Gas-Fired Hot Water Induced Draft BOILERS

INSTALLATION INSTRUCTIONS
These instructions must be affixed on or adjacent to the boiler.

MODELS
CXE-2
CXE-3
CXE-4
CXE-5
CXE-6
CXE-7

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) and C.G.A. (Canadian 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.

WARNING: Improper installation, adjustment, alteration, 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.

CROWN BOILER CO.
P.O. Box 14818 • 3633 I Street • Philadelphia, PA 19134
(215) 535-8900
New York City MEA Number 483-84-E Vol. V

The Ratings marked "Net I=B=R Ratings" indicate the amount of radiation each boiler will take care of under normal conditions and thermostat 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 plying and pickup requirements.

These boilers must stand on a non-combustible floor. If installed on a combustible floor, use Combustible Floor Base.

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BOILERS FOR USE AT HIGH ALTITUDE

This boiler is factory equipped for use at altitudes of 2,000 feet above sea level. For use at 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 223.1 - latest edition), or the manufacturer for correct offsite sizing information. High altitude orifices are available from the boiler manufacturer.

Canada Only - For altitudes in the range of 2,000-4,500 feet above sea level boilers may be field equipped for use at high altitude by soring a certified field conversion kit. The change in main burner orifice size results in the boiler's input rating being reduced by 10%. The conversion chart is carried out by a manufacturer's authorized representative, in accordance with the requirements of the manufacturer, provincial or territorial authorities having jurisdiction and in accordance with the requirements of the CAN/CGA-B149.1 and CAN/CGA-B149.2 Installation Codes. The certified field conversion kit includes a conversion data plate, which must be attached to the boiler adjacent to the rating plate indicating that the boiler has been converted for high altitude use. The conversion data plate must be filled in with the correct conversion information.
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 cold 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. Additional clearances for service may exceed clearances for the protection. Always comply with the minimum fire protection clearances shown on the boiler. An 18 inch clearance should be maintained on any side where passage is required to access another side for cleaning, servicing, inspection or replacement of any part that may need attention. An 18 inch 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 the volume of the room that is larger than the room, the area of the room shall be figured on the basis of a ceiling height of 16'. Determination of room size should be based on the total volume of all gas fired equipment installed in the room. Consult section 6.3.3 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 ventilation does not provide the necessary air, outside air shall be introduced. (See Page 4 - Fresh Air for Combustion).

6. Advisor owners to keep air passages free of obstructions. Ventilating and combustion air must enter boiler room without restrictions.

7. The floor supporting the boiler must be non-combustible. If it is combustible, place the boiler on Combustible Floor Base No. 143302 for 2-5 section boilers, or No. 1451403 for 7-15 section boilers. We use a 2" cladtile™ pad as a combustible 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 36" 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 (in-situ replacement, control replacement, etc.).

FIG. 2 - MINIMUM CLEARANCE DIMENSIONS

<table>
<thead>
<tr>
<th>Above or Inside Not Large in Comparison With Boiler</th>
<th>Room Large in Comparison With Boiler</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top</td>
<td>6&quot;</td>
</tr>
<tr>
<td>Rear</td>
<td>6&quot;</td>
</tr>
<tr>
<td>Control Side</td>
<td>8&quot;</td>
</tr>
<tr>
<td>Opposite Side</td>
<td>6&quot;</td>
</tr>
<tr>
<td>Front</td>
<td>18&quot;</td>
</tr>
<tr>
<td>Flue Vent Connector</td>
<td>6&quot;</td>
</tr>
<tr>
<td>Near Boiler Piping</td>
<td>1&quot;</td>
</tr>
</tbody>
</table>

Boiler Size | Boiler Volume (G. F. L.) | Minimum Room Volume Required To Be Large Room (G. F. L.) |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2 sect</td>
<td>4.3</td>
<td>66.7</td>
</tr>
<tr>
<td>3 sect.</td>
<td>5.6</td>
<td>89.0</td>
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<tr>
<td>4 sect.</td>
<td>6.8</td>
<td>109.3</td>
</tr>
<tr>
<td>5 sect.</td>
<td>9.1</td>
<td>129.5</td>
</tr>
<tr>
<td>6 sect.</td>
<td>9.4</td>
<td>149.8</td>
</tr>
<tr>
<td>7 sect.</td>
<td>10.6</td>
<td>170.1</td>
</tr>
</tbody>
</table>

Three UNIT MUST be SET ON A CONCRETE OR OTHER NON-COMBUSTIBLE MATERIAL BASE OR FLOOR, IT MUST NOT BE INSTALLED ON CARPETING.
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 revision, 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 air requirements.

