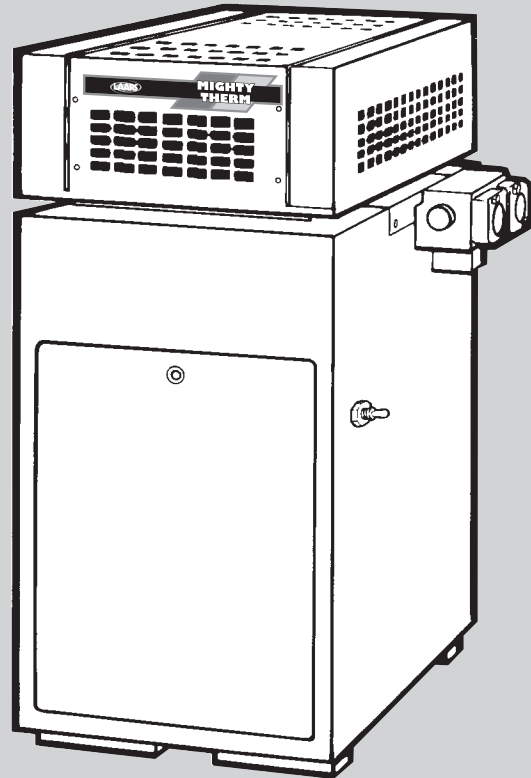


Installation,
Operation and
Maintenance
Instructions for

Mighty Therm

Hydronic Boilers
Model HH-PH
Sizes 175-400



FOR YOUR SAFETY: This product must be installed and serviced by a professional service technician, qualified in hot water boiler installation and maintenance. Improper installation and/or operation could create carbon monoxide gas in flue gases which could cause serious injury, property damage, or death. Improper installation and/or operation will void the warranty.

⚠ WARNING

If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

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

WHAT TO DO IF YOU SMELL GAS

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

Installation and service must be performed by a qualified installer, service agency, or gas supplier.

TABLE OF CONTENTS

SECTION 1.

General Information

1A.	Introduction	3
1B.	Warranty	3
1C.	Technical Assistance	3

SECTION 2.

Installation Instructions

2A.	General Information	4
2B.	Field Assembly	4
2C.	Site Location	5
2C-1.	Installation Information	5
2C-2.	Outdoor Installation (U.S. Only)	6
2C-3.	Flooring - Typical Installation	6
2D.	Combustion and Ventilation	
	Air Supply	7
2D-1.	Outdoor Air Supply	7
2D-2.	Indoor Air Supply	7
2D-3.	Exhaust Fans or Vents	7
2E.	Venting of Combustion Products	7
2E-1.	General Information	7
2E-2.	Replacement of Existing Boiler	8
2F.	Water Flow System	8
2F-1.	Reversible Water Connections	8
2F-2.	Freeze Protection	11
2F-3.	Pump Requirements	11
2F-4.	Variable Water Flow Systems	13
2F-5.	System Pressure Requirements	13

2F-6.	Chilled Water Systems	15
2F-7.	System to Boiler Piping	15
2F-8.	Filling the System	15
SF-9.	Minimum Boiler Temperature	15
2G.	Gas Supply and Piping	16
2G-1.	General Instructions	16
2G-2.	Special Precautions for Propane Gas	16
2H.	Electrical Wiring	19

SECTION 3.

Operating Instructions

3A.	Setting the Temperature Controls	19
3B.	Start-Up Procedure	20
3C.	Adjustment for Minimum Input Rate (Models with Modulating Gas Valve)	20
3D.	Hi-Limit Switch Checkout	20
3E.	Shut-Down Procedure	21

SECTION 4.

Service Instructions

4A.	Regular Inspection	21
4B.	Replacement of Gas Controls	21

SECTION 5.

Parts List for HH and PH Boilers

5A.	General Information	22
5B.	Parts List	22

SECTION 1. General Information

1A. Introduction

This manual provides installation and operation instructions for the Model HH and PH Hydronic Boilers, Sizes 175 through 400. Review all application and installation procedures completely before proceeding with the installation. Experience has shown that most operating problems are caused by improper installation.

The HH-PH boilers are offered in a basic configuration (see Figure 1). On PH boilers the pump is factory installed. On HH boilers the pump is field installed.

1B. Warranty

The HH-PH boilers are sold with a limited factory warranty.

Make all warranty claims to an authorized Laars representative or directly to the factory. Claims must

include the boiler serial number and model (this information can be found on the rating plate), installation date, and name of the installer. Shipping costs are not included in the warranty coverage.

Some accessory items are shipped in separate packages. Inspect everything for damage immediately upon delivery, and advise the transporter of any shortages or damage. Any such claims should be filed with the transporter. The transporter will not accept a claim from the shipper, Laars.

The warranty does not cover damage caused by improper installation, operation, or field modification.

1C. Technical Assistance

Consult Laars or your local company representative with any questions or problems involving the specification, installation and operation of Laars equipment. An experienced technical support staff is ready to assist in assuring the proper performance and application of Laars products.

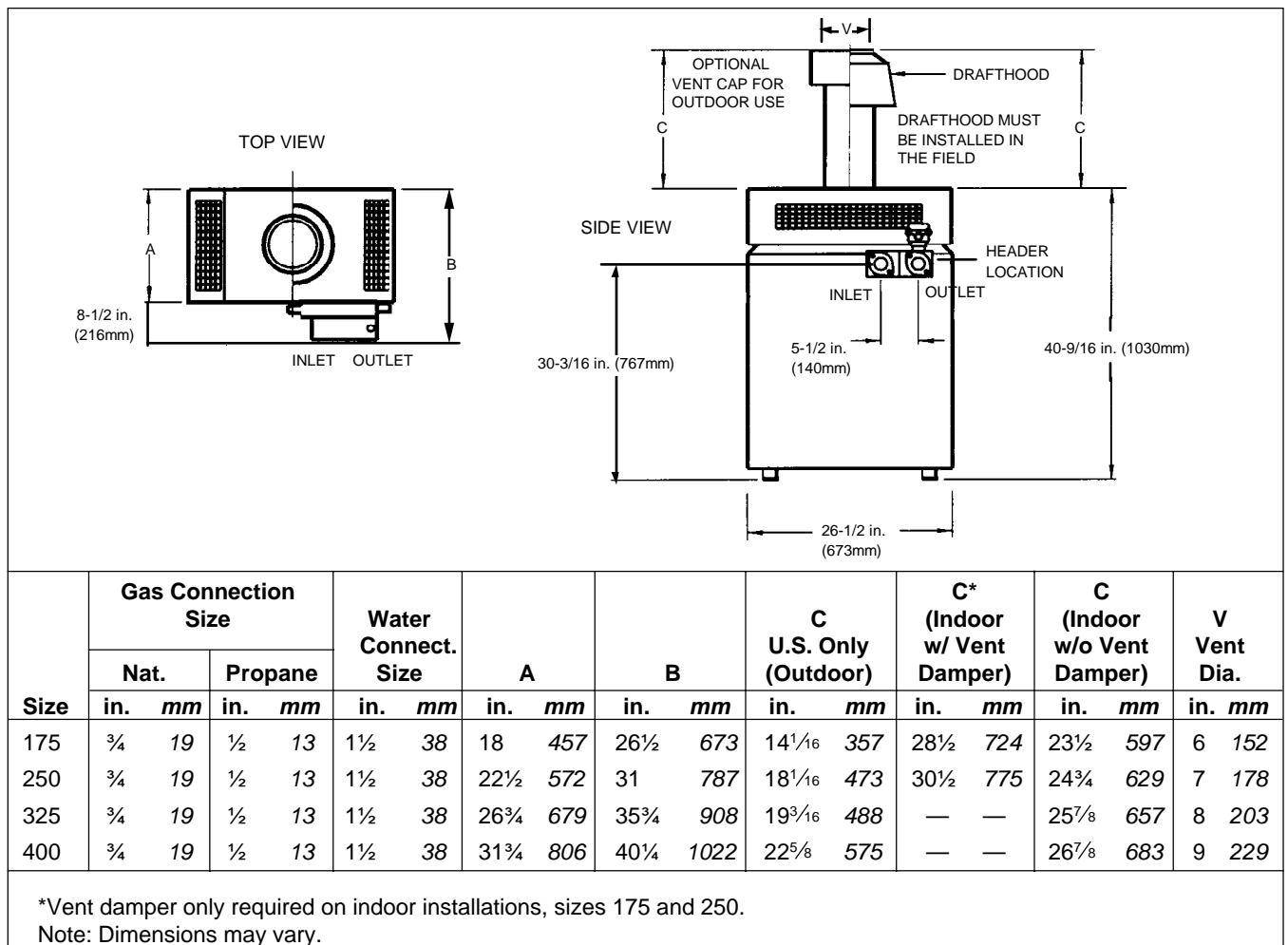


Figure 1. General Configuration.

SECTION 2.

Installation Instructions

2A. General Information

⚠ WARNING

Follow local regulations with respect to installation of carbon monoxide (CO) detectors and manufacturer's maintenance schedule of the boiler.

Install the HH-PH boilers in accordance with the procedures in this manual (or the Laars warranty may be voided), local codes and ordinances. In the absence of such codes, install the boilers in accordance with the latest edition of the National Fuel Gas Code, ANSI Z223.1. In Canada, the installation must be in accordance with CAN1-B149.1 or .2 and local codes. The authority having jurisdiction may require the installation conform to the Standard for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD-1. Any changes to the boiler, gas controls, gas orifices, wiring or draft hood may void the warranty. If field conditions require change, consult the factory.

All gas-fired products require correct installation to assure safe operation. The requirements for boilers include the following:

1. Field assembly of draft hood and vent cap (if required – see Section 2B)
2. Appropriate site location (clearances) and flooring
3. Sufficient combustion and ventilation air
4. Adequate venting of combustion products
5. Adequate water flow
6. Properly sized gas meter and piping
7. Proper electrical wiring

This manual provides the information needed to meet these requirements. Review all application and installation procedures completely before continuing the installation.

2B. Field Assembly

The HH-PH boiler is shipped from the factory with the top assembly in the low-profile configuration for outdoor installations.

The HH-PH boiler is design certified for indoor installation when equipped with a draft hood, which must be installed without modification. Check the rating plate on the boiler for the correct Laars part number.

Follow this procedure to make the conversion:

- a. Remove the top filler plate, stamped “HOT,” by slipping a fine-blade screw driver into the slot at



Figure 2. Top Filler Plate.

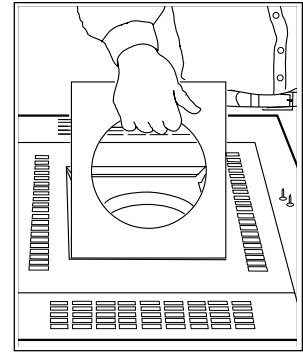


Figure 3. Adapter Plate.

the rear of the plate and gently prying it up (see Figure 2).

- b. Remove the two screws attaching the adapter plate to the top assembly and lift it out (see Figure 3).
- c. Remove the vent cap or draft hood from its package.
- d. Disengage the flue transition ring from the stack extension and place it on top of the collector assembly as shown in Figure 4.

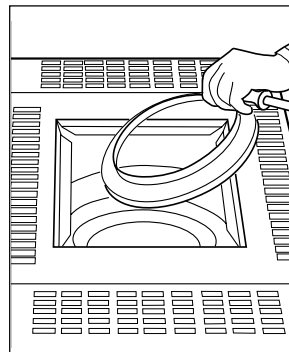


Figure 4. Flue Transition Ring.

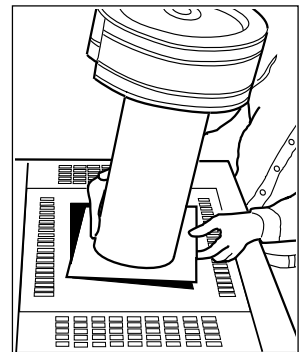


Figure 5. Vent Cap with Adapter Plate

- e. Slide the adapter plate over the bottom of the stack extension as shown in Figure 5. Fit the stack extension down over the flue transition ring. Seat the adapter plate on the top assembly and secure it with two screws (see Figure 6).
- f. Find the vent damper box which is located in the boiler package (boiler models 175 to 250 only) (see Figure 8).
- g. Install the vent damper directly to the top of the draft hood outlet. The damper operator should face to the front of the boiler, and the flow direction arrow should point **upward**. Use the vent damper wire harness to connect the vent damper to the boiler. The bracket end of the harness should be connected to the vent damper actuator.

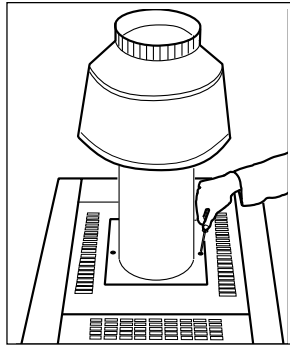


Figure 6. Drafhood with Adapter Plate.

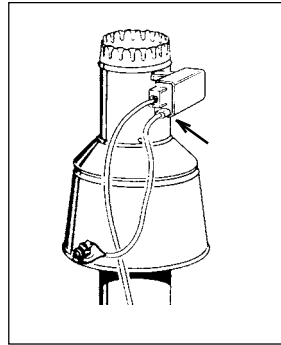


Figure 7. Drafhood Switch Receptacle.

- h. Plug the wiring for the drafhood switch into the receptacle on the left side of the vent damper box (see Figure 7).
- i. Do not modify the automatic vent damper device. The venting system must be arranged so that only the boiler is served by the vent damper device supplied with the boiler. Provide at least six inches clearance between the automatic vent damper and combustible construction, and be sure to allow access for servicing the damper.

⚠ WARNING
Do not force motor operation when the operator is fastened to the damper by moving the damper blade, turning the shaft, or turning the position indicator.

