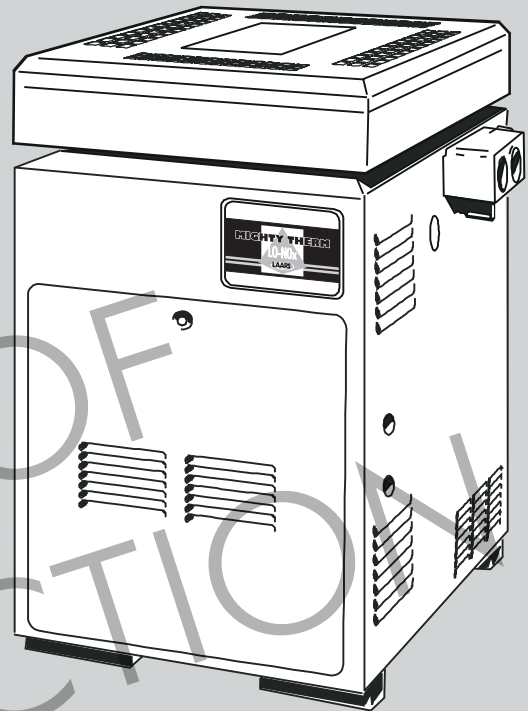


Installation, Operation
and Maintenance
Instructions for

Mighty Therm™ LO-NOx

Volume Water Heater
Model VW-PW
Sizes 250/400
For Natural Gas Only

U.S. Reg. 1,483,289
Canada Reg. 333,796



FOR YOUR SAFETY: This product must be installed and serviced by a professional service technician, qualified in hot water heater 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.

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SECTION 1. General Information

1.1 Introduction

This manual provides installation, operating, and maintenance instructions for Model VW-PW Volume Water Heaters, Sizes 250 and 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 heaters are offered in a basic configuration (see Figure 1). On PW heaters, a factory-supplied pump is mounted on the unit. PW models are not available for hard water applications. There is no pump mounted on VW units. Pump for VW units is to be field-supplied.

⚠ WARNING

Mighty Therm water heaters **must** be installed in accordance with the procedures detailed in this manual, or the Laars Heating Systems warranty will be voided. The installation must conform to the requirements of the local jurisdiction having authority, and, in the United States, to the latest edition of the National Fuel Gas Code, ANSI Z223.1. In Canada, the installation must conform to the latest edition of CAN/CGA-B149.1 Natural Gas Installation Code and/or local codes. Any modifications to the boiler, its gas controls, or wiring may void the warranty. If field conditions require modifications consult the factory representative before initiating such modifications.

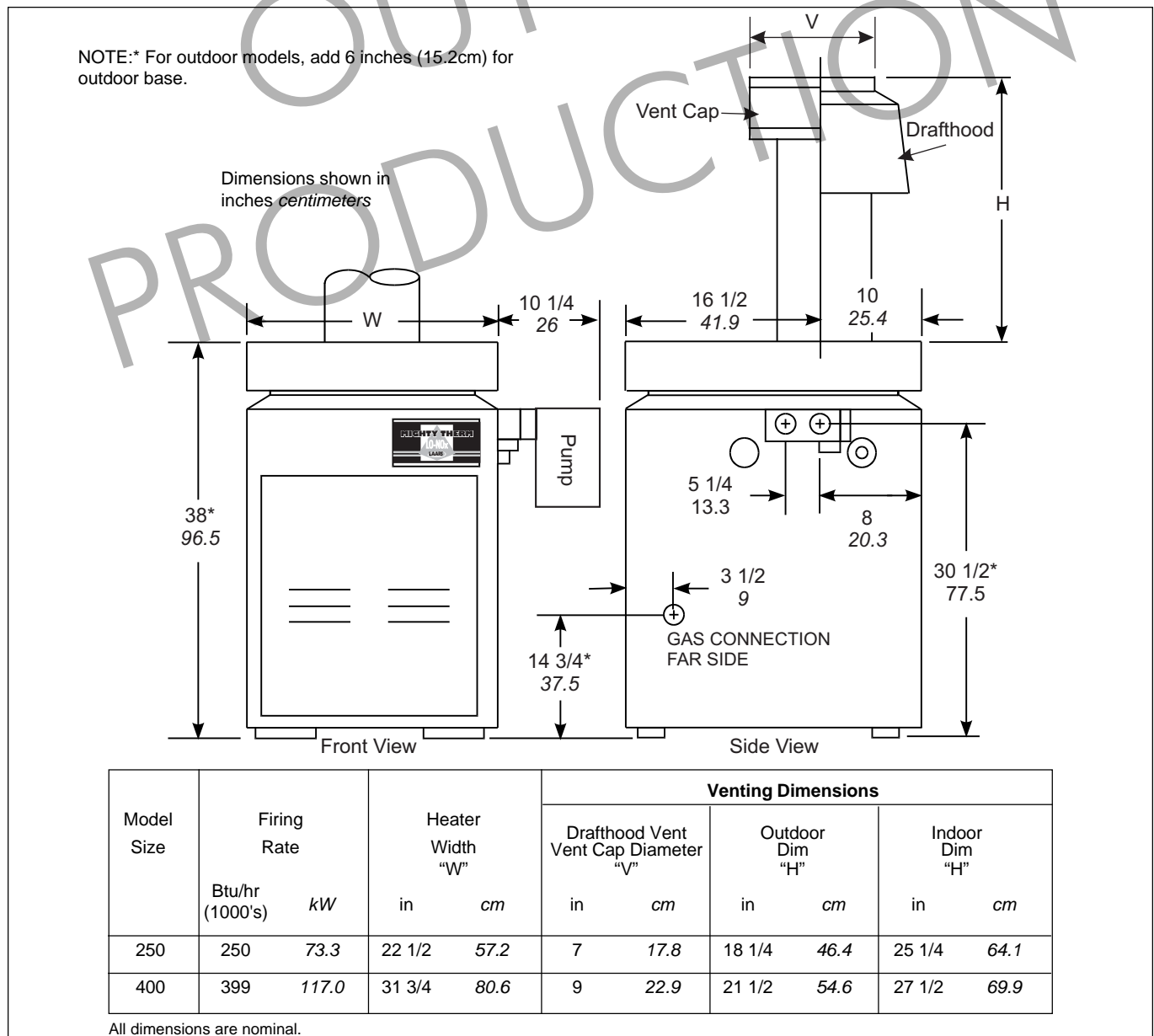


Figure 1. General Configuration.

1.2 Warranty

Laars Heating Systems Mighty Therm heaters are covered by a limited warranty. The owner should fill out the warranty registration card and return it to Laars Heating Systems.

All warranty claims must be made to an authorized Laars Heating Systems representative or directly to the factory. Claims must include the serial number and model (this information can be found on the rating plate), installation date, and name of the installer. For specific warranty conditions refer to your Limited Warranty.

Some accessory items are shipped in separate packages. Verify receipt of all packages listed on the packing slip. Inspect everything for damage immediately upon delivery, and advise the carrier of any shortages or damage. Any such claims should be filed with the carrier. The carrier, not the shipper, is responsible for shortages and damage to the shipment whether visible or concealed.

SECTION 2. Installation Instructions

2.1 General 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. Follow the manufacturer's maintenance schedule for the appliance. Follow local regulations with respect to installation of carbon monoxide (CO) detectors.

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

1. Field assembly of draft hood or vent cap (see Section 2.2).
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.

2.2 Field Assembly

The VW-PW heaters are shipped from the factory with the top assembly in the low-profile configuration

for outdoor installations. In special circumstances an outdoor vent cap may be required. Check the part number on the rating plate.

The VW, PW heaters are design certified for indoor installation when equipped with a special draft hood, which must be installed without modification. The part number for the draft hood is on the heater rating plate. Follow this procedure to make the conversion:

1. Remove the top plate, stamped "HOT", by slipping a fine-blade screwdriver into the slot and prying it up (see Figure 2).
2. Remove the top by removing all eight screws connecting it to the jacket (see Figure 3).
3. Remove the rainguard assembly (see Figure 4).
4. Remove the two screws securing the left vestibule cover (see Figure 5). The cover can be discarded.
5. Remove the vent cap or draft hood and accessories from the carton.
6. Place transition plate (with 14" long side) securely on top of flue collector so flue gases will not leak (see Figure 6).
7. Remove back portion of rainguard (see Figure 7).
8. Re-install the rainguard (see Figure 8).
9. Replace heater top and all eight screws (see Figure 9).
10. Slide the adapter plate up over the bottom of the stack extension. Fit the stack extension, of the draft hood or the vent cap, on top of the collar of the flue transition plate (see Figures 10 and 11).
11. Seat the adapter plate on the top assembly, and secure it with screws supplied in the kit (see Figure 12).
12. Attach the clips to the adapter plate by securing the slotted side of the clips with the screws in the kit (see Figure 13).
13. Use the holes in the clips as guides to drill three 1/8" dia. holes in the stack.
14. Secure the stack to the clips with the screws supplied in the kit (see Figure 13).
15. Figure 14 shows a cross-section of the finished installation.
16. Indoor models, size 250 only, require an adapter cable (included with product). The cable connects the blocked vent safety switch (BVSS) on the bell of the external draft hood to the 6-position Molex plug on the side of the unit (see Figure 15). Refer to instruction sheet included with cable.

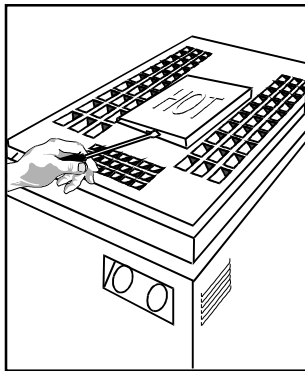


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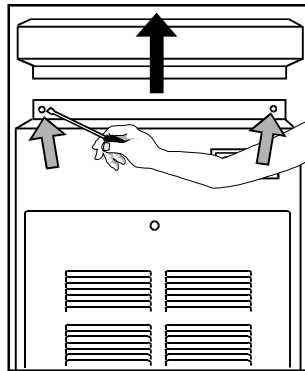


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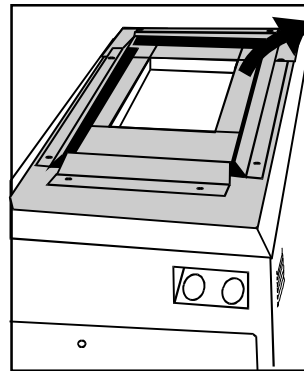


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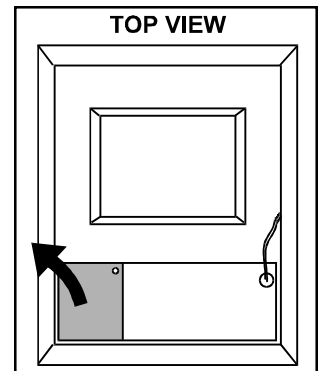


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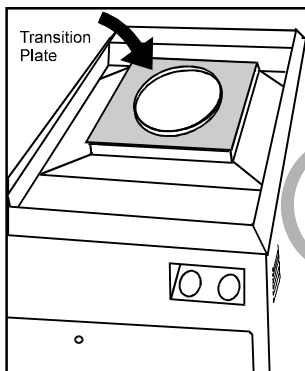


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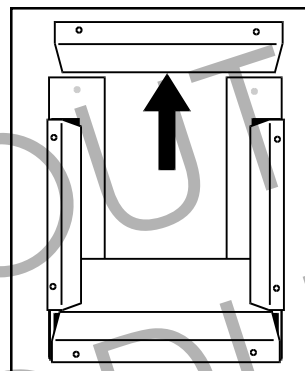


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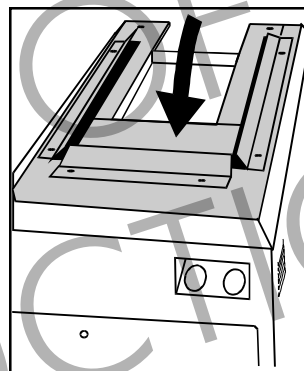


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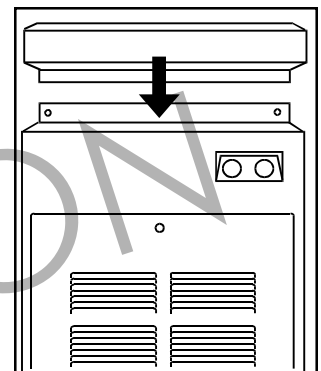


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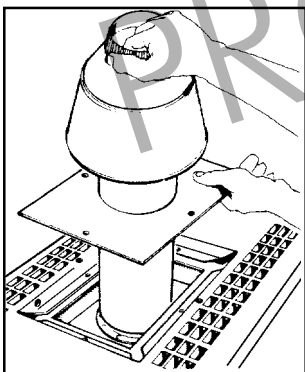


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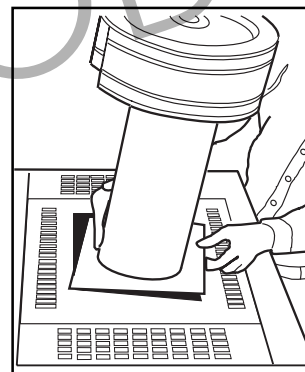


Figure 11.

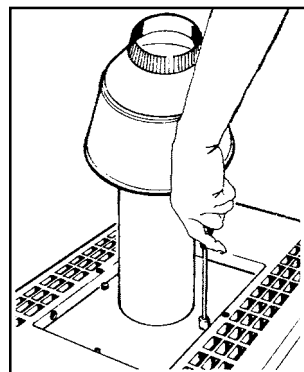


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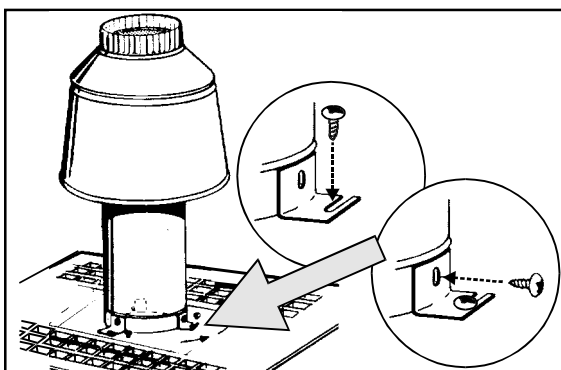


Figure 13.