EXAMPLE 1: Boiler Located in Unconfined Space

An unconfined space is defined as a space whose volume is not less than 50 cubic ft per 1,000 Btu per hour of the total input rating of all appliances installed in that 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 be tightly. Do not caulk the cracks around the windows.

Equipment located in buildings of unusually tight construction shall be provided with air for combustion, ventilation, and dilution of fuel gases using the methods described in example 28 or shall be specially equipped. The authority having jurisdiction must approve specially engineered installations.

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. The minimum dimension of each opening shall be at least 3 inches in width. Doors used shall be of the same cross-sectional area as the free area of the openings to which they connect.

1. Two permanent openings, one commencing within 12 inches of the top, and one commencing within 12 inches of the bottom, of the enclosure shall be provided. The openings shall communicate directly, or by the ducts, with the outdoors or spaces (crawl or attic) that freely communicate with the indoors.

2. Where communicating with the outdoors or spaces (crawl or attic) that freely communicate with the indoors.

b) Where communicating with the outdoors or spaces (crawl or attic) that freely communicate with the indoors. (See Figure 3A.)

2. One permanent opening commencing with 12 inches of the top of the enclosure, shall be permitted where the equipment has clearance of at least 1 inch from the sides and back and 6 inches from the front of the appliance. The opening shall directly communicate with the outdoors or shall communicate through a vertical or horizontal duct to the outdoors or spaces (crawl or attic) that freely communicate with the outdoors, and shall have a minimum free area of:

a) 1 square inch per 3000 Btu per hour of the total input of all equipment located in the enclosure. (See Figure 4), and

b) Not less than the sum of the areas of all vent connectors in the confined space.

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.

Figure 3A - FRESH AIR DUCT CAPACITIES (Btu/h)

<table>
<thead>
<tr>
<th>Fresh Air Duct Size</th>
<th>100% Free Area</th>
<th>75% Free Area</th>
<th>25% Free Area</th>
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</thead>
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<tr>
<td>3&quot; x 12&quot;</td>
<td>144,000</td>
<td>108,000</td>
<td>36,000</td>
</tr>
<tr>
<td>6&quot; x 8&quot;</td>
<td>256,000</td>
<td>192,000</td>
<td>64,000</td>
</tr>
<tr>
<td>6&quot; x 12&quot;</td>
<td>384,000</td>
<td>288,000</td>
<td>96,000</td>
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<tr>
<td>8&quot; x 16&quot;</td>
<td>512,000</td>
<td>384,000</td>
<td>128,000</td>
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</table>

Figure 3B - FRESH AIR DUCT CAPACITIES (Btu/h)

<table>
<thead>
<tr>
<th>Fresh Air Duct Size</th>
<th>100% Free Area</th>
<th>75% Free Area</th>
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<tr>
<td>3&quot; x 12&quot;</td>
<td>72,000</td>
<td>54,000</td>
<td>18,000</td>
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<td>6&quot; x 8&quot;</td>
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<td>96,000</td>
<td>32,000</td>
</tr>
<tr>
<td>6&quot; x 12&quot;</td>
<td>192,000</td>
<td>144,000</td>
<td>48,000</td>
</tr>
<tr>
<td>8&quot; x 16&quot;</td>
<td>256,000</td>
<td>192,000</td>
<td>64,000</td>
</tr>
</tbody>
</table>

Figure 4 - FRESH AIR DUCT CAPACITIES (Btu/h)

