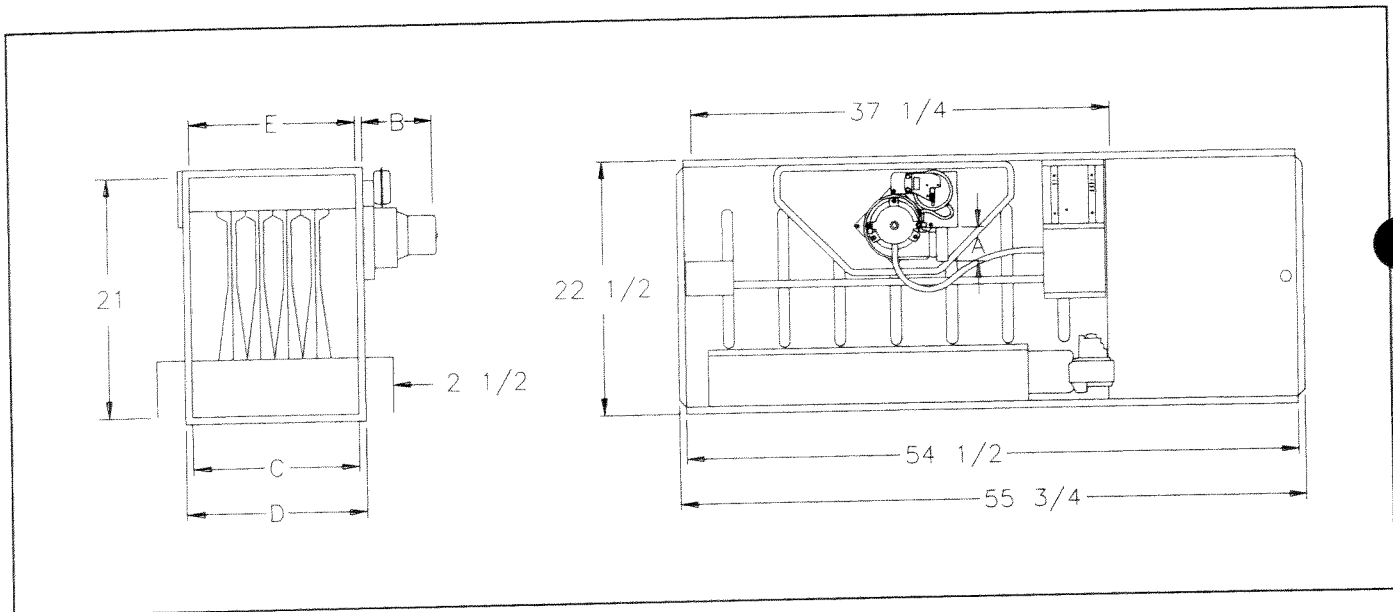
- Sufficient air must be provided to ensure there will not be a negative pressure in furnace space. In addition, there must be a positive seal between furnace and return air duct to avoid pulling air from burner area.

When a cooling unit is installed with this furnace, the furnace must be installed on the upstream side of the cooling coil to avoid condensation in the furnace heat exchanger.

- When furnace is in a residential garage, it must be installed so that pilot and main burners are located no less than 18 inches above the floor. Also, furnace should be protected from physical damage by vehicles.
- When furnace is in a public garage, airplane hanger, or other building having hazardous atmosphere, install unit in accordance with recommended good practice requirements of the National Fire Protection Association, Inc. Consult local code authorities for additional location requirements.

See Section 4 for dimensions and specifications.

SECTION 4. DIMENSIONS AND SPECIFICATIONS



INDUCED DRAFT

BTUH INPUT	MOTOR HP	MOTOR TYPE	SPEEDS	FLUE PIPE ("A")	INDUCER DEPTH ("B")	PLENUM SIZE (21" X "C")	FURNACE WIDTH ("D")	SUSPENSION LOCATION (37-1/4" X "E")	BLOWER SIZE	TEMP RISE (DEG F)	MAXIMUM C.F.M. @ .50" W.C.
40,000	1/4	PSC	3	3"	7-1/4"	9-3/4"	11"	9-1/2"	10-4	35-65	1200
60,000	1/4	PSC	3	3"	7-1/4"	12-1/4"	13-1/2"	12"	10-6	30-60	1420
80,000	1/3	PSC	3	3"	7-1/4"	14-3/4"	16"	14-1/2"	10-8	25-55	1600
100,000	1/2	PSC	3	3" to 4"	7-1/4"	17-1/4"	18-1/2"	17"	10-10	35-65	1950
120,000	1/2	PSC	3	3" to 4"	7-1/4"	19-3/4"	21"	19-1/2"	10-10	45-75	1950

Figure 1.

SECTION 5. ALLOWING FOR CLEARANCES

Use the table below for minimum clearances to combustibles. Also, instructions for attic, crawl space and suspended furnaces are given.

WARNING: Furnace installation must meet all minimum clearances from combustible material specified in this manual and all applicable codes. Failure to do so could cause a fire.



WARNING: Do not install furnace in any of the following conditions:

- On carpet, tile or other combustible material, except wood flooring
- In a closet

Doing any of the above could cause a fire.

Table 1. Clearances From Combustible Material for Furnaces with Large Installation Spaces

Top	2"
Outlet Air End*	6"
Inlet Air End	6"
Front	18"
Back	6"
Vent Connector	
Single Wall	6"
Type B1	1"

*Clearance from supply ducts within 3 feet of plenum must not be less than 2". No clearance applies beyond this distance.

If installation space is large, use clearances above for clearances to combustible materials.

You may install the furnace with less clearance from combustible material if you first protect combustible material or the furnace itself. See current National Fuel Gas Code ANSI Z223.1/NFPA54, Sections 6.3.1 and 6.3.2.

ATTIC INSTALLATION

Is installation space in attic with line contact?

Installation spaces in attics are usually large compared to the furnace. Installation space may also require line contact.

Line contact to combustible material is permissible for furnaces installed in an attic. The intersection of the furnace top and sides forms a line; this line may be in contact with combustible material. Maintain a 6" clearance to vent connection.

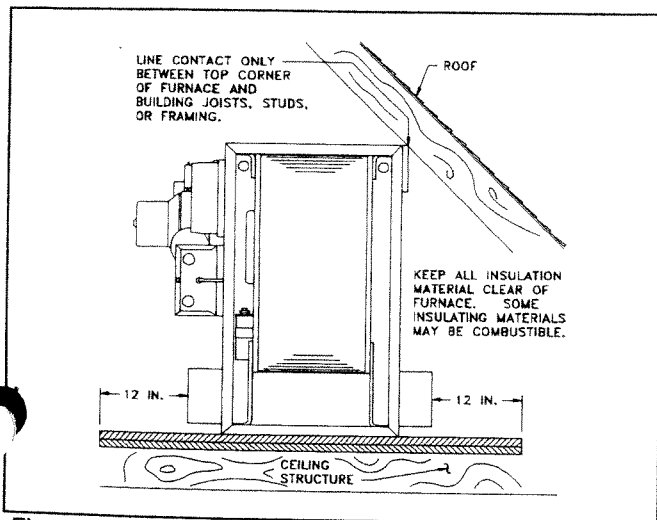


Figure 2. Installation Showing Line Contact.

For attic installations, use a platform under the furnace area. The platform should extend at least 12" beyond the furnace on all four sides. This helps prevent insulation from being drawn into the combustion chamber. Refer to Figure 2.



WARNING: Some insulating materials are combustible. When a furnace is installed in an attic or other insulated space, keep all insulating materials at least 12 inches away from furnace and all burner combustion air openings. Failure to do so could cause fire.

NOTE: Level furnace from front to back and from left to right within 1/4" per four feet.

Is installation space an alcove or small space compared to furnace size?

Horizontal furnaces are rarely installed in alcoves or small spaces. When the installation space is in an alcove or small space, the clearances for combustible materials are listed in Figure 3.

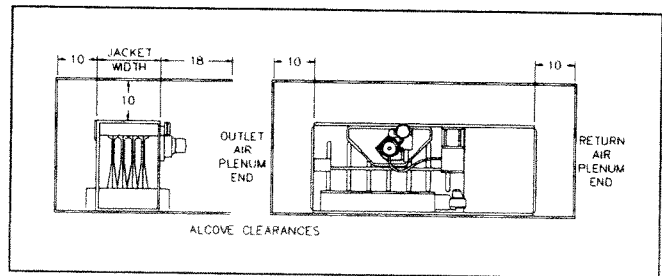


Figure 3. Alcove Clearances.

CRAWL SPACE INSTALLATION

Furnace can be hung from floor joists or installed on suitable blocks or pad. Pad or blocks must provide enough height to eliminate potential for water damage. Maintain clearances as described above.

SUSPENDING FURNACE

Some installations require that the furnace be suspended from rafters or floor joists. A common way to do this using threaded rods is shown in Figure 4. Consider this means when people may walk underneath furnace. Another common suspension means is using pipe strap. Other means that provide adequate support may be used.

Level furnace from front to back and from left to right within 1/4 inch per four feet. Maintain clearances as described previously.

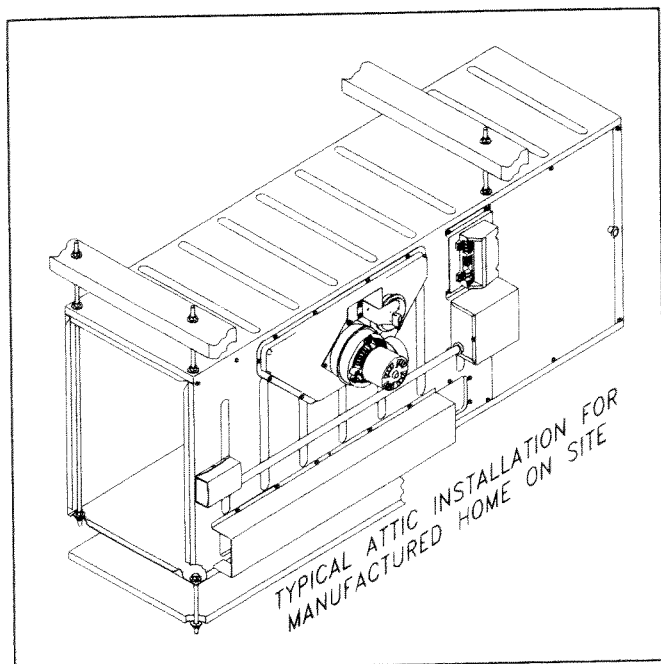


Figure 4. Furnace Suspension

SECTION 6. PROVIDING COMBUSTION AND VENTILATION AIR

The total amount of combustion and ventilation air provided within the building must equal the requirements of all gas appliances in the building. You must also allow for reduction of air available for combustion and ventilation caused by exhaust fans, range hoods and fireplaces. Sufficient air must be provided to ensure there will not be a negative pressure in furnace room or space. In addition, there must be a positive seal between furnace and return air duct to avoid pulling air from burner area.

Provide for adequate combustion and ventilation air in accordance with Section 5.3, Air for Combustion and Ventilation, of the National Fuel Gas Code, ANSI Z223.1/NFPA 54 or applicable provisions of local building codes.



WARNING: Furnaces and any other fuel burning appliances must have enough fresh air for proper combustion. Lack of adequate combustion air could cause the furnace to produce carbon monoxide resulting in nausea or asphyxiation.

Excessive exposure to air contaminated with chlorine, fluorine, bromine and iodine may result in safety and performance related problems. The following types of installation may require outdoor air for combustion due to chemical exposures:

- Commercial buildings, repair garages, beauty parlors, etc.
- Buildings with indoor pools
- Furnaces installed in laundry rooms
- Furnaces installed in hobby or craft rooms

- Furnaces installed near chemical storage rooms
- Furnaces installed near exhaust fans which vent the above areas

Exposure to the following substances in the combustion air supply may also require outdoor air for combustion:

- Aerosols
- Permanent wave solutions
- Chlorinated waxes, bleaches and cleaners
- Cat litter
- Chlorine-based swimming pool chemicals
- Cleaning solvents
- Paint removers and varnishes
- Adhesives
- Antistatic fabric softeners
- Most refrigerants



WARNING: Combustion air that contains chlorine, fluorine, bromine or iodine could cause corrosion in heat exchanger or vent system, resulting in nausea or death by asphyxiation.

UNCONFINED SPACE INSTALLATION

The National Fuel Gas Code, ANSI Z223.1/NFPA 54 do not require that you make special provisions for combustion and ventilation when furnace is in an "unconfined space" and the building is not of "unusually tight construction."

- "Unconfined spaces" have a volume of at least 50 cubic feet per 1000 Btu per hour combined input rating of all appliances installed in the space. For example: a 100,000 Btu/hr furnace and a 40,000 Btu/hr water heater would require a volume of at least $140,000 \times 50 \div 1,000$ or 7,000 cubic feet.
- "Unusually tight construction" means windows and doors are either tight fitting or are sealed construction and that walls are covered with a continuous, sealed vapor barrier and drywall or similar materials having sealed joints.

If you meet the volume requirements for unconfined space, the building is not of unusually tight construction and there are no airborne contaminants, as listed above, you may install this furnace without making special provisions for combustion and ventilation. Otherwise, follow the instructions for "confined space installation" below.

CONFINED SPACE INSTALLATION

A furnace installed in a confined space may take combustion and ventilation air from an unconfined space within the building or from outdoors. However, if the building is of unusually tight construction all combustion air must come from outdoors. Also, if return air is taken directly from a hallway or space next to furnace that communicates with furnace spaces, all combustion air must come from outdoors.



WARNING: You must provide permanent air openings to a confined furnace installation space from another area as described below. Failure to do so could result in inadequate combustion and ventilation air.

ALL COMBUSTION AND VENTILATION AIR FROM INSIDE THE BUILDING

The confined furnace space must be provided with two permanent openings to an additional room of sufficient volume so that the combined volume of the spaces meet the criteria above for an unconfined space not of unusually tight construction. The total input of all gas appliances within the combined space must be considered in making this determination.

Each opening must have minimum free area of one square inch per 1,000 Btu per hour of the total combined input rating of all gas appliances within the confined furnace space, but not less than 100 square inches. One opening must be within 12 inches of the top and one opening within 12 inches of the bottom of the furnace space. The shortest side of each air opening must be at least 3 inches long. See Figure 5.

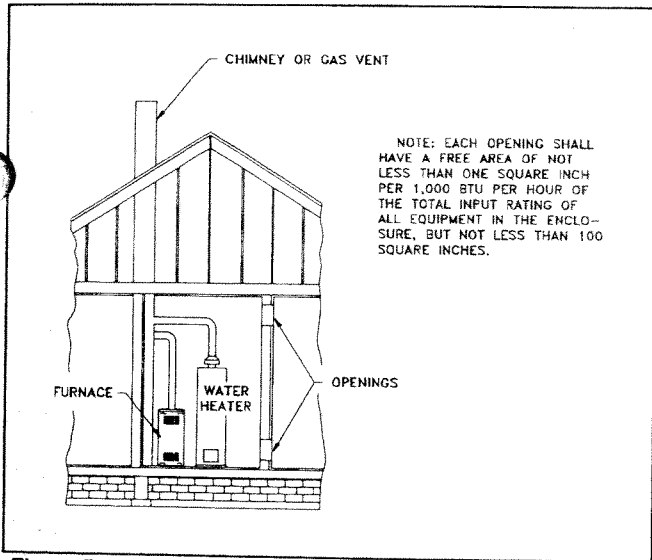


Figure 5. Confined Space, All Air From Inside The Building.

For example:

- A 100,000 Btu/hr furnace and a 40,000 Btu/hr water heater would require free area openings of $140,000 \div 1,000$ or 140 square inches.
- A 40,000 Btu/hr furnace and a 40,000 Btu/hr water heater would require free area openings of 100 square inches.

ALL COMBUSTION AND VENTILATION AIR FROM OUTDOORS

The furnace space must be provided with two permanent air openings communicating directly, or by ducts, with the outdoors or spaces that freely access the outdoors. Well ventilated attics or crawl spaces usually satisfy this

requirement. These openings will give the furnace free access to fresh air for combustion and ventilation.

You must provide air sufficient for all gas appliances within furnace space. Locate one combustion and ventilation air opening within 12 inches of top of furnace space. Locate another within 12 inches of bottom of furnace space.

Ducts which supply air from outdoors must have the same cross-sectional area as the free area of openings to which they connect.

When directly communicating with the outdoors, each opening must have a minimum free area of one square inch per 4,000 Btu per hour of total combined input rating of all gas appliances within furnace space. For example: A 100,000 Btu per hour furnace requires two openings of at least $100,000 \div 4,000$ or 25 square inches. See Figure 6 and Table 2.

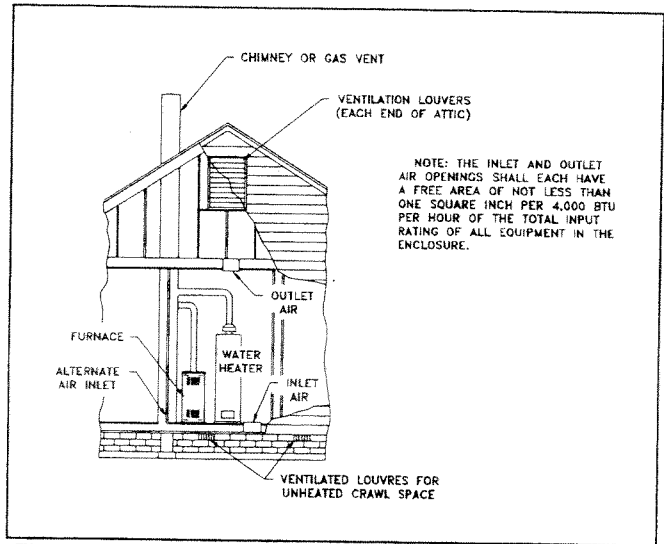


Figure 6. All Air Directly From Spaces That Freely Access The Outdoors.

Table 2. Free Opening Area Based On One Square Inch Per 4000 Btu/hr.

Total Input Btu/hr	Required Free Area Per Opening (square inches)	Minimum Round Pipe (inches dia.)	Maximum Btu/hr Input For Given Pipe Diameter
40,000	10	4	50,000
60,000	15	5	78,000
80,000	20	6	113,000
100,000	25	6	113,000
120,000	30	7	153,000
140,000	35	7	153,000
160,000	40	8	201,000
180,000	45	8	201,000

When communicating with the outdoors through vertical ducts, such openings and ducts must have a minimum free area of one square inch per 4,000 Btu per hour of total combined input rating of all gas appliances within furnace space. See Figure 7 and Table 2.

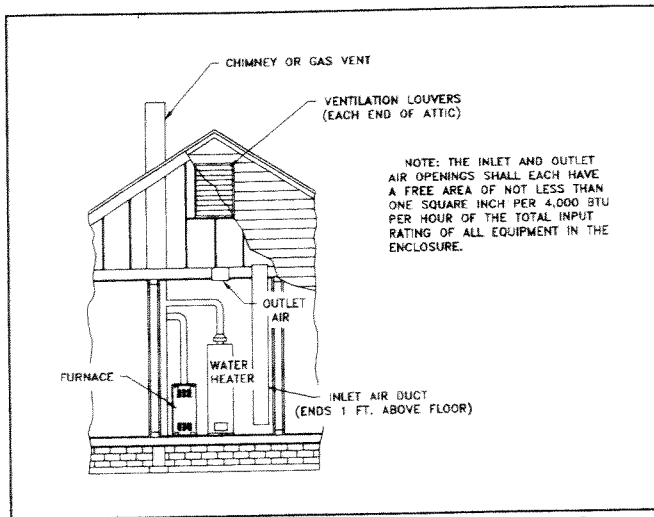


Figure 7. All Air Through Vertical Ducts From Spaces That Freely Access The Outdoors.

When communicating with the outdoors through horizontal ducts, such openings and ducts must have a minimum free area of one square inch per 2,000 Btu per hour of total combined input rating of all gas appliances within furnace space. See Figure 8 and Table 3.

Example: Furnace is 100,000 Btu per hour input and is to be installed in a confined space that contains no other gas appliances. Rectangular combustion and ventilation air ducts will run horizontally from outdoors to furnace space.

Calculate the free area required.

Because combustion and ventilation air ducts run horizontally, allow 2,000 Btu per hour.

$$\frac{\text{Furnace input (Btu/hr)}}{2,000 \text{ Btu/hr per square inch}} = \text{Free area required}$$

$$\frac{100,000}{2,000} = 50 \text{ square inches}$$

Both of the ducts must have a minimum cross sectional area of 50 square inches.

