

PENNCO



CAST IRON BOILERS

FSB SERIES

Gas Fired Hot Water Induced Draft BOILERS

MODELS

FSB-2 - FSB-3 - FSB-4 - FSB-5 - FSB-6 - FSB-7



INSTALLATION INSTRUCTIONS

These Instructions must be affixed on or adjacent to the boiler

**THIS BOILER CANNOT BE USED WITH ALL TYPES OF CHIMNEYS.
READ THESE INSTRUCTIONS CAREFULLY BEFORE INSTALLING!**

These Gas-Fired Hot Water Boilers are low pressure, sectional cast iron boilers Design Certified by A.G.A. (American Gas Association) for use with Natural and Propane Gases. They are constructed and hydrostatically tested for a maximum working pressure of 50 psi in accordance with A.S.M.E. Boiler and Pressure Vessel Code Section IV Standards for Cast Iron Heating Boilers.

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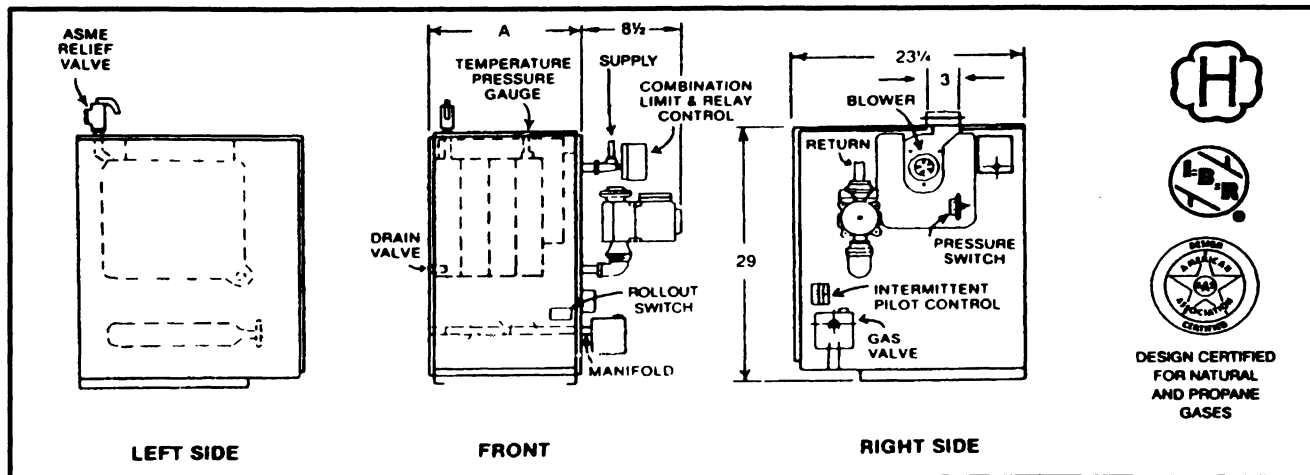
WARNING: Improper installation, adjustment, service or maintenance can cause injury or property damage. Refer to this manual. For assistance or additional information consult a qualified installer, service agency or the gas supplier. Natural Gas boilers are not to be converted to LP Gas.

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Boiler Ratings and Capacities

Fig. 1



NATURAL and PROPANE GAS

Model	No. Sections	AGA/CGA Input *MBH	Heating Capacity +MBH	Net IBR Rating *MBH	Width A	Vent Diameter (inches)	
						To Chimney (Category I)	Horizontal Vent (Category III)
FSB-2	2	42.5	36	31	11"	4	3
FSB-3	3	75.0	63	55	14-1/4"	4	3
FSB-4	4	112.5	94	82	17-1/2"	4	3
FSB-5	5	150.0	125	109	20-3/4"	4	3
FSB-6	6	187.5	155	135	24"	4	4
FSB-7	7	225.0	186	162	27-1/4"	4	4

*MBH = 1,000 Btu/h

Btu/h = British Thermal Unit Per Hour

For elevations above 2,000 ft. ratings should be reduced at the rate of 4% for each 1,000 ft. above sea level (U.S.A. only)

+ Heating capacity based on D.O.E. (Department of Energy) test procedure

The Ratings marked "Net I=B=R ratings" indicate the amount of radiation each boiler will take care of under normal conditions and thermostatic control. The Net I=B=R Ratings shown are based on an allowance of 1.15 in accordance with the factors shown on the I=B=R Standard as published by the Hydronics Institute.

Selection of boiler size should be based upon "Net I=B=R Rating" being equal to or greater than the calculated heat loss of the building.

The manufacturer should be consulted before selecting a boiler for installations having unusual piping and pickup requirements.

These boilers must stand on a non-combustible floor. If installed on a combustible floor, use Combustible Floor Base. These Gas-Fired Hot Water Boilers are low pressure, sectional cast iron boilers Design Certified by A.G.A. (American Gas Association) for use with Natural and Propane Gases. They are constructed and hydrostatically tested for a maximum working pressure of 50 psi (pounds per square inch) in accordance with A.S.M.E. (American Society of Mechanical Engineers) Boiler and Pressure Vessel Code Section IV Standards for cast iron heating boilers.

BOILERS FOR USE AT HIGH ALTITUDE

This boiler is factory equipped for use at altitudes of 0 - 2,000 feet above sea level. For use at altitudes above 2,000 feet above sea level, the input ratings are reduced by a change in main burner orifice size.

U.S.A. ONLY - For altitudes above 2,000 feet above sea level, input ratings should be reduced at the rate of 4% for each 1,000 feet above sea level. consult the *National Fuel Gas Code* (NFPA54/ANSI Z223.1 latest edition), or the manufacturer for correct orifice sizing information. High altitude orifices are available from the boiler manufacturer.

Before You Start

Check to be sure you have the right size boiler before starting the installation. See rating and capacity table on the previous page. Also be sure the new boiler is for the type of gas you are using. Check the rating plate on the right side of the boiler.

You must see that the boiler is supplied with the correct type of gas, fresh air for combustion, and a suitable chimney or horizontal venting system, and an adequate piping system. Finally, a thermostat, properly located, is needed for control of the heating system. If you have any doubts as to the various requirements, check with local authorities and obtain professional help where needed. Take the time to complete all of the steps for SAFE and PROPER operation of the heating system.

Where required by the authority having jurisdiction, the installation must conform to American Society of Mechanical Engineers Safety Code for Controls and Safety Devices for Automatically Fired Boilers, No. CDS-1*.

The installation must conform to the requirements of the authority having jurisdiction or, in the absence of such requirements, to the National Fuel Gas Code, ANSI Z223.1 latest issue.

INSTALLERS - FOLLOW LOCAL REGULATIONS WITH RESPECT TO INSTALLATION OF CO DETECTORS. FOLLOW MAINTENANCE RECOMMENDATIONS IN THIS INSTRUCTION MANUAL.

TECHNICIENS - VEUILLEZ VOUS CONFORMER À LA RÉGLEMENTATION EN VIGUEUR CONCERNANT L'INSTALLATION DES DÉTECTEURS D'OXYDE DE CARBONE. SUIVRE LES CONSIGNES D'ENTRETIEN FIGURANT DANS LE D'INSTRUCTION CJOINT.

KEEP BOILER AREA CLEAN AND FREE FROM COMBUSTIBLE MATERIALS, GASOLINE AND OTHER FLAMMABLE VAPORS AND LIQUIDS

Locating the Boiler

If your boiler is part of a planned heating system, locate it where shown on your plan. If boiler is to be part of an existing system, it is usually best to put it where the old one was. If you plan to change location, you will need additional materials as well as an adequate base. The following rules apply:

1. The boiler must be level. Metal shims may be used under base legs for final leveling.
2. Use a raised base if floor can become wet or damp.
3. The vent pipe connection should be as short as possible.
4. **Accessibility clearances must take precedence over fire protection clearances.** 18" clearance should be maintained at a side where passage is required to access to another side for cleaning or servicing, inspection, or replacement of any parts that normally may require such attention. 18" clearance is recommended on the control side for servicing.

Figure 2 shows minimum clearances to combustible construction. Rooms that are large in comparison with the size of the boiler are defined as rooms having a volume equal to or greater than 16 times the volume of the boiler. Where the actual ceiling height of a room is greater than 8', the volume of a room shall be figured on the basis of a ceiling height of 8'. Determination of room size should be based on the total volume of all gas fired equipment installed in the room. Consult section 6.3.1 of the **National Fuel Gas Code** for further information, including approved methods for reducing clearances in large rooms.

5. Equipment shall be installed in a location in which the facilities for ventilation permit satisfactory combustion of gas, proper venting and maintenance of ambient temperature at safe limits under normal conditions of use. Equipment shall be located so as not to interfere with proper circulation of air. When normal infiltration does not provide the necessary air, outside air shall be introduced (see page 4 "Fresh Air for Combustion").
6. Advise owner to keep air passages free of obstructions. Ventilating and combustion air must enter boiler room without restrictions.
7. The floor supporting the boiler must not be combustible. If it is combustible, place the boiler on Combustible Floor Base No. 14614031 for 2 - 5 section boilers, or

No.14614032 for 6-7 section boilers. We use a 2" cladlite™ pad as a combustion floor base. These are available from your local supplier. Use a minimum 24" X 30" pad for 2-5 section boilers, and a minimum 30" X 30" pad for 6-7 section boilers. The boiler must be centered on the combustible floor base.

8. The boiler shall be installed such that the automatic gas ignition system components are protected from water (dripping, spraying, rain, etc.) during appliance operation and service (circulator replacement, control replacement, etc.)

Fig. 2 - Minimum Clearance Dimensions

	Alcove or room not large in comparison with Boiler	Room not large in comparison with Boiler.
Top	6"	6"
Rear	6"	6"
Control Side	8"	6"
Opposite Side	6"	6"
Front	18"	18"
Flue/Vent Connector	6"	6"
Near Boiler Piping	1"	1"

Boiler Size	Boiler Volume (Cu. Ft.)	Min. room Vol. req'd. to be large room (Cu. Ft.)
2 Section	4.3	68.7
3 Section	5.6	89.0
4 Section	6.8	109.3
5 Section	8.1	129.5
6 Section	9.4	149.8
7 Section	10.6	170.1

THIS UNIT MUST BE SET ON A CONCRETE OR OTHER NON-COMBUSTIBLE MATERIAL BASE OR FLOOR. IT MUST NOT BE INSTALLED ON CARPETING.

Fresh Air for Combustion

Provision for combustion and ventilation air must be in accordance with Section 5.3, Air for Combustion and Ventilation, of the National Fuel Gas Code, ANSI Z223.1 latest issue, or applicable provisions of the local building codes.

WARNING

Be sure to provide enough fresh air for combustion. Enough air insures proper combustion and **assures that no hazard will develop due to the lack of oxygen.**

You must provide for enough fresh air to assure proper combustion. The fire in the boiler uses oxygen. It must have a continuous supply. The air in a house contains only enough oxygen to supply the burner for a short time. Outside air must enter the house to replace that used by the burner. Study following examples 1 and 2 to determine your fresh air requirements.

EXAMPLE 1: Boiler located in unconfined space

If your boiler is in an open area (unpartitioned basement) in a conventional house, the air that leaks through the cracks around doors and windows will usually be adequate to provide air for combustion. The doors should not fit tightly. Do not caulk the cracks around the windows.

An unconfirmed space is defined as a space whose volume is not less than 50 cubic feet per 1,000 Btu per hour of the total input rating of all appliances installed in that space.