<table>
<thead>
<tr>
<th>Fresh Air Duct Size</th>
<th>100% Free Area</th>
<th>75% Free Area</th>
<th>25% Free Area</th>
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<tr>
<td>3&quot; x 12&quot;</td>
<td>108,000</td>
<td>81,000</td>
<td>27,000</td>
</tr>
<tr>
<td>6&quot; x 8&quot;</td>
<td>192,000</td>
<td>144,000</td>
<td>48,000</td>
</tr>
<tr>
<td>6&quot; x 12&quot;</td>
<td>288,000</td>
<td>216,000</td>
<td>72,000</td>
</tr>
<tr>
<td>8&quot; x 16&quot;</td>
<td>384,000</td>
<td>288,000</td>
<td>96,000</td>
</tr>
</tbody>
</table>
1. Place boiler in the selected location (as near chimney as possible.)
2. 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.
3. Install Relief Valve on 1" pipe nipple in tapped opening in the left hand section. Connect the drain line of the same pipe size (1/4") to carry any water away to a drain. No cutoff of any description shall be placed between the safety relief valve and the boiler, or on discharge pipes between such safety valves and the atmosphere. Installation of the safety relief valve shall conform to the requirements of the ANSI/ASTM Boiler and Pressure Vessel Code, Section IV.
4. Install Drain Valve on lower left side of boiler as marked.
5. 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 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, take care 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 manufacturer's 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 coil, in an isolated box equipped with appropriate valves to prevent the chilled medium from entering the heating boiler (Fig. 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 WATER TEMPERATURE AND LARGE WATER CONTENT SYSTEMS

Significant condensation may form in this boiler and/or the venting system if the boiler is operated long period of time with return water temperatures of less than 120°F.

This condensation is corrosive and can eventually cause severe damage to the boiler and venting system. The maximum design return water temperature to prevent condensation in the boiler and venting is 120°F. The minimum high limit setting is 140°F.

1. 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 4-way mixing valve or suitable alternative is required to prevent low temperature return water from entering the boiler. Follow the mixing valve manufacturer's instructions.

2. If the boiler is to be connected to a system having a large water content (such as a former gravity system), install a system bypass as shown in Figures 7A and 7B.

3. If a boiler water reset control is used to operate the boiler, the minimum reset supply water temperature setpoint must be at least 140°F, unless a mixing valve is used as in (1) above.
FIG. 7A – BYPASS PIPING – CIRCULATOR ON SUPPLY

RETURN FROM SYSTEM

THROTTLING VALVE

SHUTOFF VALVE

AQUASTAT

THERMOMETER

THROTTLING VALVE

CIRCULATOR PUMP

FILTER WITH AIR PURGER

CITY WATER FEED

SUPPLY TO SYSTEM

ADJUST THE TWO THROTTLING VALVES TO MAINTAIN AT LEAST 120°F IN THE BOILER RETURN.

FIG. 7B – BYPASS PIPING – CIRCULATOR ON RETURN

RETURN FROM SYSTEM

THROTTLING VALVE

SHUTOFF VALVE

AQUASTAT

THERMOMETER

THROTTLING VALVE

CIRCULATOR PUMP

FILTER WITH AIR PURGER

CITY WATER FEED

SUPPLY TO SYSTEM

ADJUST THE TWO THROTTLING VALVES TO MAINTAIN AT LEAST 120°F IN THE BOILER RETURN.

BYPASS PIPING REQUIRED FOR HIGH MASS (LARGE WATER CONTENT) SYSTEMS
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. In Canada, follow CAN/CGA-B149.1 or .2 Installation Codes. It is very important to properly size the venting systems for induced draft appliances. Consult the Vent Sizing Tables, in the National Fuel Gas Code ANSI Z223.1-latest revision for correct sizing information.

In Canada, consult the Vent Sizing Tables, Amendment #1 to CAN/CGA-B149.1 and .2 Installation Codes.