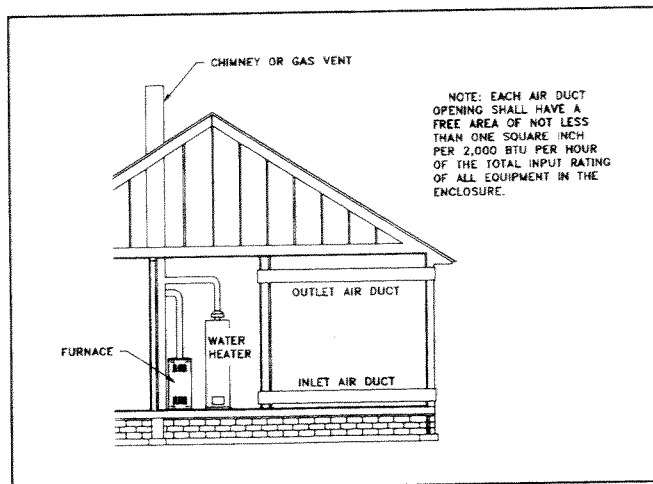


Figure 8. All Air From The Outdoors Through Horizontal Ducts.

Table 3. Free Opening Area Based On One Square Inch Per 2000 Btu/hr.

Total Input Btu/hr	Required Free Area Per Opening (square inches)	Minimum Round Pipe (inches dia.)	Maximum Btu/hr Input For Given Pipe Diameter
40,000	20	6	56,000
60,000	30	7	76,000
80,000	40	8	100,000
100,000	50	8	100,000
120,000	60	9	127,000
140,000	70	10	157,000
160,000	80	11	190,000
180,000	90	11	190,000

LOUVERS, GRILLES AND SCREENS

If you are installing a louver, grille or screen over combustion and ventilation air openings, the free area of the louver or grille must be at least as big as the free area determined above. Louver, grille and screen manufacturers supply technical data which usually includes the "free area." If you do not know the free area, assume that wood louvers have 20 to 25% free area. Assume metal louvers and grilles have 60 to 75% free area.

You must fix combustion and ventilation air louvers and grilles in the open position or interlock them with furnace operation so that they open automatically. Do not use screen smaller than 1/4-inch mesh.

SECTION 7. PROVIDING PROPER VENTING

This furnace must be connected to a venting system adequate to remove flue and vent gases to the outside atmosphere. It must be vented in accordance with Part 7, Venting of Equipment, of the National Fuel Gas Code ANSI Z223.1. It must also be vented in accordance with local building codes and vent manufacturer's instructions.

The furnaces covered by this manual are design-certified as Category I appliances. Category I appliances must operate at negative vent static pressure with a vent gas temperature high enough to avoid condensation in the vent. Category I appliances rely on the buoyancy of combustion products to vent and must be vented vertically or nearly vertically, unless equipped with an approved mechanical venter.

In most cases, proper venting is achieved by using a conventional vertical vent or chimney. However, it is not uncommon to have an installation where venting through a sidewall becomes necessary. For information on venting through a sidewall using a mechanical (power) venter, see Section 8, "Sidewall Venting". This furnace must not be vented with plastic pipe.

To supplement national and local codes, instructions for venting as Category I are contained in this manual and in an addendum, "Venting Tables For Category I Venting".

DEFINITIONS

"Vent" and "Chimney" refer to open passageways which convey vent gases from the furnace, or its vent connector, to the outside. Vents and chimneys usually run vertically or nearly vertical. When they serve only one gas appliance, they are called "dedicated" vents or chimneys. When they serve multiple gas appliances, they are called "common" vents or chimneys.


"Vent Connector" refers to a pipe or duct which connects the furnace to a vent or chimney. Vent connectors usually run directly from the furnace's vent collar to the vent or chimney. Vent connectors may have vertical and horizontal runs.

"Venting System" refers to a continuous open passageway from the vent collar to the outside. Venting systems usually have a vent connector(s) and a vent or chimney. Venting systems commonly serve a single furnace or a single furnace and a water heater. Other multiple-appliance venting systems are less common.

"Fan-Assisted Combustion System" refers to an appliance equipped with an integral mechanical means to either draw or force products of combustion through the combustion chamber and/or heat exchanger. This furnace uses a draft inducer to draw combustion products through the heat exchanger and is considered to have a fan-assisted combustion system. Category I furnaces with fan-assisted combustion systems must not be vented into single wall metal vents.

GENERAL DESIGN CONSIDERATIONS

These instructions are for venting this furnace as a Category I appliance. Venting system components discussed in these instructions are not appropriate for Category III or IV appliances which have positive pressure venting systems.

 **WARNING:** Do not connect this furnace to a vent system used by other Category III or IV appliances. Do not connect it to vents with mechanical draft systems operating at positive pressure. Improper venting could allow combustion products to collect in building during use, resulting in fire, nausea or asphyxiation.

You must connect furnace to a listed chimney or vent complying with a recognized standard or a suitably sized, constructed and lined masonry chimney. Chimney lining method and material must comply with local requirements. Use corrosion-resistant material meeting nationally recognized standards for vent construction.

This furnace must not vent into an unlined-masonry chimney or an unlined-concrete chimney and must not single appliance vent into a tile-lined chimney. However, this furnace may be common vented into a tile-lined masonry chimney provided (1) the chimney is currently serving at least one draft hood equipped appliance and (2) the vent connectors and chimney are sized in accordance with the appropriate vent table.



WARNING: Select appropriate venting materials and clearances. Inadequate vent or chimney could allow combustion products to collect in building, resulting in fire, nausea or asphyxiation.



WARNING: Do not use unlined masonry chimneys. These increase risk of condensate formation, which may cause chimney to deteriorate, allowing combustion products and condensate to collect in building.

Multistory and common venting with other Category I appliances is permitted. The venting system must be in accordance with the National Fuel Gas Code ANSI Z223.1/NFPA 54, local codes and approved engineering practices.

Vent this furnace separately from any appliance designed to burn solid fuel, such as wood or coal. If a fireplace chimney flue is used to vent this appliance, the fireplace opening must be permanently sealed.

Avoid over-sizing furnace for your application. Select a furnace model with a rated heating output close to the calculated heating load. This extends the firing period, decreasing the potential for condensate formation in the vent.

The designer must consider the building's orientation, answering two questions: Will the vent terminate outside the building where its operation could be adversely affected by winds? Could any adjacent buildings adversely affect vent operation? Allowing for these factors can reduce the possibility of down draft conditions.

If your local experience indicates possible condensation problems, provide for draining and disposal of venting system condensate.

VENT SIZING AND INSTALLATION

Proper vent size can be determined from these instructions and "Venting Tables For Category I Venting" included as an addendum to these instructions, the National Fuel Gas Code ANSI Z223.1/NFPA, or approved engineering practices. Venting tables include instructions for single appliance venting and multiple appliance (common) venting.

Refer to venting tables for correct size vent. An undersized vent cannot adequately carry all combustion products outdoors. An oversized vent will not heat up rapidly enough to avoid condensation.

Vents and chimneys usually extend vertically with offsets not exceeding 45 degrees from vertical. Consider vent pipe runs more than 45 degrees from vertical as horizontal runs. Include their length in the total horizontal run.

Vent height must be a minimum of five feet for Category I vent systems. Minimize vent connector horizontal runs to the extent possible for best performance. Horizontal portions of the venting system must be supported at each joint using hinges, straps or equivalent to prevent sagging.

Slope horizontal portions upward from furnace at least 1/4 inch per foot.

Sometimes the horizontal distance from the furnace to the vent or chimney is already given. This is known as the horizontal vent connector run. The vent or chimney height is also usually given as is the Btu per hour input of the gas appliances served by the vent. Check these parameters to be sure the venting system will work. Use venting addendum, these instructions, part 7 of current National Fuel Gas Code ANSI Z223.1/NFPA. Use vent capacity tables in venting addendum to check existing or new vent sizes for Category I furnaces.

Install vent materials following their listing terms, manufacturer's instructions, these instructions and local codes.

A gas vent passing through a roof must extend through roof flashing, jack or thimble. It must terminate above roof surface.

Designer and installer must provide an appropriately sized common vent for all appliances connected to it. See venting addendum for single appliance venting and multiple appliance (common) venting. For multistory installations, refer to current National Fuel Gas Code ANSI Z223.1/NFPA 54.

VENT CONNECTORS

Vent connectors must be made of listed single-wall or Type B double-wall components. They must be thick enough to withstand physical damage and be readily accessible for inspection, cleaning and replacement.

Use Type B vent connectors in or through attics, crawl spaces, or other cold areas. Install thimbles that meet local codes when vent connectors pass through walls or partitions of combustible material.

Keep vent connectors as short as possible by locating furnace as close as practical to vent or chimney. Avoid unnecessary turns or bends which create resistance to flow of vent gases. Adding an elbow adds resistance.


You may increase vent connector diameter to overcome installation limitations and obtain connector capacity equal to furnace input. Make this increase as close as possible to furnace vent collar, allowing for necessary adapters and fittings. Do not increase vent size more than two sizes larger than vent collar. Minimum vent connector diameter from furnace to vent or chimney is same as vent collar.

If you join two or more vent connectors before they enter the vertical vent or chimney, use caution. See venting addendum for details on properly sizing vent connectors.

Do not connect vent connector to a chimney flue serving a fireplace unless you permanently seal fireplace flue opening.

Attach vent connector to furnace vent collar. Use minimum of three equally spaced sheet metal screws around connection. Connect all other vent pipes using three equally spaced screws at each joint. The only

exception is when you use Type B vent pipe with self-locking connections.

 **WARNING:** Unsecured vent pipe connection may loosen. This can allow combustion products to collect in building.

LINED CHIMNEYS

Furnace is suitable for venting into a properly sized and lined masonry chimney. Consult National Fuel Gas Code ANSI Z223.1/NFPA 54 for construction details. Consider using chimney as a pathway for suitably sized Type B vent liner. Seal all connections where vent connectors enter chimney. See Figure 9.

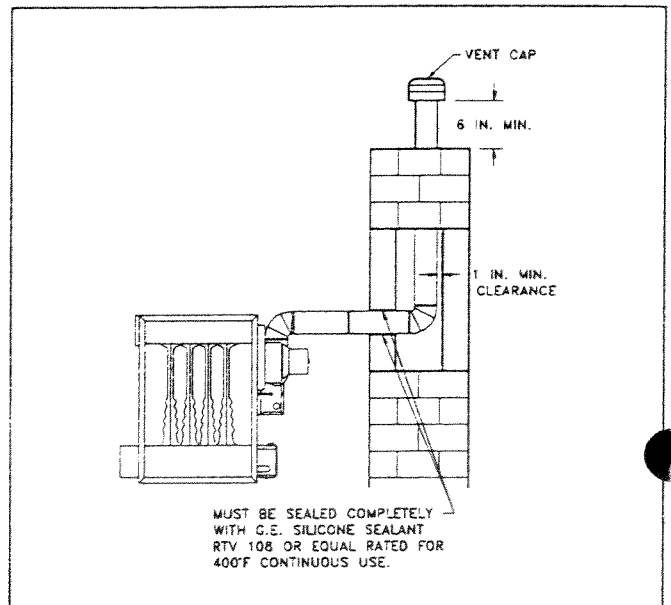



Figure 9. Type B Vent Liner.

 **WARNING:** Provide support when using a Type B vent liner in masonry chimney. Maintain at least a 1 inch clearance on all sides to reduce possibility of condensate in vent. Condensate may cause vent to deteriorate allowing combustion products to collect in building, which could result in injury or death. See Figure 10.

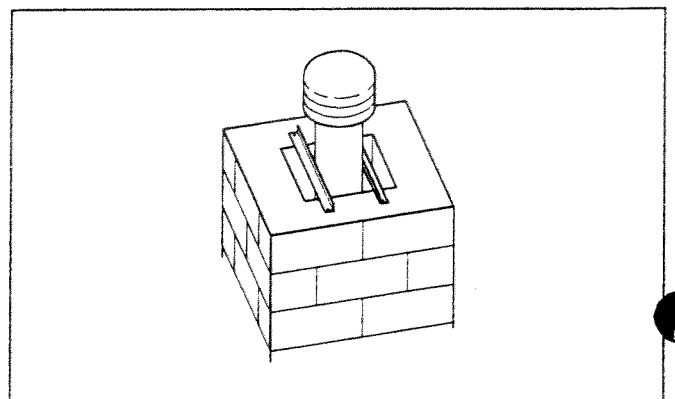


Figure 10. Supporting Type B Vent Liner.

VENT TERMINATION

Terminate all vertical vents with a listed vent cap or roof assembly unless local codes require otherwise. See vent-cap or roof-assembly manufacturer's instructions. Locate vent termination (vent cap or roof assembly) in an area without positive wind pressures or eddy currents. Eddy currents occur when air swirls over roof peaks. They can cause down-drafts and adversely affect vent operation. See Figure 11.

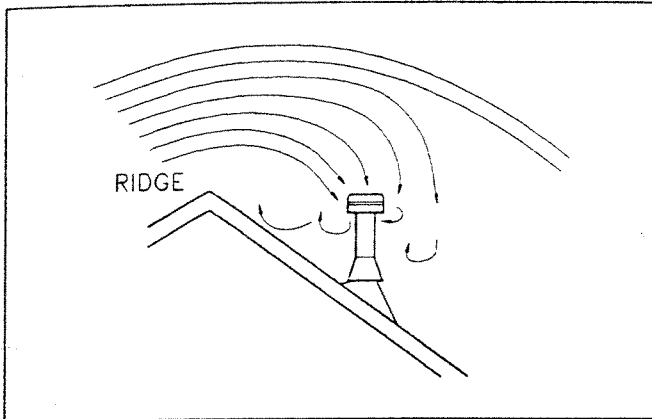
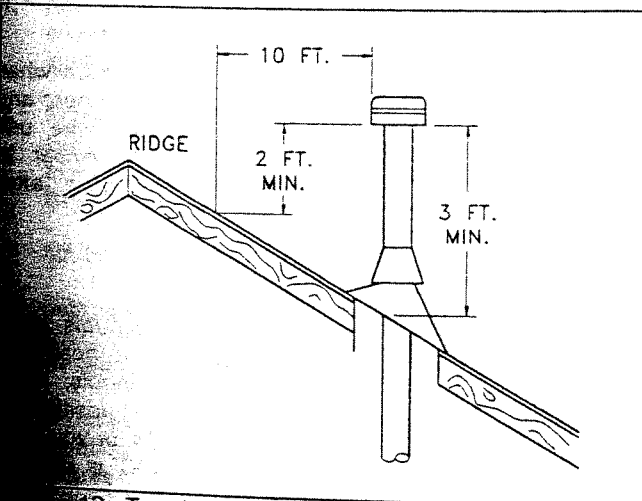


Figure 11. Eddy Currents Around Termination Cap.

Some vent termination or caps protect against eddy currents and down-drafts. Consult their manufacturer's instructions. Vent terminations or caps should usually be at least the same size as the vent. They may be larger if the installation warrants.

Vent systems must end at least five feet above the highest gas appliance connection. Vent pipe must extend at least three feet above the point where it passes through the roof. Vent termination must be at least two feet higher than any portion of building within a horizontal distance of ten feet. See Figures 12 and 13. Some vent cap manufacturers offer vent caps that allow reduced clearances. Consult their instructions.

WARNING: Failure to properly terminate vent or chimney systems could allow combustion products to collect in building.



12 Termination More Than Ten Feet From Ridge.

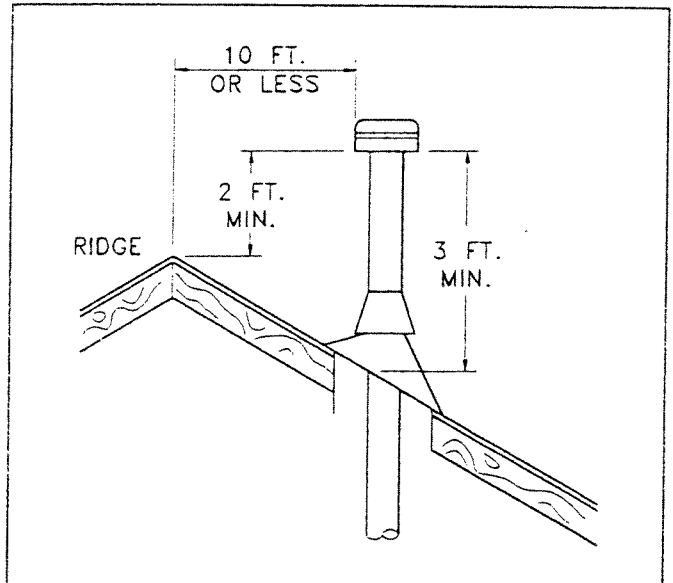


Figure 13. Termination Less Than Ten Feet From Ridge.

EXISTING VENT CONSIDERATIONS

Masonry chimneys must be lined with suitable liner. See "Lined Chimneys".

Make sure existing vent or chimney is proper size and construction for appliances that will use it. The best way to do this is to size as if it were a new installation. Compare the existing vent to your calculations and make the necessary corrections.

Examine vent or chimney clean-outs to make sure they remain tightly closed when not in use. Make sure vent or chimney passageway is clear and free of obstructions. Look for evidence of condensate or deterioration in vent or chimney. Either of these means an inadequate vent.

If you find an inadequate vent or chimney, do not leave it as is. Repair or replace it. A new vent must meet these instructions and the National Fuel Gas Code ANSI Z223.1/NFPA 54.

WARNING: An inadequate vent or chimney could allow combustion products to collect in building.

When an existing furnace is removed or replaced, the venting system may no longer be properly sized to vent the attached appliances. An improperly sized venting system may promote the formation of condensate, leakage or spillage.

The following steps shall be followed with each appliance connected to the venting system placed in operation, while any other appliances connected to the venting system are not in operation:

1. Seal any unused openings in the venting system;
2. Inspect the venting system for proper size and horizontal pitch, as required in the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and these instructions. Determine that there is no blockage or restriction,

leakage, corrosion and other deficiencies which could cause an unsafe condition;

3. In so far as is practical, close all building doors and windows and all doors between space in which appliance(s) connected to the venting system are located and other spaces of building.
4. Close fireplace dampers.
5. Turn on clothes dryers and any appliance not connected to the venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they shall operate at maximum speed. Do not operate a summer exhaust fan.
6. Follow the lighting instructions. Place the appliance being inspected in operation. Adjust thermostat so appliance shall operate continuously;
7. Test for drafthood equipped appliance spillage at the drafthood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle;
8. After it has been determined that each appliance connected to the venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliance to their previous conditions of use;
9. If improper venting is observed during any of the above tests, the venting system must be corrected. Follow the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and the venting tables provided with the furnace to correct improper vent operation. Any "common vent" re-sizing must approach minimum size determined using the venting tables.

SECTION 8. SIDEWALL VENTING

In most cases, proper venting is achieved by using a conventional vertical vent or chimney. However, it is not uncommon to have an installation where venting through a sidewall becomes necessary. This section contains information on venting through a sidewall using a mechanical (power) venter. A mechanical (power) venting system operates at negative pressure to draw the furnace flue products from the structure.

This furnace must not be vented with high temperature plastic pipe.

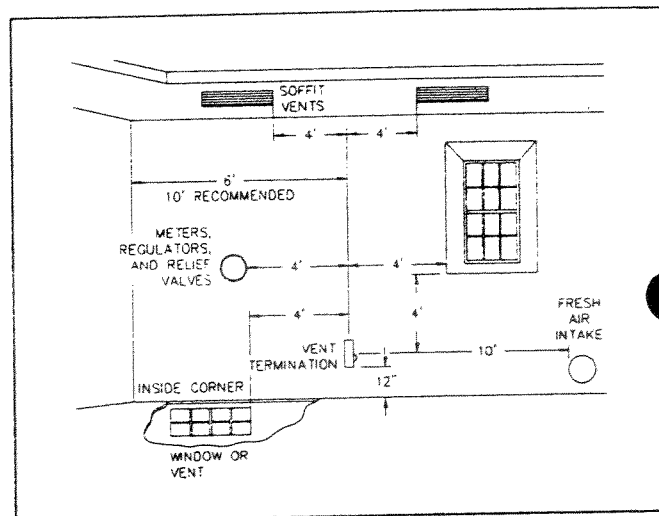
Any mechanical (power) venting system is acceptable as long as it has been certified by a nationally recognized testing agency and meets all state and local codes. The venter must be installed according to the mechanical (power) venter manufacturer's installation instructions. It must be sized appropriately for the furnace and be capable of maintaining a negative vent pressure of -0.1 to -0.5 inches W.C. in the vent pipe leaving the furnace under all operating conditions. Because this system operates at negative pressure, any single wall or Type B vent pipe may be used; however, Type B-1 pipe is recommended.

