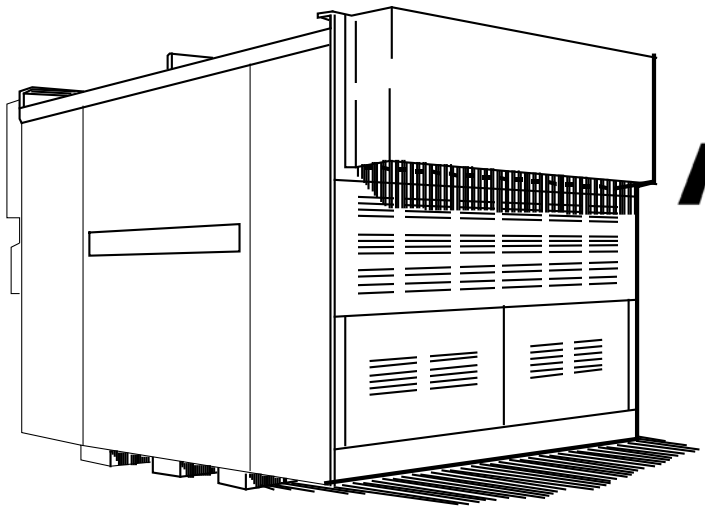


# Installation and Operation Instructions for

# MIGHTY THERM®

## Pool Heating Boiler

# Model AP

## Sizes 2000-5000 MBTU/h

**These instructions are to be stored in the packet provided on the boiler.**

**FOR YOUR SAFETY:** This product must be installed and serviced by a professional service technician, qualified in hot water boiler and 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 these instructions is not followed exactly, a fire or explosion may result causing property damage, personal injury or death.**

**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 neighbor's 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.**

**⚠ AVERTISSEMENT**

**Assurez-vous de bien suivres les instructions données dans cette notice pour réduire au minimum le risque d'incendie ou d'explosion ou pour éviter tout dommage matériel, toute blessure ou la mort.**

**Ne pas entreposer ni utiliser d'essence ou ni d'autres vapeurs ou liquides inflammables dans le à proximité de cet appareil ou de tout autre appareil.**

**QUE FAIRE SI VOUS SENTEZ UNE ODEUR DE GAZ:**

- **Ne pas tenter d'allumer d'appareils.**
- **Ne touchez à aucun interrupteur. Ne pas vous servir des téléphones dans le bâtiment où vous vous trovez.**
- **Appelez immédiatement votre fournisseur de gaz depuis un voisin. Suivez les instructions du fournisseur.**
- **Si vous ne pouvez rejoindre le fournisseur de gaz, appelez le sservice des incendies.**

**L'installation et l'entretien doivent être assurés par un installateur ou un service d'entretien qualifié ou par le fournisseur de gaz.**

H20000000J

LAARS® Heating Systems Company

# TABLE OF CONTENTS


**SECTION 1.**
**General Information**
1A. Introduction....3
1B. Warranty....3

**SECTION 2.**
**Installation**
2A. Pool Heater Placement....3
2B. Installation of Indoor Pool Heaters....4
2B-1. Combustion Air Supply....4
2B-2. Venting....5
2C. Installation of Outdoor Water Units....5
2D. Freeze Protection....6
2E. Gas Supply and Piping....6
2F. Electrical Wiring....7
2G. Piping of System to Pool Heater....7
2H. General Water Piping....7
2I. Pool Heater By-Pass Piping....8
2J. Automatic Chlorinators....8
2K. Pressure Switch....8

**SECTION 3.**
**Operation**
3A. Initial Start Up....9
3A-1. Initial Filter Cycle on a New Pool....9
3A-2. Starting Instructions....9
3A-3. Hi-Limit Checkout....10
3B. To Start Up System (See Section 3A for Initial Start Up)....10
3C. To Turn Off Pool Heater....10
3D. Spring and Fall Operation....10
3E. Winter Operation....10
3E-1. Draining Pool Heater Before Freezing....10
3E-2. Improper Use of the Pool Heater....10
3F. Time Clock Operation....11
3G. Spa (Hot Tub) Safety Rules....11
3H. Periodic Service....11
3I. Pool Water Chemistry....11