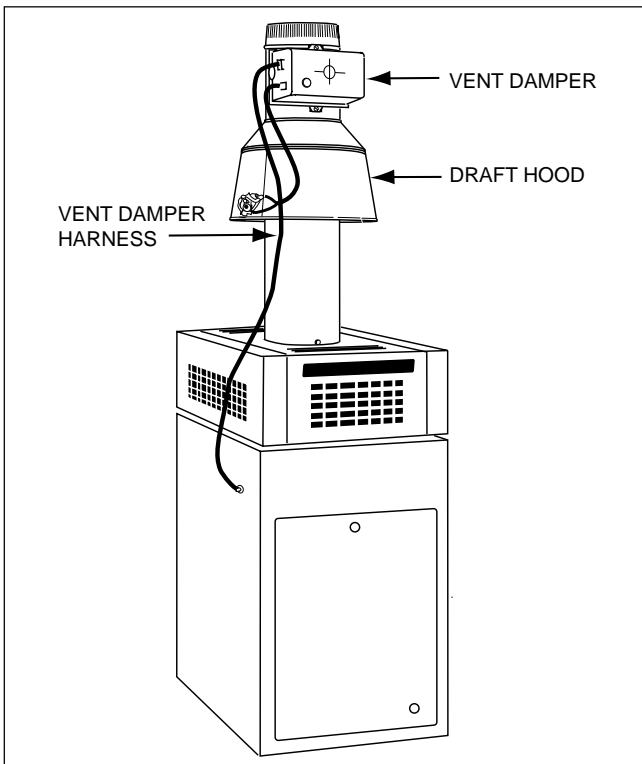


Figure 8. Vent Damper Installation (Models 175 and 250 only).

2C. Site Location

2C-1. Installation Information

⚠ WARNING
Improper installation or maintenance can cause nausea or asphyxiation from carbon monoxide in flue gases which could result in severe injury, property damage, or death.

Locate the boiler to provide clearances on all sides for maintenance and inspection. There must also be minimum distances maintained from combustible surfaces (see Table 1 and Figure 9).

Clearance from:	Indoors		Outdoors	
	inch	mm	inch	mm
Top	37	940	Unobstructed	
Water conn. side	12	305	Unobstructed	
Opposite side	6	152	6	152
Front	Alcove		Unobstructed	
Rear	6	152	6	152
Vent*	6	152	—	
Flooring	Combustible		Combustible	

Service clearance = 36 inches (914mm) at front of heater, and 18 inches (457mm) at water connection side.
*1" (25mm) if double wall vent is used.

Table 1. Minimum Boiler Clearances From Combustible Surfaces.

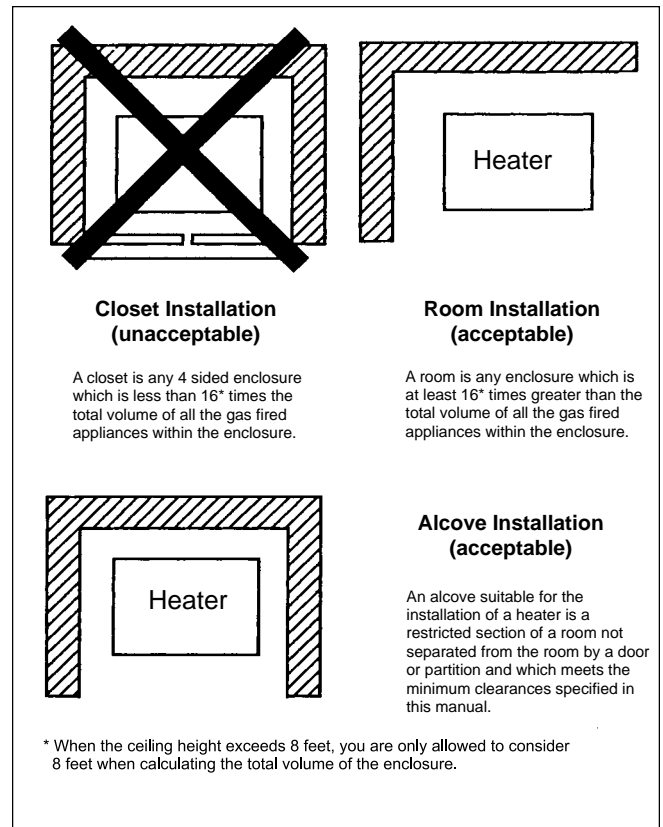


Figure 9. Alcove Installation.

The boiler must be isolated or otherwise protected from any source of corrosive chemical fumes, such as trichlorethylene, perchlorethylene, chlorine, etc. Install the boiler so that the gas ignition system components are protected from water (drippings, spraying, rain, etc.) during operation and service. Locate the boiler on a waterproof floor with a floor drain and a 6 inch (152 mm) minimum curb on all four sides to protect the building if boiler repairs are needed.

2C-2. Outdoor Installation (U.S. Only)

⚠ Caution

Outdoor installations are not recommended in areas where the danger of snow blockage exists. HH-PH boilers can be installed in the "low-profile," grate top configuration as received from the factory, or with an optional vent cap/stack.

Locate the boiler in an **open, unroofed area**. Do not locate the boiler below or adjacent to any doors, windows, louvers, grills, etc., which connect in any way with an inhabited area of a building, even though the access might be through another structure such as a garage or utility room (see Figure 10 and Table 1).

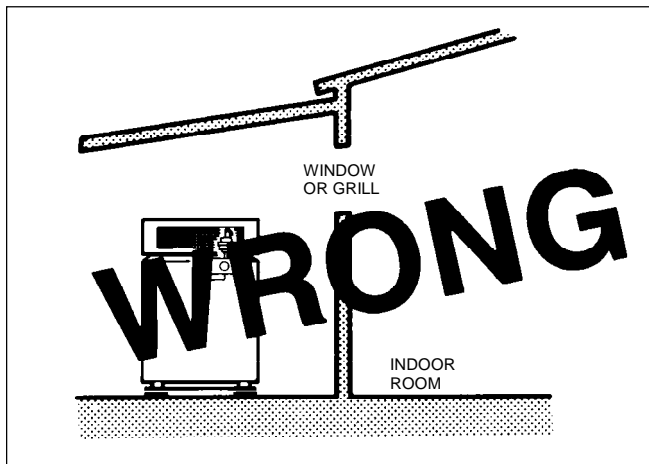


Figure 10. Incorrect Outdoor Installation.

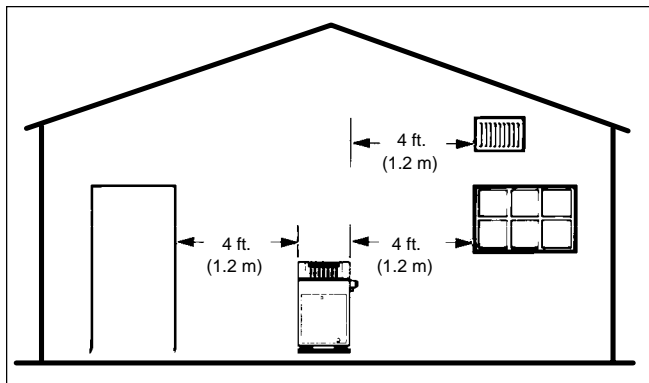


Figure 11. Outdoor Location.

There must be a minimum of 4 feet (1.2 m) horizontally between the boiler and any door, window, or gravity inlet to a building (see Figure 11). Also, the horizontal clearance should be maintained from any electric meters, gas meters, regulators, or relief equipment.

If the boiler is installed close to a structure, protect it from rain water runoff with rain gutters on the roof or other measures. Do not locate the boiler near sprinkler systems that could spray water on it.

Avoid locations where wind deflection off nearby structures might cause wind loading and downdraft conditions. Where downdraft conditions exist, locate the boiler at least 3 feet (0.9 m) from the structure.

2C-3. Flooring - Typical Installation

All boilers are equipped with a special base, as a standard part of the boiler. The unit is designed and certified for installation on combustible flooring. **Never** install the boiler on carpeting. **Never** store objects on or around the base of the boiler.

For rooftop installation, see Figure 12 through Figure 14.

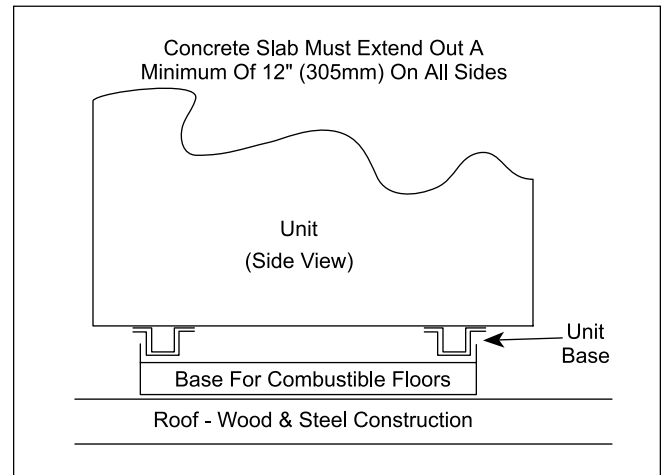


Figure 12. Standard Base for Combustible Floor.

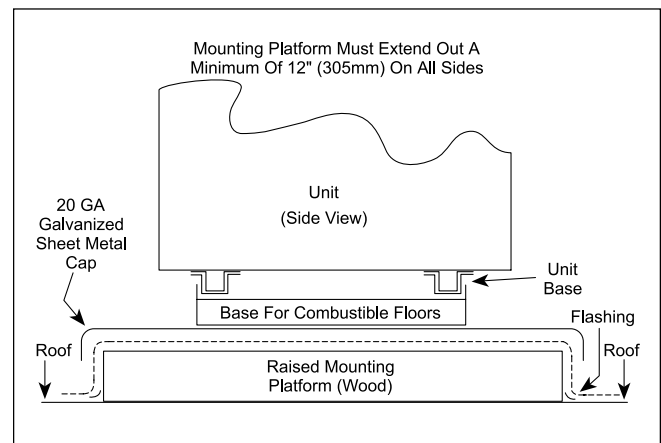


Figure 13. Typical Roof Mounting with Standard Combustible Mount Base.

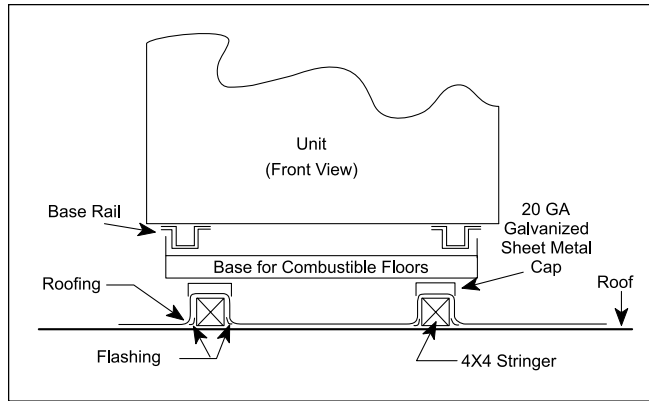


Figure 14. Typical Roof Mounting.

2D. Combustion and Ventilation

Air Supply

All indoor installations must have openings to outside air for combustion, ventilation and dilution of flue gases from inside the building (see Figure 15 and Table 2). Laars does not recommend indoor installations that do not provide combustion air from outside the building.

Boiler rooms which are confined spaces require two permanent air supply openings: one within 12 inches (305 mm) of the ceiling, the other within 12 inches (305 mm) of the floor.

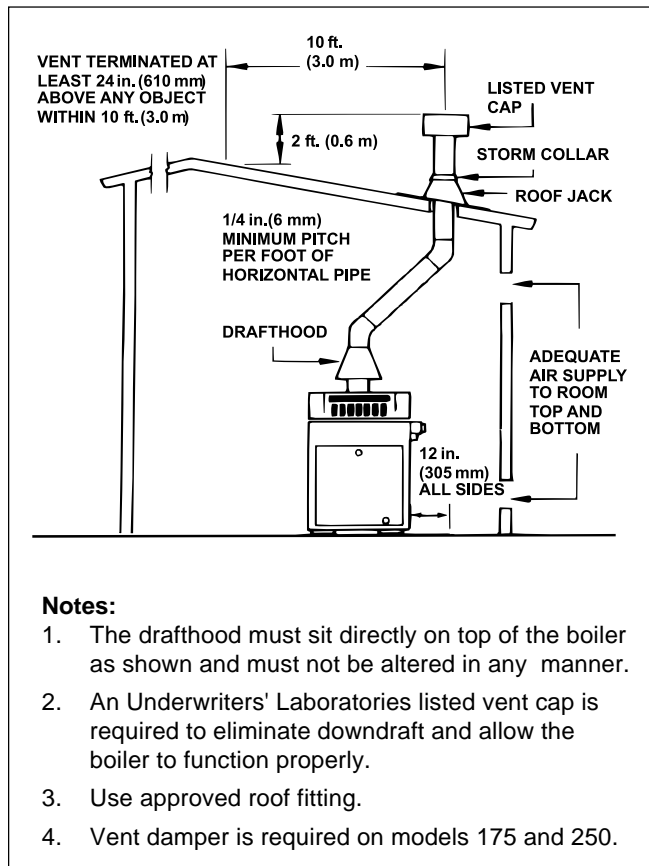


Figure 15. Indoor Installation Venting.

Model	Required Net Free Opening Area Directly from Outside			
	At Top		At Bottom	
	in. ²	cm ²	in. ²	cm ²
175	44	284	44	284
250	63	406	63	406
325	82	529	82	529
400	100	645	100	645

Note: For screens or louvers, add 50%.

Table 2. Air Openings to Outside.

NOTE: Check with louver manufacturers for net free area of louvers. If not available, add 50 percent for each screen/louver to the net free area. Check all local codes applicable to combustion air.

2D-1. Outdoor Air Supply

When combustion air comes directly through an outside wall, each opening must have a minimum free area of at least one square inch for each 4,000 BTU/h input of the total input rating of all appliances in the enclosed area. (In Canada, refer to CGA B149.1 and .2.)

2D-2. Indoor Air Supply

Confined and non-confined areas have different requirements for installation. Consult the latest edition of the National Gas Code for installation requirements.