EXAMPLE 2: Boiler located in confined space

A. All air from inside the building: The confined space shall be provided with two permanent openings communicating directly with an additional room(s) of sufficient volume so that the combined volume of all spaces meets the criteria for an unconfined space. The total input of all gas utilization equipment installed in the combined space shall be considered in making the determination. Each opening shall have a minimum free area of one square inch per 1,000 Btu per hour of the total input rating of all gas utilization equipment in the confined space, but not less than 100 square inches. One opening shall be within 12 inches of the top and one within 12 inches of the bottom of the enclosure.

B. All air from outdoors: The confined space shall be provided with two permanent openings, one commencing within 12 inches of the top and one commencing within 12 inches of the bottom of the enclosure. The openings shall communicate directly, or by ducts, with the outdoors or spaces (crawl or attic) that freely communicate with the outdoors.

1. When directly communicating with the outdoors, each opening shall have a minimum free area of one square inch per 4,000 Btu per hour of total input rating of all equipment in the enclosure.

2. When directly communicating with the outdoors through vertical ducts, each opening shall have a minimum free area of one square inch per 4,000 Btu per hour of total input rating of all equipment in the enclosure.

NOTE

If you use a fireplace or a kitchen or bathroom exhaust fan, you should install an outside air intake. These devices will rob the boiler and water heater of combustion air.

3. When communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of one square inch per 2,000 Btu per hour of total input rating of all equipment in the enclosure.

4. When ducts are used, they shall be of the same cross sectional area as the free area of the openings to which they connect. The minimum dimension of rectangular air ducts shall be not less than three inches.

EXCEPTION - If this *induced draft* boiler is the *one and only* gas fired appliance in the confined space, then each required ventilation opening as determined above may be reduced by 1/2. For example: All air from inside building, use 1 sq. in. per 2,000 Btu/hr., but not less than 50 sq. in. For all air from outside building, use:

direction communication - 1 sq. in. per 8,000 Btu/hr.
vertical ducts - 1 sq. in. per 8,000 Btu/hr.
horizontal ducts - 1 sq. in. per 4,000 Btu/hr.

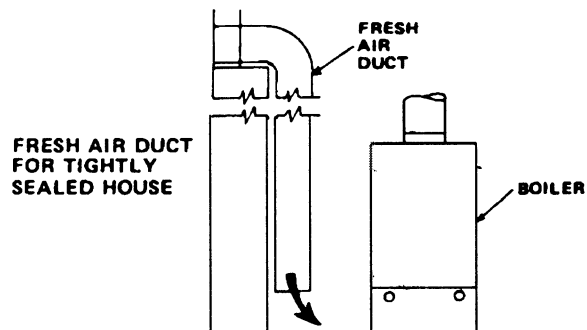
FIG. 3 FRESH AIR DUCT CAPACITIES

Fresh air duct capacities for ducts supplying fresh air to boiler in tightly constructed houses. British Thermal Units per hour input (Btuh)*.

Fresh Air Duct Size	1/4" Mesh Screen - Btuh	Wood Louvers Btuh	Metal Louvers Btuh
3" X 12"	144,000	36,000	108,000
8" X 8"	256,000	64,000	192,000
8" X 12"	384,000	96,000	288,000
8-1/2" X 16"	512,000	128,000	384,000

* Based on opening covered by 1/4" mesh screen, wood louvers or metal louvers.

FIG. 4 FRESH AIR DUCT FOR TIGHTLY SEALED HOUSE



Installation - System Piping

1. Place boiler in the selected location (as near chimney as possible).

Your boiler is shipped assembled. You need only to install the Relief Valve with a drain line to carry any water to a drain, and install the Drain Valve.

2. Install Relief Valve on 3/4" pipe nipple in tapped opening in the left end section. Connect a drain line of the same pipe size (3/4") to carry any water away to a drain. No shutoff of any description shall be placed between the safety relief valves and the atmosphere. Installation of the safety relief valve shall conform to the requirements of the ANSI / ASME Boiler and Pressure Vessel Code, Section IV.

3. Install Drain Valve on lower left side of boiler as marked.

4. Connect Supply and Return Lines to boiler. The connections may require certain additional fittings and parts, as shown on Figure 5 and 6.

If you are installing an entire new heating system, first install all of your radiation units (panels, radiators or cabinets) and the supply and return mains - then make the connections at the boiler.

In connecting the cold water supply to the water valve, make sure that a clean water supply is available. When the water supply is from a well or pump, a sand strainer should be installed at the pump.

A hot water boiler installed above radiation level must be equipped with a low water cutoff device. A periodic inspection is necessary, as is flushing of float type devices, per manufacturers specific instructions.

When boiler is used in connection with refrigeration systems it shall be installed so that the chilled medium is piped in parallel with the heating boiler with appropriate valves to prevent the chilled medium from entering the heating boiler (Figure 7).

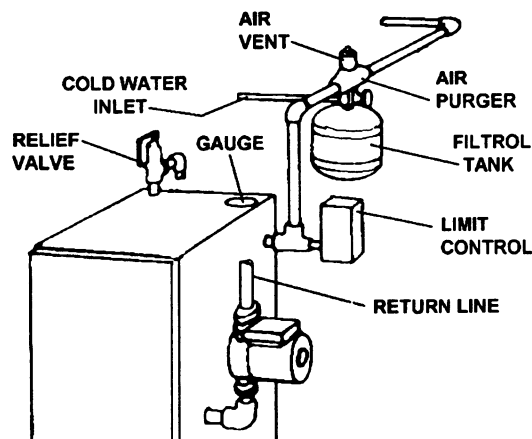
When this boiler is connected to heating coils located in air handling units where they may be exposed to refrigerated air circulation, the piping system shall be equipped with flow control valves or other automatic means to prevent gravity circulation of the boiler water during the cooling cycle.

LOW DESIGN WATER TEMPERATURE SYSTEMS (BELOW 140° F)

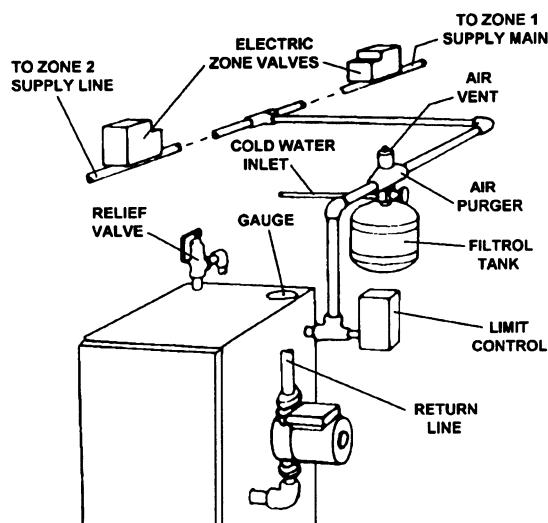
If the boiler is to be used in a heating system where design water temperatures below 140° F are desired (e.g. radiant floor heating), a 3-way or 4-way mixing valve or suitable alternative is required to prevent low temperature return water from entering the boiler. Follow the mixing valve manufacturers installation instructions.

The minimum design return water temperature to the boiler to prevent condensation in the boiler and venting is 120° F. The minimum high limit setting is 140° F.

**FIG. 5 FORCED HOT WATER
TYPICAL PIPING**

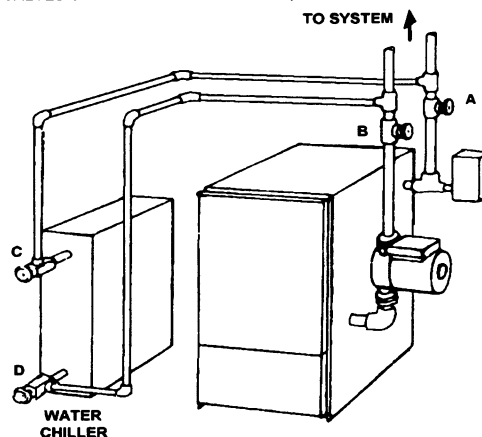


**FIG. 6 FORCED HOT WATER
TYPICAL PIPING
WITH ZONE CONTROL VALVES**



**FIG. 7 PIPING ARRANGEMENTS
FOR BOILER WHEN USED IN CONNECTION
WITH REFRIGERATION SYSTEM**

VALVES A & B - OPEN FOR HEATING, CLOSE FOR COOLING
VALVES C & D - CLOSE FOR HEATING, OPEN FOR COOLING



Chimney and Vent Pipe Connection

For boilers for connection to gas vents or chimneys, vent installations shall be in accordance with Part 7, Venting of Equipment, of the National Fuel Gas Code, ANSI Z223.1 latest issue and applicable provisions of the local building code.

CHECK YOUR CHIMNEY

This is a very important part of your heating system. It must be clean, the right size, properly constructed and in **GOOD CONDITION**. No boiler can function properly with a bad chimney.

1. Use local codes for installation or National Fuel Gas Code Z223.1 latest issue. It is very important to properly size the venting system for induced draft appliance. Consult the **Vent Size Tables**, in the **National Fuel Gas Code ANSI Z223.1** latest revision for correct sizing information.

2. The categorized vent diameter for these boilers is 4". This is the minimum permissible vent diameter in order to maintain a non-positive vent static pressure. The boiler's induced draft blower has a 3" outlet. A 3" x 4" increaser fitting is included in the parts bag. Locate the increaser fitting on the outlet of the induced draft blower, and secure gasket with a bead of the furnished silicone sealant. **The boiler installation for chimney venting is not complete unless the 3" x 4" increaser fitting is located and secured.**

3. These are high efficiency boilers with a low stack or exhaust temperature.

4. If venting into a masonry chimney without a liner, line the chimney from top to bottom with either:

- a. Listed type B vent pipe
- b. Listed flexible vent liner
- c. Poured ceramic liner

5. Outside chimneys should not be used unless they are either:

- a. Enclosed in a chase, or
- b. Lined with type b vent pipe, or listed flexible vent liner, or other certified chimney lining system.

6. The vent connector from the boiler to the chimney should run as directly as possible with as few elbows as possible.

7. Where possible, it is recommended to common vent the water heater and boiler. Consult the appropriate Vent Sizing Tables in the National Fuel Gas Code for specific requirements of multiple appliance venting.

8. If the boiler is the only appliance connected to the vent, Type B vent pipe is recommended for the vent connection.

9. Slope pipe up from boiler to chimney not less than 1/4" per foot.

10. End of vent pipe must be flush with the inside face of the chimney flue. Use a sealed-in thimble for the chimney connection.

11. The sections of vent pipe should be fastened with sheet metal screws to make the piping rigid. Use stovepipe wires to support the pipe from above.

12. Do not connect to fireplace flue.

13. Do not install a damper on this boiler.

MINIMUM VENT PIPE CLEARANCE

If the vent pipe must go through a crawl space, Type B vent pipe should be used. Where vent pipe passes through a combustible wall or partition, use a ventilated metal thimble. The thimble should be 4 inches longer in diameter than the vent pipe.

If Boiler is installed with single wall vent, it must have a 6" clearance between its surface and any combustible material.

A new Type B gas vent or flexible liner must be installed in accordance with the instructions furnished with the vent. Maintain clearances as specified for the vent pipe.

Check the vent pipe to see if it is firestopped where it goes through the floor or ceiling. It should have an approved vent cap with clearances from the roof as shown in Figure 8.