**SECTION 4.**
Maintenance....12

**SECTION 5.**
**Troubleshooting and Analysis of Service Problems**....12

**SECTION 6.**
**Conversion of this pool heater. From Indoor to Outdoor Models**
6A. SECTION I....14
6B. SECTION II....14

**SECTION 7.**
**Parts Description and Order Numbers**....16

# SECTION 1. General Information

**⚠IMPORTANT WARNING:**
The Model AP commercial pool heating boilers must be used with potable water only. For pools containing salt water, a specially equipped pool heater must be used. Consult your distributor or factory representative. The pool heater must be installed in accordance with the procedures in this manual, or the warranty could be voided. Consult local building codes and ANSI bulletin Z223.1 or in Canada CAN1-B149 before proceeding with the installation. Any modification to the pool heater, its gas controls, gas orifices, wiring or draft diverter may void the Laars warranty. Consult the factory before making any modifications.

## 1A. Introduction

This manual provides information for the installation and operation of Laars Model AP pool heating boilers. It is strongly recommended that all application and installation procedures be reviewed completely before proceeding with the installation. Consult the Laars factory, or local factory representative, with any problems or questions regarding this equipment. Experience has shown that most operating problems are caused by improper installation.

Series AP pool heating boilers are offered in two configurations: an indoor version and an outdoor version. The indoor version is convertible for outdoor use with the installation of a conversion kit as described in Section 6 of this manual. The two configurations are shown in Figure 1.

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.

## 1.B Warranty

Laars Heating Systems appliances are covered by a limited warranty. Owners should submit online warranty registration at ***www.Laars.com***.

All warranty claims must be made to an authorized Laars Heating Systems representative, directly to Customer Service, or online at ***www.Laars.com***. Claims must include the serial number and model number (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.

# SECTION 2. Installation

## 2A. Pool Heater Placement

This pool heater must be placed to provide clearances on all sides for maintenance and inspection. There must also be minimum distances maintained from combustible surfaces.

All pool heaters must be installed on a non-combustible floor. Under no circumstances can pool heaters be installed on carpeting.