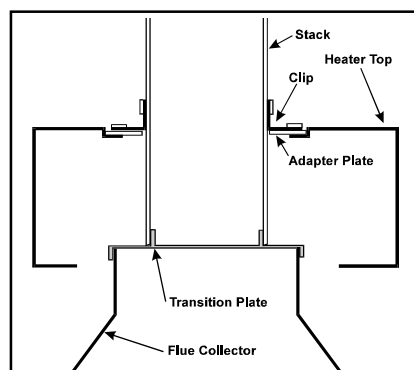
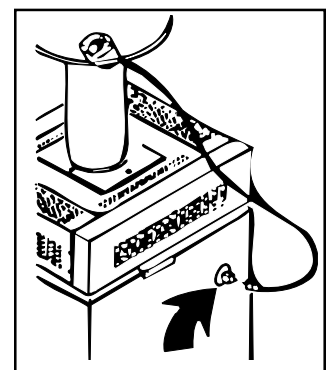


Figure 14.

Figure 15. Drafthood
Switch Receptacle.

2.3 Site Location

2.3.1 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.

Avoid placing the heater in locations where it can cause damage by water or condensate leakage. If this is not possible, provide a suitable drain pan under the heater to catch and divert any leakage. The pan must not restrict air flow around the heater.

Locate the heater to provide adequate clearance on all sides for inspection, service and to provide adequate air circulation for proper operation.

Locate the heater so the clearances from combustible surfaces shown in Table 1 and Figure 16 are met.

Locate the heater 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 heater repairs are needed.

Clearance from:	Indoors		Outdoors	
	inch	cm	inch	cm
Top	37	94	Unobstructed	
Water conn. side	12	30.5	Unobstructed	
Opposite side	6	15.2	6	15.2
Front	Alcove		Unobstructed	
Rear	6	15.2	6	15.2
Vent*	6	15.2	—	
Flooring: Combustible				
Service clearance = 36 inches (91.4cm) at front of heater, and 18 inches (46cm) at water connection side.				
*1" (2.5cm) if double wall vent is used.				
6" base for outdoor boiler is required.				

Table 1. Minimum Boiler Clearances from Combustible Surfaces.

2.3.2 Outdoor Installation

⚠ Caution

Outdoor installations are not recommended in areas where the danger of snow blockage exists.

- Locate the heater in an open, unroofed area. Do not locate the heater 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 17 and Table 1).

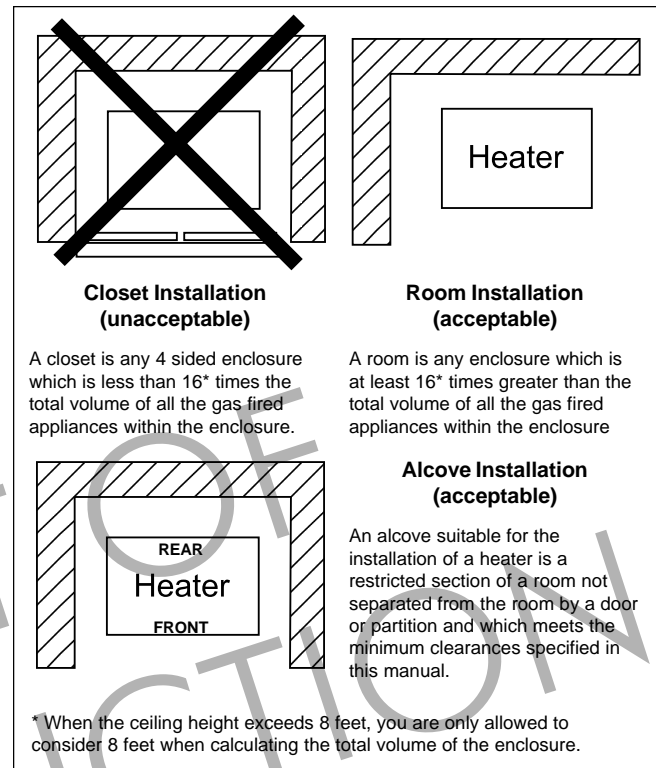


Figure 16. Alcove Installation.

- There must be a minimum of 4 feet (1.22 m) horizontally and vertically between the heater and any door, window, or gravity inlet to a building (see Figure 18).
- Minimum clearance of 4 feet (1.22m) [6 feet (1.83m) in Canada] horizontally from, and in no case above or below, unless the minimum horizontal distance is maintained, from electric meters, gas meters, regulators and relief equipment.
- If the heater 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 heater 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 heater at least 3 feet (0.91 m) from the structure.

2.3.3 Flooring - Typical Installation

All outdoor boilers must be installed with the special base, as a standard part of the heater. The base, part number R0368900, is provided in a separate package. The heater is designed and certified for installation on combustible flooring. **NEVER** install the heater on carpeting. **NEVER** store objects on or around the base of the heater. For outdoor base installation, see Figure 18.



All indoor installations must have openings to outside air for combustion, ventilation and dilution of flue gases from inside the building (see Figure 20 and Table 2). Laars does not recommend indoor installations that do not provide combustion air from outside the building.

In the United States, the most common requirements specify that the space (enclosure) shall communicate with the outdoors in accordance with method 1 or 2, which follow. Where ducts are used, they shall be of the same cross-sectional area as the free area of the openings to which they connect.

Two permanent openings, one commencing within 12" (30 cm) of the top and one commencing within 12" (30 cm) of the bottom of the enclosure shall be provided. The openings shall communicate directly, or by ducts, with the outdoors or spaces that freely communicate with the outdoors. When directly communicating with the outdoors, or through vertical ducts, each opening shall have a minimum free area of 1 square inch per 4000 Btu/hr (550 square mm/kW) of total input rating of all equipment in the enclosure. When communicating to the outdoors through



Note: For screens or louvers, add 50%.

Table 2. Air Openings to Outside.



1. The drafthood must sit directly on top of the heater as shown and must not be altered in any manner.
2. A vent cap listed or certified for the application by a Nationally Recognized Testing Laboratory (NRTL) such as Underwriter's Laboratories (UL) is required to eliminate downdraft and to allow the heater to function properly.
3. Use approved roof fitting.

Figure 20. Indoor Installation and Venting.

horizontal ducts, each opening shall have a minimum free area of not less than 1 square inch per 2000 Btu/hr (1100 square mm/kW) of total input rating of all equipment in the enclosure.

Method 2:

One permanent opening, commencing within 12" (30 cm) of the top of the enclosure shall be permitted. The opening shall directly communicate with the outdoors or shall communicate through a vertical or horizontal duct to the outdoors or spaces that directly communicate with the outdoors, and shall have a minimum free area of 1 square inch per 3000 Btu/hr (734 square mm/kW) of the total input rating of all equipment located in the enclosure. This opening must not be less than the sum of the areas of all vent connectors in the confined space.

Other methods of introducing combustion and ventilation air are acceptable, providing they conform to the requirements in ANSI Z223.1, or other applicable codes.

In Canada, Table 2 does not apply. Consult local building and safety codes or, in absence of such requirements, follow CSA B149.1.

NOTE: Check with louver manufacturers for net free area of louvers. If screens or louvers are installed, add 50 percent for each screen/louver to the net free area.

2.4.1 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 CSA-B149.1.)

2.4.2 Indoor Air Supply

Confined and non-confined areas have different requirements for installation. Check the latest edition of ANSI Z223.1 or in Canada CSA-B149.1 and all local codes applicable to combustion air.

2.4.3 Exhaust Fans or Vents

Any equipment which uses air or removes air from the heater 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 heater room. More air must be supplied to make up for the decrease.

2.5 Venting (Category I)**2.5.1 General Information**

When installed indoors, the drafthood must be connected to a venting system. 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 CSA-B149.1, 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.

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

Do not weld or bolt the vent pipe to the heater drafthood. The weight of the stack must not rest on the heater. The drafthood and heater top must be easily removable for normal heater service and inspection.

⚠ WARNING

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

Locate unit as close as practical to a chimney or vent termination. Have horizontal runs sloping upwards not less than 1/4 inch per foot (21mm/m) from the boiler to the vent terminal. Support a vent connector for the design and weight of the material used to maintain clearances and prevent physical damage and separate of joints.

Doivent présenter des tronçons horizontaux dont la pente montante est d'au moins 1/4 po par pied (21mm/m) entre la chaudière et l'évent. Doivent préciser que les sections horizontales doivent être supportées pour prévenir le fléchissement.

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 heater room.

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

When the installation of a power vent or draft fan in the venting system is necessary, qualified personnel should design the installation following good engineering practices and all applicable codes. A suitable draft switch must be wired into the heater control circuit at the terminal designated Field Interlock to keep the heater from firing unless there is a positive draft.

**2.5.2 Common Venting Systems
Venting Multiple Appliances**

When installing venting for a Mighty Therm Lo-NOx boiler or water heater installed as a Category I fan-assisted appliance with other Category I appliances through one shared duct called a "common vent", special care must be taken by the installer to ensure safe operation. In the event that the common vent is

blocked, it is possible, especially for fan-assisted devices, to vent backwards through non-operating appliances sharing the vent, allowing combustion products to infiltrate occupied spaces. **If the appliances are allowed to operate in this condition, serious injury or death may occur.**

WARNING

Operation of appliances with a blocked common vent may lead to serious injury or death. Safety devices must be implemented to prevent blocked common vent operation. If safe operation of all appliances connected to a common vent cannot be assured, including prevention of spillage of flue gasses into living spaces, common venting should not be applied, and appliances should each be vented separately.

AVERTISSEMENT

Le fonctionnement des appareils avec un système d'évacuation bloqué peut provoquer des blessures graves, voire la mort. Des dispositifs de sécurité doivent être installés pour éviter le blocage des systèmes d'évacuation. Si le fonctionnement de tous les appareils connectés à un système d'évacuation commun ne peut pas être assuré, y compris la prévention de la dispersion des gaz toxiques dans les espaces habités, on ne devrait pas installer un système d'évacuation commun et chaque appareil devrait être ventilé séparément.

It is for this reason that, in addition to following proper vent sizing, construction and safety requirements from the National Fuel Gas Code, ANSI Z223.1 or in Canada, from CSA B149.1 as well as all applicable local codes, it is required that installers provide some means to prevent operation with a blocked common vent. It is suggested that a blocked vent safety system be employed such that if the switch from one appliance trips due to excessive stack spill or backpressure indicating a blocked vent condition, that all appliances attached to the vent be locked out and prevented from operating. As an additional precaution, it is recommended that a Carbon Monoxide (CO) alarm be installed in all enclosed spaces containing combustion appliances. If assistance is required in determining how a blocked vent safety system should be connected to a LAARS product, please call Applications Engineering at (603) 335-6300.

Refer to the installation and operating instructions on all appliances to be common vented for instructions, warnings, restrictions and safety requirements. If safe operation of all appliances connected to a common vent cannot be assured, including prevention of spillage of flue gasses into living spaces, common venting should not be applied, and appliances should each be vented separately.

2.5.3 Inspection of Commonly Vented Appliances

If the instrumentation of this heater replaces an older heater in a common vent system with other appliances, or if you remove additional appliances from the common vent, all the appliances must be checked for proper venting.

At the time of removal of an existing heater, 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.
Sceller toutes les ouvertures non utilisées du système d'évacuation.
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.
Inspecter de façon visuelle le système d'évacuation pour déterminer la grosseur et l'inclinaison horizontale qui conviennent et s'assurer que le système est exempt d'obstruction, d'étranglement, de fuite, de corrosion et autres défaillances qui pourraient présenter des risques.
3. Insofar as it is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
Dans la mesure du possible, fermer toutes les portes et les fenêtres du bâtiment et toutes les portes entre l'espace où les appareils toujours raccordés au système d'évacuation sont installés et les autres espaces du bâtiment. Mettre en marche les sècheuses, tous les appareils non raccordés au système d'évacuation commun et tous les ventilateurs d'extraction comme les hottes de cuisinière et les ventilateurs des salles de bain. S'assurer que ces ventilateurs fonctionnent à la vitesse maximale. Ne pas faire fonctionner les ventilateurs d'été. Fermer les registres des cheminées.
4. Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.

Mettre l'appareil inspecté en marche. Suivre les instructions d'allumage. Régler le thermostat de façon que l'appareil fonctionne de façon continue.

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.

Faire fonctionner le brûleur principal pendant 5 min ensuite, déterminer si le coupe-tirage déborde à l'ouverture de décharge. Utiliser la flamme d'une allumette ou d'une chandelle ou la fumée d'une cigarette, d'une cigare ou d'une 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.

Une fois qu'il a été déterminé, selon la méthode indiquée ci-dessus, que chaque appareil raccordé au système d'évacuation est mis à l'air libre de façon adéquate. Remettre les portes et les fenêtres, les ventilateurs, les registres de cheminées et les appareils au gaz à leur position originale.

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. 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 Appendix G in the National Fuel Gas Code, ANSI Z223.1.

Tout mauvais fonctionnement du système d'évacuation commun devrait être corrigé de façon que l'installation soit conforme au *National Fuel Gas Code, ANSI Z223.1* et (ou) aux codes d'installation *CSA-B149.1*. Si la grosseur d'une section du système d'évacuation doit être modifiée, le système devrait être modifié pour respecter les valeurs minimales des tableaux pertinents de l'appendice F du *National Fuel Gas Code, ANSI Z223.1* et (ou) des codes d'installation *CSA-B149.1*.

2.6 Water Flow

2.6.1 Water Chemistry

Laars equipment is designed to be used in a variety of water conditions. With the proper pump, the water velocity in the heat exchanger tubes is kept high enough to prevent scaling from hard water, yet low enough to avoid erosion by soft water.

NOTE: It is possible to have hard and soft water in the same city. Check with the local water companies.

If an installer sees damage to any water handling equipment at the installation site, it should be repaired as soon as possible to help reduce maintenance costs. If there is erosion, resize the pump to reduce water velocity before the tube ruptures. If scaling is bad, set up a heat exchanger tube-cleaning maintenance schedule to prevent heat exchanger tube cracking and wear. Not fixing the condition will mean serious damage to the heater and the water system.

NOTES: In areas where the water supply is soft or corrosive, the heater must have cupronickel tubes in the heat exchanger. Laars does not warrant heat exchangers damaged by scaling, corrosion, or erosion.

2.6.2 Water Hardness

Consider the water hardness when selecting a pump for the heater (see Table 3). Hard water needs a pump which can provide high flow to prevent scaling, while soft water needs low flow to prevent erosion.

Hardness Category	Grains per Gallon	Parts per Million
Soft	1 through 7.5	17 through 128
Normal	7.6 through 17	129 through 291
Hard	Over 17	Over 291

Table 3. Water Hardness.