2D-3. Exhaust Fans or Vents

Any equipment which uses air or removes air from the boiler room can use up the combustion air supply or reverse the natural draft action of the venting system. This could cause flue products to build up in the boiler room. More air must be supplied to make up for the decrease. This must be designed by a qualified engineer.

2E. Venting of Combustion Products

2E-1. General Information

When installed indoors, the draft hood and the vent damper device (models 175 and 250) must be connected to a venting system without alteration. The venting system must be installed by a qualified installer and in accordance with the latest edition of ANSI Z223.1. In Canada, the installation must be in accordance with CAN1-B149.1 or .2, and any local codes that apply.

The vent pipe must have a listed vent cap and extend at least 2 feet (0.6 m) above any object within a 10 foot (3.0 m) radius (see Figure 15).

NOTE: Do not use sheet metal screws at the snap lock joints of Type B gas vents.

Do not weld or bolt the vent pipe to the boiler drafthood or the vent damper if one is installed. The weight of the stack must not rest on the boiler. The drafthood and boiler top must be easily removable for normal boiler service and inspection.

⚠ WARNING

Avoid ending boiler vents near air conditioning or air supply fans. The fans can pick up exhaust flue products from the boiler and return them inside the building, creating a possible health hazard.

Avoid horizontal runs of the vent pipe, and 90 degree elbows, reductions and restrictions. Horizontal runs should have at least a ¼ inch (6 mm) rise per foot in the direction of flow. Support a vent connector for the design and weight of the material used to maintain clearances and prevent physical damage and separation of joints.

Always use double-wall or insulated vent pipe (Type B or equivalent).

⚠ WARNING

In cold weather, uninsulated outside vents can chill the rising flue products, blocking the natural draft action of the venting system. This can create a health hazard by spilling flue products into the boiler room.

Avoid oversize vent piping or extremely long runs of the pipe which may cause too much cooling and condensation of flue gasses.

2E-2. Replacement of Existing Boiler

At the time of the removal of an existing boiler, the following steps shall be followed with each appliance remaining connected to the common venting system. During the testing of each unit, the other appliances remaining connected to the common venting system should not be operated.

1. Seal any unused openings in the common venting system.
2. Visually inspect the venting system for proper size and horizontal pitch. Determine that there is no blockage or restriction, leakage, corrosion, or other deficiencies which could cause an unsafe condition.
3. As far as possible, close all building doors and windows. Also close all doors between the space in which the appliances remaining connected to the common venting system are located and the other spaces of the building. Turn on any clothes dryer and any appliance not connected to the common venting system. Turn on any exhaust

fans, including range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close all fireplace dampers.

4. Place in operation the appliance being inspected. Follow the lighting instructions for the unit. Adjust the thermostat so the appliance will operate continuously.
5. After 5 minutes of main burner operation, test for spillage at the draft hood relief opening. Use the flame of a match or candle, or smoke from a cigarette, cigar, or pipe.
6. The tests should show that each appliance connected to the common venting system vents properly. Return all doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliances to their previous condition of use.
7. Any improper operation of the common venting system should be corrected. The installation should conform with the National Fuel Gas Code, ANSI Z223.1. When resizing any portion of the common venting system, the system should be sized to approach the minimum practical size. Refer to the tables in Appendix G in the National Fuel Gas Code, ANSI Z223.1. (In Canada, at the time the boiler is removed from the common venting system, the common venting system should be resized. The installation should conform to CAN/CGA B149.1 or .2.)

2F. Water Flow System

2F-1. Reversible Water Connections

NOTE: This procedure is not recommended for the PH pump-mounted models.

Laars ships the HH boiler with the water connections on the right side. The HH boiler can be installed with the water connections on either side. It could be necessary, or helpful, to switch the connections to the left side to improve access for installation service. Perform this modification before installing the boiler using the following procedures:

1. Remove the front door.
2. If there is a vent cap or drafthood installed, it must be removed before removing the grate top assembly. On indoor installations (models 175-250), the drafthood switch must be disconnected at the vent damper receptacle on the left side of the boiler.
3. If the unit is in the low-profile outdoor configuration, remove the hex-head screws (see Figure 16) and lift the top assembly straight up.
4. Remove the screws that fastens the flue collector hold-down clamps and remove the clamps (see Figure 17).

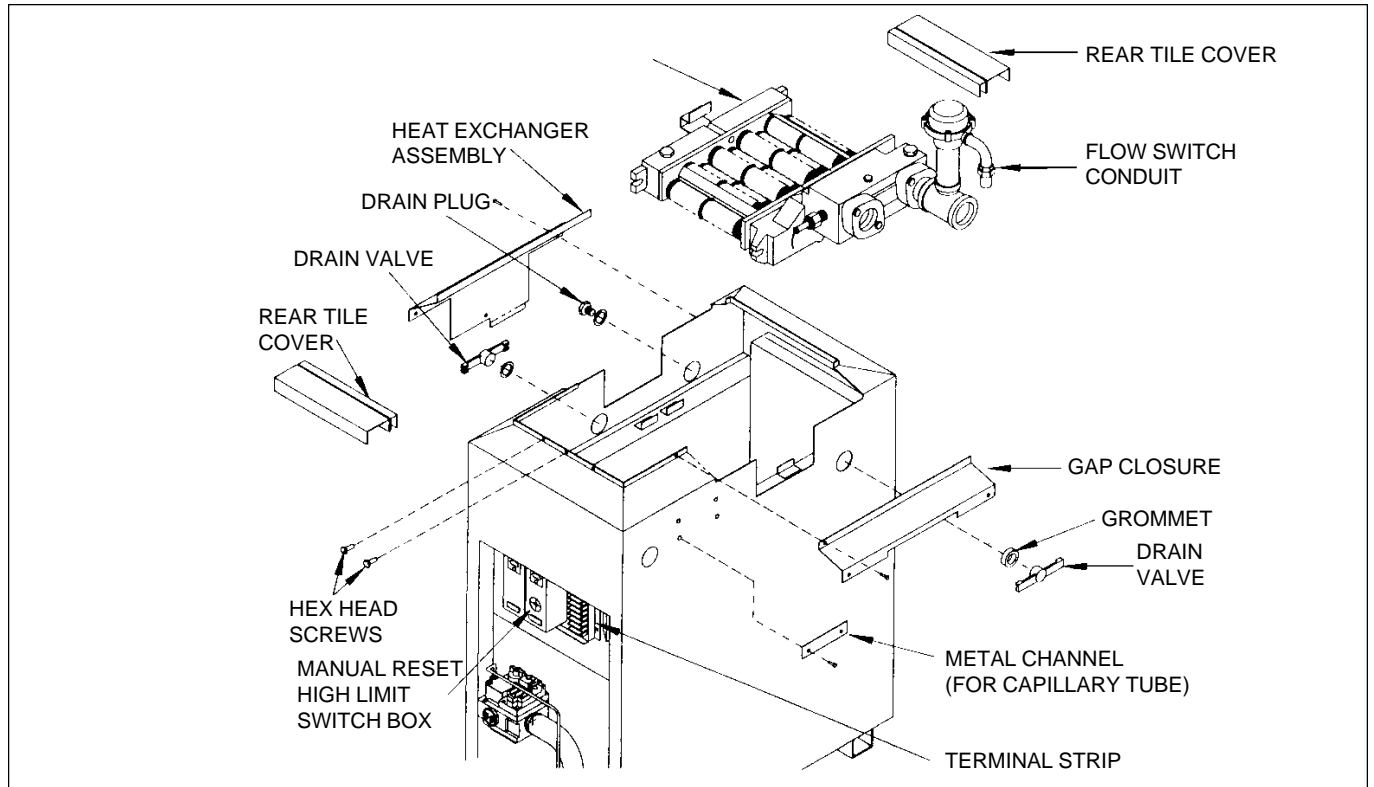


Figure 16. Heat Exchanger Removal.

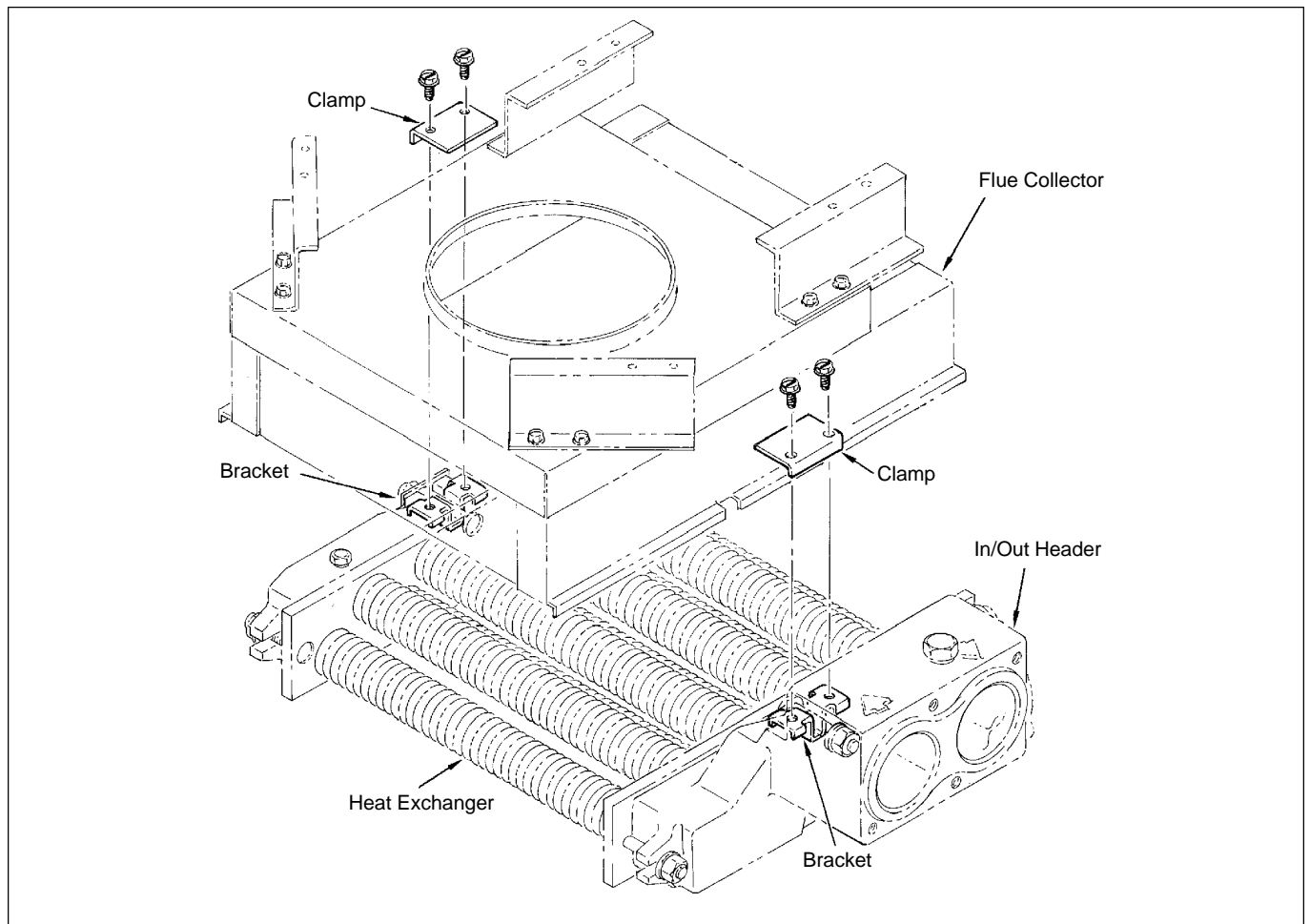


Figure 17. Flue Collector Holddown Clamps.

5. Remove the flue collector assembly by lifting it out of the chassis.
6. Remove the screws that fastens the gap closures and put them aside.

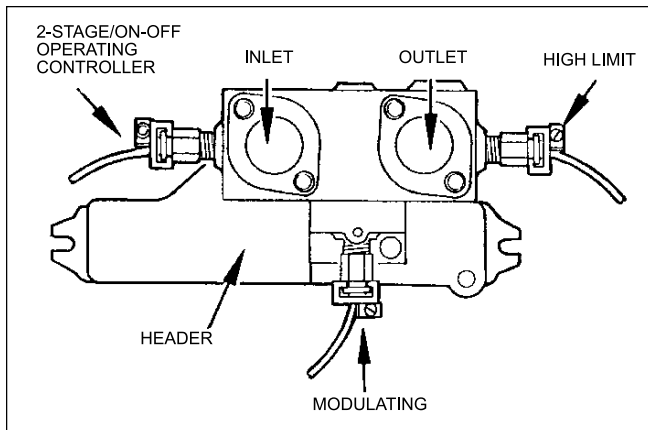


Figure 18. Sensing Bulb Locations.

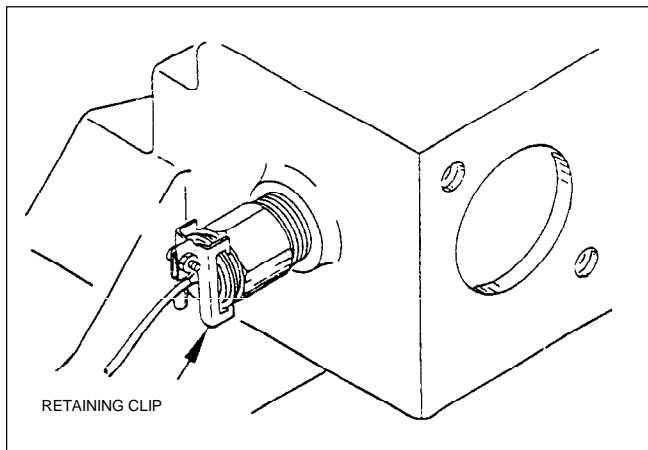


Figure 19. Capillary Tube Retaining Clip.