If clearances are less than shown in Figure 8, have the vent checked by local authorities.

For boilers for connection to gas vents or chimneys, vent installations shall be in accordance with Part 7, Venting of Equipment, of the National Fuel Gas Code, ANSI Z223.1 latest issue and applicable provisions of the local building codes.

Vent connectors serving appliances vented by natural draft shall not be connected into any portion of mechanical draft systems operating under positive pressure.

REMOVING EXISTING BOILER FROM COMMON VENTING SYSTEM

When an existing boiler is removed from a common venting system, the common venting system is likely to be too large for proper venting of the appliances remaining connected to it.

At the time of removal of an existing boiler, the following steps shall be followed with each appliance remaining connected to the common venting system in operation, while the other appliances remaining connected to the common venting system are not in operation.

1. Seal any unused openings in the common venting system.

2. Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.

3. Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.

4. Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.

5. Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar or pipe.

6. After it has been determined that each appliance remaining connected to the common 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.

7. Any improper operation of the common venting system should be corrected so the installation conforms with the National Fuel Gas Code ANSI Z223.1 latest issue. When resizing any portion of the common venting system, the common venting system shall be resized to approach the minimum size as determined using the appropriate tables in Part 11 in the National Fuel Gas Code, ANSI Z223.1 latest issue.

NOTE

It is recommended that existing gas vents be checked to be sure they meet local codes.

FIG. 8 TYPE B GAS VENT

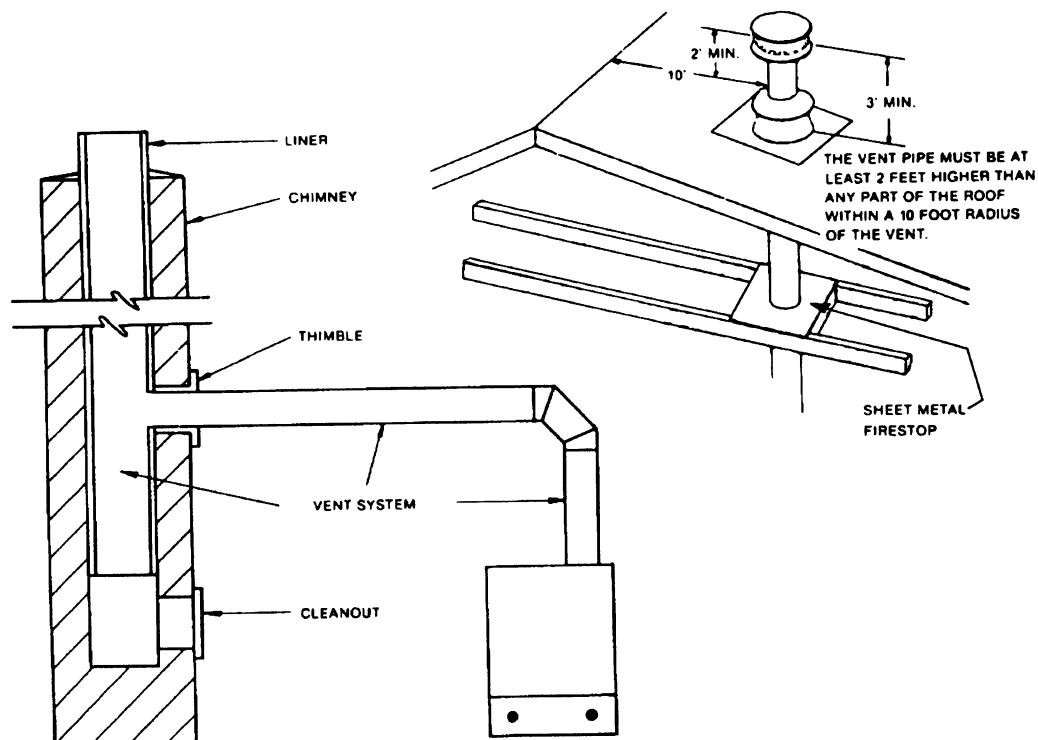


FIG. 9 HORIZONTAL VENTING

INDUCED DRAFT HIGH EFFICIENCY BOILERS

Maximum Horizontal Vent Length For Stainless Steel Vent Pipe - 30' Plus One 90° Elbow Plus Vent Termination

Minimum Horizontal Vent Length - 2' Plus One 90° Elbow Plus Vent Termination

Additional elbows are equivalent to 6 feet of straight pipe for 4" diameter 90° elbow or 3 feet of straight pipe for 3" diameter 90° elbow

**2, 3, 4, 5 Section Boilers use 3" vent pipe.
6, 7 Section Boilers use 4" vent pipe.**

CHOICE OF VENT PIPE MATERIAL

- a) U.L. Listed Z-Flex Z-Vent Stainless Steel Vent Pipe.
- b) U.L. Listed Heat-Fab Saf-T-Vent Stainless Steel Vent Pipe.
- c) U.L. Listed Flex-L StaR-34 Stainless Steel Vent Pipe.
- d) U.L. Listed ProTech Systems FasNSeal Stainless Steel Vent Pipe.

TERMINATION FITTING

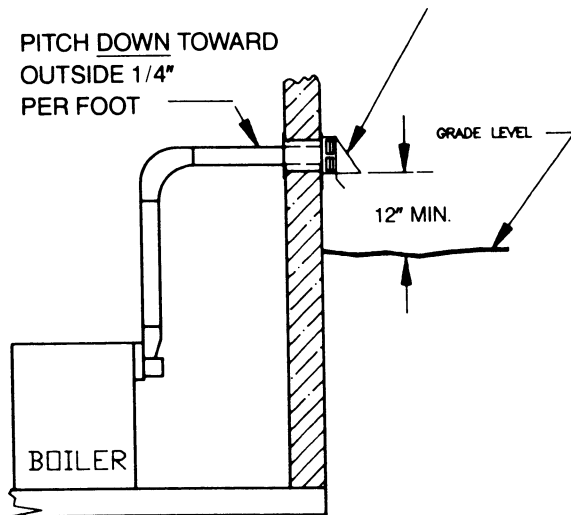
90° ELBOW, POINTING DOWN, SAME MATERIAL AND PIPE SIZE AS VENTING SYSTEM. EQUIP WITH SCREEN (MIN. 1/4" MESH) TO KEEP OUT BIRDS AND RODENTS.

OPTIONAL TERMINATION FITTING

TJERNLUND SIDE WALL VENT HOOD

VH-1-3" FOR 2, 3, 4, 5 SECTION BOILERS

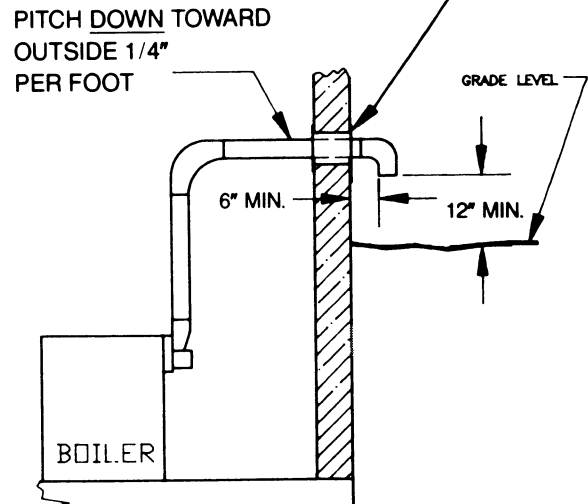
VH-1-4" FOR 6, 7 SECTION BOILERS



FOR A COMBUSTIBLE WALL, USE A THIMBLE. SELECT AS FOLLOWS:

VENT PIPE: Z-VENT, SAF-T-VENT, STAR-34
THIMBLE: SIMPSON DURAVENT THIMBLE
#905295 - 3" THIMBLE
#915295 - 4" THIMBLE

VENT PIPE: FASNSEAL
THIMBLE: FASNSEAL WALL THIMBLE
#FSWT03 - 3" THIMBLE
#FSWT04 - 4" THIMBLE



HORIZONTAL VENTING ACCESSORIES PART NUMBERS

DESCRIPTION	PART NUMBER
3" Side Wall Vent Hood (Tjernlund VH- 1-3")	161017
4" Side Wall Vent Hood (Tjernlund VH- 1-4")	161018
3" Thimble(Simpson 905295)	162019
4" Thimble (Simpson 907103)	162020

Horizontal Venting Instructions

1. These boilers may be vented horizontally as shown in Fig. 9. The vent pipe is pitched **down** from the boiler to the vent termination. **Do not** connect other appliances to this vent.

2. Vent Pipe Material:

- a) UL Listed Z-Flex Z-Vent stainless steel vent pipe from boiler to vent termination,
– or –
- b) UL Listed Heat-FabSaf-T-Vent stainless steel vent pipe from boiler to vent termination,
– or –
- c) UL Listed Flex-L StaR-34 stainless steel vent pipe from boiler to vent termination,
– or –
- d) UL Listed ProTech FasNSeal stainless steel vent pipe from boiler to vent termination.

3. Clearance to Combustible Materials:

For stainless steel vent pipe maintain 4½" minimum air space clearance to combustible materials for 3" diameter pipe, and maintain 6" minimum air space clearance to combustible materials for 4" diameter pipe.

4. Vent Pipe Size:

- a) 2, 3, 4 and 5 section boilers use 3" vent pipe connected directly to the outlet of the induced draft blower.
- b) 6 and 7 section boilers use 4" vent pipe, starting with a 3" to 4" stainless steel vent pipe transition that is connected directly to the outlet of the induced draft blower. **Do not use 3" vent pipe on 6 or 7 section boilers.**

5. Vent Pipe Length:

- a) For stainless steel vent pipe, the maximum horizontal vent length is 30 feet plus one 90° elbow plus termination fitting.
- b) Minimum horizontal vent length for all vent materials is 2 feet plus one 90° elbow plus termination fitting.
- c) For additional elbows reduce the maximum vent length as shown:
3" – 90° elbow – reduce vent length 3 feet per each 3" elbow,
4" – 90° elbow – reduce vent length 6 feet per each 4" elbow.
Example: 6 section boiler requires 3 elbows plus the termination fitting. This means 2 additional 4" elbows will be used, at 6 feet per elbow. This is equivalent to 12 feet of pipe ($2 \times 6 = 12$), therefore maximum vent length is now 18 feet ($30 - 12 = 18$).

6. Vent Termination Fitting:

For all vent pipe materials, you may use either:

- a) a 90° elbow pointing down, fitted with a minimum ¼" mesh screen to keep out rodents and birds. The elbow shall be of the same material and size as vent pipe. The elbow exit should be at least 6" away from exterior wall as shown in Figure 9.
– or –
- b) Tjernlund VH-1 Series side wall vent hood.
For 2, 3, 4, 5 section boilers use VH-1-3",
For 6, 7 section boilers use VH-1-4".

7. Vent Pipe Termination Location:

a) When venting through combustible walls, combustible clearances must be considered. The **VH-1 side wall vent hood** provides both the outside vent termination and a double wall pipe for passing through a combustible wall up to 8" thick (VH-1-4") or 9" thick (VH-1-3"). The hole in the wall must be 6¼" square for 3" vent pipe and 7½" square for 4" vent pipe, in order to insert the VH-1 side wall vent hood. The VH-1 may also be used in non-combustible walls.

b) If the **90° elbow** is the termination fitting of choice, then the single wall pipe will be passing through the side wall. For combustible walls, a UL listed thimble shall be used where the single wall pipe passes through the wall. For combustible walls using Z-Vent, Saf-T-Vent, or StaR-34 vent pipe, use the following:

3" vent pipe – use Simpson Duravent #905295 3" thimble or equivalent

4" vent pipe – use Simpson Duravent #915295 4" thimble or equivalent

Maximum wall thickness with this thimble is 7 inches.