2.6.3 Freeze Protection

Although VW, PW heaters are design-certified for outdoor installations, such installations are not recommended in areas subject to freezing temperatures unless proper precautions are taken.

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

2.6.4 Pump Requirements

PW heaters are equipped with factory-mounted and wired pumps. The pump is for heater-to-tank circulation only. See Table 4 for pump performance. PW heaters are not available for hard water applications.

VW and PW heaters are not designed for applications where the temperature of the water flowing through the heater remains below the dew point, 110°F (43°C).

Model	Heat Exch. Passes	Water Category	Flow Rate		Pressure* Drop		Water Temp Rise	
			gpm	L/s	ft.	m	°F	°C
250	2	Soft	22	1.4	5.8	1.8	18	10
		Normal	34	2.1	11.2	3.4	12	7
		Hard	46	2.9	19.1	5.8	9	5
400	2	Soft	34	2.1	13.3	4.1	19	11
		Normal	34	2.1	13.3	4.1	19	11
		Hard	46	2.9	23.4	7.1	14	8

*Pressure drop includes head loss of heat exchanger and through 30 feet (9.1 m) of pipe and normal fittings when heater is installed with storage tank. Pipe and fittings are assumed to be 1-1/2 inch (38 mm).

Table 4. Pump Performance Requirements.

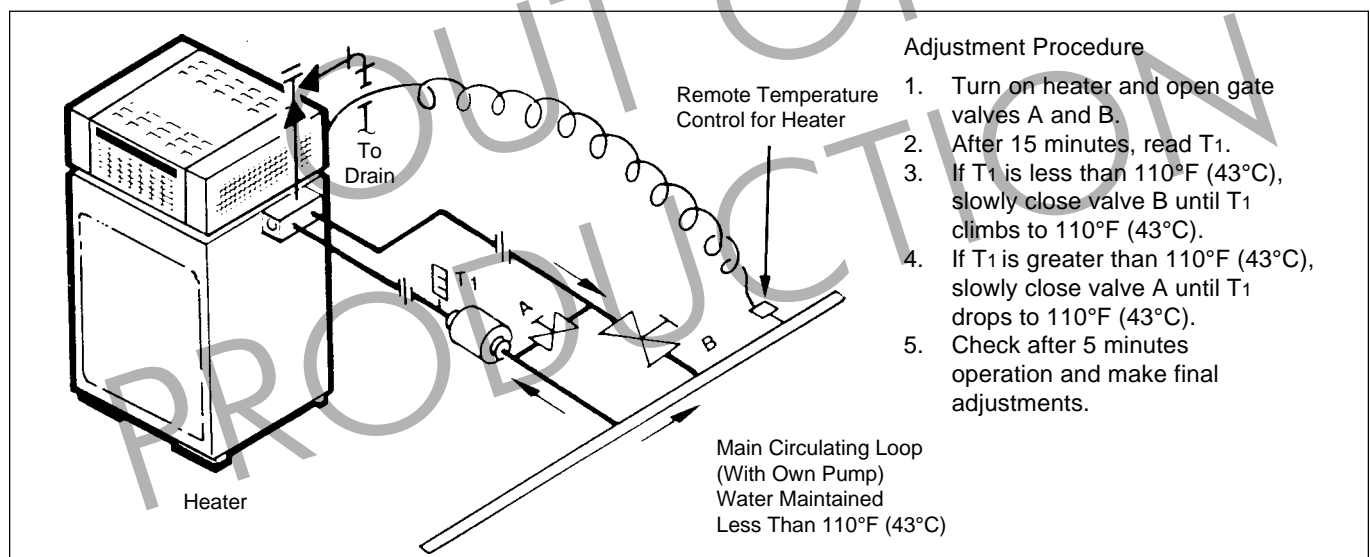


Figure 21. Cold Water Application.

The factory provided pump on the PW heaters is sized to provide proper circulation through the heater, and through the heater-to-tank circulation loop (see Figures 21, 23 and 24).

If the heater-to-tank circulation loop does not contain more than 6 elbows or 30 feet (9.1 m) of pipe, the minimum pipe fitting should be 1-1/2 inches (38 mm). If the loop does contain more than 6 elbows or 30 feet (9.1 m) of pipe, the minimum size should be 2 inches (51 mm).

2.6.5 Pressure Buildup in Water System

The water utility supply meter may contain a check valve, back flow preventer, or water pressure reducing valve that will create a closed water supply system. Contact the water supplier or local plumbing inspector on how to control this situation.

During the heating cycle of the heater, the water expands creating a pressure buildup in the water system. The pressure relief valve may discharge hot water under these conditions, causing a loss/waste of

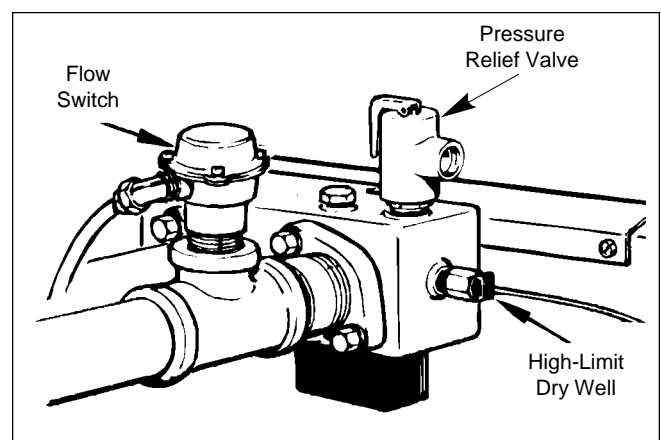


Figure 22. Pressure Relief Valve.

energy and a buildup of lime on the relief valve seat.

NOTE: Do not plug the relief valve.

There are two methods to prevent the relief valve from discharging hot water in a closed water system:

1. Install a pressure relief valve on the cold water supply line. Make sure that the discharge of this

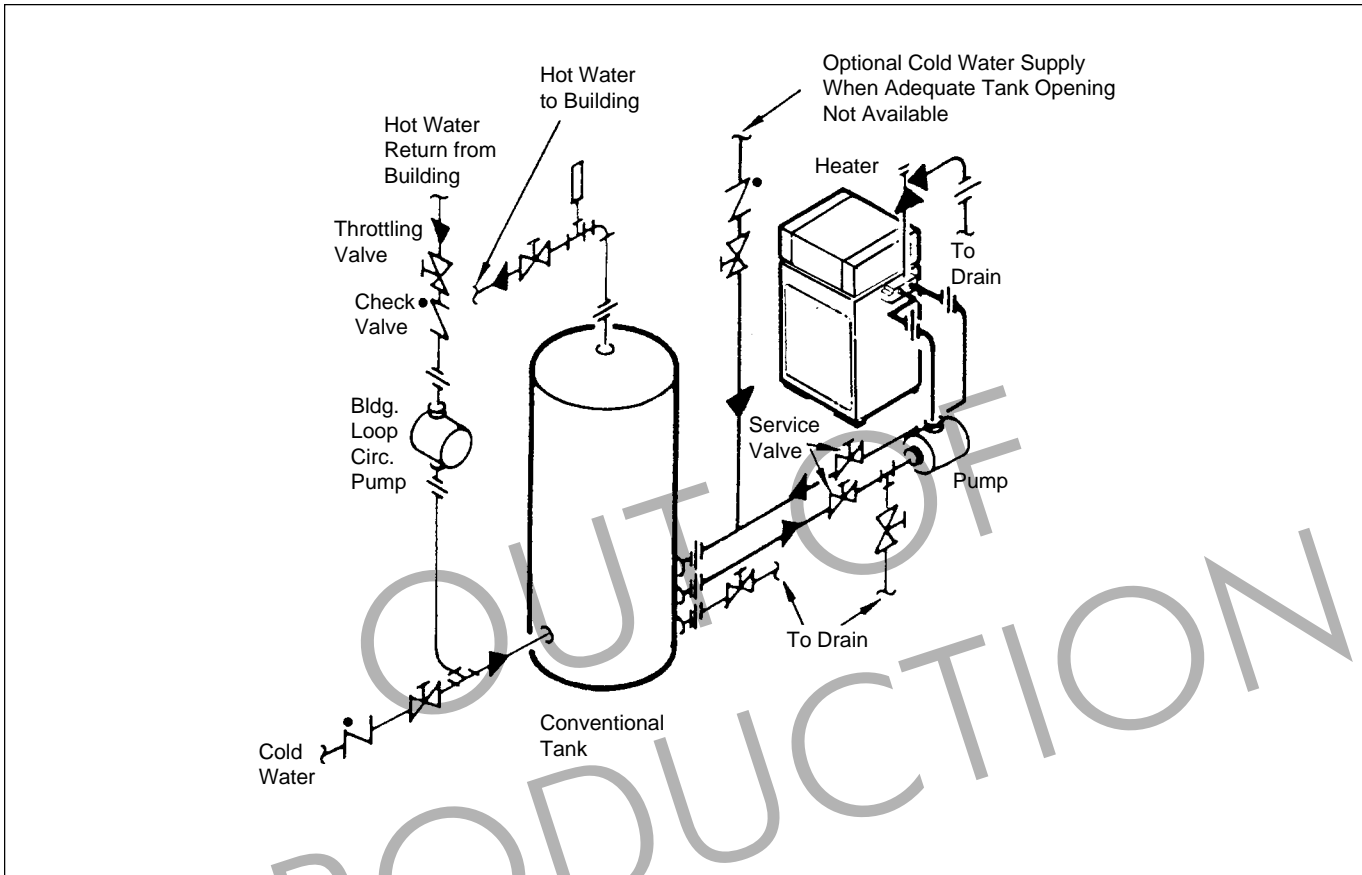


Figure 23. Hot Water Supply with Vertical Tank.

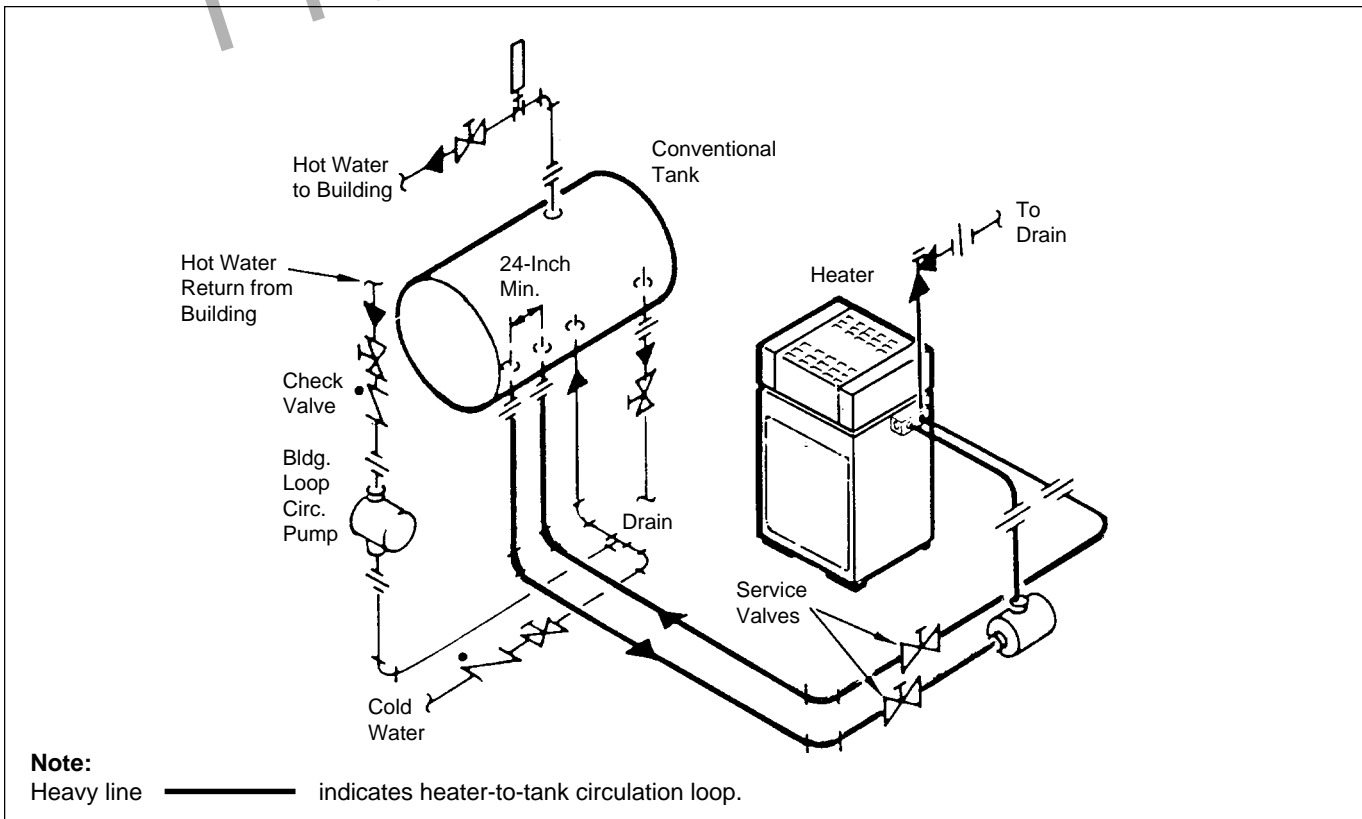


Figure 24. Hot Water Supply with Horizontal Tank.

valve is directed to an open drain and protected from freezing.

2. Install a properly sized thermal expansion tank on the cold water supply line.

2.6.6 Pressure Relief Valve

The pressure relief valve must be installed in the tapped opening provided in the boiler header with its outlet piped to a drain or floor sink. Special attention must be given to relief valve settings in installations where the boiler is located on the ground floor of a tall building. The static pressure of the system is elevated, and could cause the relief valve to leak. Where no special setting of the relief valve is ordered, the factory will furnish a 125 psi setting.

WARNING

Hot water can scald! Hot water can produce third degree burns in 6 seconds at 140°F (60°C) and in 30 seconds at 130°F (54°C).

2.6.7 Water Pressure

Keep the water pressure in the system above 30 psi (207 kPa). If the system pressure drops below 30 psi (207 kPa), it could damage the heater through lack of circulation. If for any reason, the water is turned off temporarily, to service the equipment for example, airlock could be a problem when the heater is turned back on. To eliminate the airlock, open the pressure relief valve (see Figure 22) and allow the air to bleed out until water starts to flow. As soon as full circulation is restored, the trapped air will be released through the hot water faucets.