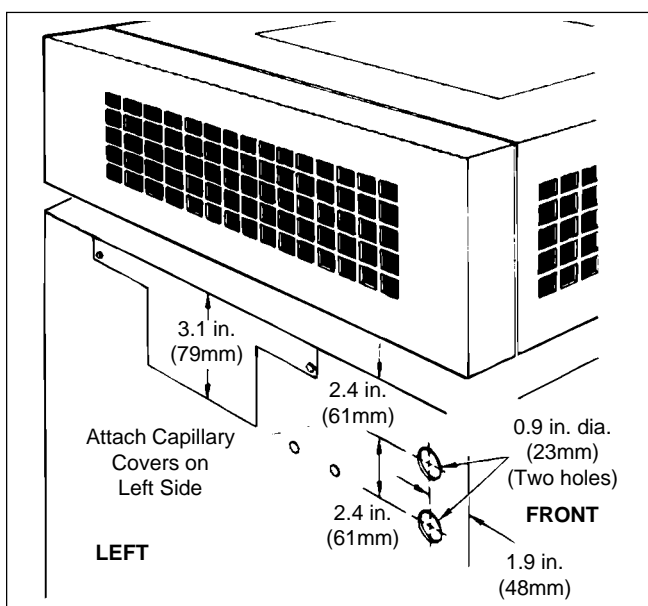


Figure 20. Hole Location, Left Side.

7. Remove the three grommets.
8. Remove the drain valve and plugs. There are two hex plugs, one on the left side, and one on the right side, near the rear of the jacket. The drain valve or plug is located on the left side near the front (see Figure 16).
9. Remove the four screws that fasten the metal channel covering the capillary tube on the right side of the jacket. Lay the channels aside.
10. A temperature control sensing bulb is located in the front of the header, on the inlet side, and a manual reset hi-limit sensing bulb is located on the back side of the header, on the outlet side (see Figure 18). Remove these sensing bulbs from the header. The following steps for removal apply to all sensing bulbs:
 - a. If there is more than one capillary tube coming out of the header, label the capillary tubes.
 - b. Loosen the screw on the capillary tube retaining clip, then gently pry the clip apart until it comes free from the thermowell (see Figure 19).
 - c. Pull the sensing bulbs out of the control compartment.
 - d. Gently pull the capillary tubes into the control compartment.
 - e. Pull the temperature sensing bulb out of the header, and temporarily route it to the front of the heater.
11. Use a pair of diagonal cutters to cut the wire bundle tie in the control compartment.
12. On the terminal strip, disconnect the two brown wires from No. 5 and No. 6 terminals.
13. Remove the flow switch conduit retaining clip and the elbow leading into the jacket.
14. Reach inside the control compartment and release the retaining nut in the upper right corner. The nut should only be finger-tight.
15. When the conduit is pulled away from the jacket, pull the two brown wires out of the control compartment. Coil the conduit and wires on top of the heat exchanger.
16. Use a chassis punch to put two $\frac{7}{8}$ inch (22mm) holes in the front left side of the jacket (see Figure 20).
17. Remove the front and rear tile covers (see Figure 16).
18. Lift out the heat exchanger assembly, turn it 180 degrees, and reseat the unit in the boiler with the water connections on the left side.
19. Reinstall the front and rear tile covers.
20. Push the capillary tube(s) out through the lower hole in the left side of the jacket.

21. Install the sensing bulb(s) into the appropriate thermowell (keep in mind that the positions of the inlet and outlet have been reversed. The inlet is now behind the outlet).
22. Fasten the capillary tube(s) by squeezing the retaining clip together, then tighten the screw.
23. Feed the two brown wires through the top hole on the left side until the conduit elbow is against the jacket.
24. Fasten the conduit by sliding the retaining nut over the two brown wires (inside the control compartment) then screwing it down finger-tight on the conduit elbow.
25. Straighten the capillary tubing and fasten it to the side of the boiler under the channel. Use the self-tapping screws to fasten the channel to the jacket.
26. Attach the two brown wires to terminals No. 5 and 6 on the terminal strip. Keep all wiring away from surfaces that will get hot during boiler operation.
27. Replace the gap closures and tighten the screws securely.
28. Replace the three grommets and the cap.
29. Reinstall the drain plug and drain valves.
30. Slip the flue collector assembly back down inside the enclosure.
31. Carefully slip a hand inside to make sure there are no gaps between the heat exchanger and the flue collector.
32. Check to make sure the wiring is not pinched against sharp edges, or resting on the collector assembly.
33. Replace the two flue collector hold down clamps.
34. Replace the top assembly and fasten it with the hex-head screws.
35. Reinstall the vent cap or draft hood if one was removed.
36. On indoor installations, plug the draft hood switch into the receptacle on the left side of the boiler.

2F-2. Freeze Protection

Proper precautions for freeze protection are recommended for boiler installations in areas where the danger of freezing exists.

Power outage, interruption of gas supply, failure of system components, activation of safety devices, etc., may prevent a boiler from firing. **Any time a boiler is subjected to freezing conditions, and the boiler is not able to fire, and/or the water is not able to circulate, there is a risk of freezing in the boiler or in the pipes in the system.** When water freezes, it expands. This can result in bursting of pipes in the system, or damage to the boiler, which could result in leaking or flooding conditions.

Do not use automotive anti-freeze. Maintaining a mixture of minimum 50% water and maximum 50% properly inhibited HVAC glycol, which contains an antifoamant, is the preferred method of freeze protection for Mighty Therm boilers. **Percentage of glycol used in the Mighty Therm boiler must not exceed 50%.** Typically, this mixture will serve as burst protection for temperatures down to approximately -35°F (-30°C). To get the desired temperature rise across the boiler when the is mixture is used, increase the water flow by 15% above the original recommendation. Increase the head loss requirement by 20%

IMPORTANT NOTES: Different glycol products may provide varying degrees of protection. Glycol products must be maintained properly in a heating system, or they may become ineffective. Consult the glycol specifications, or the glycol manufacturer, for information about specific products, maintenance of solutions, and set up according to your particular conditions.

2F-3. Pump Requirements

High recovery, low volume water boilers need enough water flow for efficient operation. The system pump must develop enough pressure to overcome the pressure drop of the boiler plus the pressure drop of the entire circulation system at the flow rates selected from Table 3.

Size	Temperature Rise in °F °C															
	20°F 11°C				25°F 14°C				30°F 17°C				35°F 19°C			
	GPM	L/s	H/L*		GPM	L/s	H/L*		GPM	L/s	H/L*		GPM	L/s	H/L*	
ft			m	ft			m	ft			m	ft			m	
175	14	0.88	1.0	0.3	11	0.69	0.6	0.2	9	0.57	0.5	0.2	8	0.50	0.3	0.1
250	20	1.26	2.1	0.6	16	1.00	1.2	0.4	13	0.82	0.8	0.2	11	0.69	0.6	0.2
325	25	1.58	3.4	1.0	20	1.26	2.1	0.6	17	1.07	1.4	0.4	15	0.94	1.1	0.3
400	31	1.96	5.2	1.6	25	1.58	3.4	1.0	21	1.32	2.3	0.7	18	1.13	1.7	0.5

Water Flow - GPM or L/s
 *Pressure drop (head loss) through the boiler, expressed in feet or meters of water (H₂O).

Table 3. Temperature Rise.

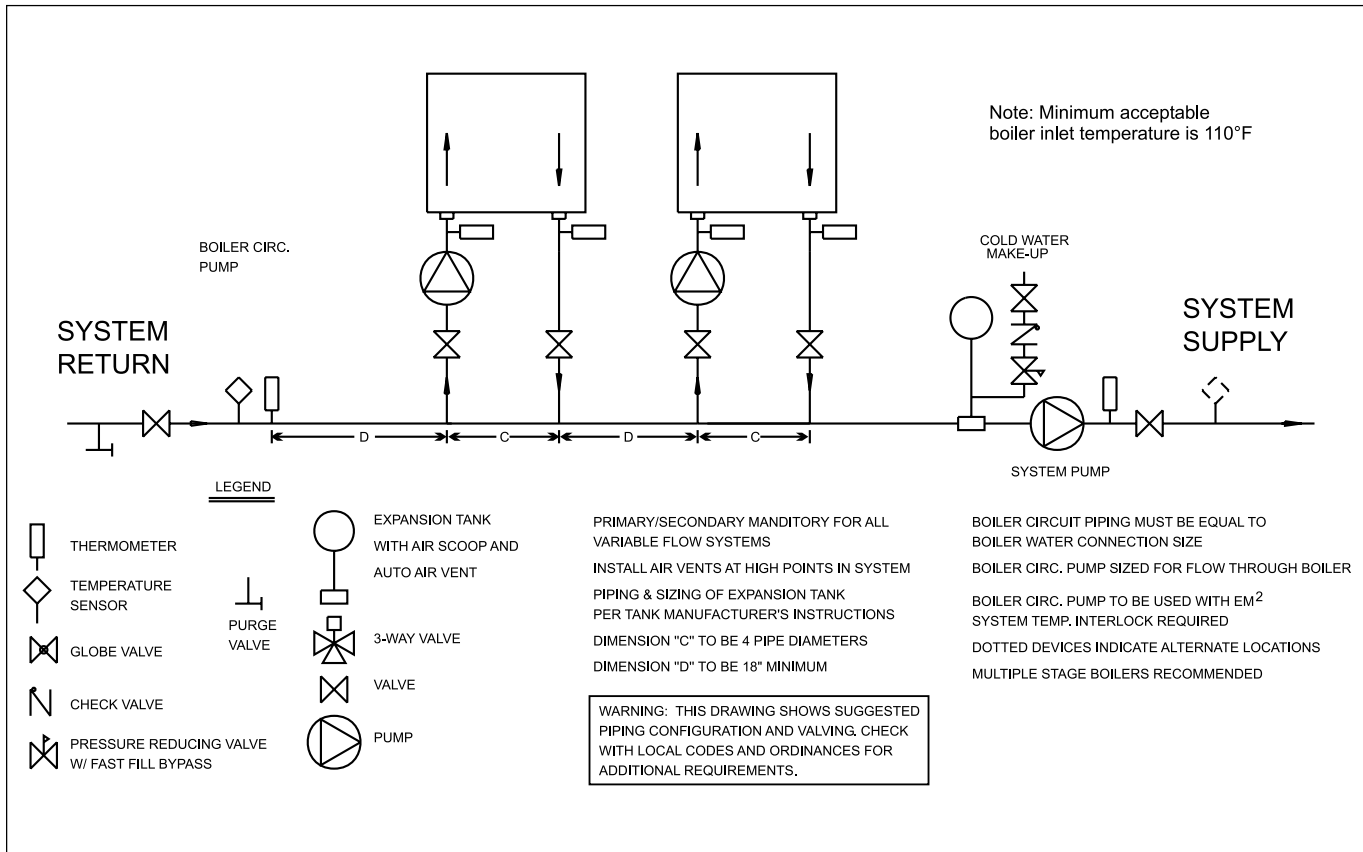


Figure 21. Piping — Multiple Boilers, Primary Secondary System.

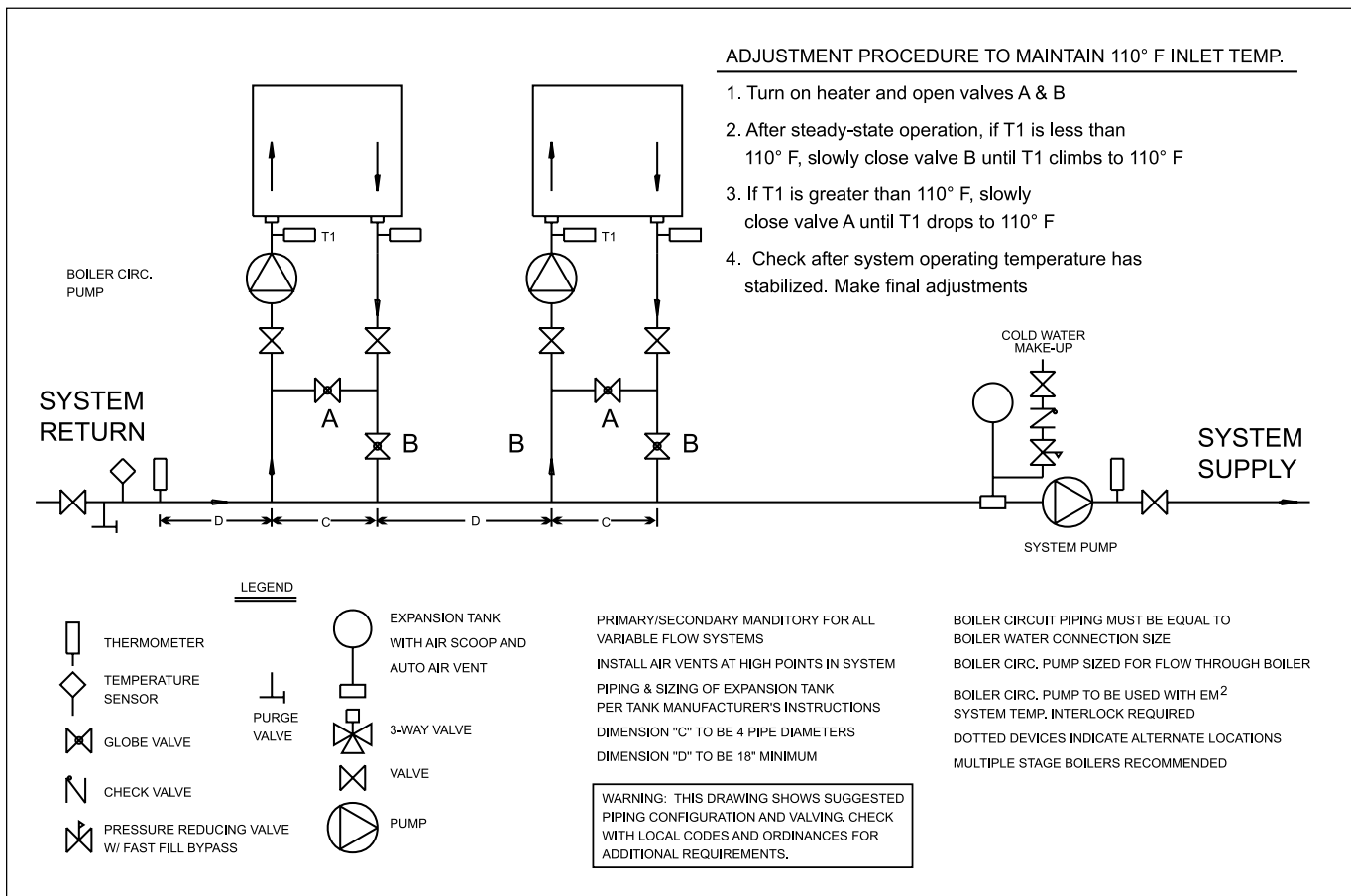


Figure 22. Piping — Multiple Boilers, Low Temperature System.