For combustible walls using ProTech FasNSeal where the single wall vent pipe must pass through the side wall, a UL Listed FasNSeal wall thimble shall be used as follows:

3" FasNSeal vent pipe – use 3" FasNSeal Wall Thimble #FSWT03

4" FasNSeal vent pipe – use 4" FasNSeal Wall Thimble #FSWT04

The thimble is adjustable for different wall thickness, with a maximum wall thickness of 7 inches. Seal the thimble along the outside edge of the plate with caulk or silicone and fasten to the wall with screws or nails.

c) For single wall pipe through non-combustible walls, the hole through the wall need only be large enough to maintain the pitch of the vent pipe, and provide proper sealing. A thimble is not required for single wall pipe passing through non-combustible walls.

d) The venting system shall terminate at least 3 feet above any forced air inlet located within 10 feet. The venting system shall terminate at least 4 feet below, 4 feet horizontally from, or 1 foot above any door, window, or gravity air inlet into any building. The bottom of the vent shall be located at least 12 inches above grade. Termination of the vent shall be not less than 7 feet above an adjacent public walkway. The vent terminal shall not be installed closer than 3 feet from the inside corner of an L shaped structure. Termination of the vent should be kept at least 3 feet away from vegetation. The venting system shall terminate at least 4 feet horizontally from, and in no case above or below, unless a 4 foot horizontal distance is maintained, from electric meters, gas meters, regulators, and relief equipment.

e) The venting system shall terminate at least 4 feet below any eave, soffit, or roof overhang.

f) The venting system shall **not** terminate underneath any deck, patio, or similar structure.

g) Put vent on a wall away from the prevailing winter wind. Locate or guard the vent to prevent accidental contact with people or pets.

h) Terminate the vent above normal snowline. Avoid locations where snow may drift and block the vent. Ice or snow may cause the boiler to shut down if the vent becomes obstructed.

i) Under certain conditions, flue gas will condense, forming moisture. In such cases, steps should be taken to prevent building materials at the vent terminal from being damaged by exhaust of flue gas.

8. Joining and Sealing the Vent Pipe:

The vent pipe needs to be both watertight and gastight. Seal all joints and seams as follows:

A. For Z-Flex Z-Vent stainless steel vent pipe use a high temperature red silicone sealant rated for 500°F. The outside of the male end and inside of the female end of the pipe must be cleaned with any commercially available brake cleaner before applying silicone bead. For 3" vent pipe runs begin with the male end of the vent pipe over the boiler's induced draft blower outlet. For 4" vent pipe runs begin with a 6" length of 3" Z-Vent (#02SVEPxx0306) over the boiler's induced draft blower outlet, to which an even bead of high temperature silicone sealant should be applied. Then connect the 3" Z-Vent to a Z-Vent 3" to 4" reducer (#02SVERxx0403). Then continue the 4" Z-Vent pipe run by connecting the 4" male end of the Z-Vent to the reducer. (A locking band may be used around this joint for additional support.) Then following the sealing instructions, push the 4" male end of the Z-Vent over the 4" increaser fitting. When using the Tjernlund VH-1 vent hood, the female end (flared end) of the vent pipe will be connected to the termination hood. The male end of the vent hood must be crimped before pushing the Z-Vent over the vent hood's connecting pipe. Before the pipes are joined, apply a ¼" bead of silicone one inch from the end of the male end. Then push the pipes together as far as they will go making sure any seams are aligned and oriented upward. Now apply another bead of silicone around this joint and smooth out. Then use a Z-Flex locking band around the center of the joint.

Z-Flex Z-Vent Size	Locking Band Part #
3"	#02SVSLBX03
4"	#02SVSLBX04

- 1) Apply the high temperature silicone approximately one inch from the end, around the male end of the pipe in an even ¼" bead.
- 2) Pipes can now be pushed together as far as they will go. The seams on pipe should be aligned and oriented upward in all horizontal appliances. Apply another bead of silicone around this joint and smooth out.
- 3) Slide locking band over center of joint and tighten gear clamps. Make sure locking band is centered on joint.
- 4) Check all joints and seams for gas tightness.
- 5) Horizontal venting shall have a slope not less than ¼" (6.4mm) every 12 inches (305mm) downward away from the boiler to prevent collection of condensate throughout the assembly.
- 6) Allow the sealant to cure for 24 hours before operating the appliance.

B. For Heat-Fab Saf-T-Vent stainless steel vent pipe use a high temperature red silicone sealant rated for 500°F. The outside of the male end and inside of the female end of the pipe must be cleaned before applying the silicone bead. For 3" vent pipe runs, the male end of the vent pipe which goes over the outlet of the boiler's induced draft blower must be crimped. The vent pipe should be crimped as minimal as possible to provide a tight fit over the outlet. After crimping is completed follow the instructions for applying silicone sealant. For 4" vent pipe runs, begin with a Saf-T-Vent 3" to 4" increaser fitting (#7374GC) over the boiler's induced draft blower outlet, to which an even bead of high temperature silicone sealant should be applied. Then continue the 4" Saf-T-Vent pipe run by connecting the 4" male end of the Saf-T-Vent to the increaser. (A locking band may be used around this joint for additional support.) The vent flow must be in the direction indicated on the vent pipe. When using the Tjernlund VH-1 vent hood, the female end (flared end) of the vent pipe will be connected to the termination hood. Apply high temperature silicone in an even ¼" bead approximately ¼" to ¾" from the end of the vent hood's connecting vent pipe. Also, run a similar size bead of silicone sealant down the seam weld of the vent pipe. Then push the female end over the vent hood's connecting vent pipe.

- 1) Apply the high temperature silicone around the male end of the pipe (without the tabs) in an even ¼" bead. Silicone bead should be approximately ¼" to ¾" from the end of the male end. Also, run a similar size bead of silicone sealant down the seam weld at the end of each joint.
- 2) Pipes can now be pushed together as far as they will go. The seams on the vent pipe should be aligned and oriented upward in all horizontal appliances. With a moistened finger or flat tool, spread any sealant that squeezes out around the circumference of the joint.
- 3) Attach the sections together with the locking rings and tabs (except at the blower outlet where no locking ring exists.) Inspect the joint to ensure that flue gases will not leak. If necessary apply additional sealant around the joint.
- 4) Horizontal venting shall have a slope not less than ¼" (6.4mm) every 12 inches (305mm) downward away from the boiler to prevent collection of condensate throughout the assembly.
- 5) Allow the sealant to cure for 24 hours before operating the appliance.

C. For Flex-L StaR-34 stainless steel vent pipe use a high temperature red silicone sealant rated for 500°F. Before applying silicone, the outside of the male end and inside of the female end of the pipe must be cleaned using a cleaner, such as methyl ethyl ketone (MEK) or naphtha. For 3" vent pipe runs, begin with the male end of the vent pipe over the boiler's induced draft blower outlet. For 4" vent pipe runs begin with a StaR-34 3" to 4" increaser fitting (#SR10304) over the boiler's induced draft blower outlet. For both 3" and 4" vent pipe runs, apply a bead of silicone sealant around the blower outlet and around the inside of the male end of vent pipe going over the blower's outlet. When using the Tjernlund VH-1 vent hood, the female end (flared end) of the vent pipe will be connected to the termination hood. Apply high temperature silicone in an even ¼" bead approximately ¼" from the end of the vent hood's connecting vent pipe. Also, run a similar size bead of silicone sealant down the seam weld of the vent pipe. Then push the female end over the vent hood's connecting vent pipe. Now fill in the channel inlet with silicone sealant. Do not try to insert the joiner band, instead fasten the vent pipe to the vent hood's pipe with a steel gear clamp.

- 1) Apply the high temperature silicone around the male end of the pipe in an even ¼" bead. Silicone bead should be approximately ¼" from the end of the male end. Also, run a similar size bead of silicone sealant down the seam weld at the end of each joint.
- 2) The seams on the vent pipe should be aligned and oriented upward in all horizontal vent pipe runs.
- 3) Insert the male end of one into the female end of the other. Push the pipe together so the female end rests up against the stop bead of the male end.
- 4) Insert a StaR-Joiner Band into the inlet of the beaded channel. Feed the Joiner Band in so it makes its way around the pipe, back to the channel inlet and it overlaps itself by about ½".
- 5) Cut the excess Joiner Band so it lays flat in the beaded channel. Fill the inlet of the beaded channel with high temperature silicone. Smooth out the silicone over the channel inlet and the silicone between the female end and the stop bead of the male end.
- 6) Horizontal venting shall have a slope not less than ¼" (6.4mm) every 12 inches (305mm) downward away from the boiler to prevent collection of condensate throughout the assembly.
- 7) Allow the sealant to cure for 24 hours before operating the appliance.

D. For ProTech Systems FasNSeal stainless steel vent pipe no cleaning fluid is required. For 3" vent pipe runs on 2, 3, 4 and 5 section boilers begin by locating the FasNSeal Ametek Adapter (part #FSAMETEK) over the boiler's induced draft blower. Continue the vent pipe run with 3" FasNSeal vent pipe. For 6 and 7 section boilers begin

by locating the FasNSeal Ametek Adapter (part #FSAMETEK) over the boiler's induced draft blower. Then connect a FasNSeal 3" to 4" increaser (part #FS34I) to the 3" adapter outlet. Continue the vent pipe run with 4" FasNSeal vent pipe. Other than the Ametek Adapter and increaser fitting, **DO NOT** use 3" vent pipe on 6 or 7 section boilers. FasNSeal vent pipe is joined and sealed by the use of an internal sealing gasket and a locking band on the female end of each vent pipe. All components should be examined for possible shipping damage prior to installation. Align all vent pipe seams and orient upward in all horizontal applications. Adjustable vent lengths are available for 4" diameter vent piping. For 3" diameter vent piping, square cut male end at the desired length.

For 2, 3, 4 and 5 section boilers using the VH-1-3" vent hood, connect the FasNSeal Vent to the VH-1-3" vent hood using FasNSeal Adapter #FSC-DUN-3. This adapter has no internal sealing gasket. To attach the adapter to the vent hood, crimp the 3" vent hood pipe, apply a ¼" bead of high temperature red silicone sealant around the outside of the vent hood's crimped connecting pipe and a similar bead of high temperature silicone around the inside of the FasNSeal adapter. After pressing the two pipes together and tightening the locking band, finish creating a complete seal by filling the FasNSeal adapter's notched hole with high temperature silicone.

For 6 and 7 section boilers using the VH-1-4" vent hood, an adapter is not required. The 4" FasNSeal vent pipe connects directly to the VH-1-4" vent hood, and is joined and sealed by the internal gasket and locking band.

To join and seal the FasNSeal vent pipe:

- 1) Insert male end into female section.
- 2) Push the units together as far as possible.
- 3) Firmly tighten locking band with a nut driver.
- 4) **DO NOT** penetrate the FasNSeal vent pipe with fasteners.
- 5) Horizontal venting shall have a slope of not less than ¼" (6.4mm)

every 12 inches (305mm) downward away from the boiler to prevent the collection of condensate throughout the assembly.