2.6.8 Storage Tank Installation

1. Be sure the floor is structurally capable of supporting the tank when it is filled with water, and is waterproof.
2. Place the tank so that manholes, inspection covers, nameplates and drain valves are accessible.
3. Be sure the tank is suitable for the water in the system. Some water is corrosive and requires a protected tank. Most tanks are available with glass, plastic, or galvanized linings.
4. If the tank is glass-lined, it should be equipped with a suitable magnesium anode. It is a good practice to replace the anode when it is approximately 50 percent used. The factory warranty on a glass-lined tank may be void if a satisfactory anode is not in place at the time of a failure or if it is consumed by cathodic action.
5. The tank must be lined if a water softener is installed in the system.
6. Make sure the tank connections in the heater-tank circulating loop are the proper size (see Section

2.6.4). If tapings are smaller than the recommended pipe size, a larger pump may be required. Consult the factory if in doubt.

7. Install a pipe in the tank drain fitting that goes to a floor sink, and install a drain valve. If a floor sink is not available, install a hose bib.
8. Hot water tanks in an existing installation are likely to have silt deposits on the bottom. Therefore, it is important to extend the pump suction pipe in the tank to a position near the top. Pipe the return from the heater to the bottom of the tank.

Note: Incorrect installation can cause rapid failure of water tanks due to electrolysis. Tanks must be installed with dielectric connections to electrically isolate the tank from stray current. Note that use of brass or bronze connectors does not replace the need for dielectric connections.

2.6.9 Thermal Circulation of Hot Water in Cold Water Supply Lines

Under certain circumstances, thermal circulation will occur in the cold water pipe supplying the water to the heating system. This happens in a multi-story building when the cold water pipe rises from its connection to the system. To correct the problem, a check valve in the cold water line supplying the heater will prevent thermal circulation, and a small expansion tank will permit heated water to expand without popping off the relief valve.

2.7 Gas Supply and Piping (Natural Gas Only)

2.7.1 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 CSA-B149.1 and all local codes that apply.
2. Check the rating plate to make sure the heater is fitted for the type of gas being used. Laars LO-NOx heaters are normally equipped to operate with natural gas below a 2000 foot (609 m) altitude.
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 CSA-B149.1 and all local codes that apply.
4. The figures in Table 5 should be used to size the gas piping from the gas meter to the heater.
5. Install a sediment trap (drip leg) ahead of the gas controls (see Figure 25). Fit the trap with a threaded cap which can be removed for cleaning.

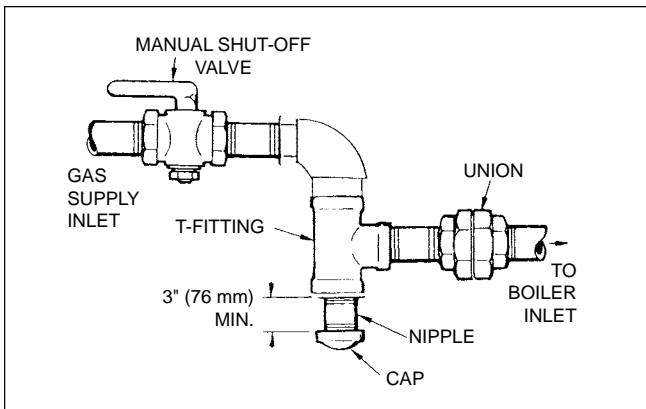


Figure 25. T-Fitting and Sediment Trap.

6. Install a non-restrictive manual gas shutoff valve for service and safety. Check the local codes.
7. Disconnect the heater and its individual shutoff valve from the supply gas system during pressure testing of the system at pressures higher than 1/2 pounds per square inch (psi) (3.4 kilopascals [kPa]). If the test pressure is equal to or less than 1/2 psi (3.45 kPa), close the manual shutoff valve on the heater during the piping pressure test.
8. Gas supply pressures to the heater are listed in Table 6.

NOTE: The heater and all other gas appliances sharing the heater gas supply line must be firing at maximum capacity to properly measure the inlet supply pressure. Low gas pressure could indicate an under-sized 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 pressure 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 heater, 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.

Distance from Gas Meter or Last Stage Regulator

Boiler Size	0-100 feet 0-30 m Nat.		100-200 feet 30-60 m Nat.		200-300 feet 60-90 m Nat.	
	in.	mm	in.	mm	in.	mm
250	1¼	32	1¼	32	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.
2. Check supply pressure and local code requirements before proceeding with work.
3. Pipe fittings must be considered when determining gas pipe sizing.

Table 5. Natural Gas, Pipe Size Requirements.

Supply Pressure Water Column	Natural Gas	
	in.	mm
Minimum	6	152
	See Rating Plate	
Maximum	10.5	267

Table 6. Gas Supply Pressure Requirements.

2.8 Electrical Wiring

WARNING

Electrically ground the heater in accordance with the latest edition of the National Electrical Code, NFPA 70. In Canada, use the latest edition of the Canadian Electrical Code CSA C22.2 No. 0. Do not rely on the gas or water piping to ground the metal parts of the heater. Often, plastic pipe or dielectric unions isolate the heater electrically. Service and maintenance personnel who work on or around the heater may be standing on wet floors and could be electrocuted by an ungrounded heater.

1. Check heater wiring and pump for correct voltage, frequency, and phase. Check to make sure heater is wired for 120 volts alternating current (VAC). If 240 VAC, contact local factory representative or Laars.
2. Wire the heater and pump exactly as shown in the wiring diagram supplied with the heater. See Figures 28 through 31 for a typical example of a wiring diagram.
3. Electrically interlock the pump and heater so the heater cannot come on unless the pump is running.

- Connect all field-installed devices (draft switches, relays, timers, outdoor temperature reset devices, etc.) to the heater 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 when tested in accordance with ANSI Z21.13.

⚠ WARNING

For your safety, when starting the heater, 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.

3.1 Start-Up Procedure

- Make sure the system pump is running and there is water flow.
- Follow the lighting and shutdown procedure in Figure 27 or 28.

3.2 Setting the Temperature Controls

The hi-limit switch is factory set, and **should not be adjusted above the factory setting.**

⚠ WARNING

Adjusting the temperature control past the recommended setting can result in a scalding injury. Hot water can produce third degree burns in 6 seconds at 140°F (60°C) and in 30 seconds at 130°F (54°C).

3.2.1 Remote Water Heater Temperature Control

The water heater can be used with a field-supplied tank aquastat, sequencing control, or other temperature control device, which will call the unit for heat when the temperature goes below the controller's setpoint. For the most efficient setting, set the tank temperature at the lowest possible setting for adequate hot water in the application.

After a setting has been chosen for the tank temperature control, set the heater temperature control 10°F (6°C) higher. The heater's temperature control senses the inlet water temperature to the heater. The heater's manual reset high limit (and automatic reset high limit, if applicable) senses heater outlet temperature.

If the unit is equipped with an automatic reset high limit, set the automatic reset high limit 20°F (11°C) above the outlet temperature to avoid nuisance lockouts. Set the manual reset high limit 5°F (3°C) above the automatic reset high limit.

For units that only have a manual reset high limit (no automatic reset high limit), set the manual reset high limit 20°F (11°C) above the outlet temperature to avoid nuisance lockouts.

Example, Imperial units: If the tank temperature is set to 140°F, set the heater's temperature control to 150°F (140°F + 10°F). Further, if the temperature rise through the heater is 25°F, the outlet temperature will be 175°F (150°F + 25°F). Therefore, set the automatic reset high limit to 195°F (170°F + 20°F), and the manual reset high limit to 200°F (195°F + 5°F).

Example, Metric units: If the tank temperature is set to 60°C, set the heater's temperature control to 66°C (60°C + 6°C). Further, if the temperature rise through the heater is 15°C, the outlet temperature will be 81°C (66°C + 15°C). Therefore, set the automatic reset high limit to 92°C (81°C + 11°C), and the manual reset high limit to 95°C (92°C + 3°C).

3.2.2 Internal Water Heater Temperature Control

When an external control is not used, the circulator between the heater and the storage tank must run continuously, so that the heater's temperature control can detect and control the water temperature in the storage tank. The water heater's temperature control is adjusted to its lowest temperature position (130°F, 54°C) when shipped from the factory. This is the preferred starting point for setting the temperature control.

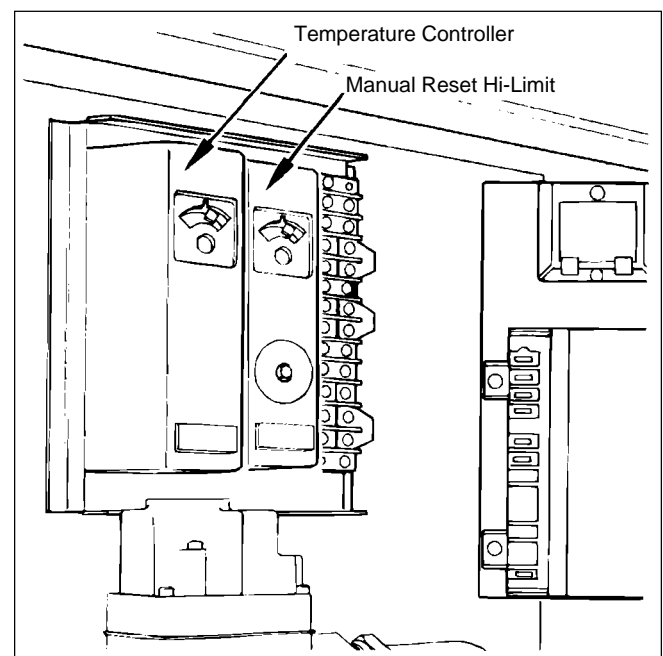


Figure 26. Temperature Controls.

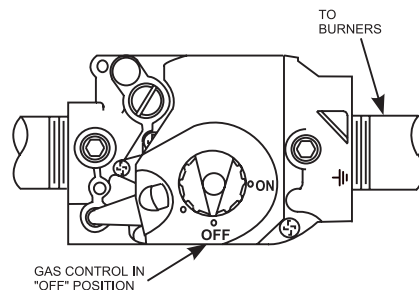
FOR YOUR SAFETY READ BEFORE OPERATING

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

- A. This appliance does not have a pilot light. It is equipped with an ignition device which automatically lights the heater. Do NOT try to light the burners by hand.
 - B. 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.
- WHAT TO DO IF YOU SMELL GAS**
- Do not try to light any appliance
 - Do not touch any electric switch; do not use any phone in your building.
 - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
 - If you cannot reach your gas supplier, call the fire department.
- C. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not push in or turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.
 - D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

OPERATING INSTRUCTIONS

1. **STOP!** Read the safety information above on this label.
2. Turn appliance switch to "OFF" and remove the heater door.
3. Turn off all electric power to the appliance.
4. Set the thermostat to lowest setting.
5. This appliance is equipped with an ignition device which automatically lights the heater. Do not try to light the burners by hand.
6. Turn gas control knob clockwise ➡ to "OFF".
7. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, STOP! Follow "B" in the safety information above on this label. If you don't smell gas, go to next step.
8. Turn gas control knob counterclockwise ↶ to "ON".
9. Set thermostat to desired setting. Replace heater door.
10. Turn on all electric power to appliance.
11. Turn appliance switch from "OFF" to "ON".
12. If the appliance will not operate, check that the pump is on, and all of the safety switches are reset. Otherwise, follow the instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.



TO TURN OFF GAS TO APPLIANCE

1. Turn appliance switch to "OFF".
2. Remove the heater door.
3. Set the thermostat to lowest setting.
4. Turn off all electric power to the appliance if service is to be performed.
5. Turn gas control knob clockwise ➡ to "OFF".
6. Replace heater door.

Figure 27. Lighting and Shutdown Instructions.

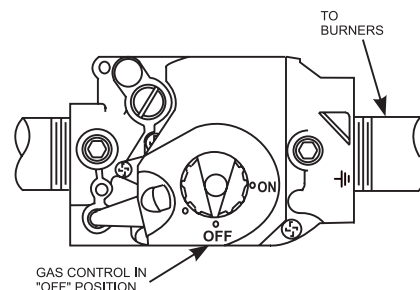
POUR VOTRE SÉCURITÉ LISEZ AVANT DE METTRE EN MARCHÉ

⚠️ AVERTISSEMENT: Quiconque ne respecte pas à la lettre les instructions dans la présente notice risque de déclencher un incendie ou une explosion entraînant des dommages, des blessures ou la mort.

- A. Cet appareil ne comporte pas de veilleuse. Il est muni d'un dispositif d'allumage qui allume automatiquement le brûleur. ne tentez pas d'allumer le brûleur manuellement.
- B. **AVANT DE FAIRE FOCTIONNER**, reniflez tout autour de l'appareil pour déceler une odeur de gaz. Reniflez près du plancher, car certains gaz sont plus lourds que l'air et peuvent s'accumuler au niveau du sol.
QUE FAIRE SI VOUS SENTEZ UNE ODEUR DE GAZ:
 - Ne pas tenter d'allumer d'appareil
 - Ne touchez à aucun interrupteur; ne pas vous servir des téléphones se trouvant dans le bâtiment.
- Appelez immédiatement votre fournisseur de gaz depuis un voisin. Suivez les instructions du fournisseur.
- Si vous ne pouvez rejoindre le fournisseur, appelez le service des incendies.
- C. Ne poussez ou tournez la manette d'admission du gaz qu'à la main; ne jamais utiliser d'outil. si la manette reste coincée, ne pas tenter de la réparer; appelez un technicien qualifié. Le fait de forcer la manette ou de la réparer peut déclencher une explosion ou un incendie.
- D. N'utilisez pas cet appareil s'il a été plongé dans l'eau, même partiellement. Faites inspecter l'appareil par un technicien qualifié et remplacez toute partie du système de contrôle et toute commande qui ont été blondés dans l'eau

INSTRUCTIONS DE MISE EN MARCHÉ

1. **ARRÊTEZ!** Lisez les instructions de sécurité sur la portion supérieure de cette étiquette.
2. Mettre le bouton de commande à "OFF". Enlevez la portière du chauffe-eau.
3. Coupez l'alimentation électrique de l'appareil.
4. Réglez le thermostat à la température la plus basse.
5. Cet appareil est muni d'un dispositif d'allumage qui met le chauffe-eau en marche automatiquement. Ne pas essayer d'allumer les brûleurs à main.
6. Tournez le bouton de la commande de gaz dans le sens des aiguilles d'une montre ➡ jusqu'à la position "OFF".
7. Attendre cinq (5) minutes pour laisser échapper tout le gaz. Reniflez tout autour de l'appareil, y compris près du plancher, pour déceler une odeur de gaz. Si vous sentez une odeur de gaz, **ARRÊTEZ!** Passez à l'étape B des instructions de sécurité sur la portion supérieure de cette étiquette. S'il n'y a pas d'odeur de gaz, passez à l'étape suivante.
8. Tournez le bouton de commande de gaz dans le sens contraire des aiguilles d'une montre ↶ jusqu'à la position "ON".
9. Remplacez le panneau d'accès aux commandes.
10. Mettez l'appareil sous tension.
11. Réglez le thermostat comme désiré et tournez le bouton de commande de la position "OFF" à la position "ON".
12. Si l'appareil ne se met pas en marche, suivez les instructions intitulées "Comment couper l'admission de gaz de l'appareil" et appelez un technicien qualifié ou le fournisseur de gaz.