2. The boiler’s induced draft blower must be of a “oulet type. A 3” x 4” increase fitting is included in the parts bag. Locate the increaser fitting on the outlet of the induced draft blower, and secure glass tubing to the bead of the furnished silicone sealant. The increaser fitting is required on this boiler for Category I venting; and 4” is the minimum permissible vent diameter. This does not imply that the vent connector is intended to be 4” diameter pipe. The vent connector shall be sized according to the appropriate venting tables in the National Fuel Gas Code or the Canadian Installation Codes, and may be required to be larger than 4” diameter.

The boiler installation for chimney venting is not complete unless the 3” x 4” increase 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 either the National Fuel Gas Code, or the Canadian Installation Codes 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 connector.

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 larger 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 Fig. 8. If clearances are less than shown in Fig. 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. In Canada, follow CAN/CGA B149.1 or .2 Installation 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 placed 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. Insular as is practical, close all building doors and windows and all doors between the spaces 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 should 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. in Canada, follow CAN/CGA B149.1 or .2 Installation Codes.

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

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**FIG. 8 - TYPE B GAS VENT**

- LINER
- CHIMNEY
- THIMBLE
- VENT SYSTEM
- CLEANOUT
- THE VENT PIPE MUST BE AT LEAST 2 FEET HIGHER THAN ANY PART OF THE ROOF WITHIN A 10 FOOT RADUS OF THE VENT.

- SHEET METAL FIRESTOP

- 2 MIN
- 3 Min
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 5 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.

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

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>PART NUMBER</th>
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<tbody>
<tr>
<td>3&quot; Side Wall Vent Hood (Tjernlund) 9-13&quot;</td>
<td>146-29-010</td>
</tr>
<tr>
<td>4&quot; Side Wall Vent Hood (Tjernlund) 9-14&quot;</td>
<td>146-29-011</td>
</tr>
<tr>
<td>3&quot; Thimble (Simpson 905295)</td>
<td>146-29-013</td>
</tr>
<tr>
<td>4&quot; Thimble (Simpson 915295)</td>
<td>146-29-014</td>
</tr>
</tbody>
</table>
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 the vent.

2. Vent Pipe Material:
   a) UL Listed Z-Flex Z-Vent stainless steel vent pipe from boiler to vent termination. 
   b) UL Listed Heat-FabSat-T Vent stainless steel vent pipe from boiler to vent termination. 
   c) UL Listed Flex-1, Staf-Saf 34 stainless steel vent pipe from boiler to vent termination. 
   d) UL Listed ProTech FastNSeal stainless steel vent pipe from boiler to vent termination.

3. Clearance to Combustible Materials:
   For stainless steel vent pipes maintain a 6" minimum air space clearance to combustible materials.

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 90° elbow, 4′ – 90° elbow – reduce vent length 6 feet per each 90° 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 (6 x 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 1/4 mesh screen to keep out rodents and birds. The elbow shall be of the same material and size as vent pipe. The elbow outlet should be at least 6" away from exterior wall as shown in Figure 9.
   b) T-Termend VW-1 Swiss 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 Terminating Location:
   a) When venting through combustible walls, combustible clearances must be provided. The VW-1-3 shall provide both the outside vent termination and a double wall pipe for passing through a combustible wall up to 8’ thick (RH-1-4”) or 5’ thick (VH-1-3). The hole in the wall must be 6’1/2” square for 3” vent pipe and 7’1/2” square for 4” vent pipe, in order to vent the VW-1 side of the vent hood. The VH-1 may also be used in non-combustible walls.
   b) The 90° elbow is the termination fitting at 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, Sat-T Vent, or Star-34 vent pipe, use the following:
      - 3" vent pipe – use Simpson Duravent #55253 3" thimble or equivalent
      - 4" vent pipe – use Simpson Duravent #12525 4" thimble or equivalent
      Maximum wall thickness with this thimble is 7 inches.
   For combustible walls using ProTech FastNSeal where the single wall vent pipe must pass through the side wall, a UL Listed FastNSeal wall thimble shall be used as follows:
      - 3" FastNSeal vent pipe – use 3" FastNSeal Wall Thimble #FSWT03
      - 4" FastNSeal vent pipe – use 4" FastNSeal Wall Thimble #FSWT04
   The thimble is adjustable for different wall thicknesses, 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 flow. 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 not be less than 7 feet above an adjacent public walkway. The vent terminus shall 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, fixe 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 gas-tight. Seal all joints and seams as follows:

A. For 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, 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 (#205370/000). Then continue the 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 follow the sealing instructions, push the 4" male end of the Z-Vent over the 4" increaser fitting. When using the TermiVent 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 cramped before pushing the Z-Vent over the vent hood's connecting pipe. Before the pipes are joined, apply a 1/4" 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.