In addition to the venter manufacturer's instructions, the furnace manufacturer requires use of a secondary safety switch which will act to turn off the furnace in the event that the vent pressure becomes positive. These devices are available through the mechanical (power) venter manufacturer.

Locate vent termination so prevailing winds will not affect its operation. When this is not possible, consider using protection from strong winds such as a fence.

Locate vent termination following the minimum clearances listed below and see the Figure below.

1. At least 12 inches above grade level and normal snow accumulation.
2. At least 4 feet below, 4 feet horizontally from or 1 foot above any door, window or gravity air inlet to the building.
3. At least 4 feet horizontally from and not above any public walkways, regulators, relief valves or gas and electric meters.
4. At least 6 feet from any inside corner formed by two exterior walls. 10 feet is desirable.
5. At least 4 feet horizontally and vertically from any soffit or under eave vent.
6. At least 3 feet above and 10 feet from any forced air inlet to the building.
7. At least 10 feet from any adjacent building.



SECTION 9. LOCATION OF GAS AND ELECTRICAL CONTROLS, DRAFT INDUCER AND PRESSURE SWITCH

CAUTION: Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. When replacing original wire, use same type, color, or equivalent wire. Remember to renumber wire ends. Verify proper operation after servicing.

A. Before you start.

Install furnace with gas and electrical controls, draft inducer and pressure switch in one of two positions. You may have gas and electrical controls, draft inducer and pressure switch in as-shipped position as shown in position "A" and "D" in Figure 14, or you may relocate the controls to position "B" and "C" in Figures 14 and 21.

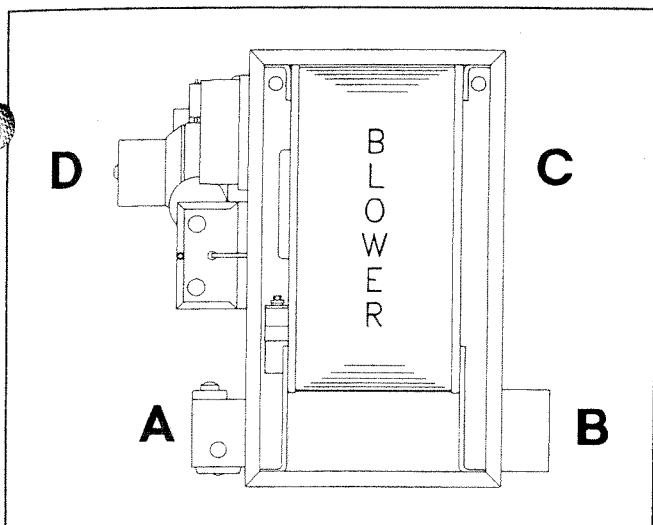


Figure 14. Controls In As-shipped Position.

For alcove installations, place controls, draft inducer and pressure switch on front of furnace. Face them toward alcove opening for easier servicing.

You may want to move controls, draft inducer and pressure switch before placing furnace in attic or crawl space. Consider if there will be enough access after you install controls, draft inducer and pressure switch on furnace. Consider pull down attic stairs, door openings, rafters, floor joists, etc. If access will be difficult, install controls, draft inducer and pressure switch at final installation site.

B. Selecting location of gas and electrical controls.

If you want gas and electrical controls in as-shipped position, proceed to E, "MOUNTING DRAFT INDUCER AND PRESSURE SWITCH".

You may move controls to position "B" and "C" shown in Figure 21. If you decide to move controls, first move gas, then electrical controls. Starting position for controls is front of furnace; ending position is rear of furnace.

C. Relocating gas controls.

1. Remove low-voltage wires from gas control. Remove orange high-voltage ignition wire from electronic ignition lockout module.
2. Remove all burner covers, burner side shields and shipping supports. Replace bottom screw removed from shipping support. Discard shipping supports. Save screws for reinstallation.
3. Lift burner rack up and pull out from front of furnace.
4. Disconnect pilot gas tubing at gas control. Remove pilot burner assembly from burner rack. Save screws for reinstallation.
5. Unscrew manifold bracket mounting screws. Remove manifold and gas control. Rotate gas control 180-degrees from its initial position. Always use backup

wrench on manifold to keep it from twisting when rotating gas control. See Figure 15.

6. Install manifold with gas control on opposite side of burner rack. Make sure brown gas control knob is up. Install manifold mounting bracket screws to torque of 60 inch-pounds. See Figure 15.

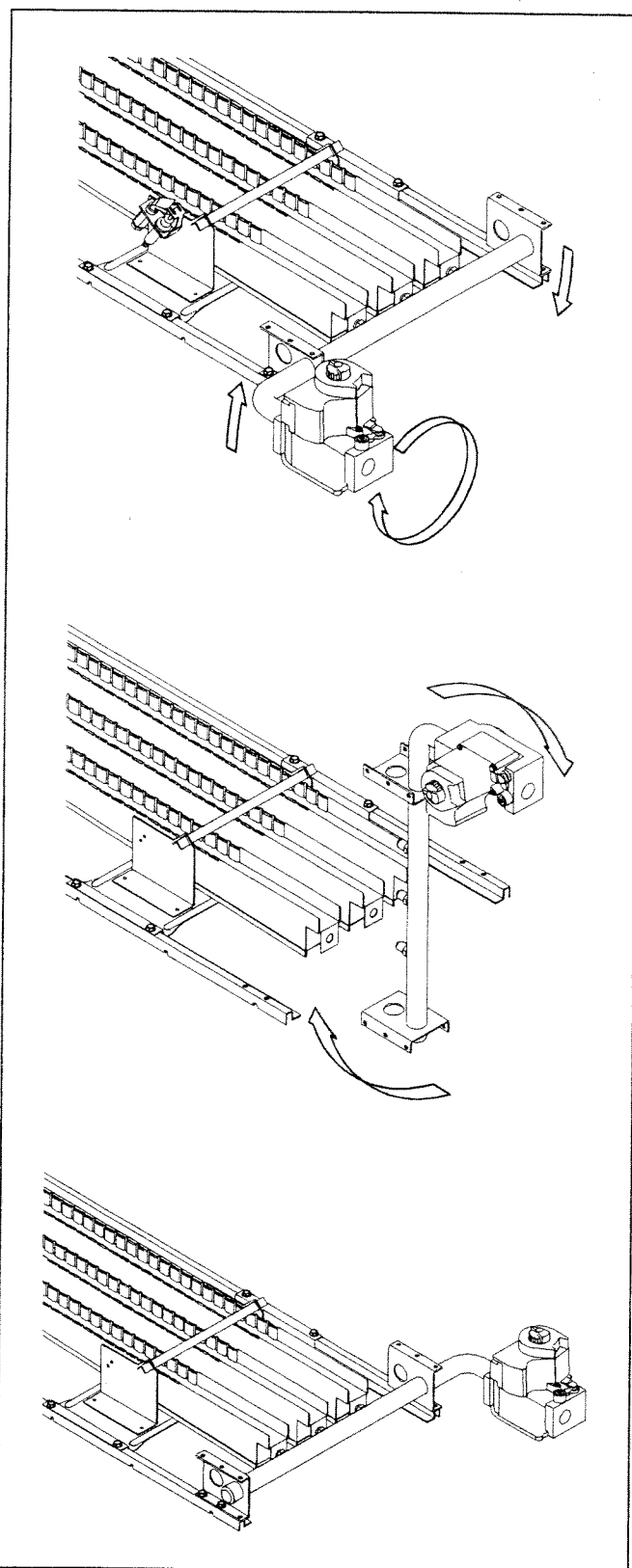


Figure 15. Reversing Gas Controls.

7. Reshape pilot tubing. See Figure 16. Be careful when you bend tubing. Do not kink.

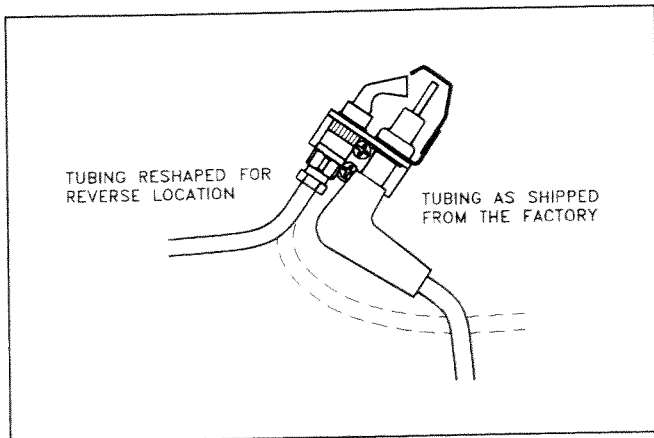


Figure 16. Reversed Pilot and Tubing

8. Install pilot burner on opposite side of burner rack using screws during removal. See Figure 17 for pilot position when reversed.

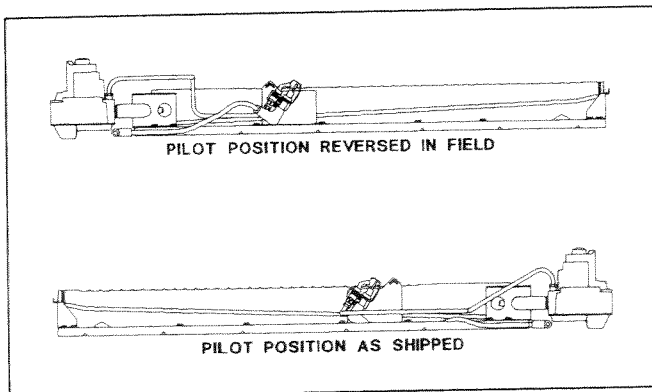


Figure 17. Field Reversed Pilot Position

9. Connect pilot tubing to gas control and tighten to torque of 60 inch-pounds.

10. Install burner rack, making sure gas control is next to blower door. Center burners beneath heat exchanger tubes. Properly located, the burner rack will nest snugly in furnace bottom, unable to move in any direction.



WARNING: Failure to install burner rack with gas control and burners properly located could cause heat exchanger failure, resulting in damage, injury or death.

11. Install burner side shields, burner covers, and screws around burner openings. Use screws saved during removal.



WARNING: Properly install burner side shields, burner covers and screws around burner openings. Failure to do so could cause heat exchanger failure, resulting in damage, injury or death.

12. Check for gas leaks using a commercial soap solution. Seal all leaks



WARNING: Never use an open flame to check for gas leaks. If a leak exists, a fire or explosion could occur, resulting in damage, injury or death.

D. Relocating electrical controls.

NOTE: These components must always be on same side of furnace. These are:

- Junction box;
- Fan/limit control;
- Auxiliary limit control;
- Gas controls;
- Electronic ignition lockout module;
- Draft inducer;
- Pressure switch.

This assures that routing of electrical wiring meets all electrical codes.

1. Remove blower door which contains operating instructions. Move pull knob from right to left side of door facing instructions. Knob will then be in proper position when you later move door to other side of furnace. Remove other door. Keep all screws.
2. Remove 3/4"-strain relief bushing from front of furnace below junction box. Remove similarly located bushing on rear of furnace.
3. Remove wire tie on blower motor wires in blower compartment. Find auxiliary limit control on upper portion of blower panel. Disconnect its blue wires. Route blue wire from burner limit switch over blower housing. Remove auxiliary limit control and hole plug on upper housing corners of blower panel and exchange locations. See Figure 18.

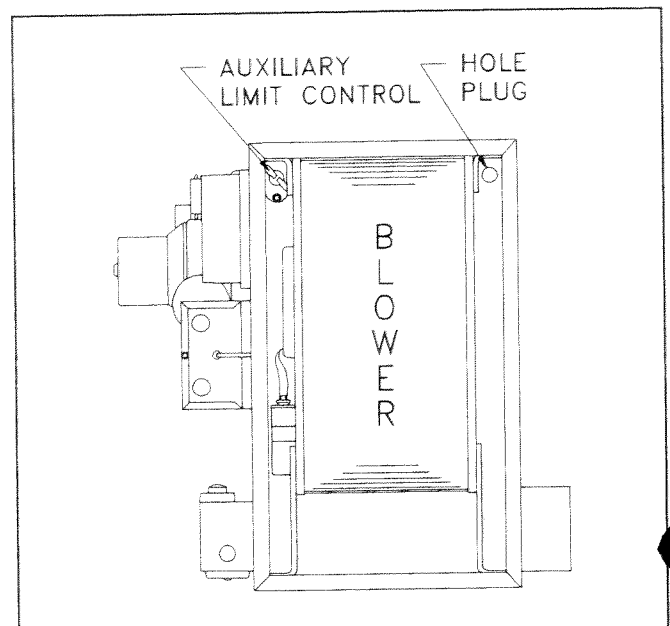


Figure 18. Auxiliary Limit Control.

4. Remove junction box and fan/limit control covers.
5. Disconnect wires in junction box as follows.
 - a. **Line voltage wiring:** See Figure 19 to identify junction box components. Remove blower motor red or blue wire from spliced fan/limit control brown wire. Remove blower motor black wire from blower relay, terminal "N.O.". Remove blower motor white wire from spliced transformer primary, white wire. Remove fan/limit control, black wire from blower relay, terminal "N.C.". Remove 3/4"-strain relief bushing from back of junction box.

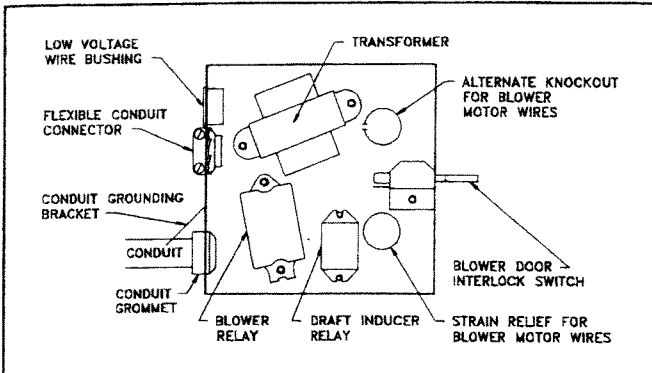


Figure 19. Junction Box Components.

- b. **Low-voltage wiring:** Pull auxiliary limit control blue wire into junction box. Remove red wire from terminal strip, terminal "W". Remove fan/limit controls yellow wire from blower relay coil terminal. Remove purple wire from inducer relay coil.
6. Disconnect electronic ignition lockout module blue wire at terminal "24V". Pull through 3/4" hole and into blower compartment. Route it under blower housing to other furnace side. Disconnect other electronic ignition lockout module blue wire and green ground wire. Save screws and wire for reinstallation.
7. Remove 3/4"-strain relief bushing from junction box. Pull blower motor wires from junction box into blower compartment. Push them across top of blower housing to opposite side of blower compartment.
8. Remove mounting plate holding electronic ignition lockout module. Leave low voltage wires attached to module. Install on rear of furnace. Connect green ground wire to casing.
9. Unfasten and remove fan/limit control, conduit, and wires from junction box. Save screws for reinstallation.
10. Plug holes vacated by fan/limit control with 7/8"-hole plug from rear of furnace.
11. Remove fan/limit control, 3/4"-strain relief bushing. Remove conduit and then conduit grommet from original fan/limit control knockout. See Figure 20.

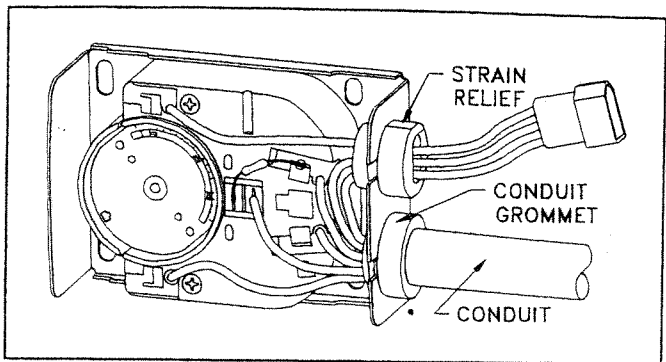


Figure 20. Fan/Limit Control.

12. Reverse fan/limit control entry locations of three wires from pressure switch and wires from 3/4" conduit.

NOTE: Reversing wire locations can be done without disconnecting any wires. Slide wires through slots in fan/limit control housing knockouts. Reverse wire locations. Install 3/4"-strain relief bushing. Install 3/4"-conduit grommet and conduit.

WARNING: Do not push conduit all the way through conduit grommet. Design of conduit grommet has a step in it to insulate and protect wires from end of conduit. End of conduit must not be visible within fan/limit control. Incorrect installation of conduit could cause an electrical short, resulting in damage, injury or death.

13. Remove junction box and 7/8"-insert bushing behind junction box. Save screws for reinstallation.
14. Plug hole vacated by junction box with 7/8"-hole plug removed from rear of furnace.
15. On side of junction box with terminal strip, move conduit grommet to low-voltage bushing location. Move low-voltage wire bushing to flexible conduit connector location and move flexible conduit connector to old conduit grommet location.
16. Rotate conduit grounding bracket 180-degrees so open part of "V" is pointing down towards relocated conduit bushing.
17. Remove junction box alternate knockout in back of junction box. See Figure 19 for location of alternate knockout.
18. At location "B" and "C", Figure 21, install 7/8"-insert bushing in furnace casing. Install junction box with blower door interlock switch facing blower end of furnace. See Figure 19 for interlock switch location.
19. Install fan/limit control (with conduit and wiring attached) at new location on rear of furnace.
20. Push fan/limit control wiring through conduit grommet on side of junction box. Install conduit in grommet. Install fan/limit control and replace cover.

WARNING: Do not push conduit all the way through conduit grommet. Conduit grommet has a step in it to insulate and protect wires from conduit end. Conduit end must not be visible within junction box. Incorrect installation of conduit could cause an electrical short, resulting in damage, injury or death.

21. Make sure conduit grounding bracket is touching conduit. See Figure 19 for location of grounding bracket.

WARNING: Furnace must have proper electrical ground. Failure to provide a proper electrical ground could cause electrical shock or fire, resulting in damage, injury or death.

22. Within junction box, route fan/limit control blue wire through 7/8" opening at the back of junction box to the auxiliary limit control open terminal. Connect auxiliary limit control blue wire that was rerouted in Step 3) to the remaining auxiliary limit control open terminal.
23. Route blower motor wires from blower compartment through 7/8"-insert bushing into junction box. Install 3/4"-strain relief bushing on blower motor wires. Then install bushing in rear of junction box.
24. Within junction box, connect line voltage and low-voltage wires. Do so in reverse order from Step 5, completing 5b, then 5a. Wiring must conform to wiring diagram on junction box cover.

WARNING: Failure to properly terminate unused motor leads could cause electrical shock.

25. Connect electronic ignition lockout module wires to gas control terminals. Connect red wire to gas control at terminal "MV". Connect white wire to gas control at terminal "PV/MV". Connect black wire to gas control at terminal "PV". See wiring diagram on junction box cover. Connect orange high-voltage ignition wire to electronic ignition lockout module at high-voltage terminal.
26. Connect blue wire from junction box terminal strip at terminal "C" to electronic ignition lockout module at terminal "24V(GND)".
27. Connect other electronic ignition lockout module blue wire, rerouted in step 6, to electronic ignition lockout module at terminal "24V".
28. Install junction box cover.
29. Inspect blower compartment and bundle loose wires together so there is not chance of wires entering blower intake.
30. Reinstall 3/4"-strain relief bushings on front and rear of furnace.

31. Install blower doors, making sure operating instructions are next to controls. Move blower door, pull knob if not done already.

E. Mounting draft inducer and pressure switch.

You must mount draft inducer and pressure switch from on the same side of furnace as the gas and electrical controls. It may be easier to do this before placing furnace in an attic or crawl space, but first determine if you have sufficient access space. If you have limited space, mount them at the final furnace site.

WARNING: Install draft inducer within same atmospheric pressure zone as burner combustion air inlets. Failure to do so could cause improper burner operation, resulting in damage, injury or death.

If you leave gas and electrical controls in as-shipped position, use the instructions in paragraph 1). If you moved gas and electrical controls, follow the instructions in paragraph 2).

1. Installing draft inducer when you leave gas and electrical controls in as-shipped position. As-shipped controls are in position "A" and draft inducer is in position "D", shown in Figure 21.