9. Support Spacing:

Do not restrict thermal expansion movement of the vent. The vent pipe must expand and contract freely with temperature change. Each run of vent piping shall be supported as follows:

- a) Z-Flex stainless steel vent piping requires a loose fitting metal strap or similar support at each joint at a maximum of 4 feet between supports.
- b) Heat-Fab stainless steel vent piping requires a support for every 6 feet of horizontal piping run. The support must be secured using at least #10 fasteners to a solid material (solid masonry or woodframing or blocking.) Do not fasten to drywall sheathing using hollow wall anchors. Each support will be 1½ inch lower than the previous support when spaced 6 feet apart.
- c) Flex-L stainless steel vent piping requires a loose fitting metal strap or similar support at each joint at a maximum of 4 feet between supports.
- d) ProTech stainless steel vent piping requires one loose fitting FasNSeal support strap (#FSSH) for every 6' of horizontal vent.

10. If the horizontal vent must go through a crawl space or other unheated space, the cool temperatures will likely cause the flue gases to continuously condense inside the vent pipe. **Do not** insulate the vent pipe. It must be visible for monthly inspection. Insure that the vent pipe is properly pitched away from the boiler, with no low spots, so that condensate in the vent will drain away from the boiler. An insulated enclosure or chase, with access for inspection and servicing of the vent, may be required to prevent freezing of liquid condensate. Consult the vent pipe manufacturer's instructions for specific guidelines.

11. At the beginning of each heating season and monthly during the heating season, check all vent pipes and the vent terminal to make sure there are no obstructions. Periodically clean the screen in the vent terminal.

Optional Horizontal Venting Instructions

Horizontal venting with a power venter is an alternate method of sidewall venting. This boiler is AGA and CGA listed for sidewall venting with standard single wall galvanized or Type B vent pipe when using the following power venter kits, which were specifically sized for these boilers:

Number of Boiler Sections	Field Controls Power Venter Kit
2, 3, 4, 5	SWG-4D
6, 7	SWG-5D

Some possible reasons for using a power venter for sidewall venting:

1. May be preferred by local codes.
2. Need a vent piping run beyond 30' (but not more than 50').
3. The boiler installation site experiences gusting or high winds. A power venter can help prevent the boiler from short cycling due to gusting or high winds by providing vent exhaust pressures greater than the boiler's induced draft blower alone.
4. When installers or homeowners prefer a negative pressure vent system instead of a positive pressure vent system.
5. May be more cost effective than stainless steel venting, particularly at longer vent lengths.

The Field Controls power vent kit includes either a SWG-II-4HD or SWG-II-5 power venter, a MG-1 4" barometric draft controller, and the CK-43D controls kit.

Confirm that installing a power venter is an option allowed by local codes. Follow the specific power venter installation instructions issued with the power venter kits. Although the power venter is equipped with its own fan, **the fan on the boiler remains in place and is unaltered when a power venter is used.** When sidewall venting, flue gases must be vented to a point in relation to the prevailing wind so that they may freely disperse without being blown back at the building causing discoloration, or into the building through doors or windows causing odors. Also, under certain conditions flue gases will condense, forming moisture. In such cases, steps should be taken to prevent building materials at the vent terminal from being damaged by the exhausted flue gas.

When installing single wall galvanized vent pipe for power venting follow the specific power venter installation instructions for layout, location of the barometric draft control and termination connections. When joining and sealing the single wall galvanized or Type B vent piping, use RTV silicone sealant with a minimum temperature rating of 400°F. For 3" vent pipe runs begin with the female end of the vent pipe over the boiler's induced draft blower outlet. For 4" vent pipe runs begin with the galvanized 3" to 4" increaser fitting (included in the boiler's parts bag) over the induced draft blower outlet. Then follow by placing the female end of the 4" vent pipe over the increaser fitting. When joining pieces of single wall galvanized vent pipe, a substantial bead of silicone should be used at the joint to insure a leakproof connection.

Gas Supply Piping

CHECK GAS SUPPLY

The gas pipe to your boiler must be the correct size for the length of the run and for the total BTU per hour of all gas utilization equipment connected to it. See Figure 10 for the proper size. Be sure your gas line complies with local codes and gas company requirements.

The boiler and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 psig (3.5 kPa).

The boiler must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 psig (3.5 kPa).

CONNECTING THE GAS PIPING

Refer to Figure 11 for the general layout at the boiler. It shows the basic fittings you will need. The gas line enters the boiler from the right side.

The following rules apply:

1. Use only those piping materials and joining methods listed as acceptable by the authority having jurisdiction, or in the absence of such requirements, by the National Fuel Gas Code ANSI Z223.1 latest revision.
2. All pipe compound materials must be resistant to liquefied petroleum gas.
3. Install ground joint union in gas supply line between shutoff valve and boiler controls.
4. Install a sediment trap upstream of gas controls.
5. Use two pipe wrenches when making the connection to the gas valve to keep it from turning.
6. Install manual shut-off valve in vertical pipe approximately 5 feet above floor.
7. Tighten all joints securely.
8. Propane gas connections should be made only by a licensed propane installer.
9. Two-stage regulation should be used by the propane installer.
10. Propane gas piping should be checked out by the propane installer.

CHECKING THE GAS PIPING

Upon completion of piping, check right away for gas leaks. Open the manual shut-off valve. Test for leaks by applying soap suds (or a liquid detergent) to each joint. Bubbles forming indicate a leak. **CORRECT EVEN THE SMALLEST LEAK AT ONCE!**

WARNING!

Never use a match or open flame to test for leaks

FIG. 10 GAS PIPE SIZES

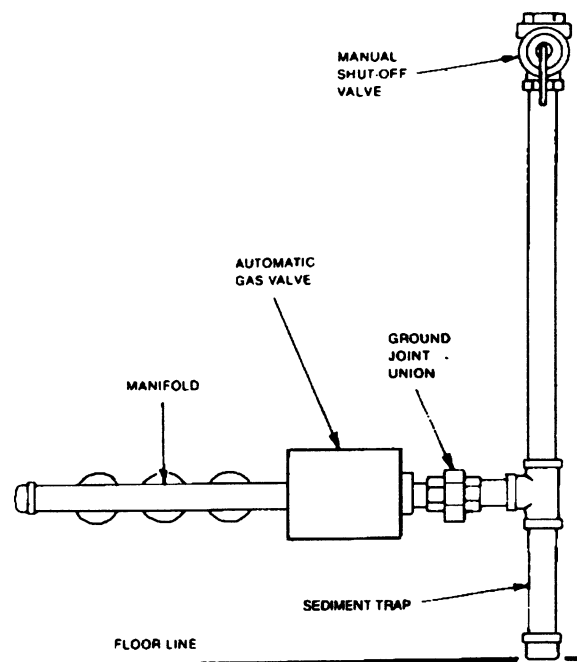
NATURAL GAS				
Length of Pipe - Ft.	Pipe Capacity - BTU Per Hour Input Including Fittings			
	1/2"	3/4"	1"	1-1/4"
20'	92,000	190,000	350,000	625,000
40'	63,000	130,000	245,000	445,000
60'	50,000	105,000	195,000	365,000

PROPANE GAS				
Length of Pipe - Ft.	Pipe Capacity - BTU Per Hour Input Including Fittings			
	Copper Tubing*		Iron Pipe	
	5/8"	3/4"	1/2"	3/4"
20'	131,000	216,000	189,000	393,000
40'	90,000	145,000	129,000	267,000
60'	72,000	121,000	103,000	217,000

* Outside diameter

The length of pipe or tubing should be measured from the gas meter or propane second stage regulator.

FIG. 11 GAS PIPING AT BOILER



Electrical Wiring

All electrical work must conform to local codes as well as the National Electrical Code, ANSI / NFPA No. 70, latest revision.

ELECTRIC POWER SUPPLY

Run a separate 120 volt circuit from a separate overcurrent protective device in the electrical service entrance panel. This should be a 15 ampere circuit. Locate a shut-off switch at the boiler. It must be turned off during any maintenance. Connect 120 volt power source to aquastat terminals L1 (HOT) and L2.

The boiler, when installed, must be electrically grounded in accordance with the requirements of the authority having jurisdiction or, in the absence of such requirements, with the National Electrical Code, ANSI / NFPA No. 70 latest revision. Run a 14 gauge or heavier copper wire from the boiler to a grounded connection in the service panel or a properly driven and electrically grounded rod.

WARNING!

Turn off electric power at fuse box before making any line voltage connections. Follow local electrical codes.

INSTALL YOUR THERMOSTAT

The thermostat location has an important effect on the operation of your boiler system. BE SURE TO FOLLOW THE INSTRUCTIONS INCLUDED WITH YOUR THERMOSTAT.

Locate the thermostat about five feet above the floor on an inside wall. It may be mounted directly on the wall or on a vertically mounted outlet box. It should be sensing average room temperature, so avoid the following:

DEAD SPOTS:

- Behind doors
- Corners and alcoves

HOT SPOTS:

- Concealed pipes
- Fireplace
- TV sets
- Radios
- Lamps
- Direct sunlight
- Kitchens

COLD SPOTS:

- Concealed pipes or ducts
- Stairwells - drafts
- Doors - drafts Unheated room or other side of wall

Set heat anticipator at .2 amps. 24 volt thermostat connects to aquastat terminals T and T.

Sequence of Operation

1. Thermostat calls for heat, powering the 1K relay coil and closing contacts 1K1 and 1K2.

2. Circulator pump is powered through terminals C1 and C2.

3. Induced draft blower and AT140C transformer primary are powered through terminals B1 and B2.

4. When blower gets up to speed and blower suction pressure reaches pressure switch setpoint, pressure switch contacts close sending 24 volts to S600 intermittent pilot control from AT140C transformer secondary.

5. Pilot gas valve opens and spark initiates to light pilot burner.

6. When pilot flame is proven, spark drops out.

7. Main gas valve opens and pilot burner ignites main burners.

8. If boiler water temperature reaches high limit setpoint, high limit contacts B-R open, cutting power to blower and S8600 intermittent pilot control.

Burners extinguish and blower stops. Circulator pump continues to run as long as the thermostat continues to call for heat. When boiler water temperature drops past the high limit setpoint and through the differential, high limit contacts B-R close, repeating steps 3 - 7.

9. If venting system becomes blocked, blower suction pressure will drop below the pressure switch setpoint, opening the pressure switch contacts and cutting power to the S8600 intermittent pilot control. Burners will extinguish, but blower will remain powered as long as the thermostat continues to call for heat. If venting system clears, steps 4 - 7 will repeat.

10. Thermostat is satisfied, ending call for heat. Relay coil 1K is de-energized, opening 1K1 and 1K2 contacts. Burners extinguish. Blower and circulator pump stop.

Electrical Wiring Diagrams



Equipment and Accessories - What They Do

RELIEF VALVE

You must have a relief valve on your boiler. Water expands as it is heated. If there is no place for the water to expand into, water pressure will build up inside the boiler and system. Should this happen, the Relief Valve will automatically open at a pre-determined pressure. This will relieve the strain on the boiler and system. Run a pipe from the relief valve (pipe must be same size as outlet and the open end must not be threaded) to an open drain, tub or sink, or other suitable drainage point not subject to freezing. Failure to do so may cause water damage or injury should relief valve release.

EXPANSION TANK (Optional)

In a properly assembled system, the expanding water flows into an expansion tank. This tank should be of the correct size.