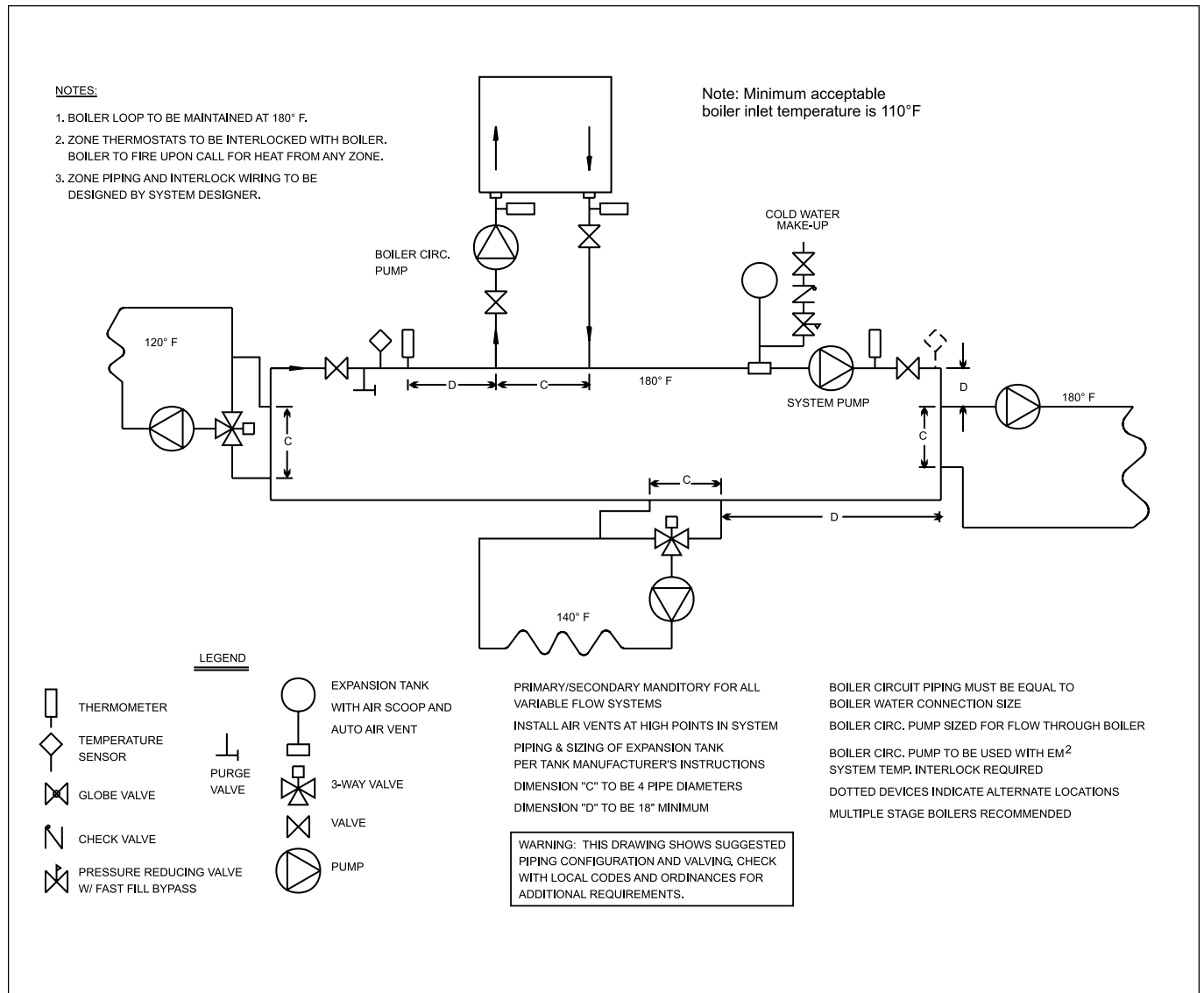


Figure 23. Hydronic Piping — One Boiler, Multi-Temperature System.

The correct flow rate can be verified by checking the temperature rise of water as it passes through the boiler. To check the temperature rise, measure the difference in water temperature between the boiler inlet and outlet to determine flow. For example: If a Size 325 boiler is installed; the inlet water temperature is 160°F (71°C); and the outlet water temperature is 185°F (85°C); then there is a 25°F (14°C) temperature rise. Per Table 3 this equals a flow rate of 20 GPM (1.3L/s) and a head loss (pressure drop) of 2.1 feet of water. If a higher temperature rise is measured, flow must be increased by changing the piping or pump size.

2F-4. Variable Water Flow Systems

There can be reduced water flow through the boiler in heating systems using zone valves, zone pumps or 3-way valves. This can result in a high temperature rise across the boiler. Laars recommends primary-secondary pumping for all variable flow

systems. The boiler pump in a primary-secondary system maintains constant flow through the boiler even though the system flow is variable. In a primary-secondary system the pressure drop of the boiler is not added to the system (see Figures 21, 22 and 23).

2F-5. System Pressure Requirements

The HH-PH boilers are designed to operate on closed, pressurized systems. A minimum of 12 psi (82.7kPa) should be maintained on the system where boiler supply water temperatures are 200°F (93°C) or less. If higher temperatures are required, the minimum system pressure should be at least 15 psi (103.4 kPa) above the water vapor pressure corresponding to the elevated water temperature.

Do not use the HH-PH boilers to operate on open, pressurized systems unless the supply water temperatures are kept below 180°F (82°C), and a minimum of 5 psi (34.5 kPa) static head is maintained at the boiler.

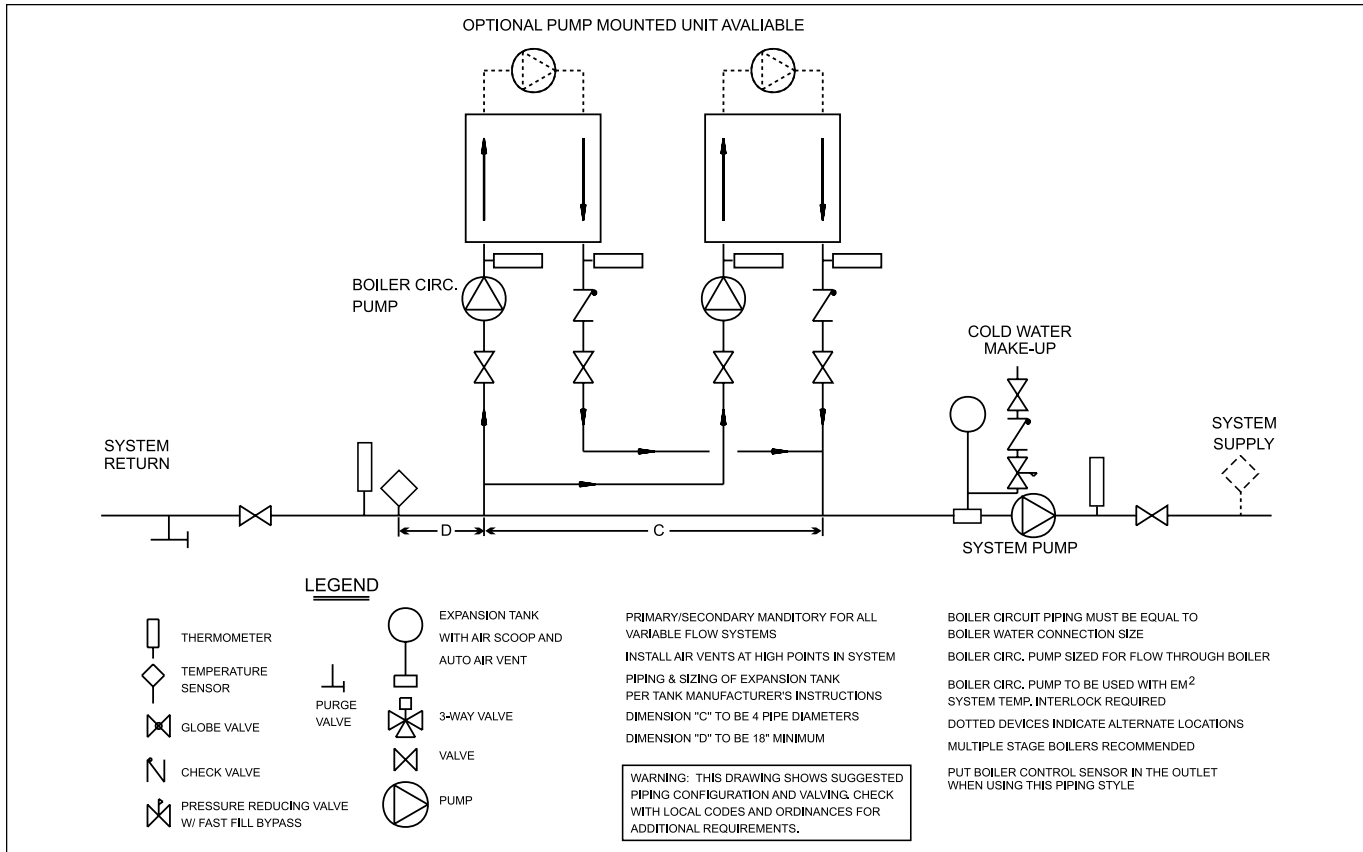


Figure 24. Hydronic Piping - Primary-Secondary, Reverse-Return.

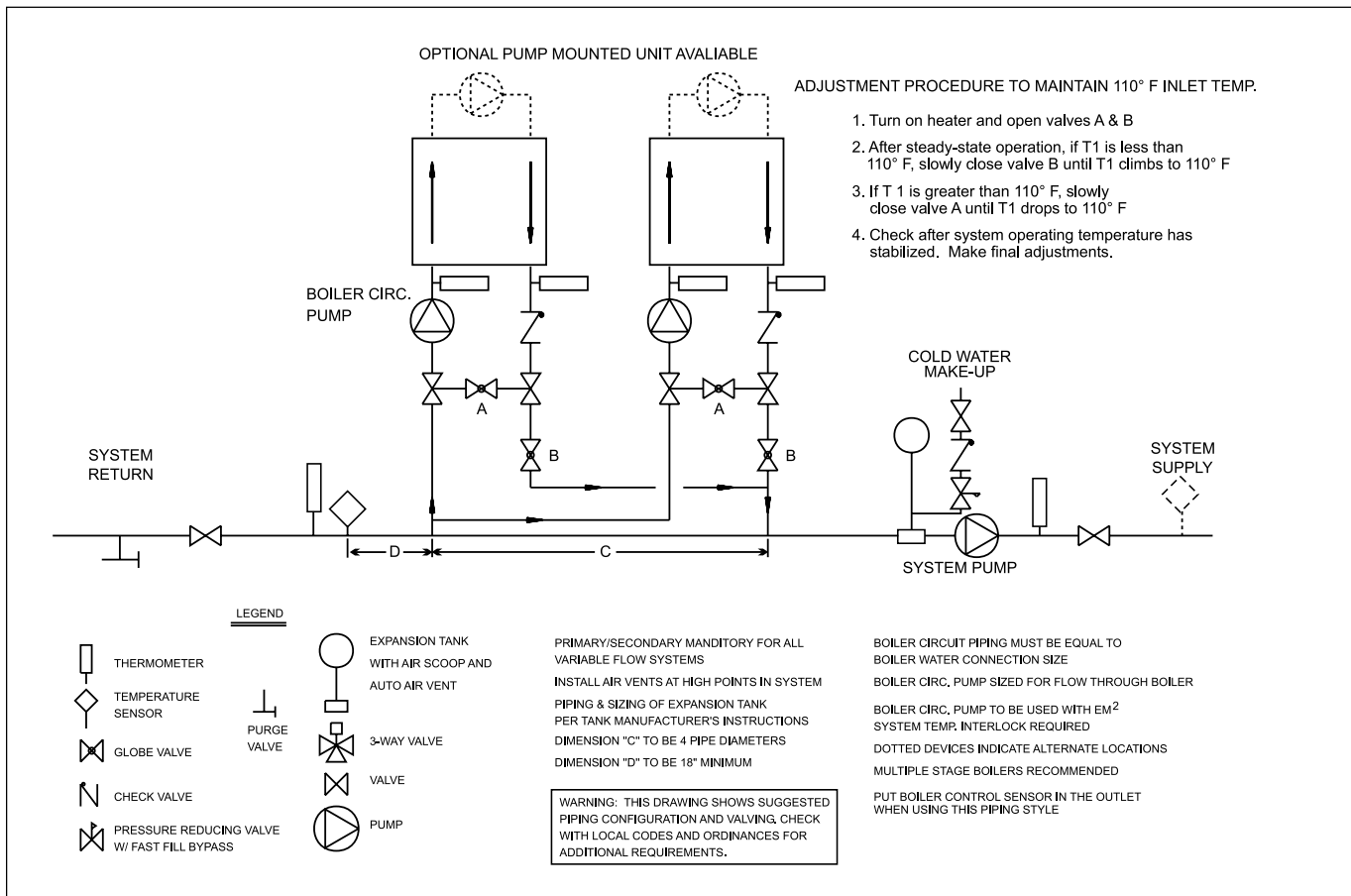


Figure 25. Hydronic Piping - Primary-Secondary, Reverse-Return, Low Temperature.