The National Fuel Code allows a pool heater

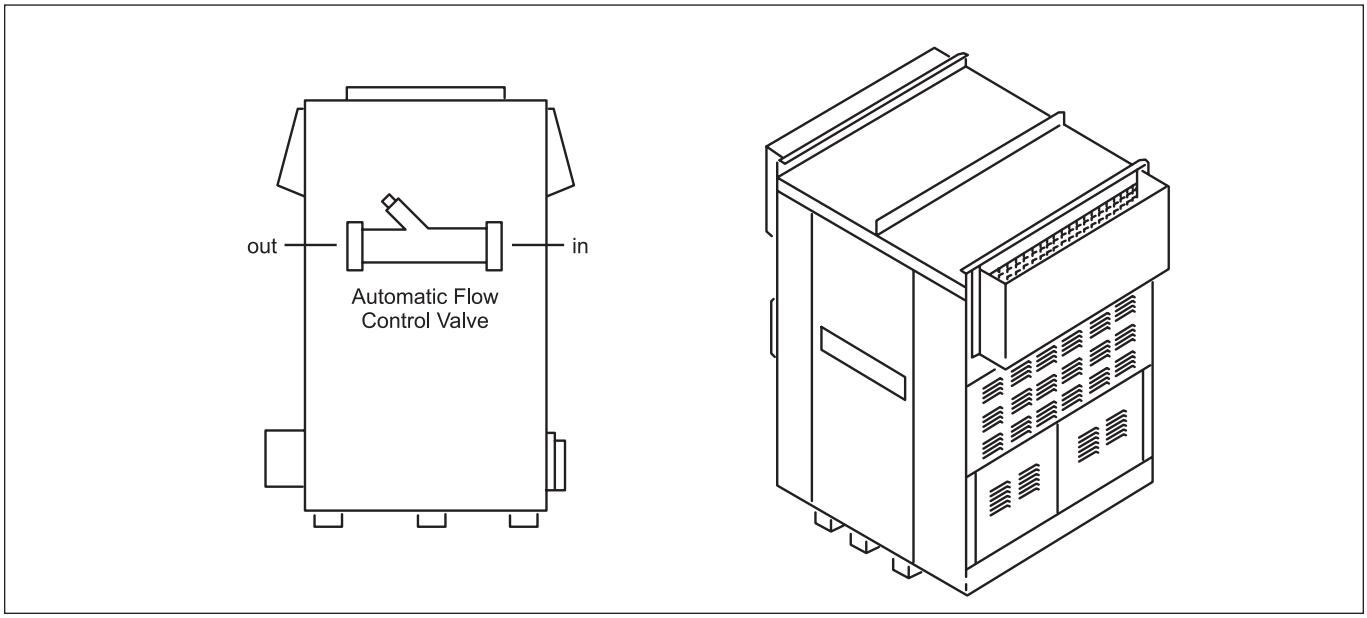
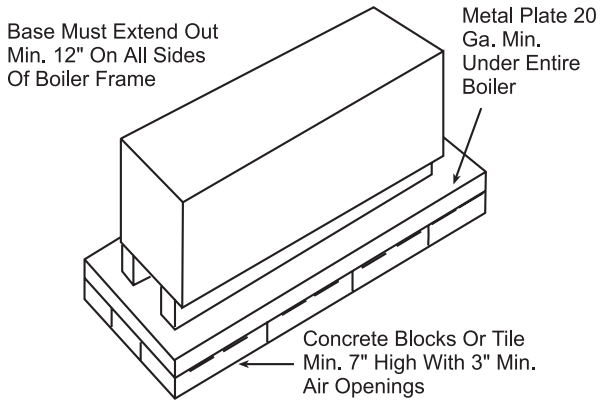



**Figure 1. Boiler Configuration - Series AP.**

to be placed on other than a non combustible surface when such an installation complies with the local codes. This code specifies the surface under the pool heater be protected with hollow masonry no less than 4" thick, covered with sheet metal at least 20 gage in thickness. Such masonry must be laid with ends unsealed, and joints matched in such a way as to provide a free circulation of air from side to side through the masonry (see Figure 2).

Outdoor installation of this unit is not permitted in Canada




Blocks must provide solid base and be braced so they cannot slip out of place. Air openings in blocks must be arranged to provide unobstructed opening through entire width or length of base.

**Figure 2. Non-Combustible Base.**

## 2B. Installation of Indoor Pool Heaters

### 2B-1. Combustion Air Supply

1. The pool heater location must provide sufficient air supply for proper combustion, and ventilation of the surrounding area as outlined in the latest edition of ANSI standard Z223.1 or, in Canada CAN1-B149, and any local codes that may be applicable. Inadequate combustion air supply may result in incomplete combustion and consequent sooting of the heat exchange and unsafe operation of the pool heater.
2. In general, (in the U.S.), these requirements specify that equipment rooms which represent confined spaces should be provided with two permanent air supply openings communicating directly through the wall to outside air; one within 12 inches of the ceiling, the other within 12 inches of the floor. Each opening should have a minimum free area of one square inch per 4,000 BTUH input of the total input rating of all appliances in the enclosed area. These requirements differ in Canada. Consult the National Standard of Canada CAN1-B149 for details. See Table 2 for recommended air supply for U.S. models. An improperly ventilated equipment room can get excessively hot and cause accelerated deterioration of controls and electrical components.
3. Exhaust Fans or Vents: Any equipment which exhausts air from the pool heater room can deplete the combustion air supply or reverse the natural draft action of the venting system. This could cause flue products to accumulate in the room. Additional air must be supplied to compensate for such exhaust. The information in Table 2 is not applicable in installations where exhaust fans or blowers of any type are used. Such installations must be designed by qualified engineers.

