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) Code IV Standards for cast iron boilers.
The Ratings marked "Net I=B=R Ratings" indicate the amount of equivalent direct cast iron 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. Specifications and dimensions are subject to change without notice.

These boilers may be installed on combustible flooring when placed on Special Base No. 42135.

This boiler must not be installed on carpeting.
Before You Start

Check to be sure you have the right size boiler before starting the installation. See rating and capacity table on 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 electrical supply. Also, the boiler must be connected to a suitable chimney and an adequate piping system. Finally, a thermostat (furnished), 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. CSD-1.

The following steps are all necessary for proper installation and safe operation of your boiler.

1. LOCATING THE BOILER
2. FRESH AIR FOR COMBUSTION
3. SYSTEM PIPING
4. CHIMNEY & VENT PIPE CONNECTION
5. GAS SUPPLY PIPING
6. ELECTRICAL WIRING
7. CHECKING & ADJUSTING

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 as nearly as possible 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.
2. Use a raised base if floor can become wet or damp.
3. The vent pipe connection should be as short as possible.
4. Maintain clearances for fire safety as well as servicing.
   See Fig. 2 for minimum clearances.
   Servicing clearances must take precedence over fire safety clearances.
   18" clearance must be maintained at a side where passage is required for access to another side for cleaning or servicing, inspection or replacement of any parts that normally may require such attention. Boilers must be installed at least 6" from combustible material on all sides. Allow at least 24" front and right side for servicing.
   The room must have a total cubic foot volume not less than 16 times that of the boiler.
5. FRESH AIR for combustion must be available at the front of the boiler. FRESH AIR for ventilation must be available to the front AND rear of the boiler.
6. The floor supporting the boiler must be non-combustible.
   If it is combustible, place the boiler on 2" concrete patio blocks. The blocks must be under the entire boiler to protect the floor.
7. Be sure installation is in accordance with the requirements of the local utility or authorities having jurisdiction and "American Standard Installation of Gas Appliances and Gas Piping" ANSI Z223.1 1988. Compliance with these regulations is required.

FIG. 2 - MINIMUM CLEARANCE DIMENSIONS

![Diagram showing minimum clearance dimensions for boiler installation.](image-url)
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 Z223.1-1988, 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.

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.

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 unconfined 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 this 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 (crawls 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 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.

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.

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)*.

<table>
<thead>
<tr>
<th>Fresh Air Duct Size</th>
<th>¼&quot; Mesh Screen Btuh</th>
<th>Wood Louvers Btuh</th>
<th>Metal Louvers Btuh</th>
</tr>
</thead>
<tbody>
<tr>
<td>3&quot; x 12&quot;</td>
<td>144,000</td>
<td>36,000</td>
<td>108,000</td>
</tr>
<tr>
<td>8&quot; x 8&quot;</td>
<td>256,000</td>
<td>64,000</td>
<td>192,000</td>
</tr>
<tr>
<td>8&quot; x 12&quot;</td>
<td>384,000</td>
<td>96,000</td>
<td>288,000</td>
</tr>
<tr>
<td>8½&quot; x 16&quot;</td>
<td>512,000</td>
<td>128,000</td>
<td>384,000</td>
</tr>
</tbody>
</table>

*Based on opening covered by ¼" mesh screen, wood louvers, or metal louvers.

FIG. 4

FRESH AIR DUCT FOR TIGHTLY SEALED HOUSE
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 and a drain line to carry any water to a drain.

2. Install Relief Valve in tapped opening in the left end section. Connect a drain line of the same pipe size (¼") to carry any water away to a drain.

3. Mount Draft Diverter on Draft Diverter Collar (Fig. 5 and 6) with two ¼" x ½" zinc plated screws. DO NOT CUT OR MAKE ANY CHANGES IN DRAFT DIVERTER.

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

If you are replacing an old boiler with this new one, possibly all you will need do is to connect the existing piping to your boiler, and install the Relief Valve.

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.

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 (Fig. 7).