B. For Heat-False Sat-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 with any commercially available brake cleaner 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 cramped. The vent pipe should be cramped 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 Sat-T-Vent 3" to 4" increaser fitting (#2374G) 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" Sat-T-Vent pipe run by connecting the 4" male end of the Sat-T-Vent to the increaser. (A locking band may be used around this joint for additional support.) The joint must be in the direction indicated on the vent pipe. When using the TermiVent 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 1/4" bead approxiately 1/8" to 1/4" from the end of the vent hood's connecting vent pipe. Run a similar size bead of silicone sealant around the seam weld of the vent pipe. Then push the flange 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 1/4" bead. Silicone bead should be approximately 1/8" to 1/4" from the end of the male end. Also, run a similar size bead of silicone sealant around the seam weld at the end of each joint.

2) Pipes 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 modestly finger or flat tool, spread any sealant that has oozed out around the circumference of the joint.

3) Attach the sections together with the locking rings and tabs (except at the baffle outlet where no locking ring exists). Inspect the joint to ensure that the gaskets will not leak. It is necessary to apply additional sealant around the joint.

4) Horizontal venting shall have a slope not less than 1/4" (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-Stat 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 should 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 Stat-34 3" to 4" increaser fitting (#237103/04) 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 svrmt. When using the TermiVent 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 1/4" bead approximately 1/2" from the end of the vent hood's connecting vent pipe. Also, run a similar size bead of silicone sealant around 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 pipes with a steel gear clamp.

1) Apply the high temperature silicone around the male end of the pipe in an even 1/4" bead. Silicone bead should be approximately 1/4" from the end of the male end. Also, run a similar size bead of silicone sealant around the seam weld of each joint.

2) The seams on the vent pipe should be aligned and oriented upward in all horizontal vent pipes run.

3) Insert the male end of one of the female ends of the other. Push the pipe together so the female end rests up against the stop bead of the male end.

4) Insert a Stat-L-Joiner Band into the inlet of the beaded channel. Feed the Joiner Band so in it makes its way around the pipe, back to the channel inlet and it overlaps itself by about 1/4".

5) Cut the excess Joiner Band so it is flush 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 1/4" (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 FastSeal 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 FastSeal Anode Adapter (part #FAST104) over the boiler's induced draft blower. Continue the vent pipe run with 3" FastSeal vent pipe. For 6 and 7 section boilers begin...
by locating the FastSeal Atemek Adapter (part #F5AMETEK) over the boiler’s induced draft blower. Then connect a FastSeal 3” to 4” increasing vent (part #F5034) to the 3” adapter outlet. Continue the vent pipe run with 4” FastSeal vent pipe. Other than the Atemek Adapter and increase fitting, DO NOT use 3” vent pipe on 6 or 7 section boilers. FastSeal 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 rotate 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 6 and 7 section boilers using the VH-1-3’ vent hood, connect the FastSeal Vent to the VH-1-3’ vent hood using FastSeal Adapter #F5C-001-3. This adapter has no internal sealing gasket. To attach the adapter to the vent hood, crimp the 3’’ vent hood pipe, apply a 1/4” 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 FastSeal adapter. After pressing the two pipes together and tightening the locking band, finish creating a complete seal by filling the FastSeal 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” FastSeal vent pipe connects directly to the VH-1-4” vent hood, and it is joined and sealed by the internal gasket and locking band.