| Clearance From | Indoor (Inches) | Outdoor (Inches) |
|---|---|---|
| Top | 24 | — |
| Water Conn. Side | 24 | 24 |
| Opposite Side | 24 | 24 |
| Front | 48 | 48 |
| Rear | 24 | 24 |
| Vent | 6 | — |

**Table 1. Minimum Boiler Clearance From Combustible Surfaces**

| Indoor Size | Each Opening* (Square Inches) |
|---|---|
| 2000 | 500 |
| 2450 | 613 |
| 3050 | 763 |
| 3500 | 875 |
| 4050 | 1013 |
| 4500 | 1125 |
| 5000 | 1250 |

Net Free Area in Square Inches*

*Area indicated is for one of two openings: one at floor level and one at the ceiling, so the total net free area would be double the figures indicated. For all other conditions, refer to latest edition of ANSI A223.1.

NOTE: Check with louver manufacturers for Net Free Area of louvers. Correct for screen resistance to the Net Free Area if a screen is installed. Check all local codes applicable to combustion air.

**Table 2. Minimum Recommended Air Supply to Equipment Room.**

4. If a blower or fan is used to supply air to the equipment room, the installer should make sure it does not create drafts which could cause nuisance shut-downs of the pilot. If a blower is necessary to provide adequate combustion air to the pool heater, a suitable switch or equivalent must be wired into the pool heater control circuit to prevent the pool heater from firing unless the blower is operating.
5. The pool heater must be completely isolated and protected from any source of corrosive chemical fumes such as emitted by trichlorethylene, perchlorethylene, chlorine, etc.

### 2B-2. Venting

1. These pool heaters have built-in draft diverters for natural draft operation and must not be connected into any portion of a mechanical draft system under positive pressure. The flue outlet must be connected to a clear, unobstructed vent of adequate capacity terminating above the highest point of the building with an approved vent cap. The venting system should be installed according to the latest edition of ANSI Z223.1 (or CAN1-B149) and any local codes having jurisdiction.
   **IMPORTANT NOTE:** Do not use sheet metal screws at the snap lock joints of Type B gas vents.
2. Do not weld or fasten the vent pipe to the pool heater draft hood. The weight of the stack must not rest on the pool heater. The draft hood and top must be easily removable for normal pool heater service and inspection.
3. Avoid long horizontal runs of the vent pipe, and too many 90 degree elbows, reductions and restrictions. Horizontal runs should have at least a 1/4" rise per foot in the direction of flow. A vent connector shall be supported for the design and weight of the material employed to maintain clearances and prevent physical damage and separation of joints.
4. Avoid terminating pool heater vents near air conditioning or air supply fans. The fans can pick up exhaust flue products from the pool heater and return them inside the building, creating a possible health hazard. A minimum of 4 feet horizontal distance must be maintained from electric meters, gas meters, and relief equipment.
5. Always use double-wall or insulated vent pipe (Type B or equivalent). 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 pool heater room.
6. Avoid oversize vent piping or extremely long runs of the pipe which may cause excessive cooling and condensation. Rule of Thumb: The total length of the vent, including the connector and any offset, should not exceed 15 feet for every inch of vent diameter. Longer total lengths shown in venting tables are based on maximum capacity, not condensation factors.
7. When the installation of a draft fan is necessary in the venting system to which this pool heater is to be connected, the installation should be engineered by competent personnel following good engineering practices. The draft fan supplier should be consulted for correct size. The installation should be in accordance with the latest edition of ANSI Z223.1 and any local codes having jurisdiction. When a draft fan is installed, a suitable draft switch must be used and wired into the pool heater control circuit at terminal designated "Field Interlock," to prevent firing of the unit unless a positive draft has been established (see Figure 3).