A hot water boiler installed above radiation level must be provided with a low water cutoff device either as a part of the boiler or at the time of boiler installation.

When a low water cutoff is used, a periodic inspection and flushing of float types is necessary. 2" clearance must be kept between system piping and any combustible material.

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
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. Fig. 8 gives minimum chimney sizes for boiler only.

If your chimney is just big enough for your new boiler, it will not have extra capacity for other gas appliances. Fig. 9 gives you an idea how a boiler might be vented to a chimney. Note that the height (HT) is measured from the vent pipe to the top.

Vent installations shall be in accordance with Part 7, Venting of Equipment, of the National Fuel Gas Code ANSI Z223.1-1988 or applicable provision 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.

Though a masonry chimney is shown, you may use an approved prefabricated chimney. If desired, we will make recommendations to you.

When two or more appliances are vented into the same chimney, the cross-sectional area inside the chimney must be at least equal to the area of the largest vent PLUS ½ the area of each additional vent.

FOR EXAMPLE: Your boiler vent has a diameter of 5 inches (area 19.6 square inches). The water heater vent, a diameter of 4 inches (12.6 square inches). The minimum area of the chimney must be 19.6 + ½ of 12.6 or 25.9 square inches. This will require a 6" diameter round chimney.

CONNECTING THE VENT PIPE

WARNING - DO NOT install a vent damper in the vent pipe of this boiler.

1. Do not modify draft diverter furnished with boiler.
2. Vent pipe must be same size as outlet collar on draft diverter.
3. Slope pipe up from boiler to chimney not less than ¼" per foot.
4. Run pipe as directly as possible with as few elbows as possible.
5. Do not connect to fireplace flue.
6. End of vent pipe must be flush with inside face of chimney flue. Use a sealed-in thimble for the chimney connection.
7. Horizontal run should not be longer than ¼ the chimney height (HT) (Fig. 9).
8. 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.

MINIMUM VENT PIPE CLEARANCE

If the vent pipe must go through a crawl space, double wall 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 larger in diameter than the vent pipe.

If boiler is installed with single wall galvanized-type vent, it must have a 6° clearance between its surface and any combustible material. If Underwriters Laboratories listed type B (insulated) vent pipe is used, clearance between it and combustible material must follow manufacturer recommendation.

### FIG. 8 - MINIMUM CHIMNEY SIZES

| Boiler Input Btu/h | Diameter of Flue Pipe to Chimney | Flue Area in Inches
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HT. 10-15 ft.</td>
<td>HT. 15-25 ft.</td>
</tr>
<tr>
<td>Up to 100,000</td>
<td>5'</td>
<td>6x6</td>
</tr>
<tr>
<td>Up to 155,000</td>
<td>6'</td>
<td>6x7</td>
</tr>
<tr>
<td>Up to 200,000</td>
<td>7'</td>
<td>7x8</td>
</tr>
<tr>
<td>Up to 300,000</td>
<td>8'</td>
<td>9x9</td>
</tr>
</tbody>
</table>

*HT = top of thimble to top of flue. See Fig. 9.
For boiler input refer to table, page 4.

### FIG. 9 - CHIMNEY REQUIREMENTS

- MUST SLOPE UP AT LEAST 1/4 INCH PER FOOT OF HORIZONTAL RUN
- ROOF RIDGE
- 2 FT. MIN
- 3 FT. MIN
- 3/4 HT MAXIMUM
Gas Supply Piping

CHECK GAS SUPPLY
The gas pipe to your boiler should run direct from the gas meter (or propane regulator). It should supply only the boiler. It must be the correct size for the length of the run and your boiler rating. See Fig. 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 ½ 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 ½ psig (3.5 kPa).

CONNECTING THE GAS PIPING
Refer to Fig. 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 black iron piping and fittings.
2. All pipe compound must be resistant to liquified petroleum gas.
3. Install ground joint union in gas supply line between shut-off 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 about 5 feet above floor.
7. Tighten all joints securely.
8. LP - gas connections should only be made by a licensed propane installer.
9. Two-stage regulation should be used by the propane installer.
10. LP - 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.
INSTALLING 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 rooms on other side of wall

GROUNDING
If an external electrical source is utilized, 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. 70-1987.