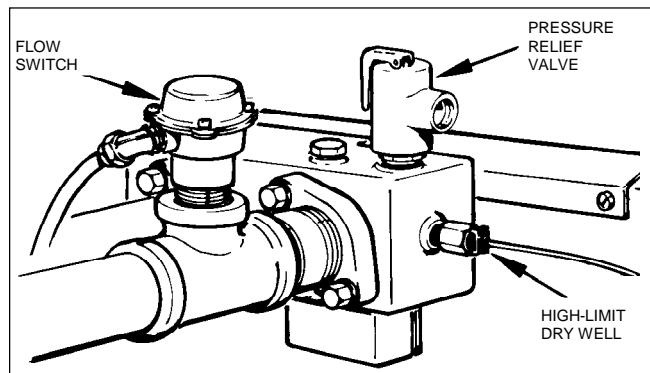


Figure 26. Pressure Relief Valve.

2F-6. Chilled Water Systems

If the boiler is part of a refrigeration system, include the right valves to isolate the boiler from the refrigeration system during times when the boiler is not operating.

When the boiler piping is connected to heating coils, which are close to refrigerated air circulation, install flow control valves or other automatic methods to prevent gravity circulation of the boiler water during the cooling cycle.

2F-7. System to Boiler Piping

1. Install gate valves at the inlet and outlet to the boiler so it can be isolated for service.
2. Make sure the pressure relief valve (see Figure 26) has its outlet piped to a drain or floor sink. Pay special attention to relief valve settings in installations where the boiler is located on the ground floor of a tall building, or where the operating temperature of the boiler is above 210°F (99°C). In both cases, the static pressure of the system is raised. This would bring raw water into the system. The factory will furnish a 75 psi (516.8 kPa) setting unless a special setting is ordered.
3. Install a low water cutoff device if the boiler is installed above radiation level.
4. Install manual and/or automatic air venting devices at high points in the system to get rid of air.
5. Install a correctly sized expansion or compression tank in accordance with the manufacturer's instructions.
6. Support the weight of all water and gas piping with suitable hangers or floor stands.
7. Check piping diagrams with local applicable plumbing, heating and building safety codes.

2F-8. Filling the System

1. Close all air vents and open the makeup water valve. Let the system fill slowly.

2. If a makeup water pump is used, adjust the pressure switch on the pumping system to maintain at least 12 psi (82.7 kPa) at the highest point in the heating loop.
3. If a water pressure regulator is installed on the makeup water line, adjust the pressure regulator to provide at least 12 psi (82.7 kPa) at the highest point in the heating loop.
4. Open air vents on all radiation units at the high points in the piping throughout the system, unless automatic air vents are installed at those points.
5. Run the system circulating pump for at least 30 minutes with the boiler shut off.
6. Recheck all air vents as described in Step 4 above.
7. With the system full of water and under normal operating pressure, the air pressure in the expansion tank should be at least 12 psi (82.7 kPa).
8. Start up the boiler following the instructions found on the inside of the boiler.
9. Operate the whole system, including the pump, boiler, and radiation units for 1 hour.
10. Shut down the entire system and vent all radiation units and high points in the system piping as described in Step 4 above.
11. Close the makeup water valve and check the strainer in the pressure reducing valve for sediment or debris. Reopen the makeup water valve.
12. Check the gauge to make sure the water pressure is right, and check water level in the system. If the water level indicated above the boiler shows that water is at the highest point in the circulating loop, then the system is ready for operation.
13. Within 3 days of start-up, recheck all air vents and expansion tank as described in Steps 4 and 8 above.

2F-9. Minimum Boiler Temperature

The boiler inlet water temperature must be minimum 110°F (43°C) when the system has come up to normal operating conditions. Lower temperature inlet water may allow the production of condensation on the outside of the copper finned tubes, which can block the flue gases and/or cause improper combustion, leading to heat exchanger sooting.

For systems with lower than 110°F (43°C) temperature, boiler must be protected from low temperature return water. There are many methods of achieving low temperature protection. Figures 22 and 25 shows an example of such a system.

Distance from Gas Meter or Last Stage Regulator						
Boiler Size	0-100 feet 0-30 m		100-200 feet 30-60 m		200-300 feet 60-90 m	
	Nat.		Nat.		Nat.	
	in.	mm	in.	mm	in.	mm
175	1	25	1¼	32	1¼	32
250	1¼	32	1¼	32	1½	38
325	1¼	32	1½	38	1½	38
400	1¼	32	1½	38	2	51

Notes:

1. These numbers are for natural gas (0.65 Sp. Gr.) and are based on ½ inch (13mm) water column pressure drop. Check supply pressure with a manometer, and local code requirements for variations. For liquefied petroleum gas, reduce pipe diameter one size, but maintain a ½ inch (13mm) minimum diameter.
2. Check supply pressure and local code requirements before proceeding with work.
3. Pipe fittings must be considered when determining gas pipe sizing.
4. For propane gas: Reduce pipe diameter one size, but maintain a ¾ inch (19mm) minimum diameter.

Table 4. Natural Gas and Propane, Pipe Size Requirements.

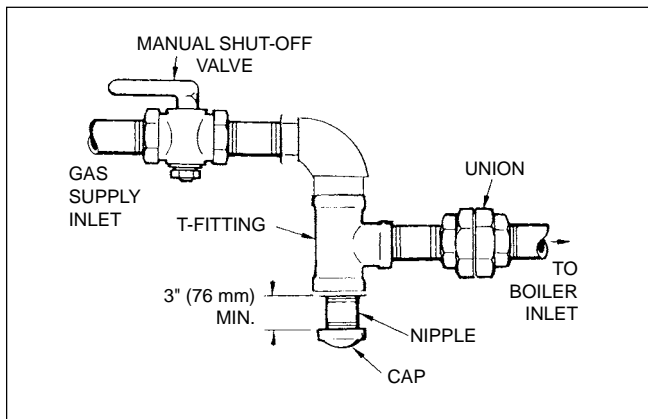


Figure 27. T-Fitting and Sediment Trap.

Supply Pressure Water Column	Natural Gas		Propane Gas	
	in.	kPa	in.	kPa
Minimum	6.5	1.6	11	2.7
Maximum	10	2.5	14	3.4

Table 5. Gas Supply Pressure Requirements.

2G. Gas Supply and Piping

2G-1. General Instructions

Review the following instructions before continuing the installation.

1. Gas piping installation must be in accordance with the latest edition of ANSI Z223.1. In Canada, the installation must be in accordance

with CAN1-B149.1 or .2 and all local codes that apply.

2. Check the rating plate to make sure the boiler is fitted for the type of gas being used. Laars boilers are normally equipped to operate below a 2000 foot (610 m) altitude. Boilers equipped to operate at higher altitudes have appropriate stickers or tags attached.
 3. If a gas pressure regulator is required, the installation must be in accordance with the latest edition of ANSI Z223. In Canada, the installation must be in accordance with CAN1-B149.1 or .2 and all local codes that apply.
 4. The figures in Table 4 should be used to size the gas piping from the gas meter to the boiler.
 5. Install a sediment trap (drip leg) ahead of the gas controls (see Figure 27). Fit the trap with a threaded cap which can be removed for cleaning.
 6. Install a manual gas shut-off valve for service and safety. Check the local codes.
 7. Disconnect the boiler and its individual shut-off valve from the gas supply system during pressure test of the system at pressures higher than ½ psi (3.4 kPa).
 8. Gas supply pressures to the boiler are listed in Table 5.
- NOTE:** The boiler and all other gas appliances sharing the boiler gas supply line must be firing at maximum capacity to properly measure the inlet supply pressure. Low gas pressure could be an indication of an undersize gas meter and/or obstructed gas supply line.
9. Do not exceed the maximum inlet gas pressures specified. Excessive pressure will result in damage to the heater's gas controls. The minimum pressures specified is for gas input adjustment.
 10. The correct burner manifold gas pressure is stamped on the rating plate. The regulator on the gas valve is preset at the factory, and does not normally need adjustment.
 11. Before operating the boiler, test the complete gas supply system and all connections for leaks using a soap solution.

Caution

Since some leak test solutions (including soap and water) may cause corrosion or stress cracking, rinse the piping with water after testing.

2G-2. Special Precautions for Propane Gas

Propane gas is heavier than air. Therefore, do not install boilers using propane gas in a pit or locations where gas might collect. Locate boilers a safe distance from propane gas storage and filling equipment.

TYPICAL WIRING DIAGRAM: IGNITION SYSTEM NO. 1 - STANDING PILOT ON/OFF OR MECHANICAL MODULATION

Example shown: HH and PH Hydronic Boilers (175-250) Version B
Natural or Propane Gas