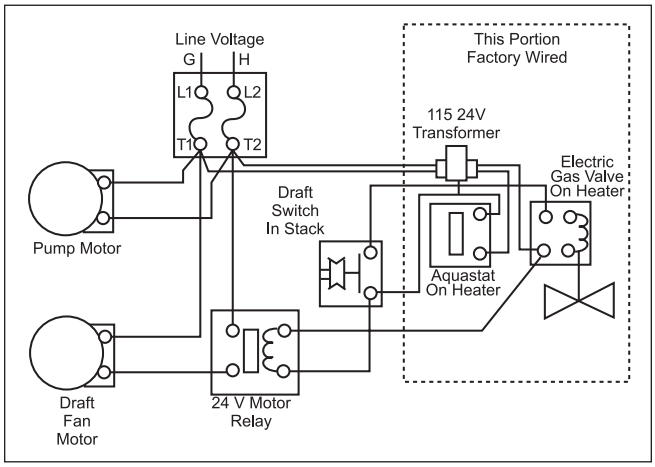



**Figure 3. Draft Fan Wiring Diagram.**

## 2C. Installation of Outdoor Units

**NOTE: Outdoor installation of this unit is not permitted in Canada.**

1. Locate the pool heater to provide the minimum clearances as listed in Section 2A, "Boiler Placement."
2. Do not locate the boiler in an enclosure or wall recess. Avoid locations where wind deflection off structures might cause down draft. When such wind conditions are possible, locate the unit at least three (3) feet from the structures.
3. Never install the pool heater under any kind of roof overhang. Do not locate the unit below or adjacent to any doors, windows, louvers, grills, etc. which communicate in any way with an inhabited area of a building. Even though such communication might be through another structure such as a garage or utility room (see Figure 4).

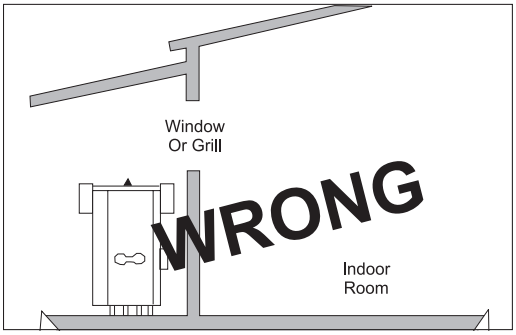



**Figure 4. Incorrect Outdoor Installation.**

4. Liquified petroleum is heavier than air. Therefore, the pool heater should not be installed in pits or other locations where gas could accumulate. The pool heater should be located a safe distance from LP gas storage and filling equipment. Consult local codes and fire protection authorities for advice relative to specific installation restrictions.

## 2D. Freeze Protection

Pool heater installations are not recommended in areas where the danger of freezing exists unless proper precautions are made for freeze protection.

## 2E. Gas Supply and Piping

Review the following instructions before proceeding with the installation.

1. Verify that the pool heater is fitted for the proper type of gas by checking the rating plate. These pool heaters are normally equipped to operate below a 2000 foot altitude. Pool heaters equipped to operate at higher altitudes have appropriate stickers or tags attached.
2. Use the figures in Table 3 to provide adequate gas piping (check local code for BTU capacity required).
3. A trap (drip leg) must be provided ahead of the gas controls (see Figure 5). Where required by code, provide a second manual gas shutoff valve. Do not remove manual valve furnished with the unit.
4. The pool heater and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 psig. The pool heater must be isolated from the gas supply piping system by closing its individual manual gas shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 psig.
5. Provide gas supply pressure to the pool heater as follows:

**Distance from Gas Meter or Natural and LP Gas**

| Indoor Size | Outdoor Size | 0-100' Nat. | 0-100' LP | 100-200' Nat. | 100-200' LP | 200-300' Nat. | 200-300' LP |
|---|---|---|---|---|---|---|---|
| 2000 | — | 2½ | 2 | 3 | 2½ | 3 | 3 |
| 2450 | 2200 | 3 | 2½ | 3 | 2½ | 3½ | 3 |
| 3050 | 2800 | 3 | 2½ | 3½ | 3 | 3½ | 3 |
| 3500 | 3200 | 3 | 2½ | 3½ | 3 | 4 | 3½ |
| 4050 | 3600 | 3½ | 3 | 4 | 3½ | 4 | 3½ |
| 4500 | 4000 | 3½ | 3 | 4 | 3½ | 5 | 4 |
| 5000 | 4500 | 4 | 3½ | 4 | 3½ | 5 | 4 |

NOTES:
These figures are based on ½" water column pressure drop.
Check supply pressure and local code requirements before proceeding with work.
Pipe fittings must be considered when determining gas pipe sizing.

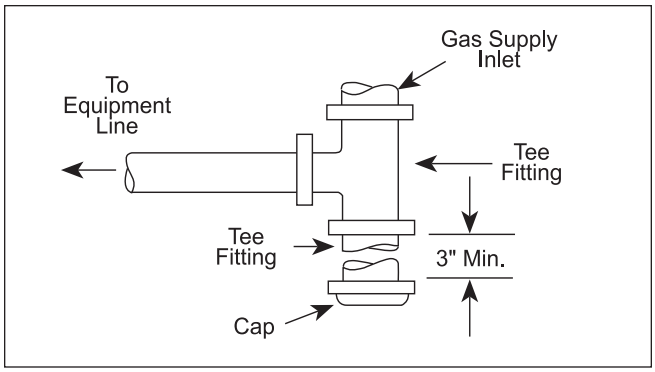



**Figure 5. Tee Fitting Sediment Trap.**

| | Natural | Propane |
|---|---|---|
| Min. (inches water column) | 7 | 11 |
| Max. (inches water column) | 9 | 14 |

Note: The pool heater and all other gas appliances sharing the 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 undersized gas meter and/or obstructed gas supply line.

6. The correct burner manifold gas pressure is stamped on the rating plate. The regulator is preset at the factory, and normally requires no further adjustment.
7. Before operating the pool heater, the complete gas supply system and all connections must be tested for leaks using a soap solution. Do not use raw flame.

**⚠Caution**

Since some leak test solutions, including soap and water, may cause corrosion or stress cracking, the piping must be rinsed with water after testing, unless it has been determined that the leak test solution is noncorrosive.

Arrangement of gas train components for on-off firing are shown schematically in the Gas Piping Diagram (see Figure 6).

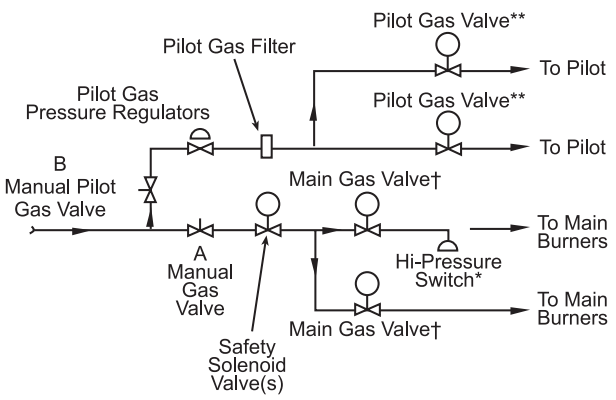



**Figure 6. Gas Piping Diagram.**

## 2F. Electrical Wiring

**⚠WARNING**

The pool heater must be electrically grounded in accordance with the most recent edition of the National Electrical Code, ANSI/NFPA 70, and in Canada, follow Canadian Electrical Code CSA C22.1. Do not rely on the gas or water piping to ground the metal parts of the pool heater. Frequently, plastic pipe or dielectric unions isolate the pool heater electrically. Service and maintenance personnel who work on or around the unit may be standing on wet floors and could be electrocuted by a poorly grounded pool heater.