ELECTRIC POWER SUPPLY

[FIG. 12 - CONNECTING WIRING]

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

All electrical work must conform to your local codes as well as the National Electric Code. If you are not familiar with wiring and codes in general, have a competent electrician do this job.
The boiler controls are all wired at the factory. You need only connect a 120 volt electric supply and the thermostat wires to the relay on the right side of the boiler.
Run a separate circuit from a separate fuse in your 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.

CONNECTING 120 VOLT WIRING TO BOILER
Remove relay cover and connect the 120 volt electric supply wires to terminals 1 and 2 on the relay (Fig. 12).
**Equipment and Optional 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 predetermined pressure. This will relieve the strain on the boiler and system. Run a pipe from the relief valve outlet (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**
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 of 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**
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 air 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.
The Diaphragm Type Tank can be mounted on the Air Purger fitting or at any other convenient place in the supply or return line.

**AIR ELIMINATING FITTING (AIR PURGER)**
An Air Purger is used to remove excess air from the system. It is installed in the supply line. It will eliminate air from the water before it reaches the radiators and bleed off this air.

**MAIN AIR VENT FOR DOWN FLOW SYSTEMS OR DIAPHRAGM TYPE EXPANSION TANK**
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**
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 ¼" tapping at the bottom of the front boiler section. It can be installed in a tee where the return line enters the boiler (Fig. 5, page 7).

**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 180° 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 two or more Zone Systems. 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.
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. Open the Valves to these units. Make sure the boiler and Expansion Tank Drain cocks are closed. The boiler bleed screw on the 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 your 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.

FOR YOUR SAFETY READ THIS BEFORE OPERATING
1. This appliance has a pilot which must be lighted by hand. When lighting the pilot, follow these instructions exactly.

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 service 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. Remove lower front panel.
4. Depress gas control knob slightly and turn clockwise to "OFF" position.

NOTE: Knob cannot be turned from "PILOT" 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 next step.

7. Find pilot - follow metal tube from gas control. The pilot is between the two burner tubes.

8. Turn gas control knob counterclockwise to "PILOT."

9. Push in control knob all the way and hold in. Immediately light the pilot with a match. Continue to hold the control knob in for about one (1) minute after the pilot is lit. Release knob and it will pop back up. Pilot should remain lit. If it goes out, repeat steps 5 through 10.
• If knob does not pop up when released, stop and immediately call your service technician or gas supplier.
• If the pilot will not light after several tries, turn the gas control knob to "OFF" and call your service technician or gas supplier.

10. Turn gas control knob counterclockwise to "ON."

11. Turn on all electric power to the appliance.
12. Set thermostat to desired setting.
13. After visually inspecting the flame, replace the lower front panel.
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 clockwise to "OFF" position. Do not force.

AUTOMATIC GAS VALVE

The Automatic Gas Valve opens or closes according to the heat requirements of the thermostat and temperature limit control. It also closes if the pilot goes out. Each individual control must be operating correctly before any gas can pass to the burners. Any one control can hold the gas supply from the burner regardless of the demand of any other control.

When the thermostat calls for heat, the gas valve opens and admits gas to the burner. When thermostat is satisfied, it opens the electrical circuit to the gas valve. The gas valve closes and stops the gas flow to the burner.

SAFETY PILOT

Safety Pilot prevents the flow of gas to burner if the pilot goes out.

SAFETY PILOT CHECK

With pilot lit and burners on, loosen thermocouple lead at automatic gas valve. As the lead is disconnected, both the main burner and pilot should go out. If one or the other remains lit, the gas valve is not functioning properly. Contact your local plumber or service technician. DO NOT RELIGHT THE PILOT. If both main burners and pilot go out, the valve test O.K. Reconnect thermocouple lead and light pilot. Tighten the lead finger-tight plus 1/4 turn with a wrench.