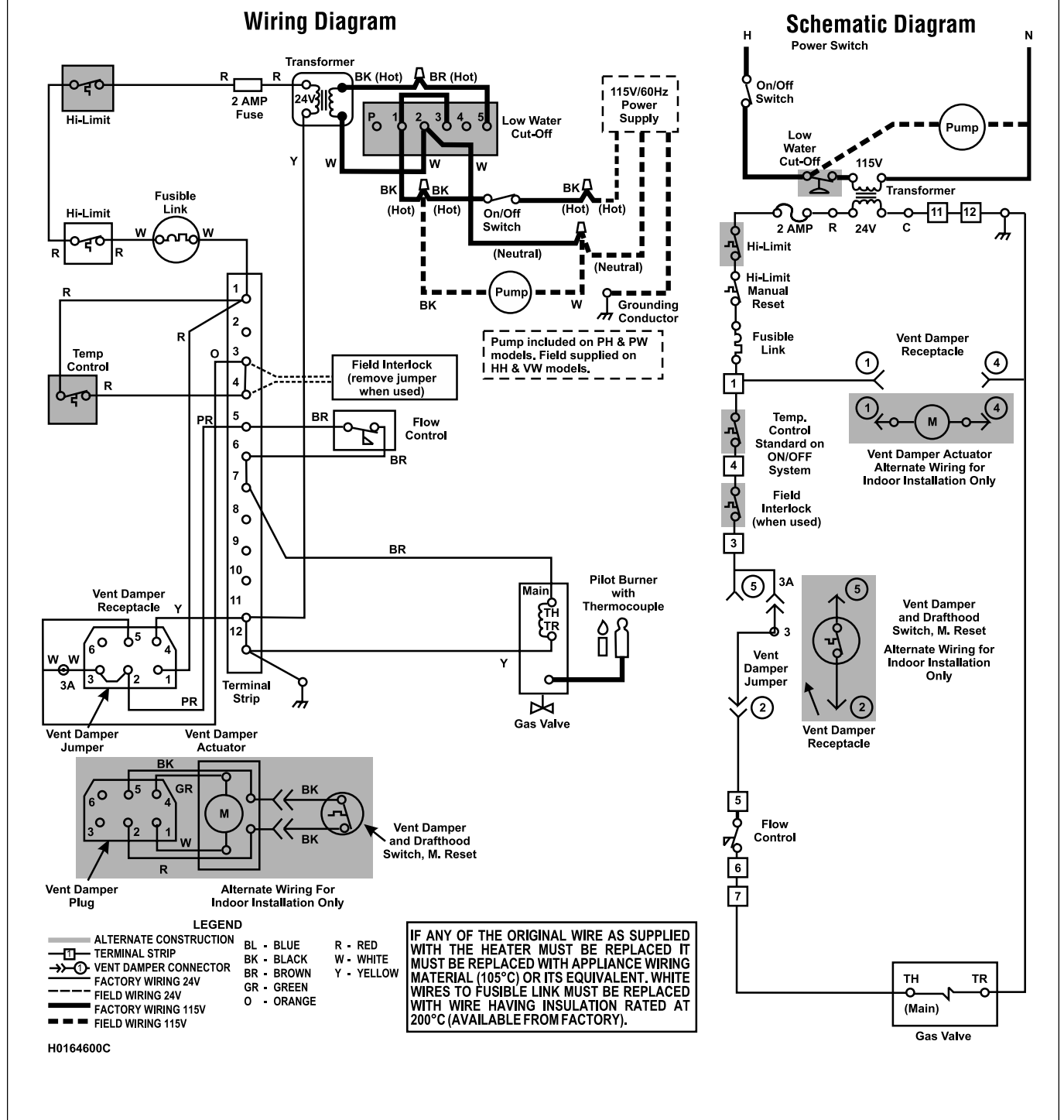


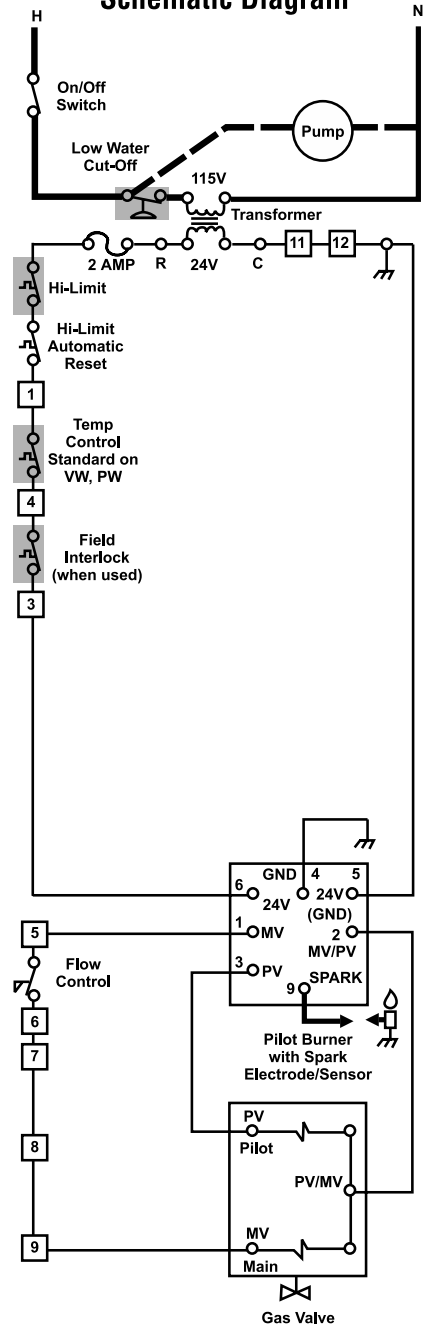
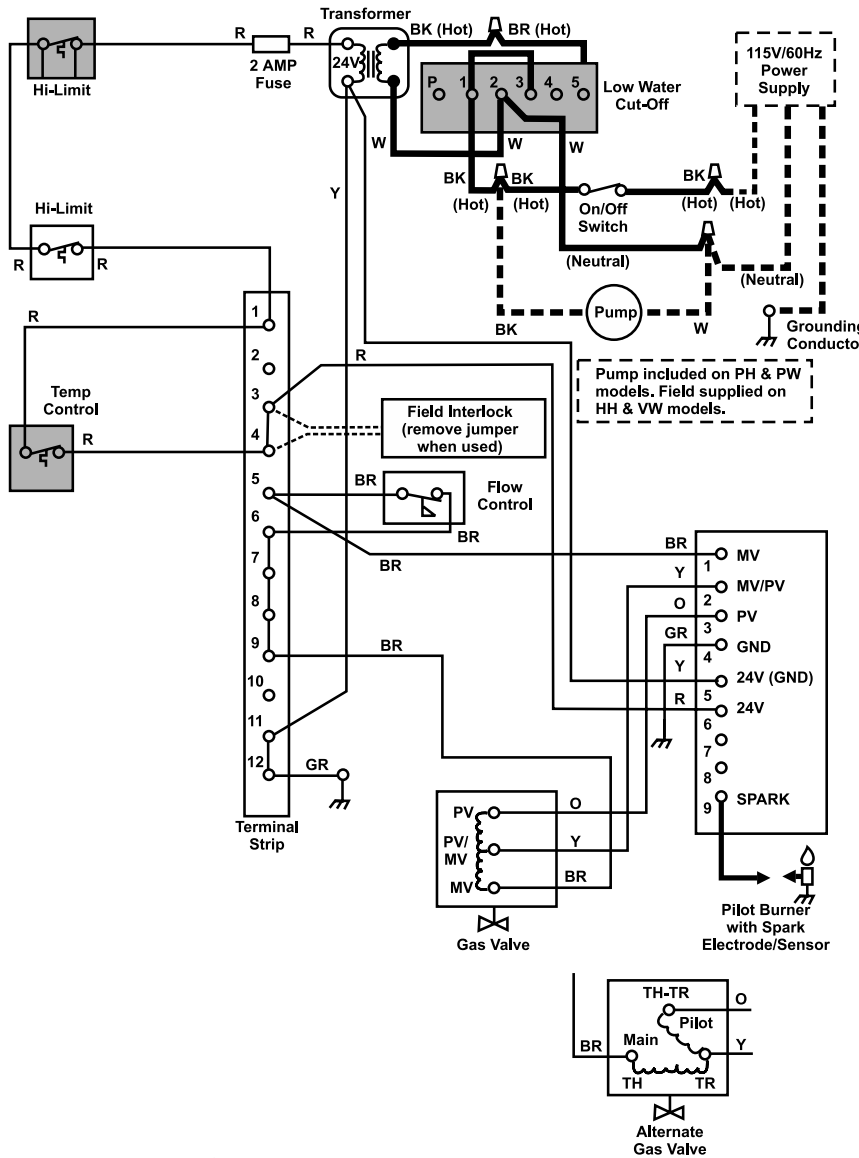
Figure 28. Typical Example of Wiring Schematic, System 1.

TYPICAL WIRING DIAGRAM: IGNITION SYSTEM NO. 12 - ELECTRONIC IGNITION ON/OFF OR MECHANICAL MODULATION

Example shown: HH and PH Hydronic Boilers (325-400) Version B
Natural or Propane Gas

Wiring Diagram

Schematic Diagram



LEGEND

- | | | |
|--------------------------|------------|------------|
| — ALTERNATE CONSTRUCTION | BL - BLUE | R - RED |
| — TERMINAL STRIP | BK - BLACK | W - WHITE |
| — FACTORY WIRING 24V | BR - BROWN | Y - YELLOW |
| — FIELD WIRING 24V | GR - GREEN | |
| — FACTORY WIRING 115V | O - ORANGE | |
| — FIELD WIRING 115V | | |
- H0115600F

IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE HEATER MUST BE REPLACED IT MUST BE REPLACED WITH APPLIANCE WIRING MATERIAL (105°C) OR ITS EQUIVALENT. WHITE WIRES TO FUSIBLE LINK MUST BE REPLACED WITH WIRE HAVING INSULATION RATED AT 200°C (AVAILABLE FROM FACTORY).

Figure 29. Typical Example of Wiring Schematic, System 12.

Consult local codes and fire protection authorities about specific installation restrictions.

2H. Electrical Wiring

⚠ WARNING

Electrically ground the boiler in accordance with the latest edition of the National Electrical Code, ANSI/NFPA 70. In Canada, use C22.1. Do not rely on the gas or water piping to ground the metal parts of the boiler. Often, plastic pipe or dielectric unions isolate the boiler electrically. Service and maintenance personnel who work on or around the boiler may be standing on wet floors and could be electrocuted by an ungrounded boiler.

1. Check boiler wiring and pump for correct voltage, frequency, and phase. If the pump circuit is other than 120V AC, check to make sure the boiler is provided with an appropriate transformer.
2. Wire the boiler and pump exactly as shown on the wiring diagram found on the inside of the boiler. See Figures 28 and 29 for typical examples of the wiring diagram.
3. Electrically interlock the pump and boiler so the boiler cannot come on unless the pump is running.
4. Connect all field-installed devices (draft switches, relays, timers, outdoor temperature reset devices, etc.) (see Figures 28 and 29) to the boiler wiring at points labeled Field Interlock.

SECTION 3. Operating Instructions

NOTE: Safe lighting and other performance criteria were met with the gas manifold and control assembly installed on the boiler during tests specified in ANSI Z21.13.

⚠ WARNING

For your safety, when starting the boiler, keep your head and face well away from the lower firebox opening to prevent any risk of personal injury. Vent pipes, drafthoods, and boiler tops get hot! These surfaces can cause serious burns. Do not touch these surfaces while the boiler is in operation. Adding a vent cap reduces the temperature on the top.

PROPANE GAS: To avoid possible injury, fire and explosion, read and follow these precautions and all instructions on this boiler before lighting the pilot. This boiler uses propane gas which is heavier than air and will remain at ground level if there is a leak. Before lighting, sniff at ground level.

If you smell gas, follow these rules:

1. DO NOT light matches. DO NOT turn electric lights or switches on or off in area. DO NOT use an electric fan to remove the gas from area.
2. Shut off gas at propane tank.
3. Telephone gas company and fire department for instructions. Give your name, address and phone number.

If your propane tank runs out of fuel, turn off gas at the boiler. After the tank is refilled, the boiler must be relit in accordance with the instructions found on the inside of the boiler. DO NOT attempt repairs on the gas control or boiler. Tampering is dangerous and voids all warranties.

3A. Setting the Temperature Controls

Boilers are shipped with the temperature control sensor bulb located in the inlet side and the hi-limit switch sensing bulb is in the outlet side (see Figure 18). Set the temperature control (see Figure 30) at the designed system supply temperature less the

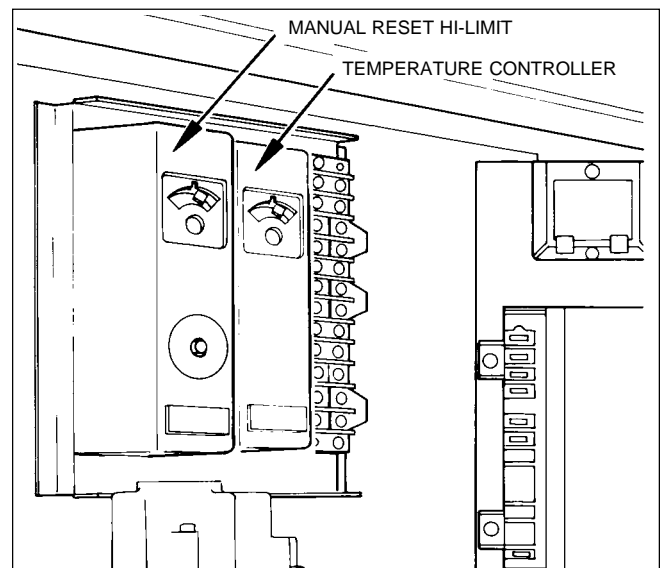


Figure 30. Temperature Controls.

temperature drop in the system. Set the hi-limit switch 15°F (8°C) above the supply temperature to the system.

3B. Start-Up Procedure

Lighting instructions can be found on the inside of the boiler. To start up the boiler:

1. Make sure the system pump is running and there is water flow.
2. Remove the control access panel (front door).
3. Set the temperature control (see Figure 30) to its lowest setting.
4. Turn electric power to the boiler OFF.
5. Turn the manual gas valve OFF.
6. Wait 5 minutes to clear out any gas, then smell for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.
7. Turn the manual gas valve ON. (For a standing or continuous pilot system, follow the lighting and shutdown instructions.)
8. Reset all safety devices - high limit, low water cutoff, etc.
9. Set the temperature control to the desired setting (see Figure 30 and section 3A).
10. Replace the control access panel.
11. Turn the electric power to the heater ON.

⚠ Caution

On a boiler equipped with the vent damper device, the damper must be in the open position when the main burners are operating.

If the boiler will not operate:

- a. Turn off all manual gas supply valves.
- b. Turn the main electrical switch OFF.
- c. Turn the gas to the boiler OFF. Follow the instructions found on the inside of the boiler and call a qualified professional technician or gas supplier.

3C. Adjustment for Minimum Input Rate (Models with Modulating Gas Valve)

Adjust the red knob on the modulating gas valve to the dial number for the desired water temperature (see Table 6). Adjusting the red knob to number "1" sets the gas flow rate to minimum. The control is factory set at "5" which is satisfactory for most installations.

Dial No.	Temp.	
	°F	°C
1	140	60
2	152	67
3	165	74
4	177	81
5	190	88
6	202	94
7	215	102
8	227	108
9	240	116

Table 6. Modulating Valve Temperature Setting.

3D. Hi-Limit Switch Checkout

After running the boiler for a long enough period, bring the water temperature within the range of the hi-limit switch and slowly back off the hi-limit setting until the boiler shuts off. The main burners should re-ignite when the hi-limit switch is reset and turned back up to its original setting. The boiler should now run until it shuts off automatically on operating control.

When all the safety shut-off devices have been tested, refer to Section 3A for the proper settings of the temperature controls.

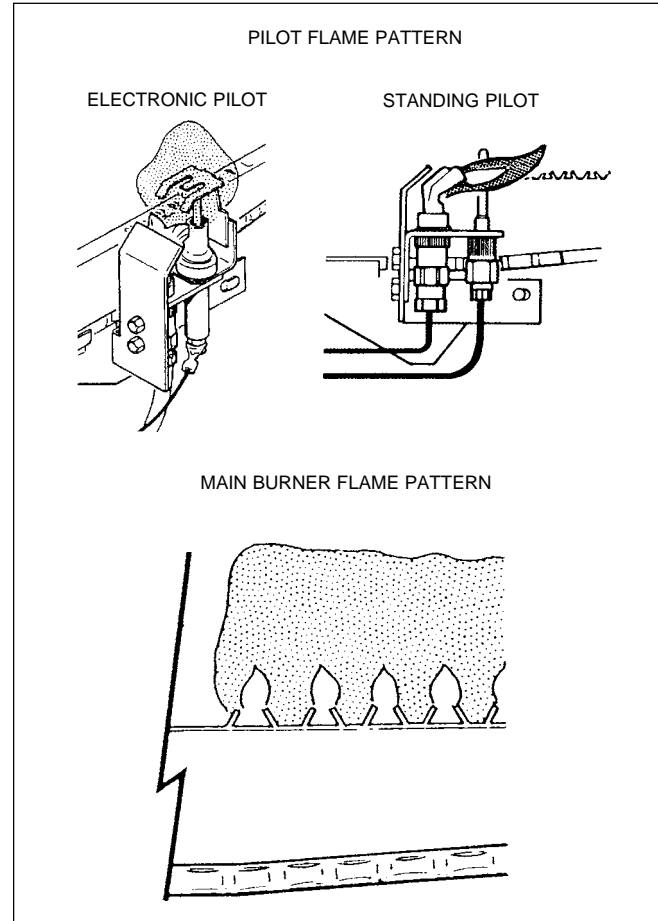


Figure 31. Flame Patterns.

3E. Shut-Down Procedure

Shut the boiler down following the instructions found on the inside of the boiler.

Where there is a danger of freezing, shut off the water supply and remove the drain plugs on both sides of the boiler jacket. Drain every part of the system subject to damage from freezing temperatures.

SECTION 4. Service Instructions

4A. Regular Inspection

NOTE: After installation and first startup, check the heat exchanger for black carbon soot buildup after the following periods of operation: 24 hours, 7 days, 30 days, 90 days, and once every 6 months thereafter. If cleaning is necessary, see the instructions in this section.