1. Check pool heater wiring and pump for correct volt age, frequency and phase. If the pump circuit is other than 115V, check to see that the pool heater is provided with an appropriate transformer.
2. Wire the pool heater and pump exactly as shown in the wiring diagram supplied with the pool heater.
3. The pump and pool heater must be electrically interlocked so the pool heater cannot come on unless the pump is running.
4. All field installed electrical safety devices and all field installed devices (draft switches, relays, timers, etc.) can be connected to the pool heater wiring at points shown in the wiring diagram designated “Field Interlock.”
5. Auxiliary Time Clock Wiring. If a time clock is used to control the filter pump operation, a separate switch must be used to shut off the pool heater at least 15 minutes before the filter pump is shut off. Wire the separate switch (sometimes called a “Fireman Switch”) at the points shown on the internal wiring diagram as “Field Interlock.”

## 2G. Piping of System to Heater

1. Be sure to provide gate valves at the inlet and outlet to the pool heater so it can be readily isolated for service.
2. The pressure relief valve must be installed in the tapped opening provided, or on a “Tee” fitting when provided, in the pool heater outlet header with its outlet piped to a drain or floor sink. Special attention must be given to relief valve settings in installations where the pool heater 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 75 psi setting. Never reduce the relief valve opening. If necessary, install the relief valve in a Tee immediately past the pool heater outlet. The weight of all water and gas piping should be supported by suitable hangers or floor stands. Check piping diagrams with local applicable plumbing, heating and building safety codes.

## 2H. General Water Piping

1. Plastic fittings, grids, or other elements of the filter system are subject to damage by the momentary “back syphoning” of hot water when the pump stops. To prevent this backflow, install a swinging gate check valve in the piping between the filter and the pool heater.
2. No Hartford Loop is required for anti-syphon protection.
3. No water flow adjustments are required except when a manual bypass valve is installed.
4. Do not install any valve or other variable restriction in the return piping between the pool heater outlet and the pool.
5. The outlet pipe is carrying a large volume of water which has bypassed the pool heater combined with a small volume of very hot water. Therefore, the temperature difference between the inlet and out pipes will be so small as to be difficult to sense by touching the two pipes.