THERMOSTAT

Keep it set at a desired room temperature. If windows are to be opened or heat is not needed, turn thermostat pointer to a lower setting.
CHECKING AND ADJUSTING

LIGHT PILOT BURNER
Light pilot using instructions in OPERATING INSTRUCTIONS (page 10). Leave thermostat at lowest setting.

ADJUST PILOT BURNER
Pilot flame should surround 3/8" to 1/2" of the thermocouple tip. Refer to Fig. 14 and 15. If flame needs adjusting, do it as follows:
1. Remove screw cover over pilot adjusting screw.
2. Insert small screwdriver and adjust flame as needed. Turn screw counterclockwise to increase flame, clockwise to decrease. (Fig. 13).
3. Turn thermostat to highest setting. Main burners should light quickly and smoothly. Turn thermostat to lowest setting. Main burners should go out. Pilot should remain lit.
4. Replace screw cover over pilot adjusting screw.

MAIN BURNER AIR ADJUSTMENT
The primary air shutters on the main burners should be adjusted so that flame forms a sharp blue cone with no yellow. Refer to Fig. 13.

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 Convector 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. Use the boiler gauge to check your settings. Make the adjustments according to its readings.

Fig. 13 - Lighting Pilot

Fig. 14 - Pilot Flame Adjustment

ADJUST THERMOSTAT HEAT ANTICIPATOR
INSTRUCTIONS FOR THE FINAL ADJUSTMENT OF THE THERMOSTAT ARE PACKAGED WITH THE THERMOSTAT. Set Heat Anticipator at .25.
Check thermostat operation. When set above temperature indicated on the thermocouple, 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.
Finally, set the thermostat for the desired temperature. Special conditions in your home and the location of the thermostat will govern this setting.

Fig. 15 - Automatic Gas Valve

1. THERMOCOUPLE
2. PILOT GAS TUBE
3. PILOT ADJUSTMENT SCREW COVER
4. CONTROL KNOB
5. AIR SHUTTER
System Checks After First Starting

These checks and adjustments pertain to the various controls and are to be made in accordance with instructions packaged with the controls.

Set the Thermostat for the desired room temperature. Next, adjust the Limit Control, which regulates the temperature of the water in the boiler. The temperatures listed in the table (pg. 11) have been found to be satisfactory for most installations. They can be varied if necessary, to suit the climate in which you live.

When the thermostat and limit control have been set, start the burner (page 10). Watch the Thermometer Gauge as the boiler warms up, and note the temperature at which it stabilized. If this temperature is not the same as the dial reading on the limit control, readjust the control to obtain the desired thermometer indication. (Any difference between this gauge and the control gauge will be due to their different locations. Always use the thermometer gauge when adjusting the controls, for it is the more accurate of the two.)

After setting limit control to limit 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.

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 - 1987 Standard.

Maintaining Your Boiler

RELIEF VALVE
This valve should open automatically when the system pressure exceeds the safe limit (30 pounds per square inch). Should it ever fail to open under this condition, shut down your system. Drain it until pressure is reduced below the safe limit. Then have the valve replaced immediately.

EXPANSION TANK
As previously noted, this tank may become waterlogged, or may receive an excess of air. Frequent automatic opening of the relief valve indicates water logging. A high boiler temperature accompanied by unusually low radiation unit temperature (and "knocking") indicates excess air in tank.
To correct either condition, close the valve between the 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.

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
Flue Passages between sections should be examined yearly and cleaned. Remove burners, venturi tubes and pilot. Remove vent pipe and draft diverter. Raise top panel of boiler and swing out to expose flue collector. Remove flue collector and clean out plate. Clean passageways between sections with a flexible handle wire brush. Remove dirt from the bottom of the boiler and reassemble all parts. Be sure to check tightness of pilot connections and adjustment of burner flames after reassembly. Be sure vent pipe connections to chimney are secure and no obstructions are present.