1. Oil the water circulating pump in accordance with the manufacturer's instructions.
2. If a strainer is used in a pressure reducing valve or in the piping, clean it every 6 months in accordance with the manufacturer's instructions.
3. At startup and every 6 months after, look at the pilot and main burner flame (see Figure 31). Use inspection mirror. Characteristics of a good flame are:
 - a. Blue in color

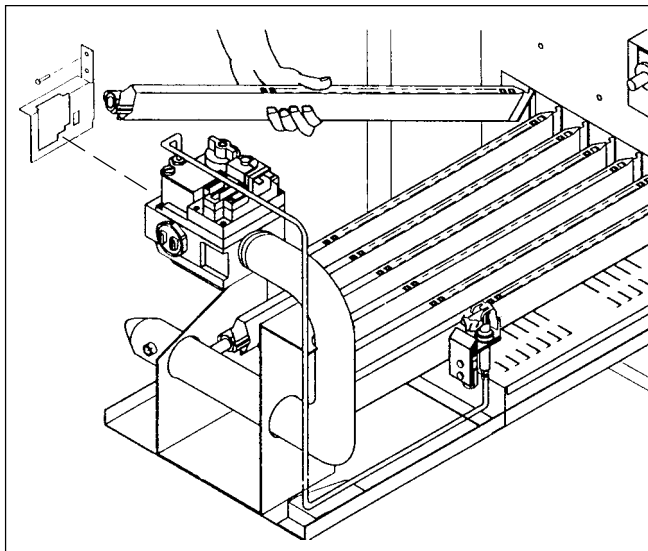


Figure 32. Burner Removal and Gas Valve.

⚠ Caution

Since some leak test solutions (including soap and water) may cause corrosion or stress cracking, rinse the piping with water after testing.

- b. Flame is not lifting off the burner ports
4. Inspect the venting system for blockage, leakage, and corrosion at least once a year.
5. Keep the equipment area clear of combustible material, gasoline, and other flammable liquids and vapors.
6. Be sure all combustion air and ventilation openings are not blocked.
7. Check for black carbon soot buildup on the external surfaces of the heat exchanger every 6 months. If cleaning is necessary, see the instructions in this section.
8. On a unit with the optional low water cutoff, check the device to be sure it is functioning correctly.
9. Do not use the boiler if any part has been under water. Replace any part of the gas control and control system, or any tile material or insulation which has been under water.

4B. Replacement of Gas Controls

⚠ WARNING

Never attempt to repair the gas valve. Such attempts will void the warranty, and could lead to dangerous results.

If the gas valve is found to be defective, replace it by following these instructions:

1. Turn all electrical power to the boiler OFF.
2. Turn off the main gas supply at the manual gas cock or the gas meter.
3. Remove the front access door on the boiler.
4. Turn OFF the gas valve to the boiler following the shut-down instructions found on the inside of the boiler.
5. Disconnect the service union in the gas line, and unscrew the main gas pipe from the gas valve (see Figure 32).
6. Remove the two screws that fastens the anti-rotation bracket on the left side of the gas valve (see Figure 32).
7. Remove the pilot gas line and thermocouple shield, if present, from the gas valve.

⚠ Caution

Label all wires before disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.

8. Tag and remove all wires from the gas valve terminals.
9. Pull the burner tray out of the boiler (see Figure 32).
NOTE: Due to sharp edges on the metal burners, wear protective gloves for the next steps.
10. Hold the gas burner or pilot burner firmly, and push it away from the manifold until it is clear of the orifice. Slide the burner to be replaced out of the burner tray (see Figure 32).
11. To replace the gas burner, insert the burner into the slot at the rear of the burner tray, line it up with the proper orifice and snap it into position.
12. To replace the pilot burner, install the pilot assembly on the new pilot burner and install it in the burner tray.
13. Screw the new gas valve onto the manifold pipe. Make sure the arrow on the bottom of the gas valve that indicates the direction of gas flow is in the proper direction. Also make sure the brass fitting is on the right side.
14. Connect the pilot gas tube to the pilot assembly and the gas valve.
15. Slide the burner tray back into the boiler and fasten it with the two brackets.
16. Install the anti-rotation bracket to the inner panel and fasten with two screws (see Figure 32).
17. Install the manifold bracket and fasten with screws.
18. Connect the service union in the gas line, and screw the main gas pipe to the gas valve (see Figure 32).
19. Turn ON the gas valve to the boiler following the lighting instructions found on the inside of the boiler.
20. Turn on the main gas supply at the manual gas cock or the gas meter.
21. Check the system for leaks using a soap solution.
22. Reconnect the electrical wires to the gas valve following the wiring diagram found on the inside of the boiler.
23. Install the front access door on the boiler.
24. Turn all electrical power to the boiler ON.

SECTION 5.

Parts List for HH and PH Boilers

5A. General Information

To order or purchase parts for the Laars HH-PH boilers, contact your nearest Laars dealer or distributor. If they cannot supply you with what you need, contact:

Laars Customer Service, 6000 Condor Drive,
Moorpark, California, 93021, Telephone (800) 900-9276, or

20 Industrial Way, Rochester, New Hampshire 03867,
Telephone (603) 335-6300.

In Canada, contact 480S. Service Road,
Oakville, Ontario, Canada L6K 2H4, Telephone (905) 844-8233.

5B. Parts List

Item	Description	Part Number
PILOT GAS SYSTEM		
1.	Burner, Pilot Only, Standing Pilot, Nat.	W0036300
	Standing Pilot, Propane	W0036400
2.	Pilot Thermocouple Only	W0036500
3.	Pilot Burner Electrode Assy., Nat.	W0030600
	Electrode Assy., Propane	W0039600
4.	Pilot Bracket Shield	10461100
5.	Ceramic Insulator Assy.	10418805
MAIN GAS SYSTEM		
6.	Burner Tray Assembly Nat. IID, On/Off	10571802-05
	Nat. IID, Mech. Mod.	10572102-05
	Nat. IID, 2-Stage	10581802-05
	Nat. Standing Pilot, On/Off	10571602-05
	Nat. Standing Pilot, Mech. Mod.	10571902-05
	Propane IID, On/Off	10737502-05
	Propane IID, Mech. Mod.	10737402-05
	Propane IID, 2-Stage	10737302-05
	Propane Standing Pilot, On/Off	10571702-05
	Propane Standing Pilot, Mech. Mod.	10572002-05
7.	Gas Valve Nat. IID	R0099400
	Nat. Stdg Pilot, (Model 175)	V0058900
	Nat. Stdg Pilot, (Model 250)	V0073300
	Nat. Stdg Pilot, (Model 325-400)	V0049900
	Propane IID, O/O, MM (Models 175 thru 400)	V0073600
	Propane IID, 2-Stage (Models 175 thru 250)	V0073100
	Propane IID, 2-Stage (Models 325 and 400)	V0073200
	Propane. Standing Pilot	RV0073700
8.	Burner, Main	RL0052300
9.	Burner, Main w/Pilot Bracket	10457500
10.	Orifice, Main Burner, Nat.	L0032200
	Orifice, Main Burner, Propane	L0032900
11.	Burner Tray Weldment	R0099502-05

Item	Description	Part Number
ELECTRICAL SYSTEM		
12.	High Tension Lead	10449513
13.	Ignition Control (nat. Gas)	E0094001
13.	Ignition Control (LP Gas)	E0111500
14.	Transformer, 115V/24V, 40VA	RE0086100
15.	Fuse Holder w/2 Amp Fuse	10690300
16.	Fuse, 2 Amp	E0084400
17.	Flow Switch	RE0013000
18.	Fusible Link (175 thru 250)	R0012200
19.	Toggle Switch	E0077000
20.	Hi-Limit, Manual Reset	RE0015900
21.	Temp Controller, On/Off	RE0014400
21.	Temp Controller, Two-Stage	E0093200
24.	Switch, Drafhood	E0121000
25.	Automatic Vent Damper w/wires (175 and 250)	E0141102-03

VENT SYSTEM

26.	Vent Cap	R0318602-05
27.	Drafhood	R0318702-05
28.	Drafhood/Vent Cap Adapter Plate	10535302-05
29.	Flue Transition Ring	10515502-05
30.	Top Assembly	10568007-10
31.	Flue Collector Assembly	10564802-05
32.	Top Filler Plate	10535202-05
33.	Clip, Baffle Retainer	S0083900
34.	Baffle, Heat Exchanger (8)	10697402-05

FIREBOX COMPONENTS

35, 36, 37.	Tile Replacement Kit, 125	R0325301
	Tile Replacement Kit, 175	R0325302
	Tile Replacement Kit, 250	R0325303
	Tile Replacement Kit, 325	R0325304
	Tile Replacement Kit, 400	R0325305
38.	Tile Cover, Side	10167300
39.	Tile Cover, Front and Rear	10314902-05
40.	Insulation, Jacket	10458902-05

WATER SYSTEM

41.	Bracket, Heat Exchanger	10457000
42.	Heat Exchanger, Tube Assy. Copper	R0095502-05
	Cupronickel	R0095602-05
43.	Plug, 1/4 Inch NPT	P0026800

Item	Description	Part Number
44.	In/Out Header Cast Iron (S0079100), 2-Pass	10593700
	Bronze (S0081700), 4-Pass	10546900
45.	Return Header Cast Iron (S0079200), 2-Pass	10593800
	Bronze (S0075900), 4-Pass	10546800
46.	Header Gasket (18)	R0050800
47.	Bolt, Dome Head (8)	F0046100
48.	Bolt, Flat Head, Square Neck, 3/8 Inch, 16 x 2-3/4 Inch	F0041000
49.	Screw, Hex Cap	F0031700
50.	Gasket Cast Iron Flange	S0076500
	Bronze Flange	S0028000
	Bronze Flange	S0053100
51.	Nut	F0040800
52.	Washer	F0011100
53.	Flange, 1-1/2 in. Cast Iron (S0076400)	10573600
	Bronze (S0071800)	10489400
54.	Pressure Relief Valve (75 psi)	RA0001200
55.	Pump and Rainshield Assembly 175	10565604-07
	175 thru 400	10565603
	250	10565605
	325 and 400	10565606
56.	Valve, Drain	P0058700
57.	Well, Temp Control, 1/2 Inch NPT	E0025900
58.	Nipple, Brass, 3/4 Inch	P0025300
59.	Nipple Bronze	P0075700
	Cast Iron	P0024400
60.	Tee Bronze	P0075600
	Cast Iron	P0071700
61.	Bushing, Brass	P0018500
62.	Bracket, Hold Down	10726300
63.	Clamp, Hold Down	10726200

JACKET COMPONENTS

64.	Jacket Assembly	10568302-05
65.	Door	10448902-05
66.	Deflector, Rear	10563707-10
67.	Deflector, Lower	10563607-10
68.	Gap Closure, In/Out	10448202
69.	Gap Closure, Return	10448302

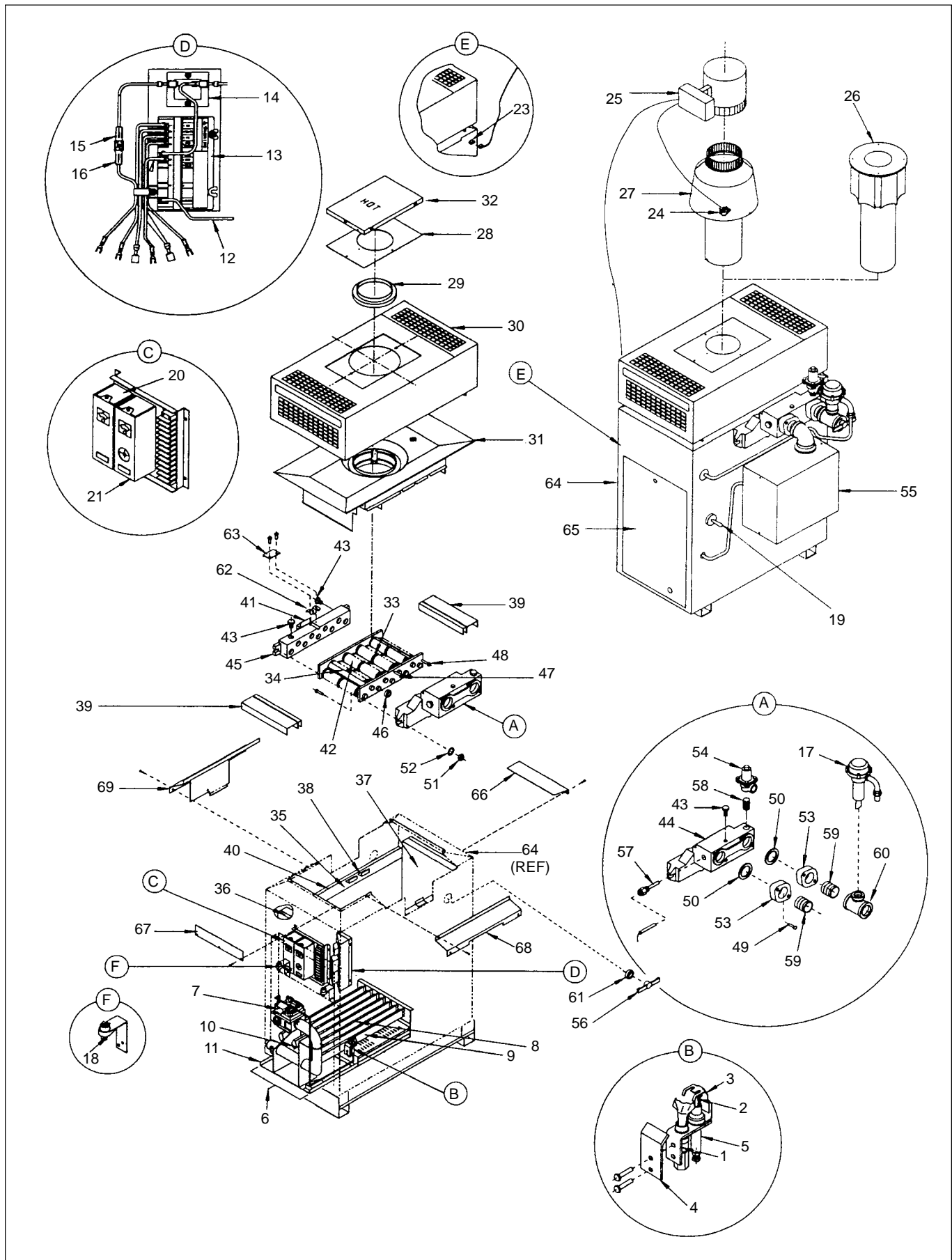


Figure 33. Parts Diagram.



H0147400E

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