The tank is filled with air. As the water expands it compresses the air in the tank to form an air pressure cushion. This "spring like" cushion serves to maintain correct operating water pressure regardless of water temperature. This assures a "full measure" of water, even in the highest radiation unit in the system. It also prevents blowing off of the relief valve.

The air in the tank in the beginning (with system filled with cold water) is sufficient for proper operation. The tank also serves as a trap for excess air in the system. The air would cause gurgling in the pipes and inefficient circulation in the radiators if left in the system.

It is possible for a tank to become "water logged" (filled with water). It can also become overfilled with air. This can happen after filling the system with new water. Fittings provided on the tank and in the line to the tank are for bleeding off excess water or air.

When installing this tank, it is important: 1) That the tank be higher than the boiler top. 2) That the pipe to the tank continuously rises up to the tank (so that air can bubble up to it).

DIAPHRAGM TYPE EXPANSION TANK (Optional)

The Diaphragm Type Expansion Tank (EX-TROL) takes the place of the conventional expansion tank. Carefully read the instructions packed with your EX-TROL Tank Assembly.

The EX-TROL Tank comes to you with a 10 - 12 pounds per square inch charge. This is the same as the pressure produced in the system by the automatic fill valve. When the system is first filled, the EX-TROL Tank will contain little or no water.

As the water is heated its pressure increases. It expands into the EX-TROL Tank, compressing the air in the tank. This compressed air cushion permits the water in the system to expand as the temperature changes.

AIR ELIMINATING FITTING (AIR PURGER) (Optional)

An Air Purger is used to remove excess air from the system. It is installed in the supply line. It will help eliminate air from the water before it reaches the radiators and bleed off this system.

MAIN AIR VENT for DOWN FLOW SYSTEMS or DIAPHRAGM TYPE EXPANSION TANK (Optional)

Before a system is filled with water, there is air in the pipes and radiation units. Some of it will be trapped as the system is filled. It is possible to eliminate most of this air through the air vents on the radiation units. A main air vent will speed and simplify this.

It should be installed on the highest point in the supply main when all radiation is below top of boiler.

AUTOMATIC FILL VALVE (Optional)

For safe, efficient operation, a hot water system must be filled with water. Adding new water, when needed can be done manually (by use of a hand valve in the water supply line). This requires regular attention to the system's needs. An Automatic Fill Valve accomplishes this without attention. It is installed in the Supply Line on hot water boilers only. The valve operates through water pressure differentials. It does not require an electrical connection.

DRAIN VALVE

This manual valve provides a means of draining all water from the boiler and system. It is often installed in the 3/4" tapping at the bottom of the left boiler section. Or it can be installed in a tee where the return line enters the boiler.

WATER TEMPERATURE CONTROL

The water temperature limit control in the relay is adjustable and may be set as necessary. It may be set as low as 140° F, or as high as 240° F. This depends on the type and amount of radiation involved and weather conditions.

CIRCULATING PUMP

Every Forced Hot-Water System requires a Circulating Pump. A separate pump or zone valve is required for each Zone, if you have a two or more zone system. This pump must have the capacity to provide the circulation required by your system. The pump is connected into the Return Main just ahead of the boiler. It is also wired to the electrical system.

BLOWER (DRAFT INDUCER)

The blower provides a means for pulling air through the boiler and exhausting the flue gasses into the vent system. The blower shuts off when the burners are not firing. This keeps heat in the house rather than having it go up the chimney.

PRESSURE SWITCH

The air pressure switch works on a negative pressure. When the blower comes on the air pressure switch operates the intermittent pilot and gas valve. The air pressure switch is factory set and will only work when the blower operates properly. It will not allow the boiler to come on if the blower does not generate enough pressure or if the venting system is blocked.

FACTORY PRESSURE SWITCH SETPOINT:

-0.4" w.c. for 2 - 5 section boilers.

-0.5" w.c. for 6 - 7 section boilers.

ROLLOUT SWITCH

(FLAME ROLLOUT SAFETY SHUTOFF)

The rollout switch is a temperature - sensitive fuse link device. It is located on the boiler base just outside the fire box. In the event of heat exchange flueway blockage causing flame to roll out of the fire box, the fuse will blow, shutting down the flow of gas to the main burners. The fuse does not change in appearance when blown.

If the rollout switch blows, it must be replaced with an exact replacement. Check heat exchanger flueways for blockage when restoring system to operating condition. Do not operate system without a rollout switch.

Starting Your Boiler

HOW A HOT-WATER SYSTEM OPERATES

Your entire heating system (boiler, piping and radiation units) is filled with water. As the water in the boiler is heated, it is pumped from the top of the boiler through the supply main to the radiation units. The cooler water in them flows back through the return main to the boiler. This provides positive and rapid response to the thermostat.

FILLING SYSTEM WITH WATER

Close the Air Vents on all radiation units. Make sure the boiler and expansion tank drain cocks are closed. The air bleed screw on the tank drain fitting should be closed. Open the valve in the line from the boiler to the expansion tank (see page 15 for additional information). Open the water inlet to the boiler and leave it open. Start with the **lowest** radiation unit. Open the air vent on this unit. When all the air has escaped and water starts to flow from the vent, close it. Go to the next radiation unit, and repeat this process. Repeat until you have covered every radiation unit in the system (ending up at the highest unit in the system). If your units have automatic vents, this manual venting is unnecessary but it will speed up the proper filling of your system.

If your system is a closed expansion tank system, you may have an Automatic Fill Valve. You may leave it open to refill the system automatically as needed. Check the temperature-pressure gauge. Note the position of the hand indicating pressure. This should be between 10 and 15 lbs. Any lowering of this movable hand below 10 lbs. will indicate loss of water due to leakage. The automatic fill valve should compensate for this. Instructions are packaged with the valve.

WARNING-Never run water into a hot empty boiler.

FOR YOUR SAFETY READ THIS BEFORE OPERATING

1. This appliance is equipped with an ignition device which automatically lights the burner. Do not attempt to light the burner by hand.

WARNING: If you do not follow these instructions exactly, fire or explosion may result with property damage, personal injury, or loss of life.

2. BEFORE OPERATING, smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WARNING: IF YOU SMELL GAS:

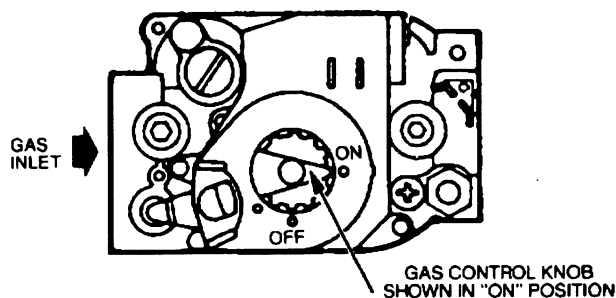
- Do not attempt to operate any appliance, do not touch any electrical switch, do not use the phone.
- Leave the building immediately and call your gas supplier.
- If your gas supplier cannot be reached, call the fire department.

3. **WARNING:** When turning or depressing the gas control knob, use only your hand to push down or turn the knob. Never use tools. If the knob will not operate by hand, the control must be replaced by a qualified technician. Force or attempted repair may result in a fire or explosion.

4. **WARNING:** If any part of this appliance has been under water, do not operate. Immediately call a qualified service technician to inspect the appliance and to replace any part of the gas control system which has been under water.

OPERATING INSTRUCTIONS

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance.
3. This appliance is equipped with an ignition device which automatically lights the burner. Do not attempt to light the burner by hand.
4. Remove burner access panel.
5. Depress gas control knob slightly and turn clockwise ➡ to "OFF" position.



NOTE: Knob cannot be turned to "OFF" unless knob is depressed slightly. Do not force.

6. **WARNING:** Wait five (5) minutes to allow any gas in the combustion chamber to vent. If you then smell gas in the appliance area or near the floor, do not touch any electrical switch, do not use the phone. Leave the building immediately and call your gas supplier. If your gas supplier cannot be reached, call the fire department. Failure to do so may result in a fire or explosion. If you don't smell gas, go to the next step.

7. Turn gas control knob counterclockwise ↶ to "ON".
8. Turn on all electric power to the appliance.
9. Set thermostat to desired setting.
10. After visually inspecting the flame, replace the lower front panel.
11. **WARNING:** If the appliance will not operate after several tries, turn the gas control knob to "OFF" and call your service technician or gas supplier.

TO TURN OFF APPLIANCE

1. Set the thermostat to lowest setting
2. Turn off all electric power to the appliance if servicing is to be performed
3. Depress gas control knob slightly and turn counterclockwise ↶ to "OFF" position. Do not force.

Checking and Adjusting

GAS VALVE SAFETY SHUTDOWN TEST

With main burners firing, disconnect the ignition cable from the intermittent pilot control box. The gas valve should shut off the main burners. **TURN OFF ELECTRIC POWER** to boiler before reconnecting ignition cable, to prevent electric shock.

ADJUST PILOT BURNER

1. Remove screw cover over pilot adjusting screw.
2. Insert small screwdriver and adjust flame as needed (Figure 14). Turn screw counter-clockwise to increase flame, clockwise to decrease (Figure 15).
3. Replace screw cover over pilot adjusting screw.

MAIN BURNER ADJUSTMENT

The stainless steel main burners do not require primary air adjustment.

ADJUST LIMIT CONTROLS

Instructions for each control are included with the controls.

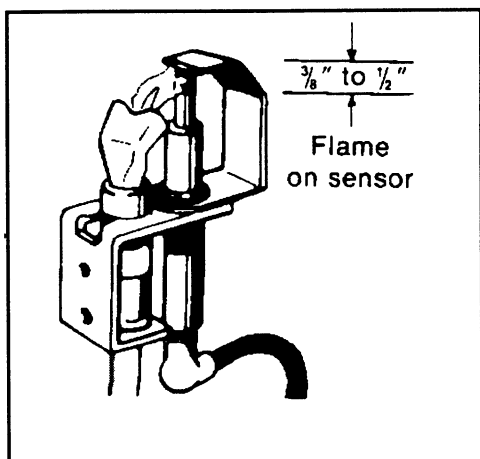
RECOMMENDED BOILER WATER TEMPERATURES

Type of heating unit	limit control setting
Standing Radiators.....	180° F
Baseboard and Convactor Radiators.....	200° F

These settings can be changed after you have had some idea how the system works. Example: If your system does not give quite enough heat in very cold weather, you can raise the limit setting to 220° F.

ADJUST THERMOSTAT HEAT ANTICIPATOR
INSTRUCTIONS FOR THE FINAL ADJUSTMENT OF THE THERMOSTAT ARE PACKAGED WITH THE THERMOSTAT.

FIGURE 14 PILOT FLAME ADJUSTMENT



Set Heat Anticipator at .2.

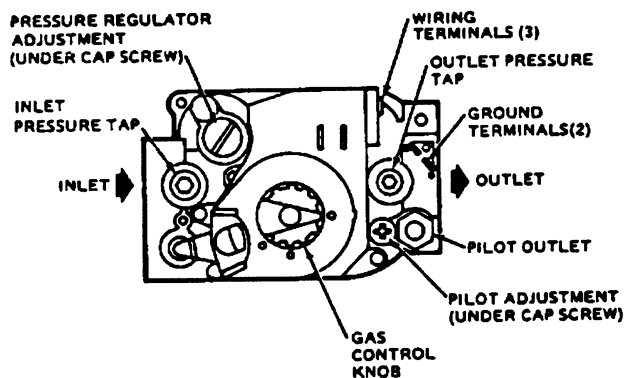
Check thermostat operation. When set above temperature indicated on the thermostat, boiler burners should ignite. Make certain the thermostat turns off the boiler when room temperature reaches the selected setting and starts the boiler operating when room temperature falls a few degrees. After setting limit control to desired setting, check to see if it shuts off the gas supply to the burners. Turn your thermostat up to call for heat and let your boiler run until the temperature of the water reaches the limit setting. The gas valve should shut off and the circulator keep running until the thermostat is satisfied, or the water cools enough to restart the burners through the limit control.