COMMENT COUPER L'ADMISSION DE GAZ DE L'APPAREIL

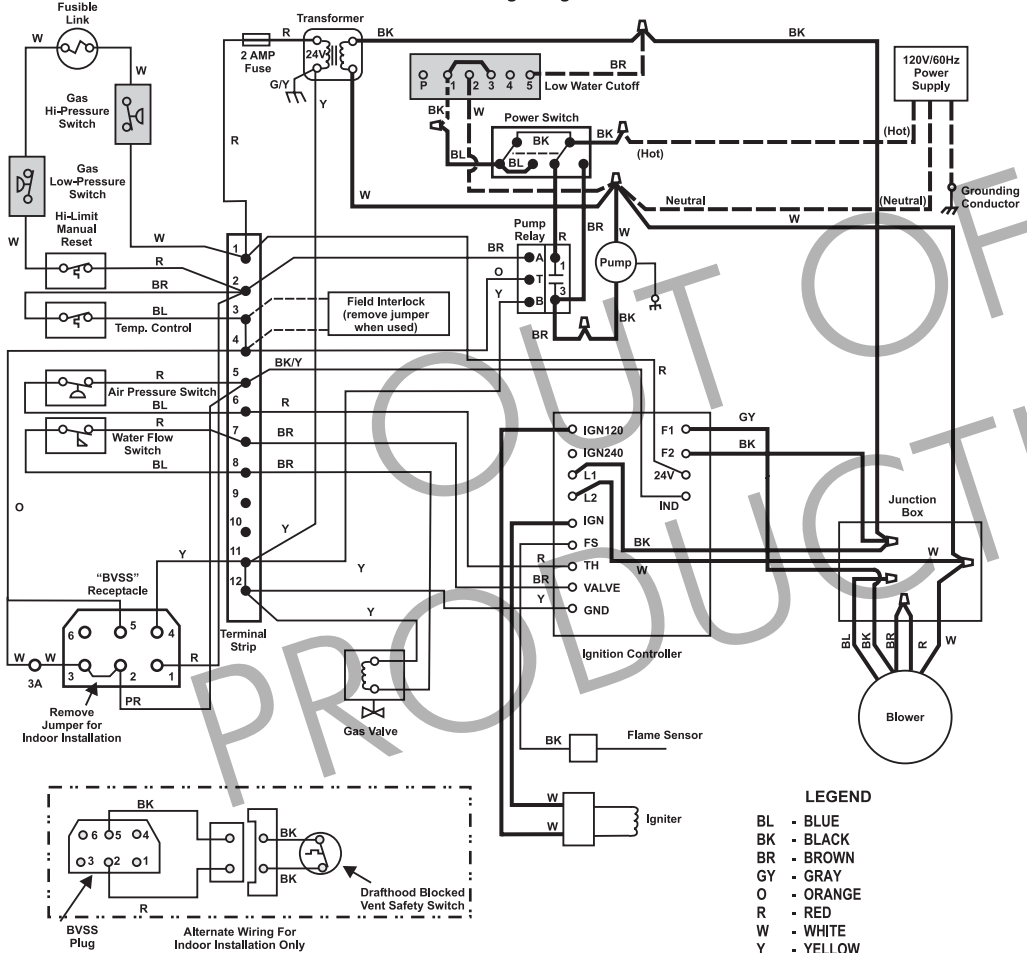
1. Mettre le bouton de commande à "OFF". Enlevez la portière du chauffe-eau.
2. Réglez le thermostat à la température la plus basse.
3. Coupez l'alimentation électrique de l'appareil s'il faut procéder à l'entretien.
4. Tournez le bouton de contrôle de gaz dans le sens des aiguilles d'une montre ➡ jusqu'à la position "OFF".
5. Remplacez le panneau d'accès aux commandes.

Figure 28. Lighting and Shutdown Instructions.

SYSTEM NUMBER 22 - HOT SURFACE IGNITION

On/Off with EM2
Volume Water Heater, PW (Size 250)

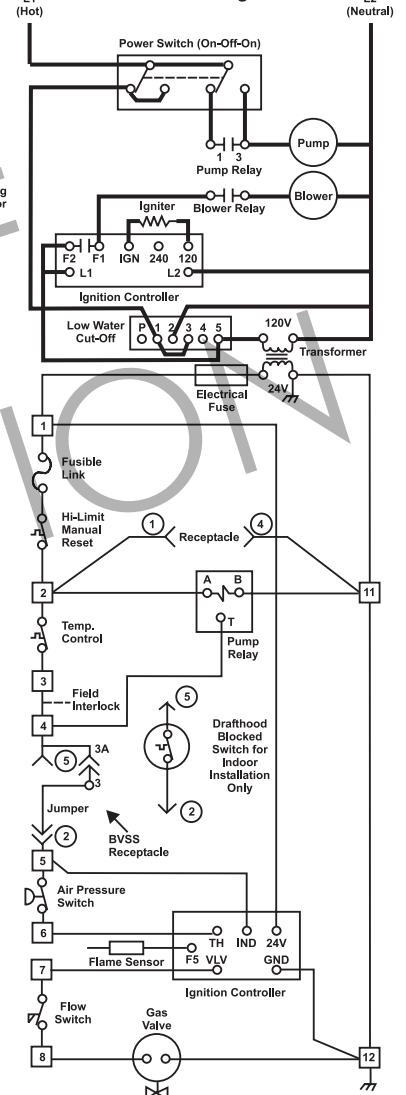
Wiring Diagram



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).

NOTE: Hard water pump is field supplied.

Schematic Diagram



- LEGEND**
- BL - BLUE
 - BK - BLACK
 - BR - BROWN
 - GY - GRAY
 - O - ORANGE
 - R - RED
 - W - WHITE
 - Y - YELLOW
 - G/Y - GREEN w/YELLOW TRACER
 - BK/Y - BLACK w/YELLOW TRACER
 - FACTORY WIRING 24V
 - FIELD WIRING 24V
 - FACTORY WIRING 120V
 - FIELD WIRING 120V
 - OPTIONAL COMPONENT
 - TERMINAL STRIP
 - BVSS - BLOCKED VENT SAFETY SWITCH

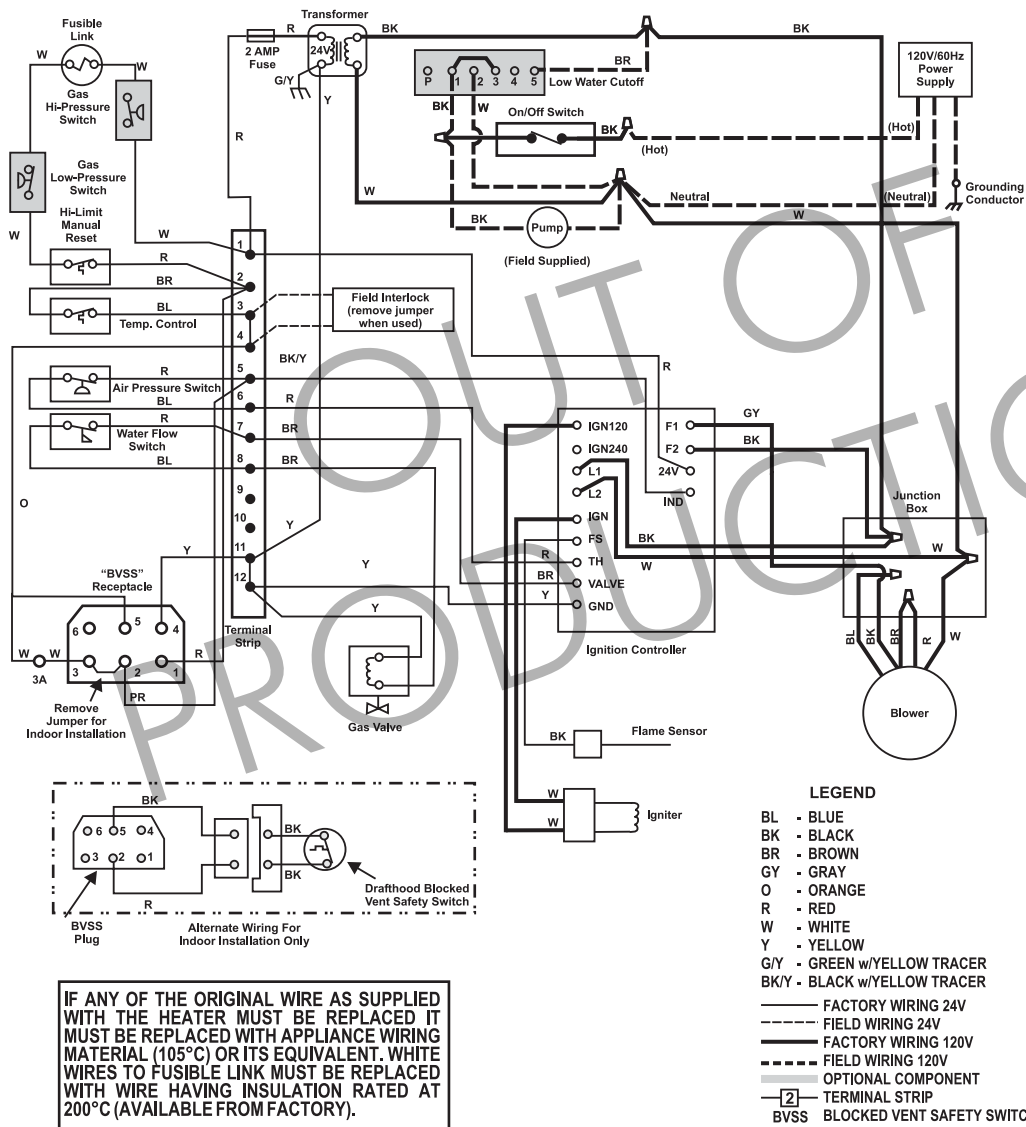
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Figure 29. Mighty Therm LO-NOx, PW250.

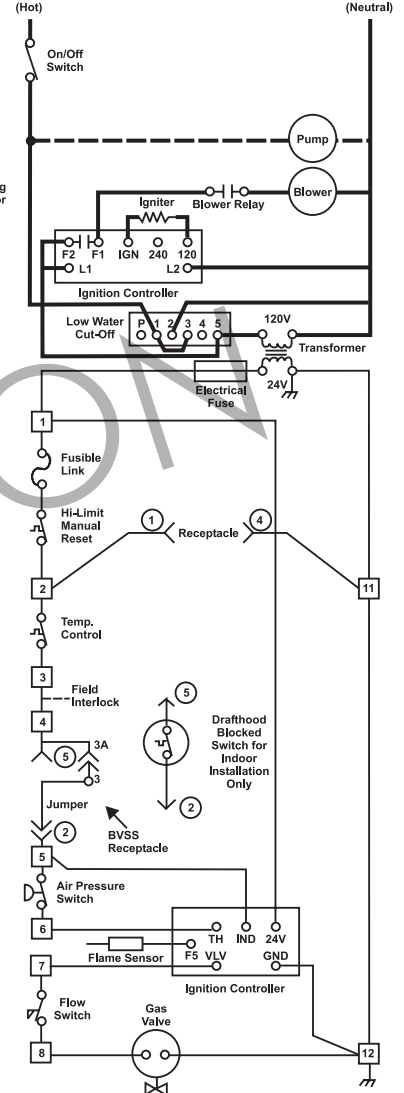
SYSTEM NUMBER 22 - HOT SURFACE IGNITION

On/Off
Volume Water Heater, VW (Size 250)

Wiring Diagram



Schematic Diagram



H0248500B

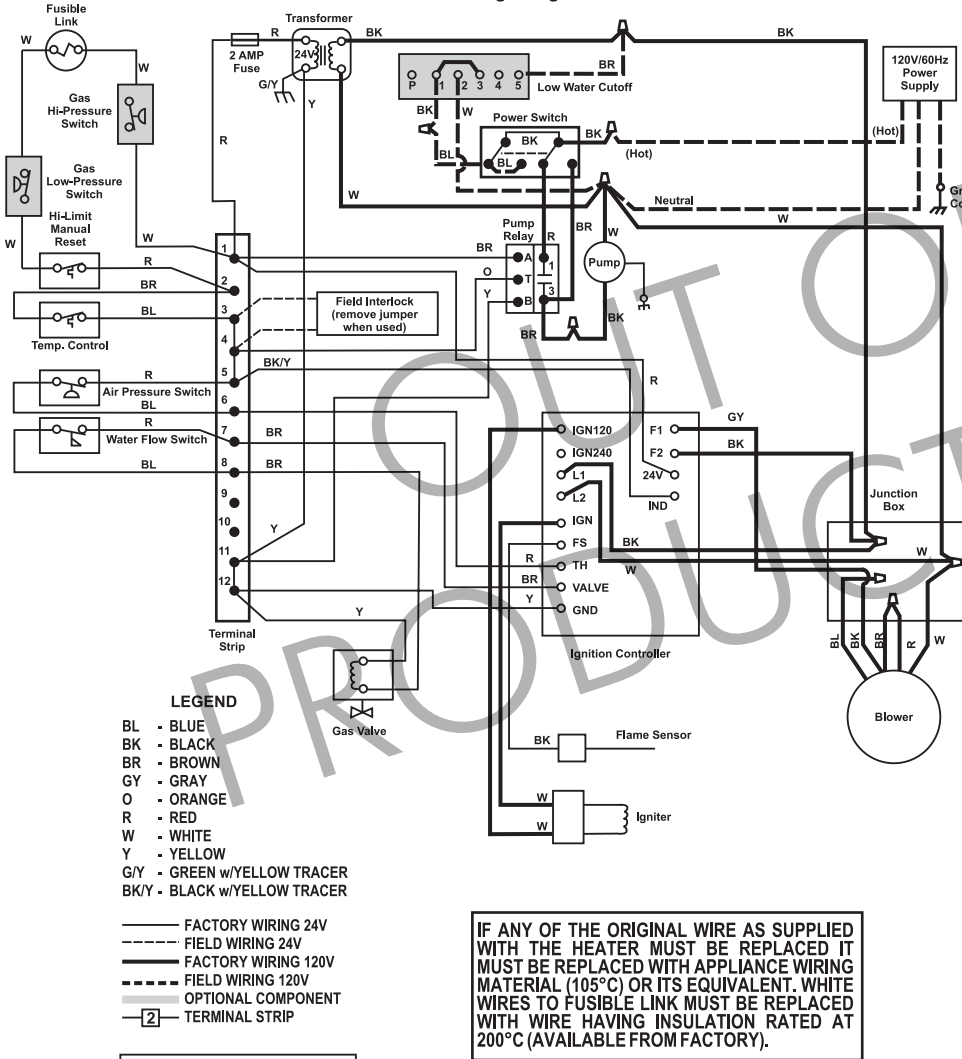
Figure 30. Mighty Therm LO-NOx, VW250.