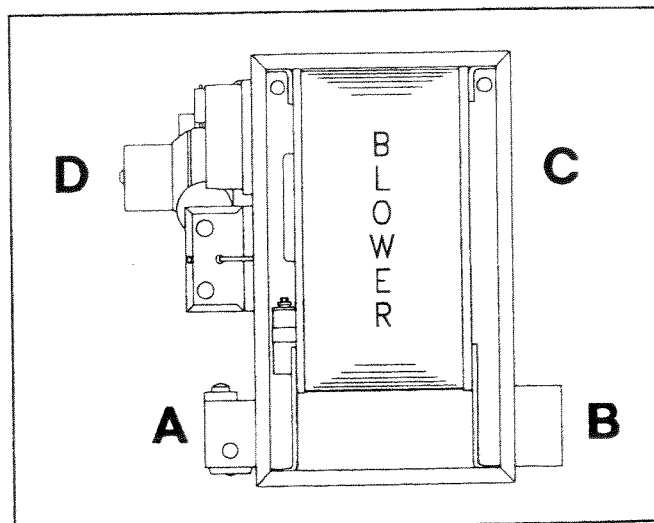


Figure 21. Controls in As-Shipped Position.

- a. Draft inducer and pressure switch are in a carton in blower compartment. Remove draft inducer and pressure switch from carton, being careful not to damage fiberglass sealing gasket.
 1. Place sealing gasket over four mounting studs on draft inducer collector box. Mounting stud pattern is not symmetrical. Sealing gasket will only fit properly one way. Align it to match stud pattern.
 2. Place draft inducer on four mounting studs with vent outlet on the right. See Figure 22. Attach draft inducer to draft inducer collector box. Use four #8-32 hex nuts from hardware package. Tighten to torque of 60 inch-pounds.

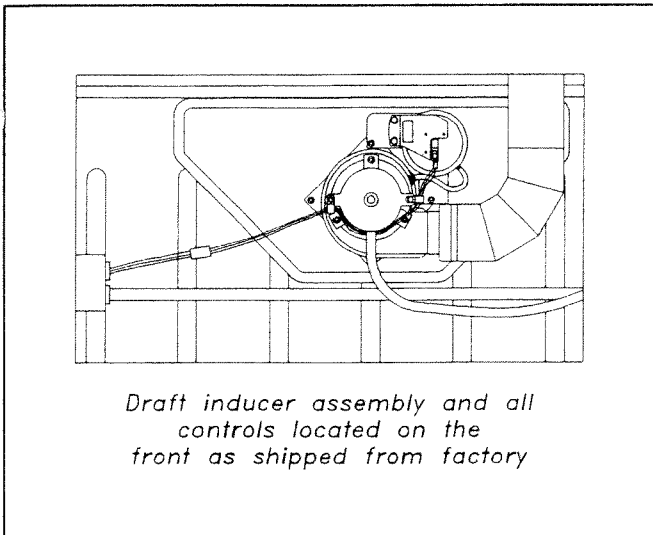


Figure 22. Inducer Assembly Front Position.

NOTE: Sealing gasket between draft inducer and draft inducer collector box must be in place. Tightly secure or furnace may shut down.

3. Remove junction box cover. Inspect end of flexible conduit from draft inducer to be sure that orange plastic anti-short bushing is still in conduit. See Figure 23. Locate flexible connector, shown in Figure 19.

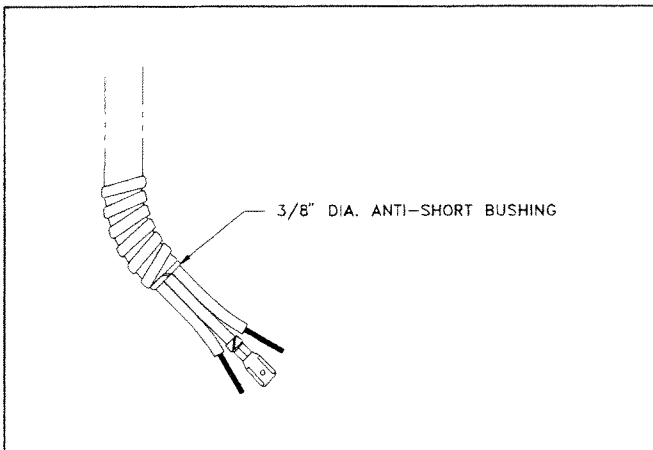


Figure 23. Anti-short Bushing.

4. Thread three wires from draft inducer through flexible conduit connector on junction box. Push flexible conduit into connector and securely tighten set screw.

Locate draft inducer relay shown in Figure 19. Using Figure 24 and the wiring diagram in the back of this manual, attach black wire from flexible conduit to 115-volt common power supply. Attach green wire to green grounding pigtail junction box.

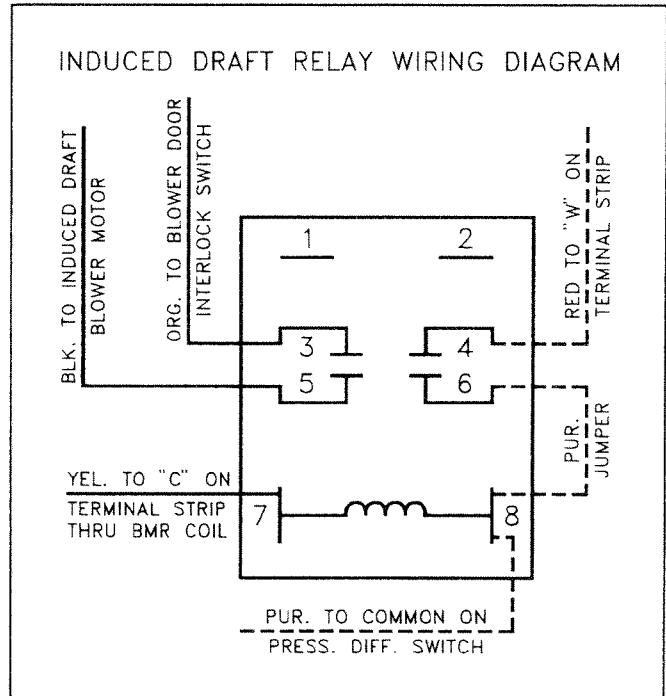


Figure 24. Induced Draft Relay Wiring.

- b. Installing pressure switch.

1. Install pressure switch on mounting studs at top and right side of draft inducer. Use #8-32 hex nuts from hardware package. See Figure 22 for correct location.

NOTE: DO NOT remove hex nuts securing draft inducer to mount pressure switch.

2. Tighten hex nuts to torque of 60 inch-pounds.
3. Connect pressure tubing draft inducer pressure fitting as shown in Figure 22. Be sure tubing is open and has no kinks or splits.
4. Attach wires that run beneath draft inducer motor to pressure switch terminals, 3/16" purple terminal to common, 1/4" red terminal to normally closed and 1/4" blue terminal to normally open.

WARNING: Do not alter wire or pressure switch terminals to allow incorrect connection. Miswiring could cause unsafe operation, resulting in damage, injury or death.

5. Plug plastic connector on pressure switch wire into plastic connector on fan/limit control wire assembly.

NOTE: Wires from pressure switch must not touch any part of draft inducer blower housing.

6. Remove heat deflector from blower compartment. Using yellow-headed screw, install on furnace side opposite draft inducer. Yellow-headed screw is 3-1/4" from heat exchanger end and 2-3/8" down from top.



WARNING: Failure to install heat deflector could allow hot surfaces to touch combustible material. This could cause fire, resulting in damage, injury or death.

2. Relocating controls and draft inducer from as-shipped position. You may move controls to position "B" and draft inducer and pressure switch to position "C" shown in Figure 25.

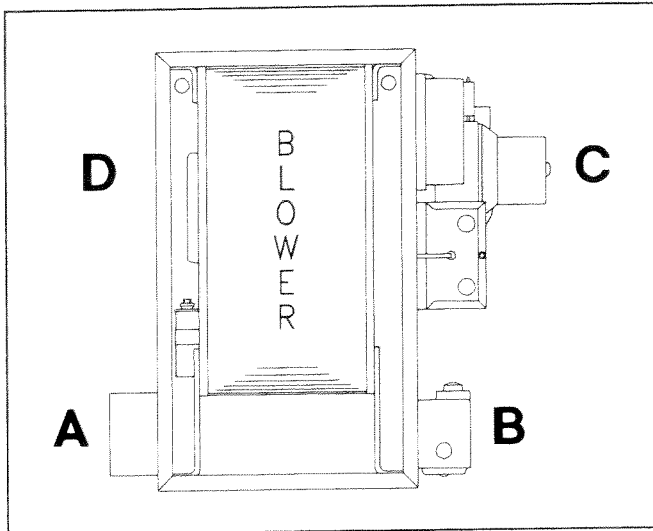


Figure 25. Controls In Reversed Position.

NOTE: These components must always be on same side of furnace. These are:

- Junction box;
- Fan/limit control;
- Auxiliary limit control;
- Electronic ignition lockout module;
- Pressure switch;
- Gas controls;
- Draft inducer.

a. Relocating draft inducer collector box.

1. Remove draft inducer collector box and screws from outlet furnace front. See Figure 26. Save screws for reinstallation.

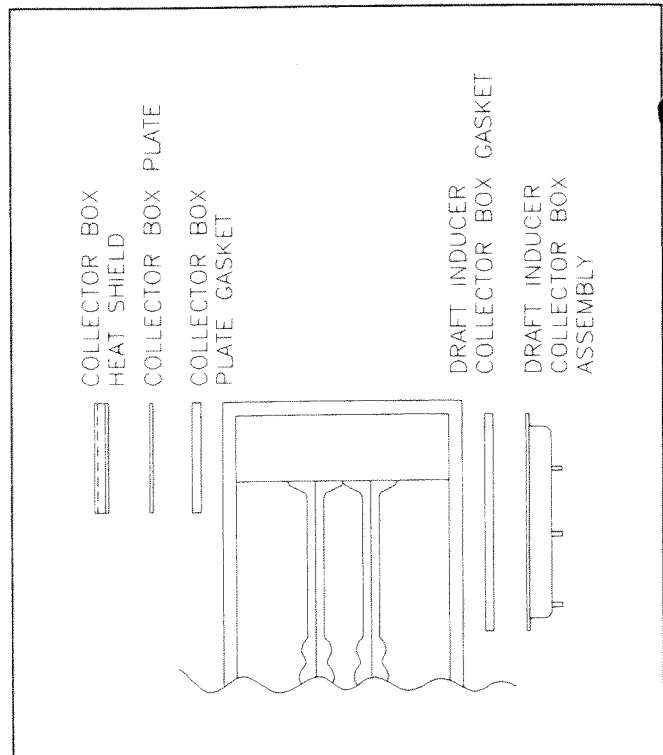


Figure 26. Collector Box Components.

2. Remove heat exchanger collector box heat shield, cover plate and fiberglass gasket located on rear of furnace. Install them on front. See Figure 26. Take care to align gasket.
3. Install four screws below heat exchanger collector box outlet on new draft inducer side of furnace. See Figure 27.

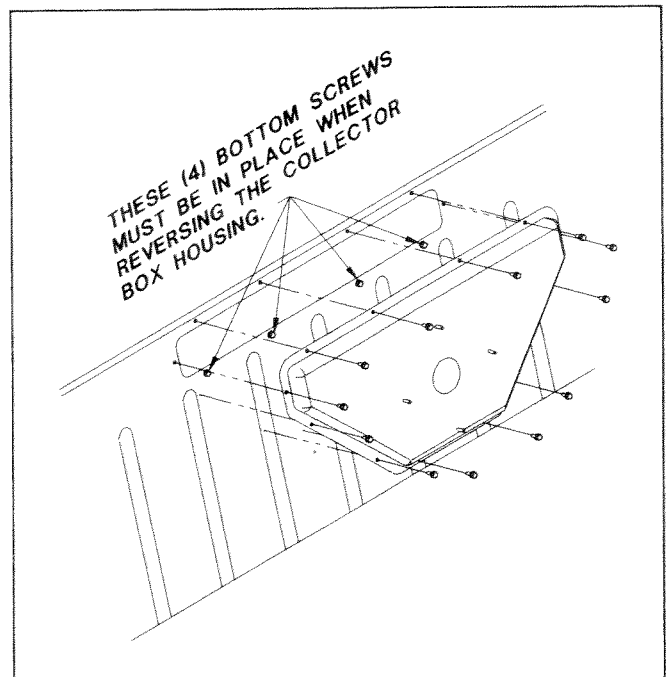


Figure 27. Four Screws Below Collector Box Outlet.

4. Install draft inducer collector box on new draft inducer side of furnace using screws saved during removal. See Figure 27. Carefully align gasket.

NOTE: Some screw holes are not open. Use self-drilling screws or a 1/8" drill. See Figure 28.

WARNING: Failure to replace all screws around heat exchanger openings may allow air leakage into heat exchanger. This could cause a fire resulting in damage, injury or death.

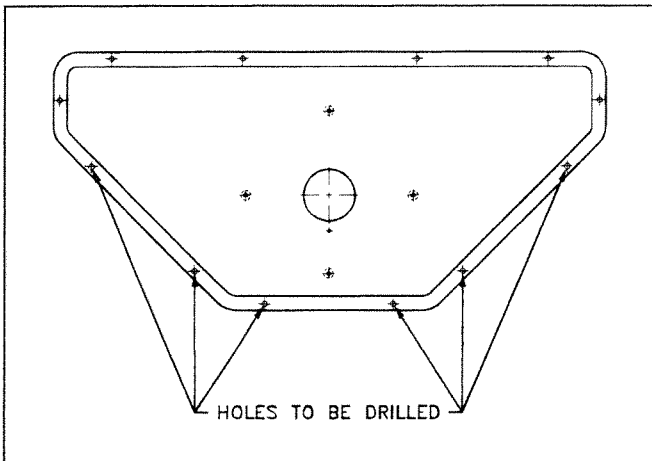


Figure 28. Holes Not In Casing.

b. Locate draft inducer and pressure switch in a carton in the blower compartment. Remove draft inducer and pressure switch, being careful not to damage fiberglass sealing gasket.

1. Place sealing gasket over four mounting studs on draft inducer collector box. Mounting stud pattern is not symmetrical. Sealing gasket will fit properly in one position. Align it to match stud pattern.
2. Place draft inducer on four mounting studs with vent outlet on the right. See Figure 29. Attach draft inducer to draft inducer collector box. Use four #8-32 hex nuts from hardware package. Tighten to torque of 60 inch-pounds.

NOTE: Sealing gasket between draft inducer and draft inducer collector box must be in place. Tightly secure or furnace could shut down.

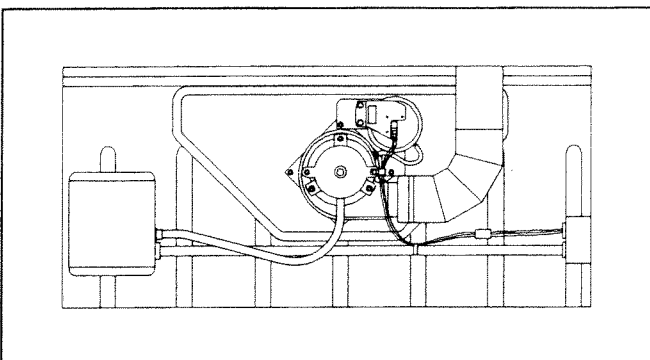


Figure 29. Inducer Assembly Rear Position.

3. Remove junction box cover. Inspect flexible conduit end from draft inducer to be sure that orange plastic anti-short bushing is in conduit. See Figure 23. Locate flexible conduit connector shown in Figure 19.
4. Thread three wires from draft inducer through flexible conduit connector on junction box. Push flexible conduit into connector and securely tighten set screw.
5. See Figure 19 for draft inducer relay location. Follow Figure 24 and furnace wiring diagram located in the back of this manual. Attach black wire from flexible conduit to terminal #5 on draft inducer relay. Attach white wire from flexible conduit to 115-volt common power supply. Attach green wire to green junction box grounding pigtail.

c. Installing pressure switch.

1. Install pressure switch on mounting studs at top and right side of draft inducer. Use #8-32 hex nuts from hardware package. See Figure 29.

NOTE: DO NOT remove hex nuts securing draft inducer to mount pressure switch.

2. Tighten hex nuts to torque of 60 inch-pounds.
3. Connect pressure tubing to draft inducer pressure fitting as shown in Figure 29. Be sure tubing is open and has no kinks or splits.
4. Attach wires running beneath draft inducer motor to pressure switch terminals. All terminals are different. You can only connect them one way.

WARNING: Do not alter wire or pressure switch terminals. Miswiring could cause unsafe operation, resulting in damage, injury or death.

5. Remove wire clamp on left hand side of draft inducer motor mount. See Figure 29.
6. Remove and discard wire clamp.
7. Install draft inducer motor mounting screw removed in Step 5).
8. Gather pressure switch wires to fan/limit control conduit. Do so directly beneath wire clamp on right hand side of draft inducer motor mount.
9. Install wire tie provided in hardware package around pressure switch wires and fan/limit control conduit. Tighten securely. Place wire tie directly beneath wire clamp. See Figure 29.
10. Locate plastic connector on pressure switch wire assembly. Locate plastic connector on fan/limit control wire assembly. Plug the two together.

NOTE: The wires from pressure switch must not touch any part of draft inducer blower housing.

11. Compare completed installation with Figure 29.

SECTION 10. INSTALLING GAS PIPING

PREPARATION

Refer to the current National Fuel Gas Code ANSI Z223.1/NFPA 54 and local codes for gas piping requirements and sizing. Pipe size running to furnace depends on:

- Length of pipe
- Number of fittings
- Specific gravity of gas
- Input requirements (Btu per hour) of all gas-fired appliances attached to same main supply line.


Plan furnace gas supply piping so it will not interfere with removal of burner assembly or blower door for servicing.

Make sure gas piping is large enough for all appliances connected to it to operate at once without lowering gas supply pressure. Failure to do so could cause lighting or burning problems on any of the appliances.

Always use a pipe thread compound which is resistant to propane (LP) gas solvent action. Sparingly apply thread compound to all joints on male threads only, starting two threads from the end.

INSTALLATION

1. Install gas pipe to inlet side of furnace gas control. Use a backup wrench on the square ends of the gas control.

 **WARNING:** Do not thread gas pipe too far. Doing so may cause a gas leak or malfunction of furnace gas control resulting in a fire or explosion.


2. When using black iron gas pipe, install a ground joint union immediately upstream of the furnace to allow for easy servicing of burner assembly and furnace gas control. Ground joint union must be listed by a nationally recognized testing laboratory.
3. After ground joint union install a drip leg (sediment trap). A convenient way to make a drip leg is by using a 1/2" NPT to 1" NPT tee. Then install a 1-1/2 inch long, 1" NPT nipple in tee with a 1" NPT pipe cap to complete drip leg.
4. Install an equipment shut-off valve in the gas supply line immediately upstream of the drip leg tee. Equipment shut-off valve must be listed by a nationally recognized testing laboratory.

TESTING FOR LEAKS

Isolate furnace and its gas control from gas supply line during leak checks. Gas supply line test pressure determines how you isolate gas control.

The furnace and its gas control must be disconnected from the gas supply piping system at the ground joint union during any pressure testing of the system at test pressures greater than 1/2 psi (14 inches W.C.).

The furnace must be isolated from the gas supply piping system by turning off the equipment shut-off valve during any pressure testing of the system at test pressures equal to or less than 1/2 psi (14 inches W.C.).

 **WARNING:** When test pressure is above 1/2 psi (14 inches W.C.), completely disconnect furnace and gas control from gas supply line. Failure to isolate furnace and gas control from test pressure could damage them, causing gas to leak, resulting in fire or explosion.

Use a commercial soap solution made to detect leaks and check all gas piping connections. Bubbles indicate gas leakage. Seal all leaks before proceeding.

SECTION 11. INSTALLING ELECTRICAL WIRING

CAUTION: Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. When replacing original wire, use same type, color, or equivalent wire. Remember to renumber wire ends. Verify proper operation after servicing.

115 VOLT WIRING

Wire furnace according to the Field Wiring Diagram shown in Figure 30, local codes and current National Electrical Code ANSI/NFPA. Also, see Furnace Wiring Diagram in the back of this manual.