To check operation of the contacts in the pressure switch, disconnect the rubber tubing (located between the blower and the pressure switch), while the boiler is operating. The burners should extinguish and the blower should keep running. When the tubing is reconnected to the pressure switch, the ignition sequence should begin, resulting in ignition of the main burners.

Finally, set the thermostat to the desired temperature. Special conditions in your home and the location of the thermostat will govern this setting.

Safe lighting and other performance criteria were met with the gas manifold and control assembly provided on the boiler when the boiler underwent tests specified in ANSI Z21.13 latest revision.

FIGURE 15 AUTOMATIC GAS VALVE



IMPORTANT

INSTALLER:

WHEN INSTALLING THIS APPLIANCE, IT MUST BE CHECKED, AND ADJUSTED IF NECESSARY, FOR MAXIMUM BURNER PERFORMANCE PER THE INSTALLATION INSTRUCTIONS.

THIS BOILER WAS PROPERLY ADJUSTED AT THE FACTORY FOR AVERAGE INSTALLATIONS. THERE IS A WIDE VARIETY OF CONDITIONS CAUSED BY ALTITUDE AND GAS/OIL MIXTURES CONTROLLED BY UTILITY COMPANIES, WHICH WILL VARY AND AFFECT THE FLAME AND UNIT PERFORMANCE. THEREFORE, IT IS NECESSARY TO MAKE ADJUSTMENTS AT TIME OF INSTALLATION.

PERFORMANCE CHECKS AND ADJUSTMENTS ARE THE RESPONSIBILITY OF THE INSTALLER.

Maintaining your Boiler

BURNERS

A visual check of the pilot and main burner flames should be made at least once each year, preferably at the beginning of the heating season. See page 17 and Figures 14, 15 and 16.

RELIEF VALVE

This valve should operate automatically if the system pressure exceeds the pressure rating (usually 30 psi) of the relief valve. Should it ever fail to open under this condition, shut down your system. Drain the system until the system pressure is reduced below the relief valve pressure rating. If valve discharge occurs, or if valve fails to open as described above, contact an authorized contractor or qualified service technician to replace the relief valve and inspect the heating system to determine the cause, as this may indicate an equipment malfunction.

This valve should be tested every month during periods of boiler operation, and at the beginning and end of any extended non-service period. Prior to testing make certain discharge pipe is properly connected to valve outlet and arranged so as to contain and safely dispose of boiler discharge. Test at normal system operating pressure. Hold the trip lever fully open for at least five seconds in order to flush free any sediment that may lodge on the valve seat. Then permit the valve to snap shut.

EXPANSION TANK

As previously noted, the tank may become waterlogged, or may receive an excess of air. Frequent automatic opening of the relief valve indicates waterlogging. A high boiler temperature accompanied by unusually low radiation unit temperature (and "knocking") indicates excess air in tank.

To correct either condition, close valve between boiler and the tank. Drain the tank until it is empty. Check all the tank plugs and fittings. Tighten as necessary. Open the valve between the boiler and tank. Water will rise to the normal height in the tank if you have an automatic fill valve. (otherwise, manually refill the system).

BOILER FLUE PASSAGES

Under normal operating conditions, with the burners properly adjusted, it should not be necessary to clean the boiler flue gas passages.

However, to assure trouble-free operation, we recommend that you have the flue passages, burner adjustment and operation of the controls checked **once each year** by a competent service technician.

Before the start of each season (or whenever system has been shut down for some time) recheck the whole system for leaks...and recheck the boiler and vent pipe for leaks. Replace or patch any boiler seals that are faulty.

VENT PIPE

The venting of this unit is very important and the piping should be checked at least once a month. If the vent piping shows any sign of leaking, replace it immediately.

WATER SYSTEM

If system is to remain out of service during freezing weather, always **drain it** completely (water left in to freeze will crack the pipes and / or boiler).

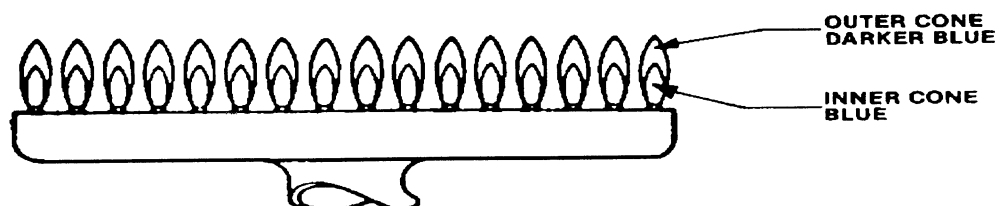
CLEANING YOUR BOILER AND BURNERS

Flue passages between sections should be examined yearly and cleaned if necessary. To clean, remove burners, pilot and vent pipe. Remove top and front jacket panels. Split the silicone seal on the flue collector and the clean out plates with a razor knife. Remove flue collector. Remove clean out plates by tapping upwards on the bottom of the plate with a hammer. Remove loose silicone sealant from sections, flue collector and clean out plates. Clean passageways between sections with a flexible handle wire brush and a straightened out wire coat hanger. Remove dirt from the bottom of the boiler and from between sections by vacuuming. Make sure all flame ports in burners are open and clear. Shake out or blow out all loose dirt in burners. Reassemble all parts. Seal flue collector and clean out plates to sections with silicone sealant (400° F RTV silicone sealant or equivalent). Reseal seams between adjacent sections where necessary. All joints **must** be airtight. Be sure to check tightness of pilot connections and condition of burner flames after reassembly (see Figure 16). Be sure vent pipe connections to chimney are secure and no obstructions are present.

BLOWER

The blower motor features a permanently lubricated ball bearing construction. Lubrication is not required.

FIG. 16



THE MAIN BURNER FLAME SHOULD FORM A SHARP BLUE CONE WITH NO YELLOW .

Service Hints

You may avoid inconvenience and service calls by checking these points before you call for service.

FOR YOUR SAFETY

WHAT TO DO IF YOU SMELL GAS

1. Do not try to light any appliance.
2. Do not touch any electric switch, do not use the phone.
3. Leave the building immediately, then call your gas supplier.
4. If you cannot reach the gas supplier, call the fire department.

IF YOUR SYSTEM IS NOT HEATING OR NOT GIVING ENOUGH HEAT

POSSIBLE CAUSE

WHAT TO DO

Thermostat is not set correctly

Reset thermostat above room temperature.

Burner is not operating properly

Check flame. If it is yellow, the burner is not getting enough air. Or, if flame is blue and noisy and seems to lift off the burner, the burner is getting too much air. Contact your service technician.

No electric power to boiler

Check overcurrent protection. Check to be sure electric power supply circuit is "ON".

Controls out of adjustment

Reset according to instructions.

Radiators not heating

Open radiator vents to vent excess air. Check flow control valve (if used). It may be in closed position.

Circulating pump not running

Check overcurrent protection. Check relay operation.

Poor electrical contact

Check all control terminals and wire joints.

Chimney flue is blocked

Pressure switch will not close and pilot spark will not operate to start pilot. Have your service technician check and correct, if necessary.

Rollout switch blown

Have your service technician check heat exchanger for blockage. Replace rollout switch with exact replacement.

IF BURNER IS NOISY

POSSIBLE CAUSE

WHAT TO DO

Gas input amount is incorrect

Contact your service technician.

RELIEF VALVE LEAKING

POSSIBLE CAUSE

WHAT TO DO

Dirt on seat

Open valve manually. Allow water to run and clear valve seat.

Water logged expansion tank

Drain tank, see instructions.

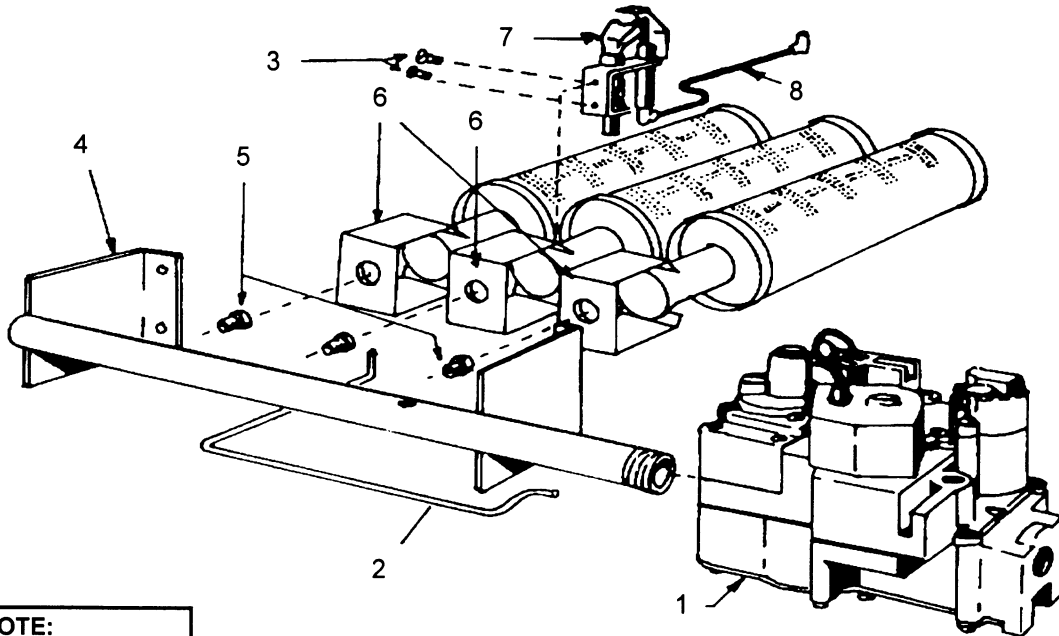
HAVE YOUR SERVICE TECHNICIAN CHECK ANY PROBLEM YOU ARE UNABLE TO CORRECT.

Repair Parts

IMPORTANT - READ THESE INSTRUCTIONS BEFORE ORDERING

All parts listed in the following Parts List may be ordered through your nearest supplier. When ordering parts, first obtain the Model Number from the data plate on your boiler, then determine the Part Number (not the key No.) and the Description of each part from the following illustrations and list. Be sure to give us all this information: The Part Number, The Part Description and The Boiler Model Number.

FOR USE WITH NATURAL GAS ONLY



NOTE:
ACTUAL GAS VALVE MAY
LOOK DIFFERENT THAN
GAS VALVE SHOWN.