SYSTEM NUMBER 22 - HOT SURFACE IGNITION

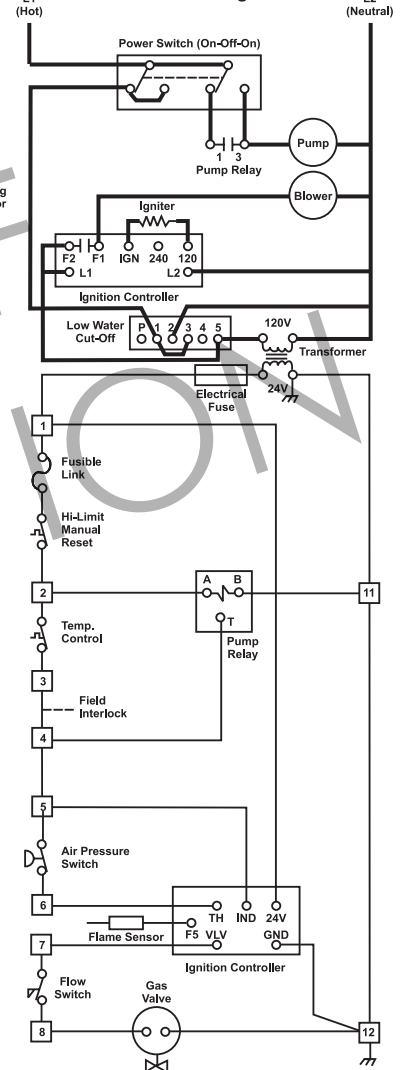
On/Off with EM2

Hydronic Boiler / Volume Water Heater (PH/PW) 400

Wiring Diagram



Schematic Diagram



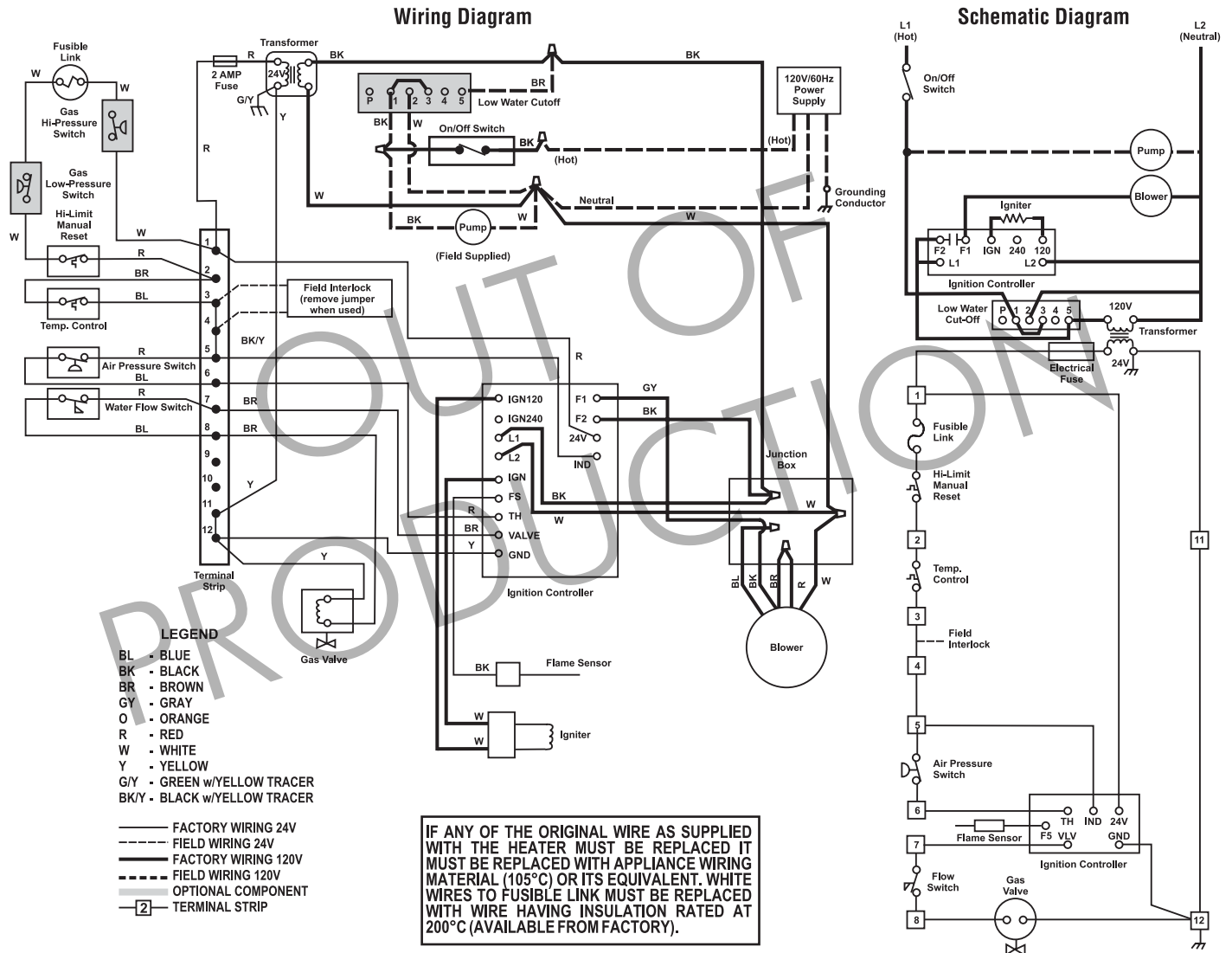
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Figure 31. Mighty Therm LO-NOx, PW/PH 400.

SYSTEM NUMBER 22 - HOT SURFACE IGNITION

On/Off

Hydronic Boiler / Volume Water Heater (HH/VW) 400



H0248600B

Figure 32. Mighty Therm LO-NOx, VW/HH 400.

If the unit is equipped with an automatic reset high limit, set the automatic reset high limit 20°F (11°C) above the outlet temperature to avoid nuisance lockouts. Set the manual reset high limit 5°F (3°C) above the automatic reset high limit.

For units that only have a manual reset high limit (no automatic reset high limit), set the manual reset high limit 20°F (11°C) above the outlet temperature to avoid nuisance lockouts.

Example, Imperial units: If the heater's temperature control is set to 130°F, and the temperature rise through the heater is 25°F, the outlet temperature will be 155°F (130°F + 25°F). Set the automatic reset high limit to 175°F (155°F + 20°F) and set the manual reset high limit to 180°F (175°F + 5°F).

Example, Metric units: If the heater's temperature control is set to 55°C, and the temperature rise through the heater is 14°C, the outlet temperature will be 69°C (55°C + 14°C). Set the automatic reset high limit to 80°C (69°C + 11°C) and set the manual reset high limit to 83°C (80°C + 3°C).

3.3 Hi-Limit Switch Checkout

After running the heater for a long enough period, bring the water temperature within the range of the hi-limit switch and slowly back off the high limit setting until the heater shuts off. The main burners should reignite (following the normal ignition cycle) when the hi-limit switch is reset and turned back up to its original setting. The heater should now run until it shuts off automatically on operating control.

Should overheating occur or the gas supply fail to shut off, turn off the manual gas control valve to the heater (refer to troubleshooting section).

3.4 Shut-Down Procedure

Shut down the heater following the instructions in Figures 27 and 28.

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

SECTION 4. Maintenance

4.1 General Instructions

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, check the main burner flame. If the flame has the

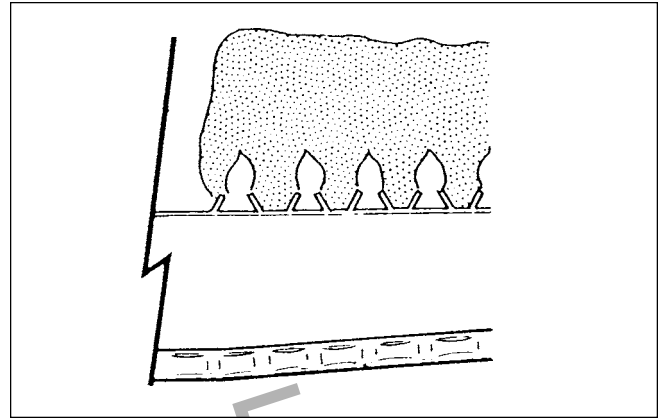


Figure 33. Flame Patterns.

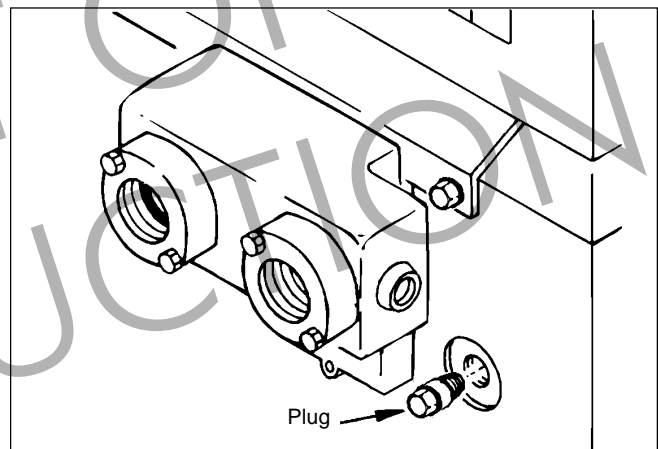


Figure 34. Scale Inspection.

appearance of sooting tips, check for debris near orifices. Call service technician (see Figure 32).

4. Inspect the venting system for blockage, leakage, and corrosion at least once a year.
5. Keep the heater 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.
8. Do not use the heater if any part has been under water. Replace any part of the control system and any gas control which has been under water.

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.

4.2 HEAT EXCHANGER

4.2.1 Inspecting the Heat Exchanger

To check the scale buildup, periodically inspect the tube having the highest temperature as follows:

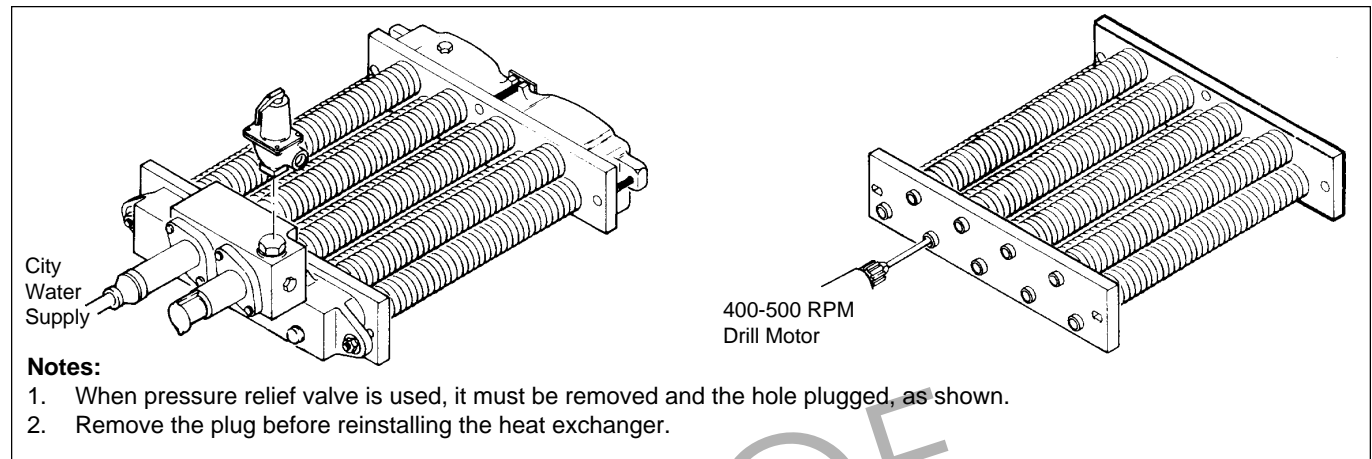


Figure 35. Heat Exchanger Tube Cleaning.

1. Open the drain valve on the left side of the heater.
2. Remove the large, hex-head plug located on the right side of the heater under the in/out header (see Figure 34). Perform this inspection after 60 days of and after 120 days of operation. This will establish a regular inspection routine.

4.2.2 Cleaning the Heat Exchanger

An inspection and cleaning of the complete heat exchanger can only be done by removing it from the heater.

1. Remove the heat exchanger.

⚠ WARNING

Black carbon soot buildup on a dirty heat exchanger can be ignited by a random spark or flame. To prevent this happening, dampen the soot deposits with a wet brush or fine water spray before servicing the heat exchanger.

2. Remove the heat baffles and check for a light accumulation of soot or corrosion on the outside of the heat exchanger tubes.

NOTE: While the heat exchanger is out of the heater, inspect the firewall refractory insulation blocks for cracks, wear, and breakage. Replace if necessary.

3. Use a wire brush to remove soot and loose scale from the heat exchanger. Do not use water or compressed air for cleaning.

NOTE: Use only the correct carbide tipped reamers which are available from Laars.

4. Ream the insides of the tubes (see Figure 35).
5. Pull the reamer out frequently to remove lime powder and prevent the drill from binding in the tube.
6. Install new gaskets. Do not reuse the old ones.