FIG. 16

THE MAIN BURNERS SHOULD BE ADJUSTED SO THE FLAME FORMS 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

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>What to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermostat is not set correctly</td>
<td>Reset thermostat above room temperature.</td>
</tr>
<tr>
<td>Burner is not operating properly</td>
<td>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.</td>
</tr>
<tr>
<td>No electric power to boiler</td>
<td>Check fuse. If blown, replace. Check to be sure electric power supply circuit is &quot;ON.&quot;</td>
</tr>
<tr>
<td>Controls out of adjustment</td>
<td>Reset according to instructions.</td>
</tr>
<tr>
<td>Radiators not heating</td>
<td>Open radiator vents to vent excess air. Check flow control valve (if used). It may be in closed position.</td>
</tr>
<tr>
<td>Circulating pump not running</td>
<td>Check fuse. If blown, replace. Check relay operation.</td>
</tr>
<tr>
<td>Poor electrical contact</td>
<td>Check all control terminals and wire joints.</td>
</tr>
<tr>
<td>Chimney flue is blocked</td>
<td>Pressure switch will not close and pilot spark will not operate to start pilot. Have your service technician check and correct, if necessary.</td>
</tr>
</tbody>
</table>

### IF BURNER IS NOISY

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>What to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas input amount is incorrect</td>
<td>Contact your service technician.</td>
</tr>
</tbody>
</table>

### RELIEF VALVE LEAKING

<table>
<thead>
<tr>
<th>Possible Cause</th>
<th>What to do</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dirt on seat</td>
<td>Open valve manually. Allow water to run and clear valve seat.</td>
</tr>
<tr>
<td>Water logged expansion tank</td>
<td>Drain tank, see instructions.</td>
</tr>
</tbody>
</table>

HAVE YOUR SERVICE TECHNICIAN CHECK ANY PROBLEM YOU ARE UNABLE TO CORRECT.
FIG. 17 - 24 VOLT HOT WATER BOILER WIRING
(Circulator Controlled by Water Temperature)

FIG. 18 - 24 VOLT HOT WATER BOILER WIRING
(Constant Circulation)

FIG. 19 - 24 VOLT HOT WATER BOILER WIRING
(Combination Limit & Relay L8148E)

IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE BOILER MUST BE REPLACED, IT MUST BE REPLACED WITH THE SAME WIRE OR ITS EQUIVALENT.
repair parts

important — read these instructions before ordering

all parts listed in the following parts list may be ordered through your nearest supplier or direct from the factory.

when ordering parts, first obtain the model number from the data plate on your boiler, then determine the part no. (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 no. — the part description — the boiler model no.

for use with natural gas only

gas burners and manifold parts

this is a repair parts list — not a packing list

<table>
<thead>
<tr>
<th>key no.</th>
<th>description</th>
<th>2 section</th>
<th>3 section</th>
<th>4 section</th>
<th>5 section</th>
<th>6 section</th>
<th>7 section</th>
<th>8 section</th>
<th>9 section</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>part no.</td>
<td>part no.</td>
<td>part no.</td>
<td>part no.</td>
<td>part no.</td>
<td>part no.</td>
<td>part no.</td>
<td>part no.</td>
</tr>
<tr>
<td>2</td>
<td>pilot tube</td>
<td>433-00-956</td>
<td>433-00-956</td>
<td>433-00-957</td>
<td>433-00-957</td>
<td>433-00-909</td>
<td>433-00-909</td>
<td>433-00-909</td>
<td>433-00-909</td>
</tr>
<tr>
<td>4</td>
<td>gas manifold</td>
<td>146-16-009</td>
<td>146-16-010</td>
<td>146-16-011</td>
<td>146-16-012</td>
<td>146-16-013</td>
<td>146-16-014</td>
<td>146-16-015</td>
<td>146-16-016</td>
</tr>
<tr>
<td></td>
<td>air shutter springs</td>
<td>146-34-061</td>
<td>146-34-061</td>
<td>146-34-061</td>
<td>146-34-061</td>
<td>146-34-061</td>
<td>146-34-061</td>
<td>146-34-061</td>
<td>146-34-061</td>
</tr>
</tbody>
</table>