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 FastSeal vent pipe with fasteners.
5. Horizontal venting shall have a slope of not less than 1/4” (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) 2-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 wood framing or block). Do not use metal hangers. Each support will be 1/8” 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 FastSeal support strap (#F5SH) 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 flu 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. Follow the specific power venter installation instructions issued with the power venter kits, which were specifically sized for these boilers:

<table>
<thead>
<tr>
<th>Number of</th>
<th>Field Controls</th>
<th>Power Vent Kit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiler Sections</td>
<td>Power Vent Kit</td>
<td>SWG-4D</td>
</tr>
<tr>
<td>2, 3, 4, 5</td>
<td>SWG-5D</td>
<td></td>
</tr>
<tr>
<td>6, 7</td>
<td>SWG-5D</td>
<td></td>
</tr>
</tbody>
</table>

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 installing or homeowners prefer a negative pressure vent system instead of a positive pressure vent system.
5. A power venter may be more effective than stainless steel venting, particularly at longer vent lengths.

The Field Controls power vent kit includes either a SWG-5-4HD or SWG-3-5 power vent, a MG-1 4” barometric draft controller, and the CK-X4D 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, flu 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 discoleration, or into the building through doors or windows causing odors. Also, under certain conditions flu 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 flu gas.

When installing single wall galvanized pipe vent 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 at 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” increase 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 increase fitting. When joining pieces of single wall galvanized vent pipe, a substantial bead of silicone should be used at the joint to assure 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 input of all gas utilization equipment connected to it. 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 the 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 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 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. In Canada, follow the CAN/CGA B149.1 and .2 Installation Codes for Gas Burning Appliances and Equipment.

2. All pipe compound must be resistant to liquified petroleum gas.

3. Insert 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. Propane gas connections should only be made 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

<table>
<thead>
<tr>
<th>Length of Pipe - Ft.</th>
<th>Pipe Capacity - BTU Per Hour Input</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Includes Fittings</td>
</tr>
<tr>
<td></td>
<td>1/4&quot;</td>
</tr>
<tr>
<td>20</td>
<td>92,000</td>
</tr>
<tr>
<td>40</td>
<td>63,000</td>
</tr>
<tr>
<td>60</td>
<td>50,000</td>
</tr>
</tbody>
</table>

### PROPANE GAS

<table>
<thead>
<tr>
<th>Length of Pipe - Ft.</th>
<th>Pipe Capacity - BTU Per Hour Input</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Includes Fittings</td>
</tr>
<tr>
<td></td>
<td>Copper Tubing</td>
</tr>
<tr>
<td></td>
<td>1/4&quot;</td>
</tr>
<tr>
<td>20</td>
<td>131,000</td>
</tr>
<tr>
<td>40</td>
<td>90,000</td>
</tr>
<tr>
<td>60</td>
<td>72,000</td>
</tr>
</tbody>
</table>

*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

![Diagram of gas piping at boiler](image)
All electrical work must conform to local codes as well as the National Electrical Code, ANSI/NFPA-70, latest revision. In Canada, electrical wiring shall comply with the Canadian Electrical Code, CSA-C22.1.

**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 supply 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 ground 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 on 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 K1 and K2.
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 58650 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 58600 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 58600 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 K1 is de-energized, opening 1K1 and 1K2 contacts. Burners extinguish. Blower and circulator pump stop.
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.
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 (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 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 water. This can happen after filling the system with new water. Fitting (if 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 is filled 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.

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 to 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 (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 ¾” tapping at the bottom of tee 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 gases 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” wc for 2-5 section boilers.
-0.5” wc 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 exchanger flow switch blocking cause 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 flow switches for blockage when restoring system to operating condition. Do not operate system without a rollout switch.
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 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 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.

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 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. This appliance is equipped with an igniter 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.

7. Turn gas control knob counterclockwise up 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 clockwise 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. (Fig. 14). Turn screw counter-clockwise to increase flame, clockwise to decrease (Fig. 15).
3. Replace screw cover over pilot adjusting screw.

MAIN BURNER(S)
The main burners do not require primary air adjustment and are not equipped with primary air shutters. Main burner flames should form sharp blue inner cones in a soot free blue outer mantle, with no yellow. Puffs of air from blowing on the flame or stamped on the floor will cause the flames to turn orange momentarily. This is not unusual. Remain still when observing the main burner flames. If the flame appearance is not correct, check main burner orifices and the burner throat and flame ports for dust and lint obstruction. It may be necessary to remove the rollout shield to observe the main burner flame. Replace rollout shield after observation. Refer to Figure 16.