7. Tighten the header bolts progressively, starting with the two center bolts. Maximum torque is 20 inch pounds (27 Nm). Do not over-torque.
8. Pressure test the heat exchanger for leaks with city water supply before re-installing.
9. When placing the heat exchanger back in the heater, carefully hold the refractory insulation blocks apart and lower the heat exchanger into place. Be sure the sheet metal covers, which protect the insulation blocks, are replaced carefully.
10. If a header bolt is stripped, drive it out of the header plate and replace it (see Section 6, Parts List).
11. Reinstall the heat exchanger.

SECTION 5. Troubleshooting and Service

5.1 Gas Pressure Tests

Use the following procedures to check the main gas supply and manifold gas pressures. A manometer kit is available from Laars and instructions for its use are included in the kit. A dry gas pressure gauge may also be used for either test.

5.1.1 Checking the Main Line Gas Pressure

1. Attach a manometer (or a dry gas pressure gauge) to heater jacket (see Figure 36).
2. Open both columns on the manometer.
3. Use shutoff valve outside the heater jacket to shut off all gas supply to the heater.
4. Remove the 1/8 inch (3.2 mm) NPT test plug in the inlet side of the gas valve and replace it with the 1/8 inch (3.2 mm) NPT fitting from the manometer kit.

5. Attach one end of the manometer hose to the fitting on the gas valve and the other end to the manometer.
6. Open gas supply shutoff valve outside the heater and follow the lighting instructions in Figures 27 and 28 to turn on the heater.
7. With the main burners firing, the manometer reading should be between 6 and 10.5 inches (152 and 267 mm) W.C.

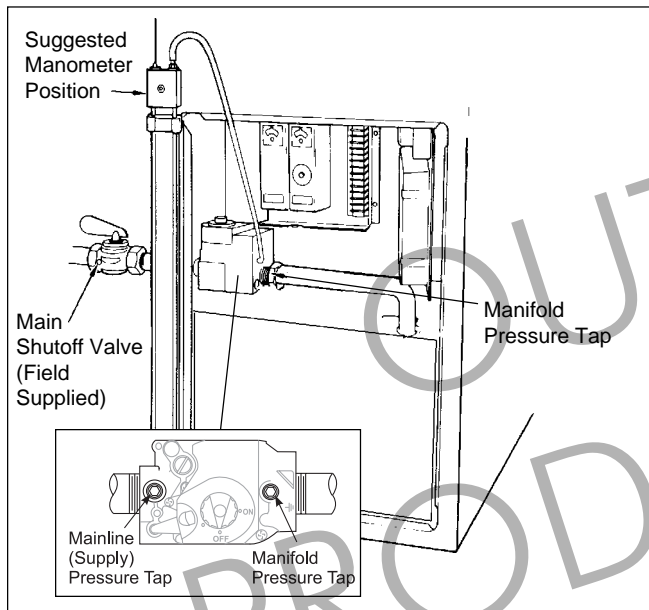


Figure 36. Gas Manifold Pressure Test.

5.1.2 Checking the Manifold Regulated Gas Pressure

1. Attach a manometer (or a dry gas pressure gauge) to heater jacket (see Figure 36).
2. Open both columns on the manometer.
3. Use shutoff valve, on outside of heater jacket, to shut off all gas supply to the heater.
4. Remove the 1/8 inch (3.2 mm) NPT test plug on the outlet side of the gas valve, and replace it with the 1/8 inch (3.2 mm) NPT fitting from the manometer kit.
5. Attach one end of the manometer hose to the fitting on the gas valve and the other end to the manometer.
6. Turn on gas supply to the heater, and follow the lighting instructions in Figures 27 and 28 to turn on the heater.
7. With the main burner firing, the manometer reading should be 4 inches (102mm) W.C. for natural gas.
8. Turn the toggle switch to OFF.
9. Shut the system down following the shutdown instructions in Figures 27 and 28.
11. Disconnect the manometer tubing from the gas valve and replace the 1/8 inch (3.2 mm) NPT fitting with the original plug.

5.2 Electrical Troubleshooting

⚠ WARNING

Electricity can cause property damage, injury, or loss of life. All troubleshooting and servicing must be done by a qualified hot water heater technician.

This section describes procedures for checking the electrical power and control components of the heater. Read all of these procedures before starting repairs.

Problems with heaters not firing are usually caused by something reducing water flow through the heater, causing the protective switches in the heater system to shut down the heater.

The following tools are required for proper service and problem diagnosis of the heater and heating system.

1. Gas pressure test kit with range from 0 to 14 inches (0 to 356 mm) W.C.
2. Electric meter(s) with the following ranges:
 - a. 0 to 500 volts VAC
 - b. 0 to 2000 ohms (Ω)
 - c. 0 to 20 microamps (μA)
3. Tube cleaning kit with a reamer, stainless steel brush, speed handle, and handle extensions.
4. A pressure gauge and a thermometer with proper ranges for heater operation.

5.2.1 Heater Does Not Come On

Important: Disconnect power to the heater before removing or replacing any component or wire connection.

⚠ WARNING

If power is not disconnected, jumpering gas valve or accidental grounding of the wire harness, or component terminals to the heater frame or jacket could cause an electrical shock hazard and could cause the ignition control fuse to blow or may cause the heater to fire, resulting in property damage, injury or loss of life.

1. Make sure the heater has been properly installed.
2. Make sure the pump is not airlocked, clogged or otherwise inoperative.
3. Make sure the gas valve is on and there is gas pressure in the line.
4. Check all electrical connections and wiring. Finding a loose connection or a charred wire can save a lot of time and money.
5. Check the fuse inside the twist-lock fuse holder. If it is burned, replace it with a 2-amp fuse (Part No. E0084400). If there is a short, the cause of

the short must be found and repaired. Do not jumper or bypass the fuse.

6. Make sure the electrical circuit to the heater is on.
7. Make sure the toggle switch on the right side of the heater is on.
8. Make sure the temperature control is set high enough to call for heat.
9. Make sure the manual reset on the safety controls (e.g., low water cutoff, hi-limit switch, etc.) has not tripped. If it has, reset it.

If the pump is circulating water, and the rest of these items check out all right, the trouble could be in the heater control system.

⚠ Caution

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

⚠ Attention

Au moment de l'entretien des commandes, étiquetez tous les fils avant de les débrancher. Les erreurs de câblage peuvent nuire au bon fonctionnement et être dangereuses. S'assurer que l'appareil fonctionne adéquatement une fois l'entretien terminé.

5.2.2 Testing the Transformer

NOTE: Keep the pump running.

Testing the transformer requires an AC voltmeter with a 50 volt (V) range. Test the transformer using the following procedures:

1. Clip a lead from the voltmeter to the yellow wire terminal on the transformer (this lead stays connected to this terminal for all tests).
2. Touch the other lead to the red wire terminal (see Figure 37). The voltmeter should read 20 to 28VAC.
3. If the voltmeter does not show voltage, check the electrical power supply.
4. If the voltage is less than 20VAC, the electrical circuit to the heater may be supplying less than 103VAC. This could be due to high pump load or air conditioners or other appliances on the circuit.

5.2.3 Testing the Electrical Power Supply

The electrical components of the VW and PW heaters operate with supply voltage ranging from 103 to 126VAC at 60 Hertz (Hz). To test the electrical power supply:

1. Measure the voltage at the hot and neutral connections inside the heater electrical junction box.

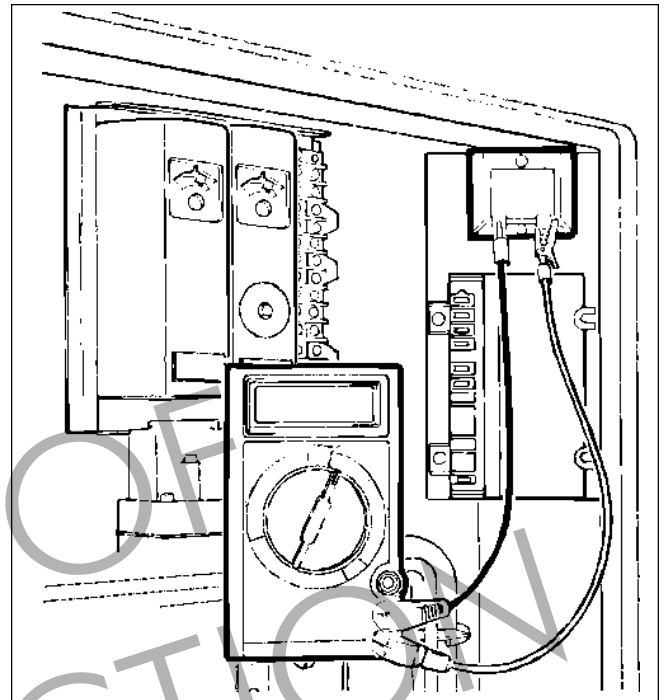


Figure 37. Testing the Transformer.

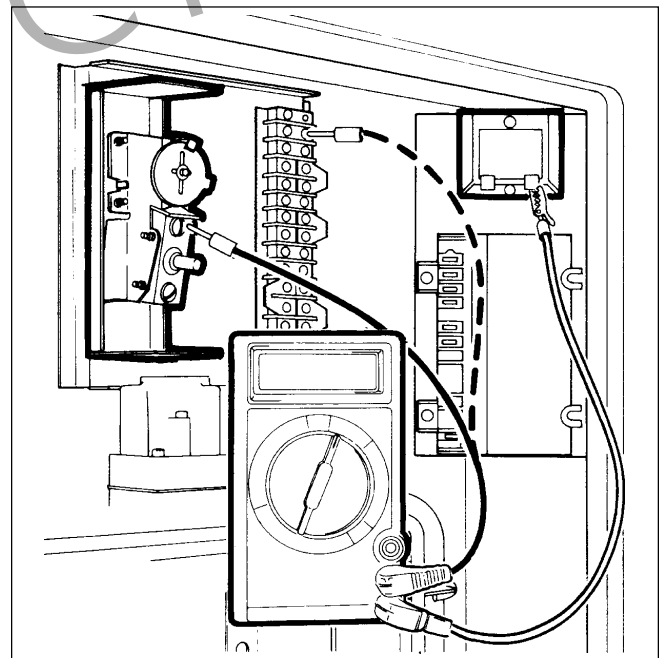


Figure 38. Testing the Manual Reset Hi-limit Switch.

2. Voltage outside of the required range may be due to poor wiring connections, to other loads (e.g., air conditioners, compressors) on the circuit, to high pump load, or to an electrical utility company problem.

5.2.4 Testing the Manual Reset Hi-Limit Switch

To test the manual reset hi-limit switch (see Figure 38):

1. Touch the other lead of the voltmeter to both terminals of the manual reset hi-limit switch. The voltmeter should read 20 to 28VAC at both terminals.
2. If no voltage is detected at one terminal, reset the manual reset hi-limit switch by pressing the reset button. Check the temperature setting.
3. If after pressing the reset button there is still no voltage indicated at one terminal, replace the manual reset hi-limit switch. An open switch may indicate excessive water temperatures or improper setting.

5.2.5 Testing the Flow Switch

The flow switch is a safety device that senses water flow through the heater. When the switch senses adequate water flow, it closes, allowing the heater to fire. If the water flow is too low, the switch remains open and prevents the heater from firing regardless of the temperature control setting.

The flow switch is factory mounted and wired. Never attempt to repair the flow switch. If the flow switch is found to be defective, replace the flow switch. To test the flow switch:

1. Remove cap from flow switch (see Figure 22).
2. Touch a voltmeter lead to each terminal of the flow switch.
3. If the voltmeter reads voltage at each of the terminals, the switch is good.
4. If there is no voltage at one terminal, it indicates an open switch. Replace the flow switch.

5.2.6 Testing the Fusible Link (flame roll-out switch)

The fusible link is a thermally fusible element which shuts down the heater if it detects excessive temperatures inside the heat exchanger compartment. To test the fusible link (flame roll-out switch):

1. Remove the electrical wiring from the fuses and check across each fuse's terminals with a continuity or ohm meter.
2. Touch the voltmeter lead to the lower terminal on the terminal block.
3. If the voltmeter reads voltage, the safety fuse and the fusible link are good.
4. Replace the fuse when an open circuit is detected. An open fuse indicates overheating in the heat exchanger compartment.
5. Check for blockage of the heat exchanger.

5.2.7 Testing the Fuse

To test the fuse:

1. Clip a lead of the voltmeter to the grounding terminal.

2. Touch the other voltmeter lead to terminal number (1) one on the terminal strip.
3. If there is no voltage, replace the fuse. A blown fuse is usually an indication of a short in the 24VAC circuit. It is important that the cause of the short be found and repaired. Do not jumper or bypass the fuse.

5.2.8 Testing the Ignition Control

WARNING

The ignition control and igniter operate on 120V power. Keep this in mind while servicing the heater, and take care to avoid electrical shock, which can cause serious injury or loss of life.

The ignition control provides power to the igniter, energizes the gas valve when there is a call for heat, and senses when a flame is established. To test the ignition control for spark ignition:

1. Clip one lead from the voltmeter to the yellow wire terminal on the transformer (or to terminal number (12) twelve on the terminal strip).
2. Touch the other voltmeter lead to terminal number (6) six on the terminal strip.
3. If the voltmeter reads voltage, the temperature control and the manual reset hi-limit switch are not keeping the heater from firing.
4. Make sure the flame sensor is clean and positioned in place, the terminal connection is tight, and the lead is at least 3/8 inch (9.5 mm) from the heater chassis and other metal parts.

NOTE: The ignition control cannot be repaired in the field. If it does not operate properly, replace it.

5.2.9 Combustion Air Blower

This heater uses a fan-assisted combustion process. For proper operation of the burners, inspect the air blower for contamination one week after start-up and every six (6) months thereafter.

1. To inspect and service the blower, shut off all electrical and gas supply to the heater.
2. Disconnect the air hose from the air blower (see Figure 39) and from the air inlet elbow.
3. Remove the screws holding the blower bracket (see Figure 39) off the inner front panel.
4. Inspect the blower wheel. Clean the blower housing and its wheel from any contamination or debris.
5. Check the air hose for any blockage or rupture. Clean any blockage, if ruptured or holes exist, replace the hose.
6. Reassemble all parts securely in place.