†not illustrated.
Liquefied Petroleum Gas Burners and Manifold Parts
This is a Repair Parts List - Not a Packing List

<table>
<thead>
<tr>
<th>KEY NO.</th>
<th>DESCRIPTION</th>
<th>3 SECTION</th>
<th>4 SECTION</th>
<th>5 SECTION</th>
<th>6 SECTION</th>
<th>7 SECTION</th>
<th>8 SECTION</th>
<th>9 SECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>10-32 x 3/16&quot; Hex Head Screw (2 Req'd.)</td>
<td>146-95-301</td>
<td>146-95-301</td>
<td>146-95-301</td>
<td>146-95-301</td>
<td>146-95-301</td>
<td>146-95-301</td>
<td>146-95-301</td>
</tr>
<tr>
<td>4</td>
<td>Gas Manifold</td>
<td>146-16-010</td>
<td>146-16-011</td>
<td>146-16-012</td>
<td>146-16-013</td>
<td>146-16-014</td>
<td>146-16-015</td>
<td>146-16-016</td>
</tr>
<tr>
<td>‡</td>
<td>Pilot Mounting Bracket</td>
<td>425-00-885</td>
<td>425-00-885</td>
<td>425-00-885</td>
<td>425-00-885</td>
<td>425-00-885</td>
<td>425-00-885</td>
<td>425-00-885</td>
</tr>
</tbody>
</table>

Quantity is 1 unless otherwise noted.
* Requires 1 less than the number of sections.
‡ Not Illustrated.
### Natural Gas

#### Jacket — Section and Base Parts

*This is a repair parts list, not a packing list*

**GAS-FIRED HOT WATER BOILERS**
**GAS-FIRED HOT WATER BOILERS**

**BOILER CONTROLS AND PIPING**

<table>
<thead>
<tr>
<th>KEY NO.</th>
<th>DESCRIPTION</th>
<th>PART NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3/4&quot; ASME Relief Valve</td>
<td>146-22-011</td>
</tr>
<tr>
<td>2</td>
<td>3/4&quot; x 5&quot; Nipple</td>
<td>146-07-040</td>
</tr>
<tr>
<td>3</td>
<td>Temperature Pressure Gauge</td>
<td>146-23-003</td>
</tr>
<tr>
<td>4</td>
<td>3/4&quot; x 1/4&quot; Reducing Bushing</td>
<td>146-93-003</td>
</tr>
<tr>
<td>5</td>
<td>1 1/4&quot; x 2 1/2&quot; Nipple</td>
<td>146-07-044</td>
</tr>
<tr>
<td>6</td>
<td>1 1/4&quot; x 3/4&quot; x 1 1/4&quot; Tee</td>
<td>146-93-049</td>
</tr>
<tr>
<td>7</td>
<td>High Limit Control L4006A</td>
<td>146-62-136</td>
</tr>
<tr>
<td>†</td>
<td>Comb Hi Limit &amp; Relay Control L8148E</td>
<td>146-62-024</td>
</tr>
<tr>
<td>8</td>
<td>BX Circulator Cable</td>
<td>433-01-904</td>
</tr>
<tr>
<td>9</td>
<td>Grundfos Circulator</td>
<td>146-26-045</td>
</tr>
<tr>
<td>10</td>
<td>1 1/4&quot; Close Nipple</td>
<td>146-07-009</td>
</tr>
<tr>
<td>11</td>
<td>1 1/4&quot; Ell</td>
<td>146-93-042</td>
</tr>
<tr>
<td>12</td>
<td>1 1/4&quot; x 3 1/2&quot; Nipple</td>
<td>146-07-008</td>
</tr>
<tr>
<td>‡</td>
<td>Drain Valve</td>
<td>146-22-001</td>
</tr>
</tbody>
</table>

‡ Not Illustrated