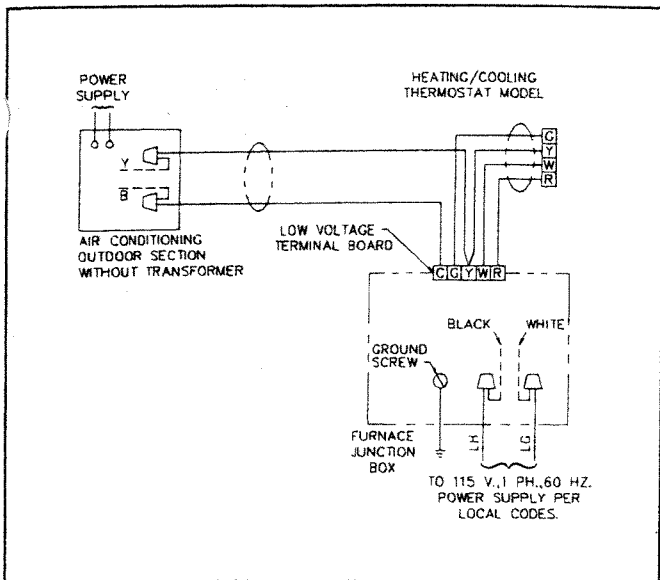


Figure 30. Field Wiring Diagram.

Install proper electrical grounding by attaching grounding source to green wire in furnace junction box. Follow local codes or in the absence of local codes, the current National Electrical Code ANSI/NFPA 70.



WARNING: Failure to provide a proper electrical ground could result in electric shock or fire.

Provide furnace with its own separate electrical circuit and means of circuit protection. Furnace must have an electrical disconnect switch located at the furnace.



WARNING: Failure to provide the above shut-off means could result in electrical shock or fire.

Use electrical wiring that meets current National Electrical Code ANSI/NFPA 70 and local codes. Use Type T (63 degrees C rise) wire or equivalent.

APPROXIMATE HEAT ANTICIPATOR SETTING

Wire system using field wiring diagram in Section 11. Find heat anticipator under room thermostat cover. Set heat anticipator at 0.8 for Electronic Ignition and Induced Draft models.

CAUTION: Unapproved 24 VAC accessories which draw power from the furnace's transformer should not be installed on this furnace. Addition of such accessories may cause improper furnace operation and limit transformer life.

SECTION 12. SEQUENCE OF OPERATION

When your indoor temperature drops below the temperature set on your thermostat, the thermostat turns your furnace on as follows:

Thermostat calls for heat, closing inducer relay. Inducer motor starts and pressure switch proves sufficient combustion air and closes, energizing ignition lockout module. Module opens pilot valve in gas control and at same time sparks to light pilot gas. Module senses pilot flame and opens main gas valve in gas control. Main burners light.

Your blower turns on automatically in approximately 90 seconds, or when there is enough heat build-up in heat exchanger. Blower pulls air from structure through air filter and over heat exchanger. Warmed air moves through air ducts to room registers.

When room temperature reaches thermostat setting, the draft inducer stops, the gas control closes, and gas flow to pilot and main burners stops. The blower stops automatically after it removes heat from heat exchanger.

SECTION 13. INSTALLING DUCT SYSTEM

Properly size duct system based on heat loss and heat gain calculations to assure good heating and cooling installations, potentially fewer call-backs and delivery of required circulating air. Install duct system to meet current Standard for Installations of Warm Air Heating and Air Systems ASHRAE/NFPA 90 and local codes.

CAUTION: Failure to follow these standards could reduce air flow or increase air leakage, resulting in reduced system performance or furnace damage.

Design duct system so furnace will operate at a static pressure of 0.50 inches W.C. or less. This static pressure limitation includes the total pressure losses on both the supply air side and the return air side of the system. Supply side pressure loss includes the cooling coil, ducts and room registers. Return side pressure loss includes the return grilles and ducts. Pressure losses are calculated based on 400 cfm per ton of cooling.

SUPPLY AIR DUCT WORK

Supply air duct (plenum) connections must be at least as big as the furnace supply opening. Attach to furnace duct flanges. Seal supply air duct work to furnace casing, walls, ceilings or floors it passes through. End duct work outside furnace space.

On furnaces not equipped with a cooling coil, a removable access panel which is large enough to allow viewing of the heat exchanger should be provided in the supply duct. The access panel should be accessible when the furnace is installed. Seal access panel cover to prevent leaks.

An eighteen inch long transition between furnace and cooling coil may be needed to allow free airflow into the coil. Also, consult cooling coil installation instructions.

RETURN AIR DUCT WORK


NOTE: Return air plenum connection must be same size as furnace return air opening. Attach to return air plenum

flange. Connect all return air ducts to plenum. Do not connect them to top, bottom, sides or doors of furnace blower compartment.

Whether you install furnace with or without air conditioner, return air plenum should extend 18" from furnace connection without turns or round pipe connections. To make sure return air enters blower compartment smoothly and balanced, consider:

- Size and shape of return air plenum;
- Number of return air ducts;
- Your own experience.

Be sure you balance airflow into blower assembly side opposite the motor with airflow into blower motor side.



WARNING: Failure to seal return air duct work could allow combustion products to enter circulating air stream resulting in injury or death by asphyxiation.

DUCT DAMPERS

You may balance air flow with dampers installed in each branch run duct and adjust for even temperature throughout the heated space. For proper furnace operation, make sure:

- Supply air registers and return air grilles are open;
- Rugs, carpets, drapes or furniture are clear of registers and grilles;
- Size and shape of supply air plenum is correct;
- Number of supply air ducts is correct.
- You consider your own experience and seek assistance if needed.

Uneven air flow could cause blower motor to overheat. Avoid vent system reverse pressure by running return air duct work outside furnace space. Seal return air duct work to furnace casing, walls, ceilings or floors it passes through. End duct work outside furnace space.

If furnace will share common duct system with a separate cooling unit, install furnace parallel to or upstream of cooling unit. This avoids condensation in heating element. Do not install cooling coil in return air duct work. With parallel flow, dampers or other means must prevent chilled air from entering furnace. If dampers or other means are not in full heat or cool position, furnace or cooling unit must not operate.

SECTION 14. SELECTING AND INSTALLING AIR FILTERS

CAUTION: You must install air filters to keep these components clean: blower motor, blower wheel and air conditioning coil, if there is one. Dirty equipment may reduce system efficiency or cause erratic control

performance, resulting in damage to blower motor or heat exchanger and air conditioner (if installed).

Air filters are not supplied with furnace. Obtain and install correct size.

Air velocity must not exceed 300-feet per minute through low velocity disposable filters. Air velocity must not exceed 650-feet per minute through high velocity cleanable filters. Too small a filter could cause excess static pressure, adversely affecting furnace operation. Follow minimum sizing and quantity recommendations in Table 5, as well as the air filter manufacturer's.

Table 5. Recommended Filter Size.

GAS INPUT* (Btu/hr)	MOTOR* HORSE- POWER	FIELD	HIGH
		SUPPLIED DISPOSABLE AIR FILTER (two required)	VELOCITY WASHABLE AIR FILTER (one required)
40,000	1/4	16" X 20" X 1"	16" X 20" X 1"
60,000	1/4	20" X 20" X 1"	20" X 20" X 1"
80,000	1/3	20" X 20" X 1"	20" X 20" X 1"
100,000	1/2	20" X 25" X 1"	20" X 25" X 1"
120,000	1/2	20" X 25" X 1"	20" X 25" X 1"

*GAS INPUT and MOTOR HP can be found on furnace rating plate.

Do not install air filters inside furnace casing. You may use an appropriately sized and installed return grille or in-duct air filter. Consult filter manufacturer for installation instructions. Use good engineering practices when selecting filter location.

To inspect, replace or clean air filters, follow User's Information Manual instructions.

SECTION 15. CHECKS BEFORE STARTING FURNACE

Before starting furnace for the first time, be sure you can answer "Yes" to each of these questions:

1. Have you removed the cardboard blower wheel shipping support from inside the blower wheel on the side opposite the motor?
2. Is furnace properly equipped to operate with available fuel?
3. Have you cleared away all loose construction and insulation materials?
4. Is furnace level?
5. If furnace is in crawl space, is it at least 8" above the ground?
6. Does furnace have sufficient ventilation air?
7. Does vent system meet current National Fuel Gas Code ANSI Z223.1/NFPA 54 and local codes?
8. Is vent connector securely fastened to draft inducer?

9. Did you completely check gas pipe and controls for gas leaks?
10. If you moved controls, is gas control next to blower door?
11. If you moved controls, are hole plugs in all vacated holes? Are all wires properly insulated and connected?
12. If you moved controls or draft inducer, did you replace all screws?
13. Is draft inducer installed correctly?
14. For all models, have you pushed burner limit switch reset buttons?
15. Is heat deflector installed on supply air end of furnace opposite the draft inducer?
16. Does electrical wiring follow current National Electrical Code ANSI/NFPA 70 as well as local codes?
17. Is furnace electrically grounded?
18. Is room thermostat properly installed and heat anticipator set correctly?
19. Is duct system correctly sized and sealed?
20. Are air filters in place and correctly sized?
21. On furnace installations above a 2,000 foot elevation, is furnace derated properly?

SECTION 16. GAS SUPPLY PRESSURE AND PILOT ADJUSTMENT

You will need a 0 to 15 inch water manometer with 0.1 inch resolution and a 1/8" NPT manual shut-off valve to measure actual gas pressure.



WARNING: You must have correct gas supply and pilot pressure for proper pilot ignition and burner operation. Failure to accurately adjust pressure could cause a fire or explosion.

CHECKING GAS SUPPLY PRESSURE

1. Turn off gas at equipment shut-off valve in gas supply line just ahead of furnace.
2. Remove inlet pressure plug from gas control.
3. Install 1/8" NPT manual shut-off valve in hole vacated by plug. Make sure valve is in off position.
4. Attach manometer to 1/8" NPT manual shut-off valve just installed.

5. Slowly open equipment shut-off valve in gas supply line just ahead of furnace.
6. Slowly open 1/8" NPT manual shut-off valve leading to manometer.
7. Turn on all gas appliances attached to gas supply line.
8. With furnace operating, read gas supply pressure on manometer.
 - Natural gas supply pressure must be between 5 and 10.5 inches W.C.
 - Propane gas (LP) supply pressure must be between 11 and 14 inches W.C.
9. If gas supply pressure is not within these limits, call gas supplier.
10. Turn off all gas appliances attached to gas supply line.

PILOT FLAME ADJUSTMENT

Before adjusting pilot flame, confirm that gas supply pressure is correct, as explained above.

NOTE: Pilot flame adjustment was checked at the factory and should not require adjustment. However, pilot adjustment is possible if necessary.

1. Start furnace following "Operating Instructions" on front door.
2. Pilot flame should cover 1/2 inch of tip of flame sensor as shown in Figure 31.
3. If you need to adjust pilot flame, remove pilot adjustment cover screw on gas control. Save cover screw for re-installation. Turn inner adjustment screw clockwise to decrease pilot flame; counter-clockwise to increase pilot flame. Install cover screw and tighten to torque of 5 inch-pounds to prevent gas leakage.
4. Shut off furnace.
5. Turn off gas at equipment shut-off valve in gas supply line just ahead of furnace. Remove shut-off valve from gas control inlet pressure tap. Install pressure tap plug. Turn on gas.
6. Check pilot adjustment cover screw and gas control inlet pressure tap plug for gas leaks. Use a commercial soap solution made for leak detection.

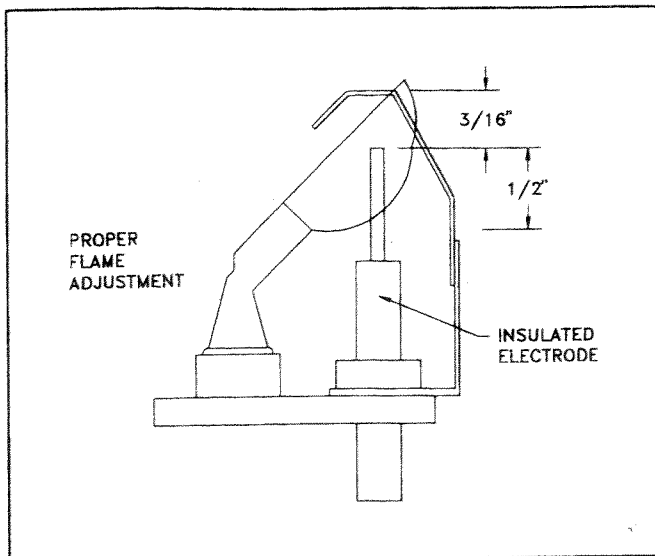


Figure 31. Pilot Flame Adjustment.

SECTION 17. MANIFOLD PRESSURE ADJUSTMENT

You will need a 0 to 15 inch water manometer with 0.1 inch resolution and a 1/8" NPT manual shut-off valve to measure actual manifold pressure.



WARNING: Correct manifold pressure is necessary for proper ignition and burner operation. Failure to accurately adjust pressure could cause heat exchanger failure.



WARNING: Do not set Propane (LP) manifold pressure at 11.0 inches W.C. It could cause heat exchanger failure.

Check gas supply pressure first. Follow instructions in Section 16.

1. Turn off gas at equipment shut-off valve in gas supply line just ahead of furnace.
2. Remove plug from outlet pressure tap in gas control.
3. Install 1/8" NPT manual shut-off valve in hole vacated by plug. Make sure shut-off valve is in off position.
4. Attach manometer to 1/8" NPT manual shut-off valve just installed.
5. Slowly open equipment shut-off valve in gas supply line just ahead of furnace. Start furnace following "Operating Instructions" on blower door.
6. Slowly open 1/8" NPT manual shut-off valve leading to manometer.
7. Read manifold pressure on manometer.

8. Adjust manifold pressure by turning gas control regulator adjusting screw clockwise to increase pressure or turning counter-clockwise to decrease pressure. Manifold pressure must be within allowable range below:
 - Natural gas manifold pressure must be between 3.2 and 3.8 inches W.C.
 - Propane gas (LP) manifold pressure must be between 9.7 and 10.3 inches W.C.

NOTE: For natural gas, if gas flow rate can't be properly set within these pressure ranges then you must change main burner orifices to obtain proper gas flow rate.

9. Shut off furnace. Turn off gas at equipment shut-off valve in gas supply line just ahead of furnace. Install outlet pressure tap plug in gas control. Turn on gas.
10. Check regulator adjustment cover screw and gas control plug for gas leaks. Use a commercial soap solution made for leak detection.

SECTION 18. CHECKING GAS INPUT RATE

It is the installer's responsibility to see that the Btu input rate of the furnace is properly adjusted. Under-firing could cause inadequate heat, excessive condensation or ignition problems. Over-firing could cause sooting, flame impingement or overheating of heat exchanger.



WARNING: Failure to adjust furnace to the proper firing rate could cause heat exchanger failure.

Depending on your local gas heating value and elevation, you may need to adjust manifold pressure or change orifices to get proper gas input rate. Check with your local gas supplier to determine heating value (Btu/cu.ft.) of natural gas in your area.

NOTE: If furnace is being installed at an altitude of more than 2000 feet above sea level, you must derate the furnace. See Section 19, "Derating For High Altitude."

NATURAL GAS INPUT RATE

Natural gas heating value (Btu/cu.ft.) can vary significantly. Before starting natural gas input check, obtain gas heating value at your location from local supplier. You will need a stopwatch to measure actual gas input.

1. Gas supply pressure must be between 5 and 10.5 inches W.C. for natural gas. See Section 16, "Gas Supply Pressure and Pilot Adjustment."
2. Turn off all other gas appliances. You may leave pilots on.

3. Start furnace following "Operating Instructions" on blower door.

Let furnace warm up for 6 minutes.

5. Locate gas meter. Determine which dial has the least cubic feet of gas and how many cubic feet per revolution it represents. This is usually one-half, one or two cubic feet per revolution.

6. With stopwatch, measure time it takes to consume two cubic feet of gas.

- If dial is one-half cubic foot per revolution, measure time for four revolutions.
- If dial is one cubic foot per revolution, measure time for two revolutions.
- If dial is two cubic feet per revolution, measure time for one revolution.

7. Divide this time by two. This gives average time for one cubic foot of gas to flow through meter. Example: If it took 58 seconds for two-cubic feet to flow, it would take 29 seconds for one-cubic foot to flow.

8. Calculate gas input using this formula:

$$\text{Gas input} = \frac{\text{Gas Heating Value (Btu/cu.ft.)} \times 3,600 \text{ sec/hr}}{\text{Time (Seconds for one cubic foot of gas)}} = \text{Btu/hour}$$

Example:

Assume it took 29 seconds for one cubic foot of gas to flow and heating value of 1,000 Btu/cu.ft.

$$\text{Gas Input} = \frac{1,000 \times 3,600}{29} = 124,138 \text{ Btu per hour}$$

If you left no other pilots on, this is the furnace gas input.

9. If you left water heater, dryer or range pilots on, allow for them in calculating correct furnace gas input. A quick way is to allow 1,000 Btu per hour for a water heater, 500 Btu per hour for dryer and 500 Btu per hour for each range burner pilot.

Example:

If you left gas water heater, dryer, two range burner pilots and one oven pilot on, allow:

Water heater pilot	1,000 Btu per hour
Dryer pilot	500 Btu per hour
2 range burner pilots	1,000 Btu per hour
1 range oven pilot	500 Btu per hour


3,000 Btu per hour

Subtracting 3,000 Btu per hour from 124,138 Btu per hour measured above equals 121,138 Btu per hour.

This would be the correct furnace gas input after allowing for pilots left on.


10. Manifold pressure may be adjusted within the range of 3.2 inches W.C. to 3.8 inches W.C. to get rated input ± 2 percent. See Section 17, "Manifold Pressure Adjustment." If you cannot get rated input with manifold pressure within the allowable range, you must change orifices. See Section 19C, "Changing Main Burner Orifices."

PROPANE (LP) GAS INPUT RATE



WARNING: Propane (LP) gas installations do not have gas meters to double check input rate. Measure manifold pressure adjustment with an accurate manometer. Failure to accurately adjust pressure could cause heat exchanger failure, asphyxiation, fire or explosion, resulting in damage, injury or death.

1. Make sure you have correct pilot orifice and main burner orifices.
2. Gas supply pressure must be between 11 and 14 inches W.C. for propane (LP) gas. See Section 16, "Gas Supply Pressure and Pilot Adjustment."
3. Start furnace following "Operating Instructions" on blower door.
4. Let furnace warm up for 6 minutes.
5. Adjust manifold pressure to 10.0 inches W.C. ± 0.3 inches W.C. See Section 17, "Manifold Pressure Adjustment."



WARNING: Do not set Propane (LP) manifold pressure at 11.0 inches W.C. It could cause heat exchanger failure.

Table 6.

Induced Draft Models Initial Orifice Size		
Input* Btu/Hr	Natural Gas *Initial Orifice Size	Propane *Orifice Size
All Induced Draft Models	2.15	1.30mm
California Nox Models	2.15	See Note Below
*See furnace rating plate located on blower door.		
NOTE: Nox rods and clips must be removed when converting unit to Propane (LP) gas.		

Check with your local gas supplier to determine heat value (Btu/Cu.Ft.) of gas in your area. Depending on your local heat value and elevation, you may need to adjust manifold pressure or change orifices to get proper gas input rate.

SECTION 19. DERATING FOR HIGH ALTITUDE

A. Installer responsibility.

For operations at elevations above 2,000 feet the density of air is reduced, therefore the furnace should be derated at the rate of four percent (4%) for each 1,000 feet above sea level. It is the installer's responsibility to see that the input is adjusted properly.

If the gas supplier has not already derated the gas BTU value, derating must be achieved by reducing the size of the main burner orifices. See orifice size chart below for proper sizing. Contact gas supplier for more information.


Adjustment of the manifold pressure to a lower pressure reading than what is specified in Section 17, "Manifold Pressure Adjustment" is considered to be an improper derate procedure. With lower density of air and a lower manifold pressure at the burner orifice, the orifice will not aspirate the proper amount of primary air into the burner. Insufficient primary air can cause incomplete combustion, yellow tipping and quite possibly carbon build-up.

B. New orifice size.

See appropriate chart to determine new orifice size

A natural gas orifice kit containing the natural gas orifices indicated in the charts below is available through your supplier. A similar propane (LP) gas orifice kit is available. Individual orifices are also available in a convenient lot size. Use only these orifices to assure proper performance.