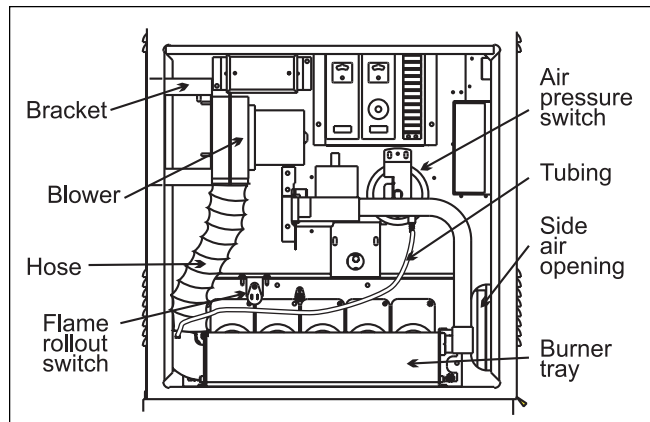


Figure 39. Controls Location.

5.2.10 Heater Will Not Shut Off

1. If the heater stays on with the brown wire on the gas valve disconnected, replace the gas valve.

⚠ WARNING

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

2. Check electrical components for loose wires.
3. Check all wiring connections for correct order of the components wiring, follow the wiring diagram provided with the heater.

SECTION 6.

Replacement Parts

6.1 Ordering Information

To order or purchase parts for Laars products, contact your nearest Laars dealer or distributor. If they cannot supply you with what you need, contact Laars Customer Service at the address shown on the back cover of this manual.

Visit our website at www.laars.com for Service Center listings.

6.2 Parts List

Key No.	Description	Model No.	Order Part No.
IGNITER SYSTEM			
1	Transformer, 115V/24V 40VA Ignition.....	All	E0086100
2	Ignition Control	All	R0328800
3	In-Line Fuse Assembly	All	E0228900
4	Hot Surface Ignitor	All	R0317200
Key		Model	Order

No.	Description	No.	Part No.
MAIN GAS ASSEMBLY			
5	Burner Tray Assembly	250	R0360003
	.....	400	R0360005
6	Air Inlet Elbow	All	R0360300
7	Gas Valve	All	R0336800
8	Gas Orifice (set of 8) (Note 1)	All	R0360100
9	Anti-Rotation Bracket	All	R0331800
10	Burner, Main	All	R0360400
11	Gas Pipe with Attachment	All	R0360200
12	Flame Sensor	All	R0360900
13	Manifold	250	R0365803
	.....	400	R0365805
14	Air Inlet Hose	All	R0360600
ELECTRICAL SYSTEM			
15	Fusible Link Assembly	All	R0361800
16	Fusible Link	All	R0361900
17	Blower	All	R0360500
18	Air Pressure Switch with Tubing	All	R0360700
19	Toggle Switch (on/off) (not shown)	All	E0077000
	Toggle switch (EM2) (not shown)	All	E0109200
20	Hi-Limit, Manual Reset	All	E0015900
21	Temp Controller, On/Off	All	E0014400
22	Flow Switch	All	E0013000
23	Switch BVSS, Drafthood	250	E0121000
24	Switch BVSS, Harness	250	10697802
25	BVSS Adaptor Cable	250	10887300
26	Top Enclosure	250	R0343403
	.....	400	R0343405
27	Top Filler Plate	250	R0343703
	.....	400	R0343705
28	Rainshield Kit	250	R0318303
	.....	400	R0318305
29	Flue Collector Assembly	250	R0316403
	.....	400	R0316405
30	Outdoor Vent Cap	250	10561503
	.....	400	10561505
31	Indoor Drafthood	250	R0368703
	.....	400	10561405
32	Flue Transition Plate	250	10861903
	.....	400	10861905
33	Adapter Plate	250	10535303
	.....	400	10535305
34	Clip	All	10211000
35	Flue Collector Hold Down Bracket	All	10726200
WATER SYSTEM			
36	Heat Exch, Tube Assy, Copper	250	R0095503
	.....	400	R0095505
	Heat Exch, Tube Assy, Cupronickel	250	R0095603
	.....	400	R0095605
37	Plug, 1/4 inch NPT	All	P0026800
38	In/Out Header		
	Cast Iron (S0079200), 2-Pass	All	10593800
	Bronze (S0075900), 4-Pass	All	10546900
39	Return Header		
	Cast Iron (S0079200), 2-Pass	All	10593800
	Bronze (S0075900), 4-Pass	All	10546800
40	Header Gasket (18)	All	R0050800
41	Bolt, Dome Head (8)	All	F0046100
42	Screw, Hex Cap (4)	All	F0051400

Key No.	Description	Model No.	Order Part No.
43	Gasket		
	Cast Iron Flange	All	S0076500
	Bronze Flange	All	S0028000
	Bronze Flange	All	S0053100
44	Nut	All	F0040800
45	Washer	All	F0011100
46	Flange, 1-1/2 inch		
	Cast Iron (S0076400)	All	10573600
	Bronze (S0071800)	All	10489400
47	Pressure Relief Valve (125 psi)	All	A0001200
48	Pump and Rainshield Assembly (not shown)		
	(soft)	250	10766903
	(normal)	250	10767003
	(soft)	400	10766905
	(normal)	400	10767005
49	Valve, Drain	All	P0058700
50	Well, Temp Control, 1/2 inch NPT	All	E0025900
51	Nipple, Brass, 3/4 inch	All	P0025300
52	Nipple, n Bronze (1-1/2 inch)	All	P0075700
	Nipple, Cast Iron (1-1/2 inch)	All	P0024400
53	Tee, Bronze	All	P0075600
	Tee, Cast Iron	All	P0071700
54	Bushing, Brass	All	P0018500
55	Heat Exchanger Support Bracket	All	10457000
56	Flue Collector Hold Down Clamp	All	10726300
57	Clip, Baffle Retainer	All	S0083900

Key No.	Description	Model No.	Order Part No.
58	Baffle, Heat Exchanger (8)	250	10697403
	.....	400	10697405
59	End Baffle, Heat Exchanger	250	R0365903
	.....	400	R0365905

FIREBOX COMPONENTS

60	Complete Combustion Chamber Assy	250	R0316703
	.....	400	R0316705

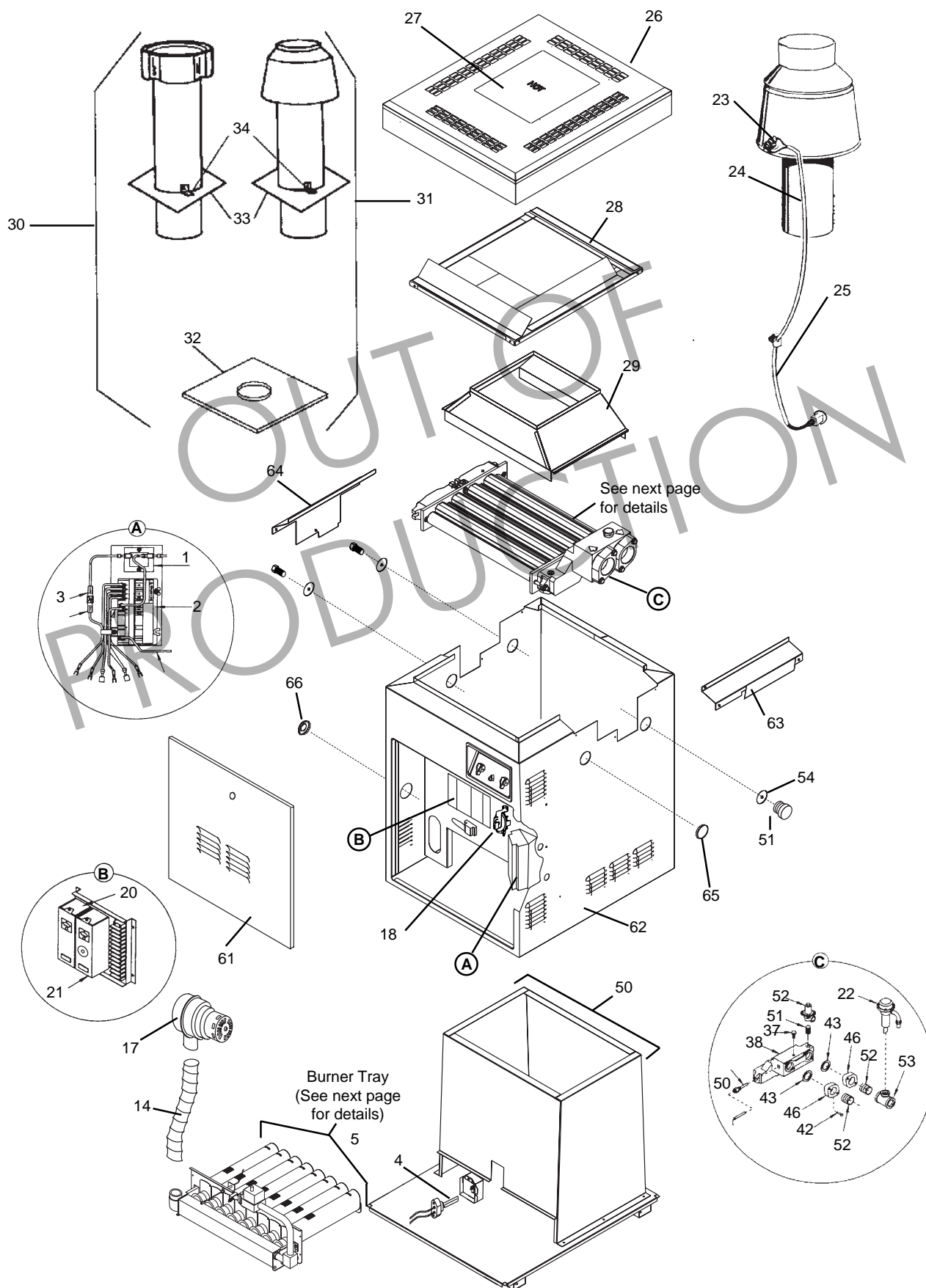
JACKET COMPONENTS

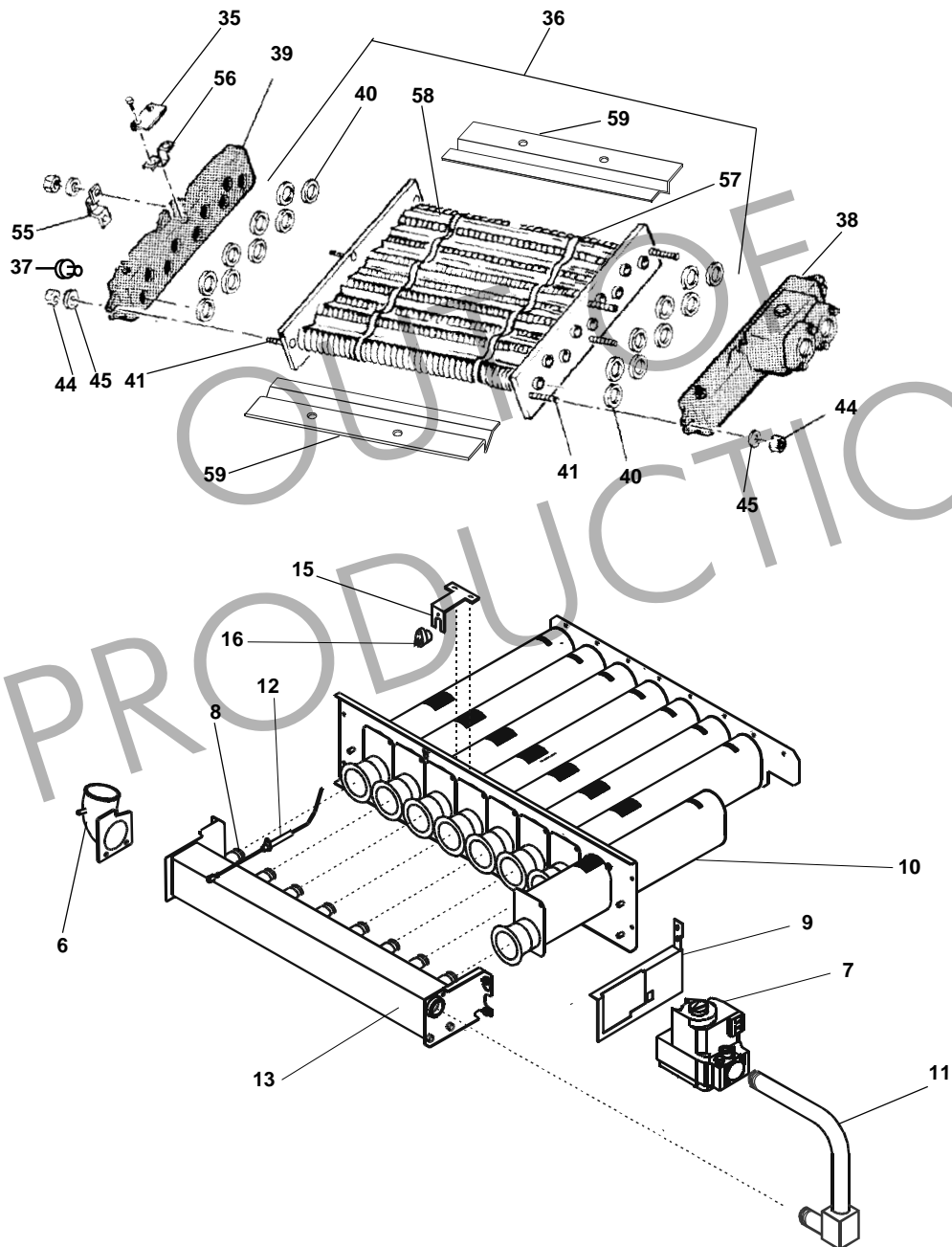
61	Door with Latch	250	R0360803
	.....	400	R0360805
62	Jacket Assy, Less Top Assy	250	R0343503
	.....	400	R0343505
63	Gap Closure, Inlet/Outlet	All	R0344300
64	Gap Closure, Return	All	R0344400
65	Button Plug, 1-3/4"	All	F0035300
66	Button Plug, 2" (w/ hole for gas line)	All	F0056600
67	Outdoor Base (not shown)	All	R0368900

OPTIONAL COMPONENTS

67	Touch-up Spray Paint, Pewter + Black	All	R0335800
68	Touch-up Spray Paint, Pewter Only	All	X0022700
69	Touch-up Spray Paint, Black Only	All	X0022900

NOTE 1: The Laars LO-NOx heater is designed for operation only with natural gas up to an altitude of 2000 feet. The orifice set listed in the above parts list reflects these conditions. For other applications contact your authorized Laars dealer or our Customer Service department.





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