ADJUST LIMIT CONTROLS
Instructions for each control are included with the controls.

RECOMMENDED BOILER WATER TEMPERATURES

<table>
<thead>
<tr>
<th>Type of Heating Unit</th>
<th>Limit Control Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stirling Radiators</td>
<td>180° F</td>
</tr>
<tr>
<td>Baseboard and Convectors Radiators</td>
<td>200° F</td>
</tr>
</tbody>
</table>

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 200° F.

FIG. 15 - AUTOMATIC GAS VALVE

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 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 allows 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 the operation of the contacts in the pressure switch, disconnect the rubber tubing (tucked between the boiler and the pressure switch) from 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 for 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.
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 open 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 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, 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 lift 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 passages 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). Reassemble beams 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.

CIRCULATOR PUMP ISOLATION VALVES
The isolation valves in the circulator pump flanges should be operated manually once or twice per year to prevent the valves from becoming stuck in the open position. Rotate the valves from the open position to the closed position and back to the open position.
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.

<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 overcurrent protection. 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 overcurrent protection. 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>
<tr>
<td>Rollout switch blown</td>
<td>Have your service technician check heat exchanger for blockage. Replace rollout switch with exact replacement.</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.
**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 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.

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**FOR USE WITH NATURAL GAS ONLY**

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**NOTICE:** Actual gas valve may look different than gas valve shown.

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**NATURAL GAS BURNERS & MANIFOLD PARTS**

THIS IS A REPAIR PARTS LIST – NOT A PACKING LIST

<table>
<thead>
<tr>
<th>KEY NO.</th>
<th>DESCRIPTION</th>
<th>PART NUMBERS FOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24 Volt Gas Valve, Natural Gas</td>
<td>2 Section</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 Section</td>
</tr>
<tr>
<td>2</td>
<td>Pilot Tube</td>
<td>4 Section</td>
</tr>
<tr>
<td>3</td>
<td>10-32 x 3/16&quot;Slotted Hex Head Screws</td>
<td>5 Section</td>
</tr>
<tr>
<td>4</td>
<td>Gas Manifold</td>
<td>6 Section</td>
</tr>
<tr>
<td>5</td>
<td>Orifice – Natural Gas*</td>
<td>7 Section</td>
</tr>
<tr>
<td>6</td>
<td>Main Burner Less Pilot Bracket**</td>
<td></td>
</tr>
<tr>
<td>6A</td>
<td>Main Burner with Pilot Bracket</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Pilot Burner with Orifice, Natural Gas</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Rollout Shield</td>
<td></td>
</tr>
</tbody>
</table>

| 425-00-932 | 425-00-932 | 425-00-932 | 425-00-932 | 425-00-932 | 425-00-932 | 425-00-932 | 425-00-932 | 425-00-932 |

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*Not illustrated.

**Requires 1 less than the number of sections.

**Requires 2 less than the number of sections.
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 PARTS LIST — NOT A PACKING LIST**

<table>
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<th>KEY NO.</th>
<th>DESCRIPTION</th>
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<th>3 Section</th>
<th>4 Section</th>
<th>5 Section</th>
<th>6 Section</th>
<th>7 Section</th>
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<tbody>
<tr>
<td>3</td>
<td>10-32 x 3/16&quot; Slotted Hex Head Screws</td>
<td>146-95-301</td>
<td>146-95-301</td>
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*Not illustrated.*