C. Changing Orifices

 **WARNING:** To prevent electrical shock and gas leaks, turn off electrical power and gas before changing orifices.

Follow this procedure:

1. Set room thermostat to its lowest or off setting.
2. Turn off electricity to furnace.
3. Remove low-voltage wires from gas control. On Electronic Ignition and Induced Draft models, remove orange high-voltage ignition wire from electronic ignition lockout module.
4. Turn off manual shut-off valve in furnace gas supply line.
5. Disconnect gas supply line upstream from furnace's gas control.
6. Take burner cover off by removing three screws. Save screws for reinstallation.
7. Remove and discard shipping supports if still in place. Replace lower screws.

8. Take burner side shield off by removing two screws. Save them for reinstallation.
9. Lift burner rack up and pull out furnace.
10. Disconnect pilot gas tubing at gas control.
11. From side of burner rack opposite gas control, remove one sheet metal screw as shown in "A" in Figure 32. Save screw for reinstallation.
12. Loosen burner rack screw one turn, as shown in "B" in Figure 32.
13. From gas control side of burner rack, remove two screws from manifold bracket as shown in "C" in Figure 32. Save screws for reinstallation.
14. Pivot manifold away from burners as shown in "D" in Figure 32.
15. Remove original gas orifices, illustrated as "E" in Figure 32.
16. Install new orifices finger-tight into manifold. Do not cross-thread. Tighten to torque of 50 inch-pounds.
17. Slowly return manifold to its place by sliding each burner over its orifice. Replace two screws as shown in "C", Figure 32, and one screw as shown in "A", Figure 32.

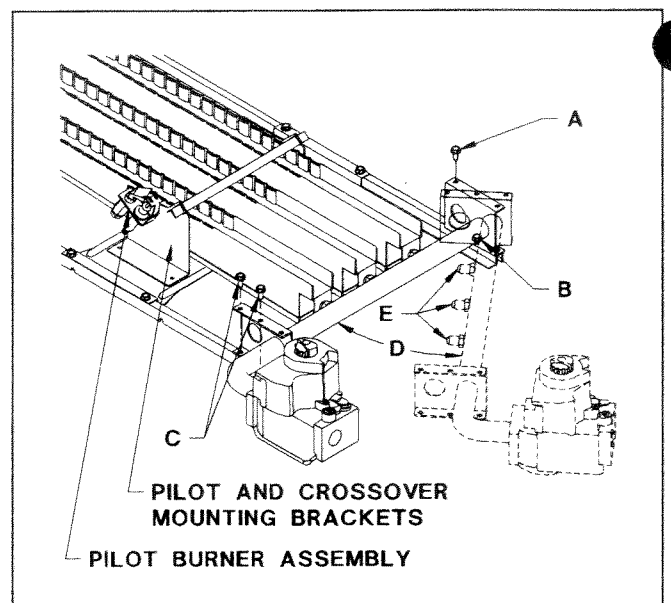


Figure 32. Changing Orifices.

18. Tighten four screws in manifold bracket to torque of 60 inch-pounds.
19. Tighten gas control pilot tube fitting to torque of 60 inch-pounds.
20. Slide burner rack assembly into place. When properly installed, it nests snugly in bottom of furnace and does not move in any direction.

21. Install front burner side shield. Use screws saved earlier. Properly place side shield support leg. See Figure 33.

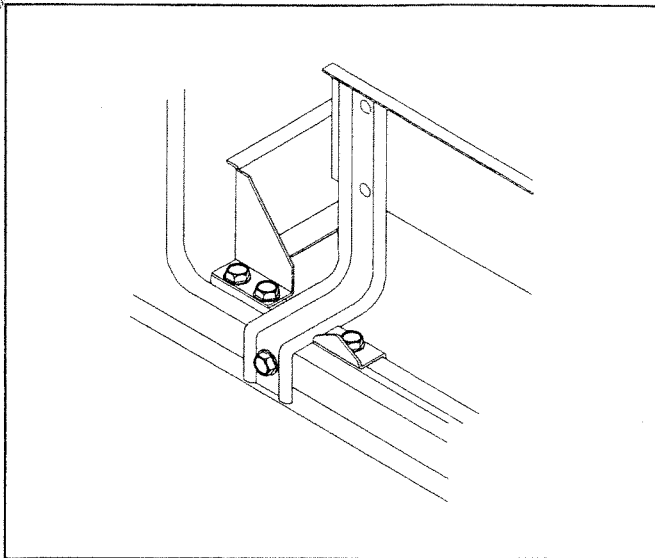


Figure 33. Burner Side Shield.

22. Install front burner cover using screws saved earlier.
23. Connect low-voltage wires to gas control.
- Connect red wire from electronic ignition lockout module at terminal "MV" to gas control at terminal "MV".
 - Connect white wire from electronic ignition lockout module at "MV/PV" to gas control at terminal "PV/MV".
 - Connect black wire from electronic ignition lockout module at terminal "PV" to gas control at terminal "PV".
 - Connect orange high-voltage ignition wire from pilot/ignitor to electronic ignition lockout module at high-voltage terminal.

24. Follow procedures below to complete installation.

Table 7. Natural Gas Orifice Size.

Gas Heat* Value Btu/cu. ft.	ELEVATION								
	Up to 2000 Feet	2001 to 3000 Feet	3001 to 4000 Feet	4001 to 5000 Feet	5001 to 6000 Feet	6001 to 7000 Feet	7001 to 8000 Feet	8001 to 9000 Feet	9001 to 10000 Feet
800-849	2.35mm	2.30mm	2.30mm	2.25mm	2.20mm	2.20mm	2.15mm	2.10mm	2.05mm
850-899	2.30mm	2.25mm	2.20mm	2.20mm	2.15mm	2.10mm	2.10mm	2.05mm	2.00mm
900-949	2.25mm	2.20mm	2.15mm	2.15mm	2.10mm	2.05mm	2.05mm	2.00mm	1.95mm
950-999	2.20mm	2.15mm	2.10mm	2.05mm	2.05mm	2.00mm	1.95mm	1.95mm	1.90mm
1000-1049	2.15mm	2.10mm	2.05mm	2.05mm	2.00mm	2.00mm	1.95mm	1.90mm	1.85mm
1050-1100	2.10mm	2.05mm	2.00mm	2.00mm	1.95mm	1.90mm	1.90mm	1.85mm	1.85mm

*At standard conditions: 30.0 inches Mercury, 60°F, Saturated.

NOTE: Shaded orifices above are available separately.

Table 8. Propane (LP) Gas Orifice Size.

Gas Input (Btu/Hr)	ELEVATION								
	Up to 2000 Feet	2001 to 3000 Feet	3001 to 4000 Feet	4001 to 5000 Feet	5001 to 6000 Feet	6001 to 7000 Feet	7001 to 8000 Feet	8001 to 9000 Feet	9001 to 10000 Feet
40,000-120,000	1.30mm	1.25mm	1.25mm	1.20mm	1.20mm	1.20mm	1.15mm	1.15mm	1.10mm

NOTE: All orifices above are included in propane gas orifice kit.

SECTION 20. NORMAL BURNER FLAME HEIGHT

- A. Furnace operates more efficiently with a taller burner flame at blower end of furnace. This design extracts more heat from heat exchanger. Figure 34 illustrates approximate burner flame height of first primary mantle at middle of burner.

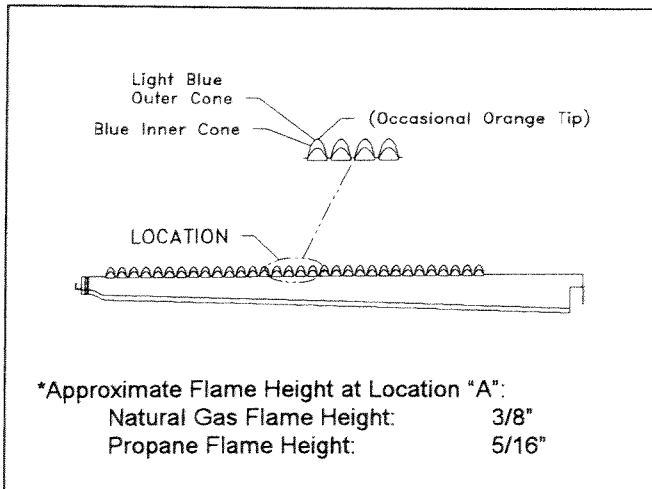


Figure 34.

B. Operate furnace 5 minutes. If burner flame height appears abnormal, check:

- Orifice size; see Section 18.
- Spoiler screw size and alignment; make sure they are driven fully in and positioned parallel with the vertical, front to back and left to right;
- Manifold pressure and gas input; see Sections 17 and 18.
- Gas supply line pressure; see Section 16.

SECTION 21. ADJUSTING BLOWER SPEED


CAUTION: Inadequate air circulation could cause excessive air temperature rise through furnace. This could cause high-temperature limit switch to cycle burners on and off which could reduce furnace efficiency and shorten life of heat exchanger and blower motor.

Determine initial cooling and heating speeds in system design stage. See product data sheet for airflow data. Depending on test results performed in Sections 22 and 23, you may want to change blower motor speed.


Air conditioning models use three-speed motors. Blower motor cooling speed is high-speed (black motor wire) as-shipped. Blower motor heating speed is medium-speed (blue motor wire) as-shipped. Note that cooling speed in the field is usually higher than heating speed.

Motor speed wire color designations are:

- High-Speed Black
- Medium-Speed Blue
- Low-Speed Red

 **WARNING:** Before changing blower motor speed, always turn off electrical power to furnace to prevent risk of electrical shock which could result in damage, injury or death.

1. If the desired cooling and heating speeds are different, within the junction box:
 - a. Connect desired blower motor wire to blower relay at terminal "N.O." for cooling speed.
 - b. Connect desired blower motor wire to fan/limit control conduit brown wire for heating speed.
 - c. Insulate remaining blower motor wire.
2. If your desired cooling and heating speeds are the same:
 - a. Cut blower motor black wire. Leave black pigtail attached to blower relay at terminal "N.O."
 - b. Connect pigtail, fan/limit control brown wire and desired cooling/heating speed blower wire.
 - c. Insulate remaining blower motor wires.

 **WARNING:** Properly insulate unused blower motor wires in junction box to meet requirements of current National Electrical Code ANSI/NFPA 70. Failure to insulate could cause shock or fire, resulting in damage, injury or death.

SECTION 22. MEASURING DUCT SYSTEM STATIC PRESSURE

System airflow can be determined from the Product Data Sheet when duct system static pressure is known. Improper airflow in heating mode may result in poor heating performance and reduced heat exchanger life. Improper airflow in cooling mode may cause poor cooling performance or air-conditioning coil freeze-up.

High duct system static pressure is an indication of an overly restrictive duct system. Static pressure in excess of 0.5 inches W.C. indicates a need for duct system redesign to ensure proper volume of air flow.

You will need a 0 to 1 inch W.C. slope gauge with 0.01 inch resolution and two pressure measurement taps.

Follow this procedure:

1. Open supply air registers and return air grilles. Make sure the registers and grilles are free of obstruction from rugs, carpets, drapes or furniture.
2. Set balancing dampers in supply duct system.
3. Check duct work for obstructions or leaks.
4. Make sure filters are clean and in place.

5. Make sure that blower speed taps are set for proper heating and cooling. Refer to Section 21, "Adjusting Blower Speed."
6. Place slope gauge near furnace, level and adjust scale to read 0.00 inches W.C.
7. Insert one static pressure tap into supply air transition duct between furnace and cooling coil or in the supply air plenum for heating only systems. Connect this pressure tap to positive pressure side of slope gauge. See Figure 35.
8. Insert other static pressure tap in return air plenum. Connect this pressure tap to negative pressure side of slope gauge. See Figure 35.

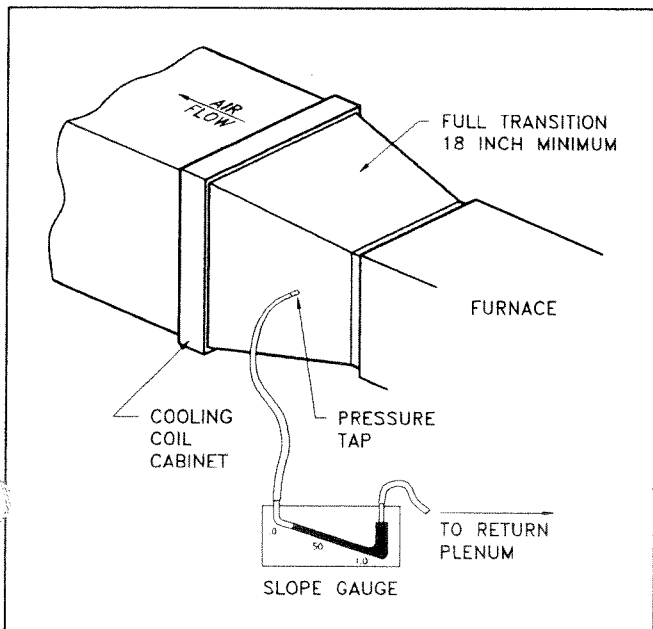


Figure 35. Measuring Duct System Static Pressure.

9. Start blower.
 - Blower heating speed can be run by jumping terminals "R" and "W" on 24 volt terminal block located on junction box.
 - Blower cooling speed can be run by jumping terminals "R" and "G" on 24 volt terminal block located on the junction box.
10. Read duct system static pressure from slope gauge.

NOTE: If air filter location is upstream of return air pressure tap, static pressure must be adjusted to exclude filter pressure drop. Do this by subtracting 0.08 inches W.C. from the measured static pressure.

$$\text{Duct System Static Pressure} = \text{Measured Pressure} - 0.08 \text{ inches W.C.}$$

11. Remove jumper wire from 24 volt terminal strip. Remove pressure taps and seal holes in duct work.

NOTE: Failure to seal holes could result in reduced system performance.

SECTION 23. MEASURING AIR TEMPERATURE RISE

Air temperature rise (supply air temperature minus return air temperature) must be within allowable air temperature rise range specified on furnace rating plate.

You will need 2 thermometers with 1 degree resolution capable of reading up to 200 degrees F.

Follow this procedure:

1. Open supply air registers and return air grilles. Make sure the registers and grilles are free of obstruction from rugs, carpets, drapes or furniture.
2. Set balancing dampers in supply duct system.
3. Check duct work for obstructions or leaks.
4. Make sure filters are clean and in place.
5. Make sure that blower speed taps are set for proper heating and cooling. Refer to Section 21, "Adjusting Blower Speed."
6. Place one thermometer in supply air plenum approximately 2 feet from furnace. Locate thermometer tip in center of plenum to ensure proper temperature measurement.
7. Place second thermometer in return air duct approximately 2 feet from furnace. Locate thermometer tip in center of duct to ensure proper temperature measurement.
8. Set room thermostat on highest temperature setting. Operate furnace 6 minutes. Record supply air and return air temperatures.
9. Calculate air temperature rise by subtracting return air temperature from supply air temperature.
 - If air temperature rise is above the temperature rise range, furnace is overfired or has insufficient airflow. Check gas input following the instructions in Section 18, "Checking Gas Input Rate." If air temperature rise is still above temperature rise range specified, more heating air flow is needed. Change blower heating speed to a higher setting following instructions in Section 21, "Adjusting Blower Speed."
 - If air temperature rise is below the temperature rise range, furnace is underfired or has too much airflow. Check gas input following the instructions in Section 18, "Checking Gas Input Rate." If air temperature rise is still below temperature rise range specified, less heating air flow is needed. Change blower heating speed to a lower setting following instructions in Section 21, "Adjusting Blower Speed."
 - After making adjustments, you must check air temperature rise to verify that resulting air temperature rise is within allowable range. If air temperature rise is still outside the temperature

rise range, check duct system design with a qualified heating engineer. It may be necessary to re-size the duct work. Recheck air temperature rise after revising duct systems.


10. Set room thermostat to desired setting.
11. Remove thermometers and seal duct work holes.

NOTE: Failure to seal holes could result in reduced system performance.

SECTION 24. CHECKING CONTROLS

Before leaving the work site, check to see that all controls are functioning properly.

You will need a 0 to 15 inch water manometer with 0.1 inch resolution and a 1/8" NPT manual shut-off valve.


 **WARNING:** High temperature limit of fan/limit control is factory preset. Do not adjust it. Incorrect high temperature limit setting could cause furnace overheating and fire, resulting in damage, injury or death.

Checking controls:

1. Remove front burner cover; replace screws.
 2. Turn off electricity at electrical disconnect switch next to furnace.
 3. Turn brown gas control knob clockwise to off position.
 4. If it's not already installed, install "U" tube water manometer in gas control outlet (manifold) pressure tap.
 5. Set room thermostat to its highest temperature.
 6. Turn on electricity at electrical disconnect switch located next to furnace. Electronic ignition lockout module should start to spark pilot ignitor, but pilot burner should not light. Manifold pressure should remain at zero.
 7. Electronic ignition lockout module should spark pilot ignitor for given lockout time of module and go into lockout mode. Lockout time for Honeywell S8600H is 75 to 90 seconds.
- NOTE: Honeywell electronic ignition lockout module will stop sparking when module locks out.
8. Turn off electricity at electrical disconnect switch located next to furnace. Turn brown gas control knob counterclockwise to on position. Wait 60 seconds for electronic ignition lockout module to reset.
 9. Turn on electricity at electrical disconnect switch located next to furnace. Pilot should light from spark and ignite burners. Wait for blower motor to start.

10. Cycle electrical disconnect switch next to furnace on and off. Watch at least five ignition cycles. Pilot should light from spark and light main burners without delay.
11. Burner flames should look the same height with circulating blower on and off. If not or if they are floating around at top of burner ports, remove rear burner cover, replace screws.
12. Turn off gas by turning brown gas control knob clockwise to off. Turn on blower. Check burner box openings on furnace front and rear. Check for air leaks between heat exchanger sealing flanges and casing front and rear panels. Detect air leaks by passing a match flame along burner box sealing flanges. Tighten screws until air leaks stop. Install burner covers.
13. With main burners and blower operating, block off all return air grilles to restrict return air. Wait for fan/limit control to cycle burners off.
14. Remove all restrictions from return air grilles. In a few minutes, main burners should automatically reignite. This test shows how fan/limit control protects furnace against overheating.
15. Set room thermostat to desired setting.


SECTION 25. MAINTAINING FURNACE IN GOOD WORKING ORDER

 **WARNING:** Use replacement parts listed in parts list only. Use of incorrect parts on this furnace could cause improper furnace operation, resulting in damage, injury or death.

Inspection and cleaning by a qualified service person should be performed once before each heating season begins and once during heating season. Make sure the inspection includes each of the items listed below.

Before inspecting furnace:

1. Turn room thermostat to its lowest or off setting.
2. Turn off equipment shut-off valve.
3. Wait at least five minutes for furnace to cool if it was recently operating.
4. Turn off furnace electrical power.

 **WARNING:** Failure to disconnect electrical power before servicing furnace could result in electrical shock or death.

Inspect the following:

FURNACE NAMES AND MODEL NUMBERS MANUFACTURED BY CONSOLIDATED INDUSTRIES

COMPANY NAME	TRADE NAME	MODEL
Addison Products Company	Weatherking	GHC
Amana Refrigeration	Amana	GSE-DN, GS, HBA
Arco Comfort Products	ACP, Arcoaire, Northrup	GHB
Bard Manufacturing	Bard	HG, ESG, ISG, SG
Coleman Company (Evcon Industries)	Coleman	2505-2509B 2505-2509C, BGH
Consolidated Industries Corp.	Consolidated	HAC/HCC, HCA, HBA
DMO Industries	Duomatic-Olsen Olsen, Airco	HCC, HCA, HBA
Goettl Air Conditioning, Inc.	American Best, Goettl	HCC, HCA, HBA
Goodman Manufacturing Company	Franklin Electric, GMC, Hamilton Electric, Janitrol, Johnstone, Liberty	HAC, HCC, HCA, HBA
Heat Controller, Inc.	Century, Comfort Aire	GSH, GTH
ICG/Keeprite	Keeprite	HAC/HCC, HCA, HBA
Magic Chef Air Conditioning	Magic Chef	EG, ENG
MLX Refrigeration and Air Conditioning	Heatmaster	HAC/HCC, HCA, HBA
Premier Furnace Company	Premier, Sunburst, Sun Glow, P.F.C.	HAC/HCC, HCA, HBA
Sears	Kenmore	735
Square D Company	Sundial	GH
Trane Company	Trane, American Standard	THS, THN, THP, THD
Westbrook Distributing, Inc.	Heatmaster	HAC/HCC, HCA, HBA

SEAL KIT USAGE

LIST PRICE	SEAL KIT PART NUMBER	FURNACE MODEL USED ON HAC, HCC, HCA	FURNACE MODEL USED ON HBA
	301497	040N*3R 040N*3RX 050*3R 050*3RX	040ND3R 040ND3RX
	301498	060N*3R 060N*0T 075N*3R 075N*0T	060ND3R 060ND3RX
	301499	080N*4R 080N*0T 100N*4R 100N*0T 060N*4R 060N*4RX 075N*4R 075N*4RX	080ND4R 080ND4RX
	301500	120N*5R 080N*5R 080N*5RX 100N*5R 100N*5RX	100ND5R 100ND5RX
	301501	140N*5R	120ND5R 120ND5RX

*NOTE: This letter may be an S, D, E, or F.