NATURAL GAS BURNERS & MANIFOLD PARTS

THIS IS A REPAIR PART LIST - NOT A PACKING LIST

KEY NO.	DESCRIPTION	PART NUMBERS FOR					
		2 Section	3 Section	4 Section	5 Section	6 Section	7 Section
1	24 Volt Gas Valve, Natural Gas	240060	240060	240060	240060	240060	240060
2	Pilot Tube	321001	321001	321002	321002	321002	321002
3	#10-32 x 3/16" Slotted Hex Head Screw (2 Req'd.)	482002	482002	482002	482002	482002	482002
4	Gas Manifold	160425	160426	160427	160428	160351	160352
5	Orifice - Natural Gas*	101000	101000	101000	101000	101000	101000
6	Main Burner*	160068	160068	160068	160068	160068	160068
‡	Pilot Burner	160069	160069	160069	160069	160069	160069
7	Pilot Burner with Orifice, Natural Gas	240008	240008	240008	240008	240008	240008
8	Ignition Cable	240077	240077	240077	240077	240077	240077
‡	Rollout Shield	160970	160971	160972	160973	160974	160975

‡ Not Illustrated

Quantity is 1 unless otherwise noted.

* Requires 1 less than the number of sections.

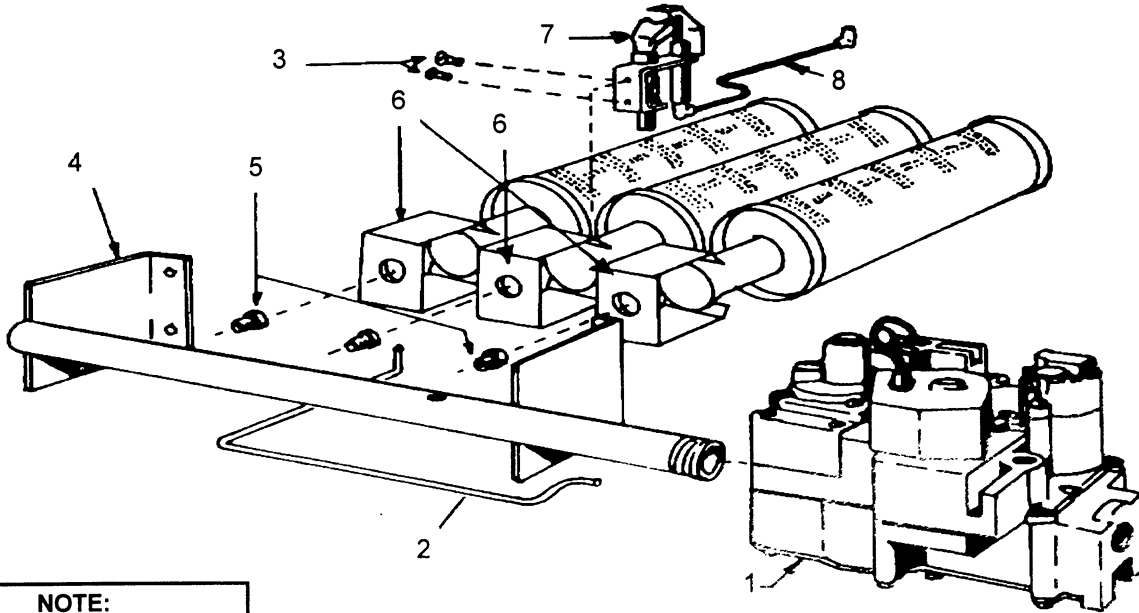
Repair Parts

IMPORTANT - READ THESE INSTRUCTIONS BEFORE ORDERING

All parts listed in the following Parts List may be ordered through your nearest supplier.

When ordering parts, first obtain the Model Number from the data plate on your boiler, then determine the Part Number (not the key No.) and the Description of each part from the following illustrations and list. Be sure to give us all this information: The Part Number, The Part Description and The Boiler Model Number.

FOR USE WITH PROPANE GAS ONLY



NOTE:
ACTUAL GAS VALVE MAY
LOOK DIFFERENT THAN
GAS VALVE SHOWN.

PROPANE GAS BURNERS & MANIFOLD PARTS

THIS IS A REPAIR PART LIST - NOT A PACKING LIST

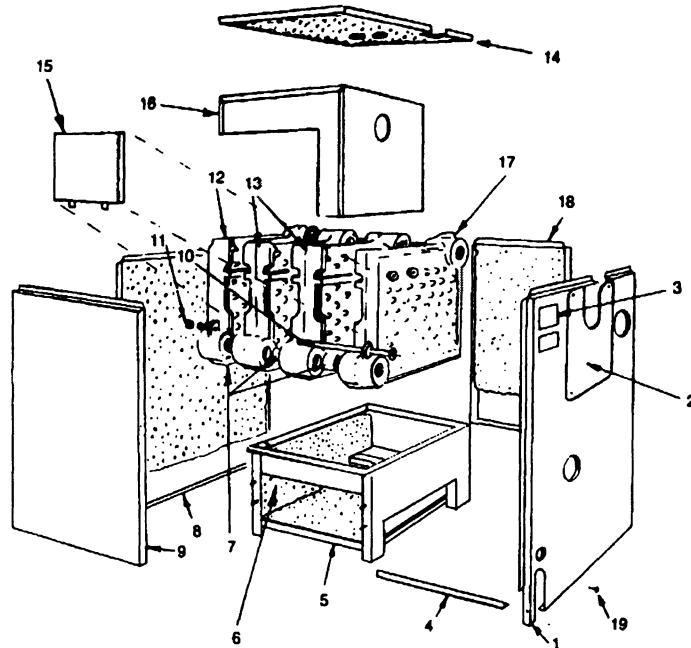
KEY NO.	DESCRIPTION	PART NUMBERS FOR					
		2 Section	3 Section	4 Section	5 Section	6 Section	7 Section
1	24 Volt Gas Valve, Propane Gas	240060	240060	240060	240060	240060	240060
2	Pilot Tube	321001	321001	321002	321002	321002	321002
3	#10-32 x 3/16" Slotted Hex Head Screw (2 Req'd.)	482002	482002	482002	482002	482002	482002
4	Gas Manifold	160425	160426	160427	160428	160351	160352
5	Orifice - Propane Gas *	101001	101001	101001	101001	101001	101001
6	Main Burner *	160068	160068	160068	160068	160068	60068
‡	Pilot Bracket	160069	160069	160069	160069	160069	160069
7	Pilot Burner with Orifice, Propane Gas	240050	240050	240050	240050	240050	240050
8	Ignition Cable	240077	240077	240077	240077	240077	240077
‡	Rollout Shield	160970	160971	160972	160973	160974	160975

‡ Not Illustrated

Quantity is 1 unless otherwise noted.

* Requires 1 less than the number of sections.

Repair Parts

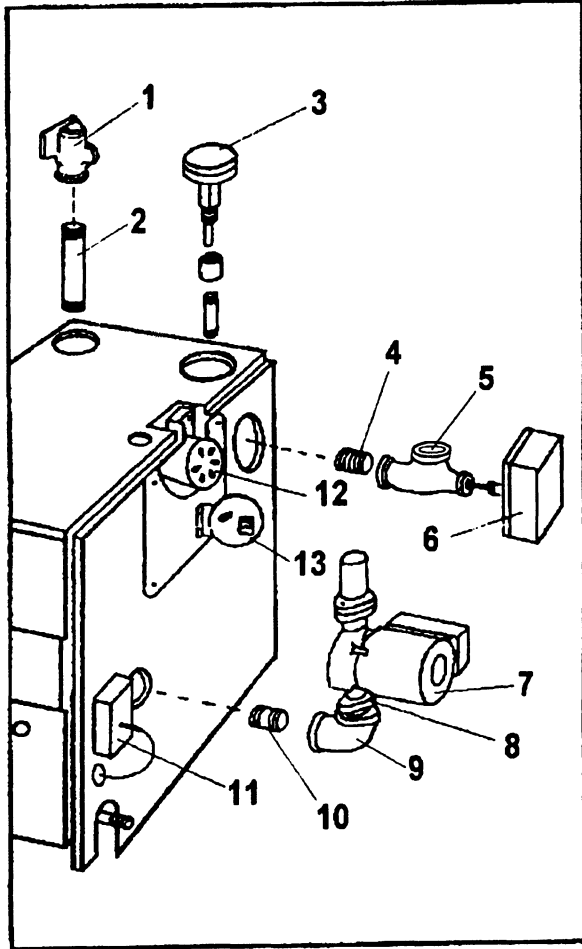


KEY NO.	DESCRIPTION	PART NUMBERS FOR					
		2 Section	3 Section	4 Section	5 Section	6 Section	7 Section
1	Jacket Right Side Panel	160446	160446	160446	160446	160446	160446
2	Blower Cover Plate	160473	160473	160473	160473	160473	160473
3	Rating Plate	160501	160501	160501	160501	160501	160501
4	Jacket Tie Bar	160076	160077	160078	160079	160080	160081
5	Boiler Base	160408	160409	160410	160411	160355	160356
6	Insulation, Base Side (2 Req'd.)	160424	160424	160424	160424	160424	160424
6	Insulation, Base Front	160489	160490	160491	160492	160493	160494
6	Insulation, Base Rear	160495	160496	160497	160498	160499	160500
7	Nipple, Boiler	160048	160048	160048	160048	160048	160048
8	Jacket, Left Side Panel	160445	160445	160445	160445	160445	160445
9	Jacket, Front Panel	160452	160453	160454	160455	160480	160481
10	1/4" Tie Rod (2 Req'd.)	160052	160053	160054	160055	160071	160072
11	Nut & Washer	—	—	—	—	—	—
12	Section, Left End	160405	160405	160405	160405	160405	160405
13	Section, Intermediate	160407	160407	160407	160407	160407	160407
14	Jacket Top Panel	160441	160442	160443	160444	160485	160486
15	Cleanout Plate(s)	160437	160438	160439	160440	160487	160488
16	Flue Collector	160412	160413	160414	160415	160417	160418
17	Section, Right End	160406	160406	160406	160406	160406	160406
18	Jacket Back Panel	160448	160449	160450	160451	160482	160483
‡	Jacket, Complete	160420	160421	160422	160423	160390	160391
19	#10 x 1/2" Sheet Metal Screw	341006	341006	341006	341006	341006	341006
‡	Block Assembly (includes 7, 10, 12, 13 & 17)	160401	160402	160403	160404	160395	160396
‡	Combustible Floor Base	162015	162015	162015	162015	162016	162016

‡ Not Illustrated

Repair Parts

BOILER CONTROLS and PIPING



KEY NO.	DESCRIPTION	PART NO.
1	3/4" ASME Relief Valve	540005
2	3/4" x 5-1/2" Nipple	464043
3	Temperature / Pressure Gauge	160070
4	1-1/4" x 5-1/2" Nipple	464023
5	1-1/4" x 3/4" x 1-1/4" Tee	220001
6	L814A Comb Hi Limit & Relay Control	240019
7A	Grundfos Pump UP 15-42F	222001
7B	Taco Pump 007	480001
8	1-1/4" x 2-1/2" Nipple	464026
9	1-1/4" Ell	220025
10	1-1/4" x 6" Nipple	464024
11	Intermediate Pilot Control - Natural Gas	240070
11	Intermediate Pilot Control - Propane Gas	240072
12	Induced Draft Blower	160430
13	Pressure Switch 2, 3, 4 & 5 Section	484001
	Pressure Switch 6 & 7 Section	484002
‡	Rubber Tube (Blower to Pressure Switch)	160433
‡	Rollout Switch	160460
‡	1-1/4" x 3/4" Bushing	464034
‡	Grundfos Isolation Valve Set	222002
‡	Taco Isolation Valve Set	480004
‡	AT140C 24V Transformer	240026
‡	1/4" x Close Nipple	220011
‡	1/4" Coupling	220002
‡	3" x 4" Increaser Fitting	300000

‡ Not Illustrated