**Requires 1 less than the number of sections.**

**Requires 2 less than the number of sections.**
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<th>5 Section</th>
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<tr>
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<td>Jacket Right Side Panel</td>
<td>730-00-1050</td>
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<td>Brower Cover Plate</td>
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<td>425-01-735</td>
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<td>425-01-737</td>
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<td>Insulation, Base Front</td>
<td>146-14-112</td>
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<td>146-14-115</td>
<td>146-14-116</td>
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<td>146-14-122</td>
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<td>146-14-124</td>
<td>146-14-125</td>
<td>146-14-126</td>
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<td>Jacket, Front Panel</td>
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<td>730-00-1037</td>
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<td>146-85-002</td>
<td>146-85-002</td>
<td>146-85-003</td>
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<td>Nut &amp; Washer</td>
<td>146-95-041</td>
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<td>Jacket Back Panel</td>
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<td>730-00-1024</td>
<td>730-00-1025</td>
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<td>Jacket, Complete</td>
<td>730-00-1002</td>
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<td>730-00-1004</td>
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<td>19</td>
<td>10 x 1/4&quot; Sheet Metal Screw</td>
<td>146-95-074</td>
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<td>20</td>
<td>Lock Assembly Includes 7, 10, 11, 12, 13, 17</td>
<td>410-01-212</td>
<td>410-01-312</td>
<td>410-01-412</td>
<td>410-01-512</td>
<td>410-01-612</td>
<td>410-01-712</td>
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<tr>
<td>21</td>
<td>Combustible Floor Base</td>
<td>146-14-031</td>
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2 Not Illustrated.
# BOILER CONTROLS AND PIPING

<table>
<thead>
<tr>
<th>KEY NO.</th>
<th>DESCRIPTION</th>
<th>PART NO.</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>1 1/4&quot; ASME Relief Valve</td>
<td>146-22-011</td>
</tr>
<tr>
<td>2</td>
<td>1 1/2&quot; x 5/8&quot; Nipple</td>
<td>146-07-040</td>
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<tr>
<td>3</td>
<td>Temperature Pressure Gauge - (3/4&quot; Stem)</td>
<td>146-23-007</td>
</tr>
<tr>
<td>4</td>
<td>1 1/4&quot; x 5/16&quot; Nipple</td>
<td>146-07-019</td>
</tr>
<tr>
<td>5</td>
<td>1 1/4&quot; x 1/2&quot; x 1 1/2&quot; Tee</td>
<td>146-93-049</td>
</tr>
<tr>
<td>6</td>
<td>LB146A Comb Hi Limit &amp; Relay Control</td>
<td>433-00-551</td>
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<tr>
<td>7A</td>
<td>Grundfos Pump UP15.42F</td>
<td>116-23-045</td>
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<tr>
<td>7B</td>
<td>Teco Pump 007</td>
<td>146-26-047</td>
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<td>1 1/2&quot; Return Nipple</td>
<td>146-07-004</td>
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<td>9</td>
<td>Intermeten Pilot Control (SIR600M)</td>
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<td>10</td>
<td>Induced Draft Blower and Gasket</td>
<td>433-00-511</td>
</tr>
<tr>
<td>11</td>
<td>Pressure Switch - 2, 3, 4, 5, 6, 7</td>
<td>146-65-006</td>
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<td></td>
<td>Section</td>
<td>146-35-005</td>
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<td>12</td>
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<td>146-26-043</td>
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<td>13</td>
<td>Rubber Tube (Flanged to Pressure Switch)</td>
<td>146-29-003</td>
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<td>Rod Out Switch</td>
<td>146-29-002</td>
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<td>15</td>
<td>1 1/2&quot; x 3/4&quot; Bushing</td>
<td>146-63-005</td>
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<td>16</td>
<td>47 VAC 24 V. Transformer</td>
<td>146-62-060</td>
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<tr>
<td>17</td>
<td>1 1/4&quot; Close Nipple</td>
<td>146-07-031</td>
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<td>18</td>
<td>1/4&quot; Coupling</td>
<td>146-93-054</td>
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<tr>
<td>19</td>
<td>3&quot; x 4&quot; Insulating Fitting - Guaranteed</td>
<td>146-28-012</td>
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<td>20</td>
<td>450°F Black Silicone Rubber Adhesive</td>
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<td></td>
<td>Sealant (10 3/4 oz. Cartridge)</td>
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<tr>
<td>21</td>
<td>500°F Red Silicone Rubber Adhesive</td>
<td>146-06-023</td>
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</tbody>
</table>

*Not Illustrated*