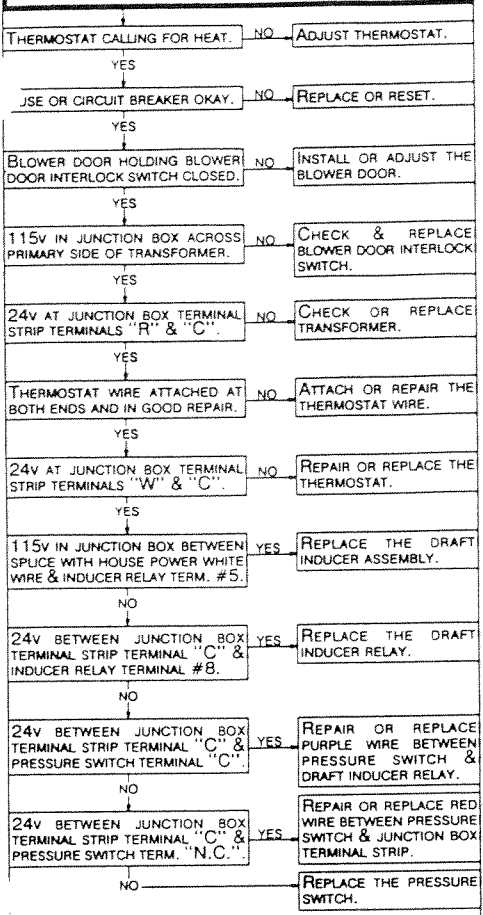
H B A
SEQUENCE OF OPERATION

1. THERMOSTAT CALLS FOR HEAT.
2. 24V APPLIED TO INDUCER RELAY, INDUCER STARTS.
3. INDUCER BUILDS NEGATIVE PRESSURE
4. PRESSURE SWITCH MONITORS PRESSURE AND SWITCHES WHEN SUFFICIENT PRESSURE IS ACHIEVED TO SUPPLY 24V TO IGNITION MODULE.
5. AT SAME TIME, 24V IS APPLIED TO FAN CONTROL HEATER.
6. IGNITION MODULE OPENS THE GAS CONTROL PILOT VALVE AND STARTS THE PILOT IGNITOR TO SPARKING.
7. PILOT FLAME IS ESTABLISHED AND MODULE OPENS MAIN GAS VALVE TO ALLOW GAS TO FLOW TO BURNERS.
8. BLOWER WILL START ON TIME BASIS.
9. THERMOSTAT IS SATISFIED AND TURNS OFF INDUCER, PRESSURE SWITCH, MODULE AND GAS CONTROL.
10. BLOWER STOPS WHEN AIR TEMPERATURE REACHES 90°F AT FAN CONTROL ELEMENT.

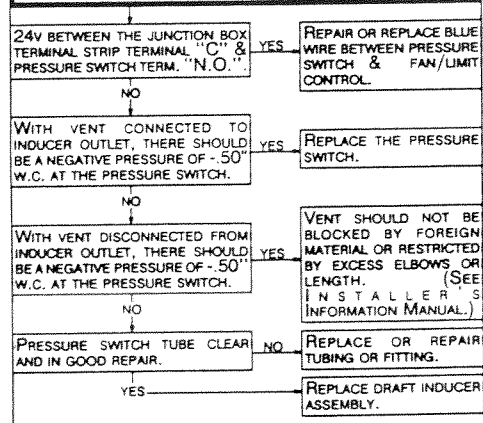
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INDUCED DRAFT / 24V(1) 24V(2) 24V(3) 24V(4) 24V(5)

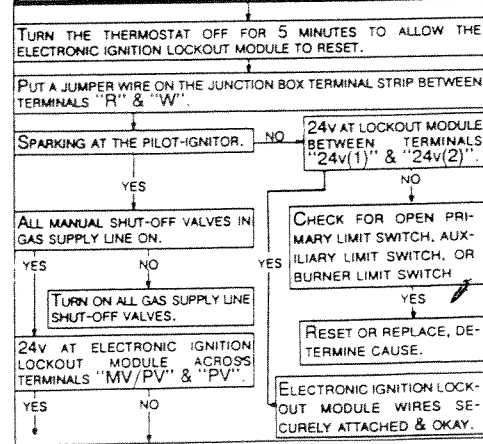
NO HEAT: INDUCER OFF, PILOT OFF, MAIN BURNERS OFF, BLOWER OFF



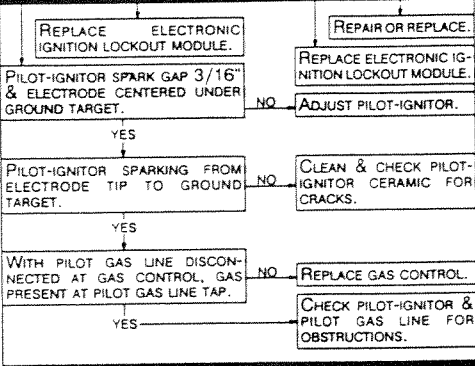
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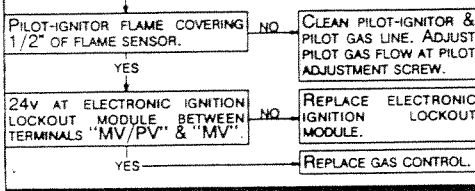
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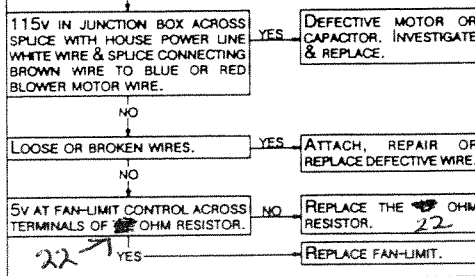
NO HEAT: INDUCER ON, PILOT OFF, BURNERS OFF, BLOWER ON (continued)



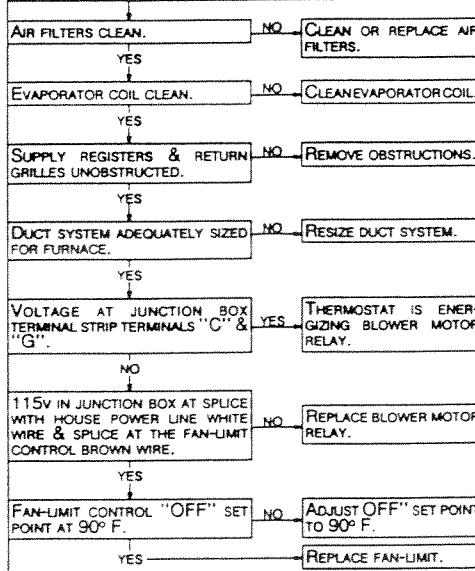
NO HEAT: INDUCER ON, PILOT ON, MAIN BURNERS OFF, BLOWER ON



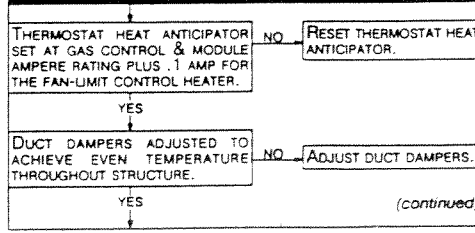
INDUCER, PILOT & MAIN BURNERS CYCLE ON & OFF, BLOWER OFF



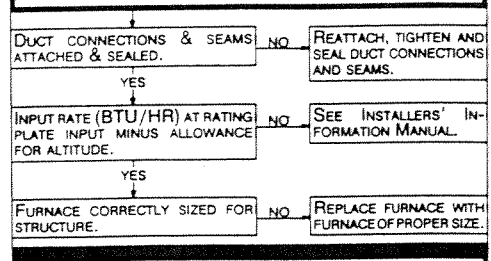
INDUCER, PILOT AND MAIN BURNERS CYCLE ON & OFF, BLOWER ON CONTINUOUSLY



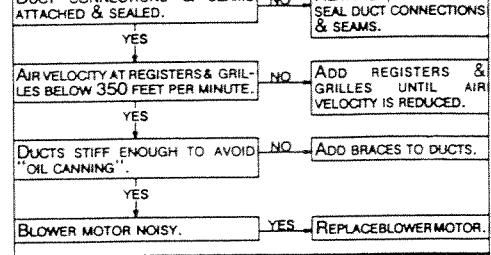
INDUCER, PILOT, MAIN BURNERS AND BLOWER ON BUT THE FURNACE DOES NOT MAINTAIN THE TEMPERATURE SET AT THE THERMOSTAT.



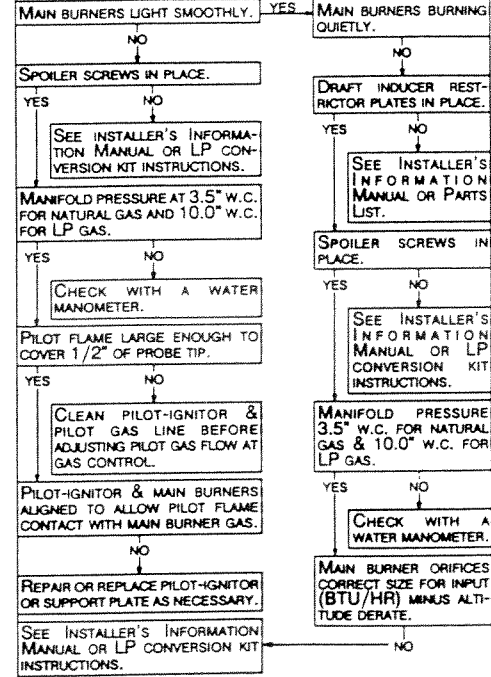
INDUCER, PILOT, MAIN BURNERS AND BLOWER ON BUT THE FURNACE DOES NOT MAINTAIN THE TEMPERATURE SET AT THE THERMOSTAT. (continued)



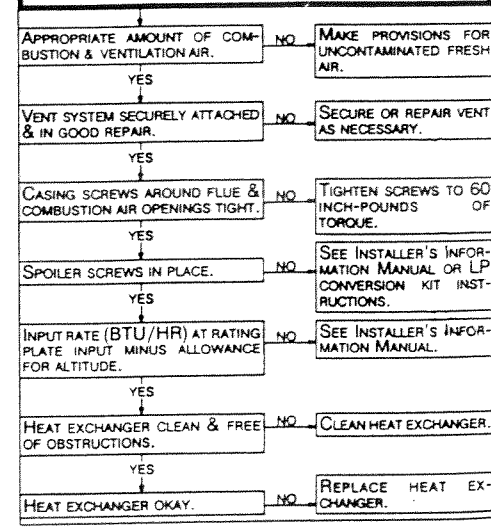
AIR NOISE



BURNER NOISE



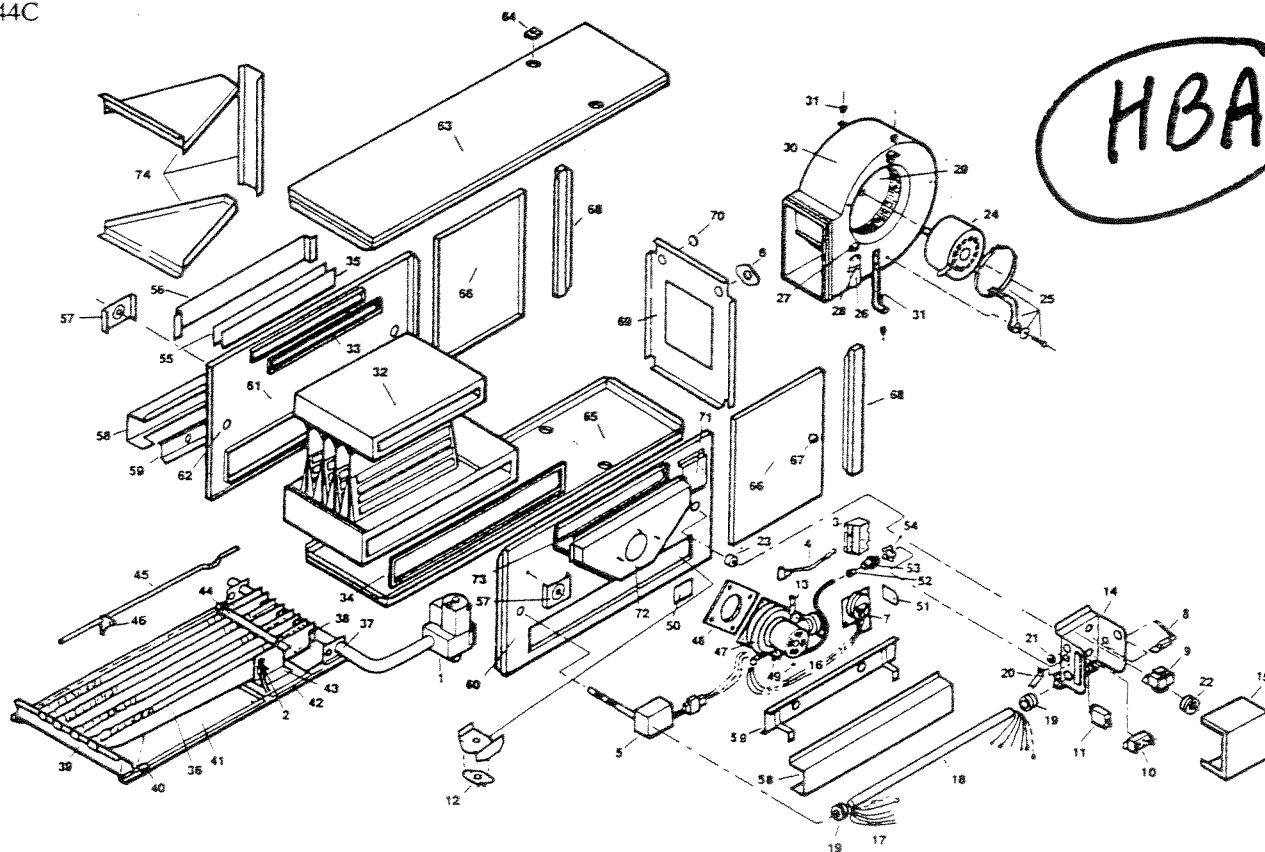
COMBUSTION ODORS, SOOTING FLAME, FLOATING FLAME



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PARTS LIST

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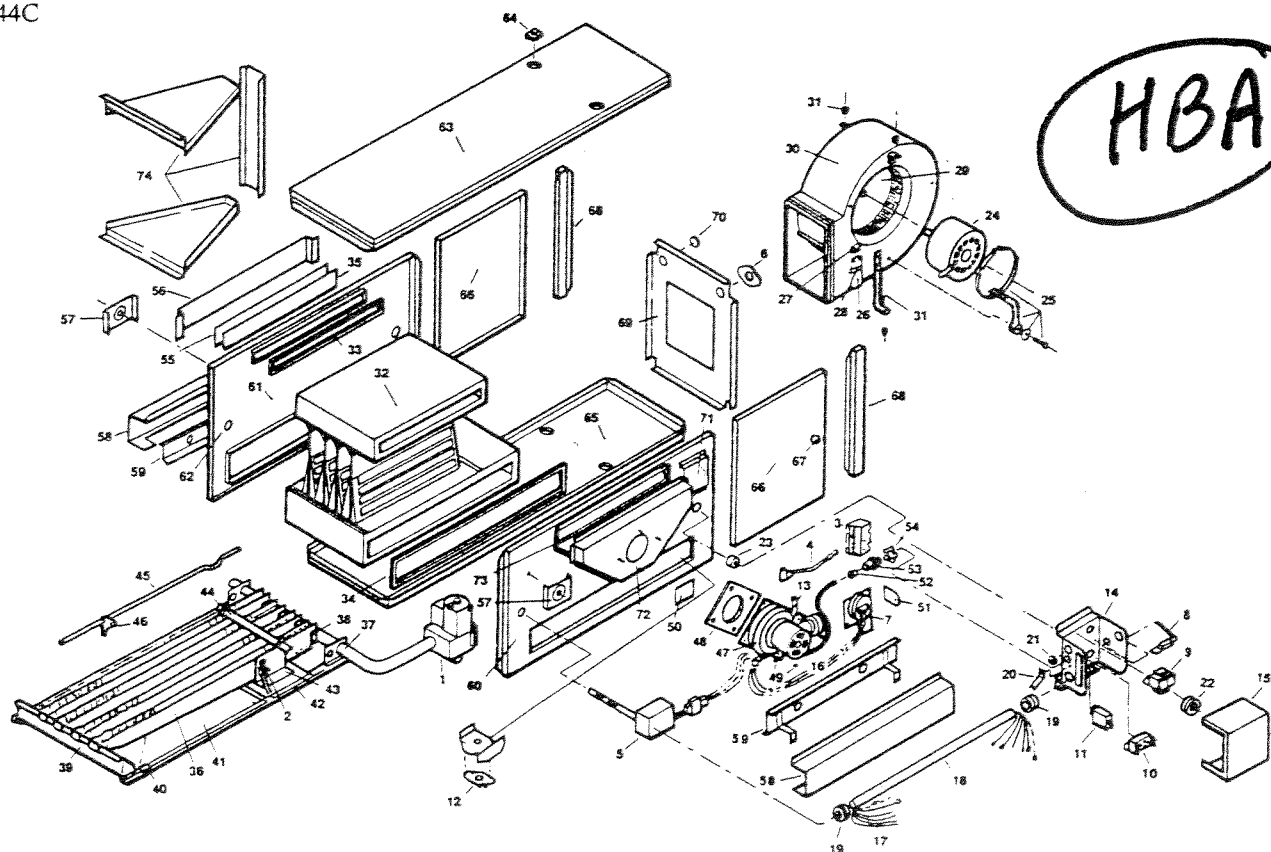


INDUCED DRAFT HORIZONTAL GAS FURNACE

Ill. No.	Part Description	No. Req.	Part Number For Each Furnace Size				
			40,000	60,000	80,000	100,000	120,000
CONTROLS GROUP							
<u>Electronic Ignition</u>							
1	Gas Control - HW Nat VR8204	1	2075011	2075011	2075011	2075011	2075011
2	Pilot/Ignitor Assembly - HW Nat Q345	1	3011931	3011931	3011931	3011931	3011931
3	Lockout Module - S8600H	1	207762	207762	207762	207762	207762
4	Lockout Module Wiring						
	Kit: Ignition Wire and Module	1	2077621	2077621	2077621	2077621	2077621
	Ignition Wire Only	1	207763	207763	207763	207763	207763
ELECTRICAL GROUP							
<u>Controls</u>							
5	Fan/Limit Control Kit - HW	1	300919	300919	300919	300919	300919
6	Auxiliary Limit Switch	1	207030	207030	207030	207030	207030
7	Pressure Switch With Wiring Harness	1	2078051	2078061	2078071	2078081	2078091
8	Blower Door Interlock Switch	1	300229	300229	300229	300229	300229
9	Transformer - 40 VA	1	207023	207023	207023	207023	207023
10	Blower Relay	1	207025	207025	207025	207025	207025
11	Draft Inducer Relay	1	207470	207470	207470	207470	207470
12	Burner Limit Switch	2	3013631	3013631	3013631	3013631	3013631
<u>Hardware</u>							
13	Pressure Switch Tubing	1	207810	207810	207810	207810	207810
14	Junction Box	1	300863	300863	300863	300863	300863
15	Junction Box Cover	1	300219	300219	300219	300219	300219
16	Pressure Switch Wiring Harness	1	207811	207811	207811	207811	207811
17	Fan/Limit Control Wiring Harness	1	302058	302058	302058	302058	302058
18	Fan/Limit Control Conduit	1	300233	300233	300233	300233	300233
19	Fan/Limit Control Conduit Grommet	2	207173	2007173	207173	207173	207173
20	Fan/Limit Control Conduit Grounding Bracket	1	300834	300834	300834	300834	300834
21	Low Voltage Wire Bushing	1	207052	207052	207052	207052	207052
22	Strain Relief	1	207054	207054	207054	207054	207054
23	3/4" Bushing	1	207021	207021	207021	207021	207021

PARTS LIST

207844C



INDUCED DRAFT HORIZONTAL GAS FURNACE

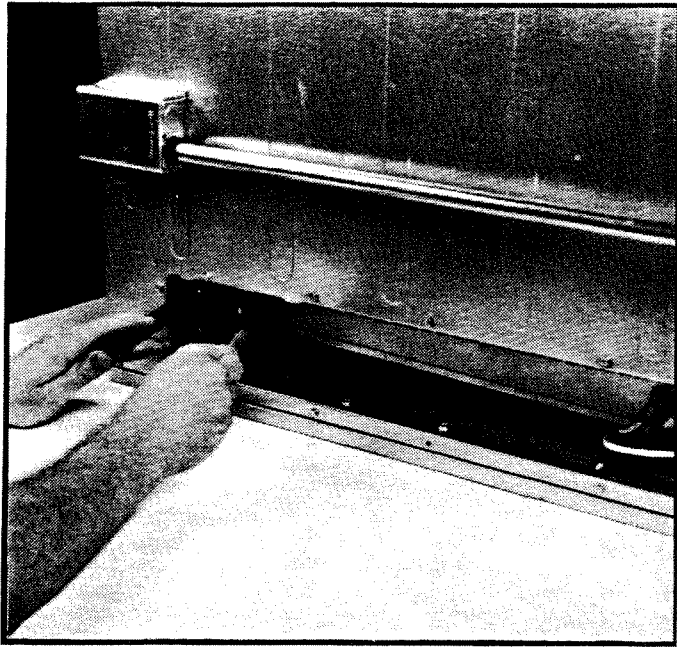
Ill. No.	Part Description	No. Req.	Part Number For Each Furnace Size				
			40,000	60,000	80,000	100,000	120,000
CONTROLS GROUP							
Electronic Ignition							
1	Gas Control - HW Nat VR8204	1	2075011	2075011	2075011	2075011	2075011
2	Pilot/Ignitor Assembly - HW Nat Q345	1	3011931	3011931	3011931	3011931	3011931
3	Lockout Module - S8600H	1	207762	207762	207762	207762	207762
4	Lockout Module Wiring						
	Kit: Ignition Wire and Module	1	2077621	2077621	2077621	2077621	2077621
	Ignition Wire Only	1	207763	207763	207763	207763	207763
ELECTRICAL GROUP							
Controls							
5	Fan/Limit Control Kit - HW	1	300919	300919	300919	300919	300919
6	Auxiliary Limit Switch	1	207030	207030	207030	207030	207030
7	Pressure Switch With Wiring Harness	1	2078051	2078061	2078071	2078081	2078091
8	Blower Door Interlock Switch	1	300229	300229	300229	300229	300229
9	Transformer - 40 VA	1	207023	207023	207023	207023	207023
10	Blower Relay	1	207025	207025	207025	207025	207025
11	Draft Inducer Relay	1	207470	207470	207470	207470	207470
12	Burner Limit Switch	2	3013631	3013631	3013631	3013631	3013631
Hardware							
13	Pressure Switch Tubing	1	207810	207810	207810	207810	207810
14	Junction Box	1	300863	300863	300863	300863	300863
15	Junction Box Cover	1	300219	300219	300219	300219	300219
16	Pressure Switch Wiring Harness	1	207811	207811	207811	207811	207811
17	Fan/Limit Control Wiring Harness	1	302058	302058	302058	302058	302058
18	Fan/Limit Control Conduit	1	300233	300233	300233	300233	300233
19	Fan/Limit Control Conduit Grommet	2	207173	2007173	207173	207173	207173
20	Fan/Limit Control Conduit Grounding Bracket	1	300834	300834	300834	300834	300834
21	Low Voltage Wire Bushing	1	207052	207052	207052	207052	207052
22	Strain Relief	1	207054	207054	207054	207054	207054
23	3/4" Bushing	1	207021	207021	207021	207021	207021

III. No.	Part Description	No. Req.	Part Number For Each Furnace Size				
			40,000	60,000	80,000	100,000	120,000
BLOWER GROUP							
24	Blower Assembly	1	300245	300247	300249	300251	300252
	Motor	1	2072212	2070312	2071662	2071022	2071022
25	Motor Mounting Hardware Kit	1	300825	300667	300667	300667	300667
26	Capacitor	1	207071	207071	207071	207769	207769
28	Capacitor Strap	1	207081	207081	207081	207081	207081
29	Blower Wheel- Direct Drive 10 x 4	1	2070392	N/A	N/A	N/A	N/A
	10 X 6	1	N/A	2070402	N/A	N/A	N/A
	10 X 8	1	N/A	N/A	2070422	N/A	N/A
	10 X 10	1	N/A	N/A	N/A	2070442	2070442
30	Blower Housing and Cutoff Assembly	1	300855	300856	300857	300858	300858
31	Blower Feet and Grommet Kit	1	300859	300860	300861	300861	300862
HEAT EXCHANGER GROUP							
32	Heat Exchanger Assembly	1	3021001	3021011	3021021	3021031	3021041
33	Collector Box Gasket	2	207019	207019	207019	207019	207019
34	Burner Box Gasket	2	207020	207020	207020	207020	207020
35	Collector Box Plate Gasket	1	207022	207022	207022	207022	207022
BURNER GROUP							
Burner Rack Assembly Without Gas Controls							
	Standard Rack Assembly	1	302164	302165	302166	302167	302168
36	NOX Rack Assembly	1	302169	302170	302171	302172	302173
	Main Burner	*	*(2)	*(3)	*(4)	*(5)	*(6)
	Standard Burner		3000011	3000011	3000011	3000011	3000011
	NOX Burner		3020011	3020011	3020011	3020011	3020011
37	Manifold (With Orifices)						
	Standard Assembly	1	302174	302175	302176	302177	302178
	NOX Assembly	1	302174	302175	302176	302177	302178
38	Main Burner Orifice (Natural Gas)	*	*(2)	*(3)	*(4)	*(5)	*(6)
	Standard Assembly		207085215	207085215	207085215	207085215	207085215
	NOX Assembly		207085215	207085215	207085215	207085215	207085215
39	Rear Support End Plate	1	300309	300310	300311	300312	300313
40	Locating Clip	2	300385	300385	300385	300385	300385
41	Radiation Shield	1	300394	300395	300396	300397	300398
42	Side Rail	2	300301	300301	300301	300301	300301
43	Ignition & Crossover Support Assembly	1	300370	300371	300372	300373	300374
44	Burner Crossover Replacement Kit						
	Standard Burners	1	302201	302202	302203	302204	302205
	NOX Burner	1	302196	302197	302198	302199	302200
45	NOX Rod	*	*(8)	*(12)	*(16)	*(20)	*(24)
			302184	302184	302184	302184	302184
46	NOX Rod Support Clip	*	*(20)	*(30)	*(40)	*(50)	*(60)
			302002	302002	302002	302002	302002
DRAFT INDUCER GROUP							
47	Draft Inducer Assembly	1	302066	302066	302066	302066	302066
48	Draft Inducer Assembly Gasket	1	207458	207458	207458	207458	207458
49	#8-32 Hex Nuts	4	207468	207468	207468	207468	207468
50	Inlet Restrictor Plate	1	302069	302070	302071	302072	N/A
51	Outlet Restrictor Plate	1	302073	302074	302075	N/A	N/A
52	Anti-Short Bushing	1	207466	207466	207466	207466	207466
53	Flexible Conduit Connector	1	207462	207462	207462	207462	207462
54	Flexible Conduit Connector Nut	1	N/P	N/P	N/P	N/P	N/P
CASING GROUP							
55	Collector Box Plate	1	300200	300200	300200	300200	300200
56	Collector Box Heat Shield	1	3002011	3002011	3002011	3002011	3002011
57	Collector Box Heat Deflector	2	300666	300666	300666	300666	300666
58	Burner Cover	2	300455	300455	300455	300455	300455
59	Burner Side Shield	2	300221	300221	300221	300221	300221
60	Front Panel	1	300171	300171	300171	300171	300171
61	Rear Panel	1	300175	300175	300175	300175	300175
62	7/8" Hole Plug	2	207061	207061	207061	207061	207061
63	Top Panel	1	300737	300738	300739	300740	300741
64	Blower Mounting Nut	4	207038	207038	207038	207038	207038
65	Bottom Panel	1	300849	300850	300851	300852	300853
66	Blower Door	2	300177	300177	300177	300177	300177
67	Blower Door Knob	1	207062	207062	207062	207062	207062
68	Corner Post	2	300178	300178	300178	300178	300178
69	Blower Panel	1	300865	300866	300867	300868	300869
70	1" Hole Plug	1	207070	207070	207070	207070	207070
71	Lockout Module Mounting Bracket	1	302054	302054	302054	302054	302054
72	Induced Draft Collector Box Assembly	1	3020381	3020381	3020381	3020381	3020381
73	Induced Draft Collector Box Assembly Gasket	1	207467	207467	207467	207467	207467
ACCESSORY GROUP							
74	Filter Frame Kit	1	300650	300653	300655	300657	300659
*	Propane Conversion Kit	1	301050	301050	301050	301050	301050
*	Shipping Carton	1	207007	207008	207009	207010	207011

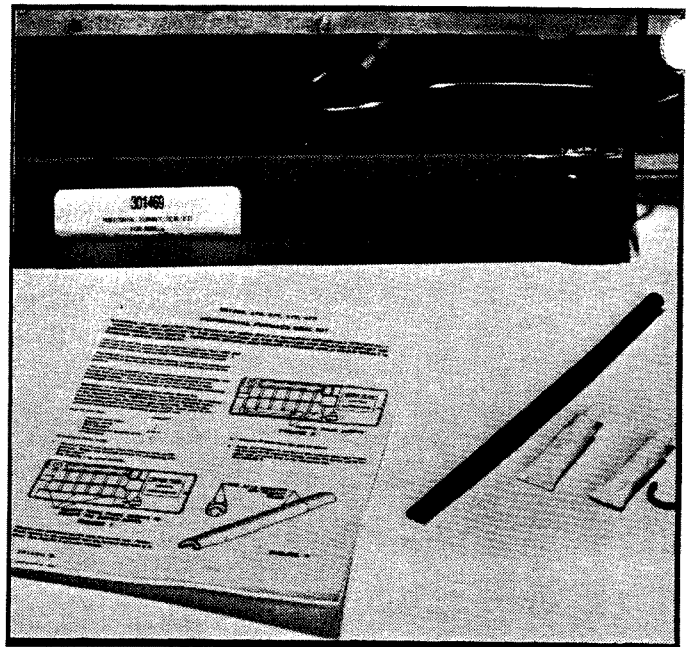
*Indicates number required varies. N/A indicates part Not Applicable. N/P indicated No Part Number. ** Btu/Hr Input and Motor HP are listed on the blower door.

III. No.	Part Description	No. Req.	Part Number For Each Furnace Size				
			40,000	60,000	80,000	100,000	120,000
BLOWER GROUP							
24	Blower Assembly	1	300245	300247	300249	300251	300252
25	Motor	1	2072212	2070312	2071662	2071022	2071022
25	Motor Mounting Hardware Kit	1	300825	300667	300667	300667	300667
26	Capacitor	1	207071	207071	207071	207769	207769
28	Capacitor Strap	1	207081	207081	207081	207081	207081
29	Blower Wheel- Direct Drive 10 x 4	1	2070392	N/A	N/A	N/A	N/A
	10 X 6	1	N/A	2070402	N/A	N/A	N/A
	10 X 8	1	N/A	N/A	2070422	N/A	N/A
	10 X 10	1	N/A	N/A	N/A	2070442	2070442
30	Blower Housing and Cutoff Assembly	1	300855	300856	300857	300858	300858
31	Blower Feet and Grommet Kit	1	300859	300860	300861	300861	300862
HEAT EXCHANGER GROUP							
32	Heat Exchanger Assembly	1	3021001	3021011	3021021	3021031	3021041
33	Collector Box Gasket	2	207019	207019	207019	207019	207019
34	Burner Box Gasket	2	207020	207020	207020	207020	207020
35	Collector Box Plate Gasket	1	207022	207022	207022	207022	207022
BURNER GROUP							
Burner Rack Assembly Without Gas Controls							
	Standard Rack Assembly	1	302164	302165	302166	302167	302168
	NOX Rack Assembly	1	302169	302170	302171	302172	302173
36	Main Burner	*	*(2)	*(3)	*(4)	*(5)	*(6)
	Standard Burner		3000011	3000011	3000011	3000011	3000011
	NOX Burner		3020011	3020011	3020011	3020011	3020011
37	Manifold (With Orifices)						
	Standard Assembly	1	302174	302175	302176	302177	302178
	NOX Assembly	1	302174	302175	302176	302177	302178
38	Main Burner Orifice (Natural Gas)	*	*(2)	*(3)	*(4)	*(5)	*(6)
	Standard Assembly		207085215	207085215	207085215	207085215	207085215
	NOX Assembly		207085215	207085215	207085215	207085215	207085215
39	Rear Support End Plate	1	300309	300310	300311	300312	300313
40	Locating Clip	2	300385	300385	300385	300385	300385
41	Radiation Shield	1	300394	300395	300396	300397	300398
42	Side Rail	2	300301	300301	300301	300301	300301
43	Ignition & Crossover Support Assembly	1	300370	300371	300372	300373	300374
44	Burner Crossover Replacement Kit						
	Standard Burners	1	302201	302202	302203	302204	302205
	NOX Burner	1	302196	302197	302198	302199	302200
45	NOX Rod	*	*(8)	*(12)	*(16)	*(20)	*(24)
			302184	302184	302184	302184	302184
46	NOX Rod Support Clip	*	*(20)	*(30)	*(40)	*(50)	*(60)
			302002	302002	302002	302002	302002
DRAFT INDUCER GROUP							
47	Draft Inducer Assembly	1	302066	302066	302066	302066	302066
48	Draft Inducer Assembly Gasket	1	207458	207458	207458	207458	207458
49	#8-32 Hex Nuts	4	207468	207468	207468	207468	207468
50	Inlet Restrictor Plate	1	302069	302070	302071	302072	N/A
51	Outlet Restrictor Plate	1	302073	302074	302075	N/A	N/A
52	Anti-Short Bushing	1	207466	207466	207466	207466	207466
53	Flexible Conduit Connector	1	207462	207462	207462	207462	207462
54	Flexible Conduit Connector Nut	1	N/P	N/P	N/P	N/P	N/P
CASING GROUP							
55	Collector Box Plate	1	300200	300200	300200	300200	300200
56	Collector Box Heat Shield	1	3002011	3002011	3002011	3002011	3002011
57	Collector Box Heat Deflector	2	300666	300666	300666	300666	300666
58	Burner Cover	2	300455	300455	300455	300455	300455
59	Burner Side Shield	2	300221	300221	300221	300221	300221
60	Front Panel	1	300171	300171	300171	300171	300171
61	Rear Panel	1	300175	300175	300175	300175	300175
62	7/8" Hole Plug	2	207061	207061	207061	207061	207061
63	Top Panel	1	300737	300738	300739	300740	300741
64	Blower Mounting Nut	4	207038	207038	207038	207038	207038
65	Bottom Panel	1	300849	300850	300851	300852	300853
66	Blower Door	2	300177	300177	300177	300177	300177
67	Blower Door Knob	1	207062	207062	207062	207062	207062
68	Corner Post	2	300178	300178	300178	300178	300178
69	Blower Panel	1	300865	300866	300867	300868	300869
70	1" Hole Plug	1	207070	207070	207070	207070	207070
71	Lockout Module Mounting Bracket	1	302054	302054	302054	302054	302054
72	Induced Draft Collector Box Assembly	1	3020381	3020381	3020381	3020381	3020381
73	Induced Draft Collector Box Assembly Gasket	1	207467	207467	207467	207467	207467
ACCESSORY GROUP							
74	Filter Frame Kit	1	300650	300653	300655	300657	300659
*	Propane Conversion Kit	1	301050	301050	301050	301050	301050
*	Shipping Carton	1	207007	207008	207009	207010	207011

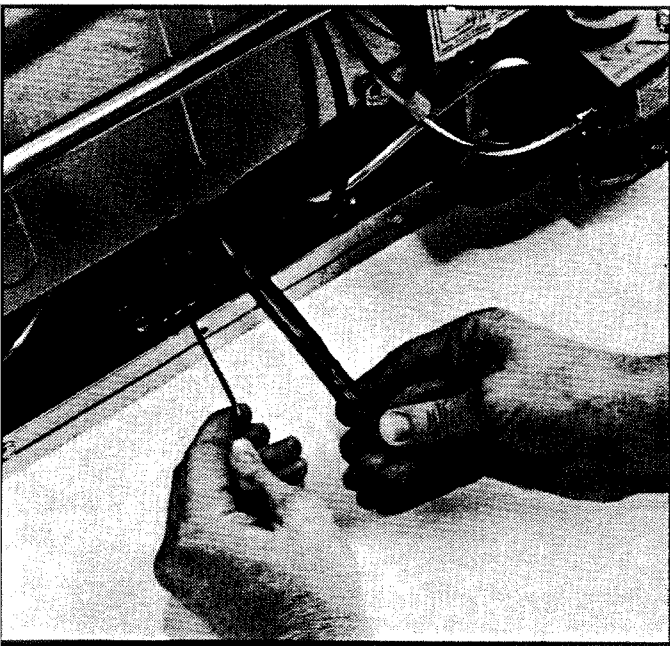
*Indicates number required varies. N/A indicates part Not Applicable. N/P indicated No Part Number. ** Btu/Hr Input and Motor HP are listed on the blower door.



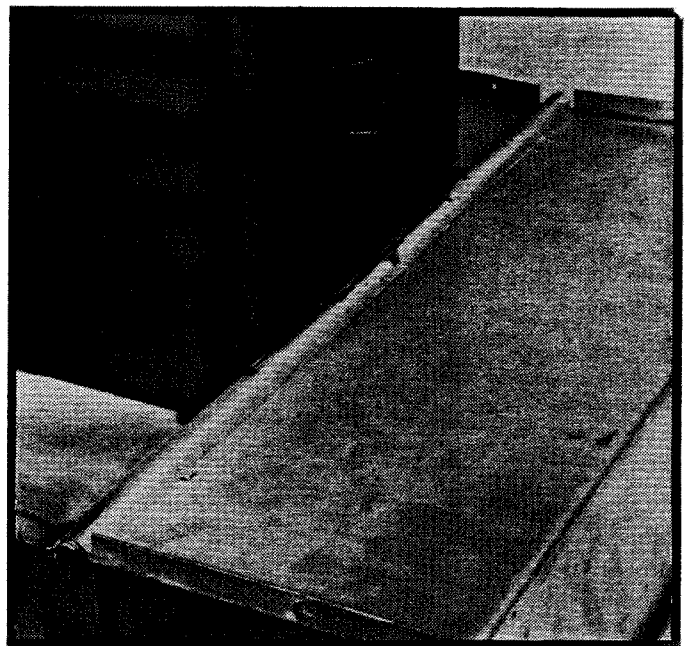
5. Inspection of the Expansion Joint on the outlet end of the heat exchanger.



6. Components needed to seal an expansion joint crack. (Kit also includes orifices, new burner cover with burner limit switches installed, and burner carryover. See kit installation instructions for details.)



7. Method for installing expansion joint seal. (Black silicone sealant has been used for improved visibility in photos.)



8. Burner Box Expansion Joint before repair.

How to Use the Troubleshooting Charts

The following troubleshooting information was designed to assist qualified service personnel in quickly pinpointing malfunctions which may occur. To use these charts, first find the corresponding malfunction in the left column of the tables. Then, starting with Step 1, go through the check-out procedure. **To avoid an incorrect diagnosis, it is essential these procedures be done in order. Do not skip any steps!**

Before beginning the troubleshooting procedure, first ensure the furnace is properly wired and phased with the incoming supply voltage.

Incoming Supply Voltage	Furnace Connection Inside Junction Box
L1 or black wire (115V)	Black
Neutral or white wire (0V)	White
Equipment ground or bare wire (0V)	Green

With a volt-ohm-meter, the following readings will occur if the furnace is properly wired:

- Black Wire to Furnace Casing - 115 volts
- White Wire to Furnace Casing - 0 volts
- Green Wire to Furnace Casing - 0 ohms

WARNING: Individuals who service this furnace must have training and experience reading and understanding wiring diagrams and electrical troubleshooting procedures. Some steps in this procedure require checking live line voltage circuits (115V). Anyone who cannot read wiring diagrams or who is not versed in electrical safety procedures should not attempt to repair this furnace.