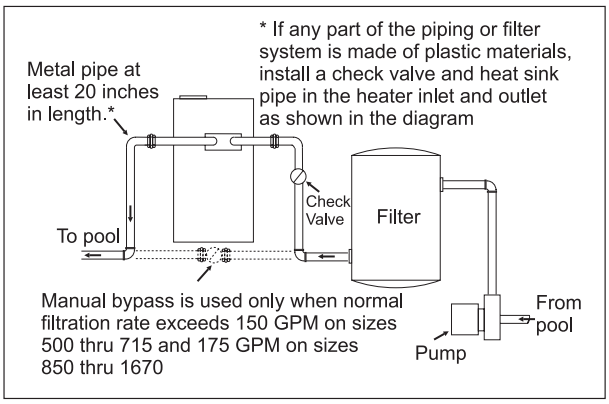



**Figure 7. Manual By-Pass Installation.**

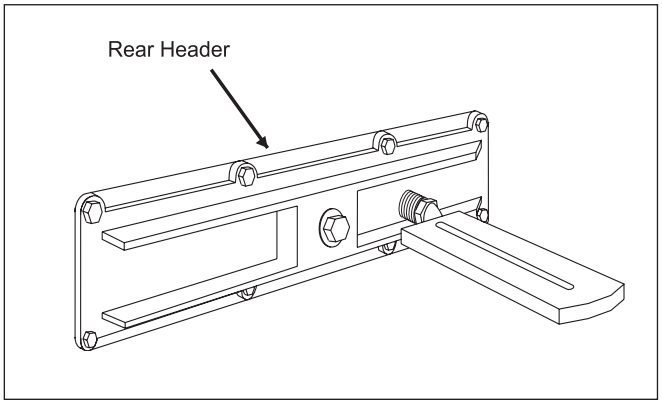



**Figure 8. Thermometer Location.**

## 2 I. Pool heater By-Pass Piping

All sizes and models of this pool heating boiler are equipped with an automatic flow control valve. Do not install a manual bypass valve unless the normal filtration rate exceeds 300 GPM. If the normal filtration rate exceeds that figure:

1. Install the manual bypass valve as illustrated in Figure 7.
2. Install a thermometer in the threaded opening in the rear header as shown in Figure 8.
3. Set the manual bypass valve as follows:
   a. Clean or backwash the filter completely.
   b. Close the manual bypass valve completely.
   c. Close the pool heater's main gas valve.
   d. Start the filtration system with all valves set for normal filtration.
   e. After 3 minutes, record the thermometer reading at the rear header (this is the pool water temperature).
   f. Open main gas valve and turn the thermostat to its highest setting to start the pool heater.
   g. Gradually open the bypass valve until the temperature difference shown in column 6 of Table 4 is achieved. For example, if the temperature reading in Step "e" was 60 degrees, and the pool heater is a Model 3500, the thermometer should read 75 degrees. Make sure this temperature difference remains constant for at least 5 minutes.
   h. Remove the handle from the bypass valve to prevent anyone from changing the setting. The automatic flow control valve will maintain proper flow through the pool heater regardless of the reduced water flow due to a dirty or clogged filter.

| Indoor Size | Outdoor Size | Part No. | Bypass Spring Color Code | Min. Flow Req'd (GPM)Cap. | Max. Bypass Valve (GPM) | Temp. Rise at Rear Header |
|---|---|---|---|---|---|---|
| 2000 | ------ | S220 | Black | 110 | 300 | 15 |
| 2450 | 2200 | S221 | White | 134 | 300 | 15 |
| 3050 | 2800 | S221 | White | 167 | 300 | 15 |
| 3500 | 3200 | S222 | Brown | 191 | 300 | 15 |
| 4050 | 3600 | S222 | Brown | 221 | 300 | 15 |
| 4500 | 4000 | S222 | Brown | 246 | 300 | 15 |
| 5000 | 4500 | S222 | Brown | 273 | 300 | 15 |

**Table 4. By-Pass Valve Adjustments.**

## 2J. Automatic Chlorinators

A concentration of chlorine in the pool heater can be very destructive. Therefore, the following rules regarding the installation and operation of automatic chlorinators must be followed.

1. The chlorinator should be installed so that it introduces the gas or solution downstream from the pool heater.
2. The chlorinator should be wired so that it cannot operate unless the filter pump is running.
3. The chlorinator should be provided with an anti-syphoning device so that when the pump shuts off, chlorine will not syphon back into the pool heater.
4. When the chlorinator is installed in the system where the chlorine flows through the pool heater, corrosion can occur. Excessive concentrations of chlorine, caused by improper adjustment or failure of the chlorination equipment, can cause pool heater damage which is not covered by the warranty.

## 2K. Pressure Switch

The pressure switch on the pool heater is factory set at 4 psi. Do not tamper with the switch unless the pool heater is installed more than 3 feet below the

surface of the pool. If this condition exists, follow this procedure to adjust the switch:

1. With the pool heater on, the filter pump running and the filter clean, slowly increase the pressure setting until the pool heater shuts off. Slowly decrease the pressure setting until the pool heater comes back on. Decrease the pressure setting another 2 psi to complete the switch setting.
2. Test the setting by closing the manual gas valve and turning off the filter pump. Turn the thermostat to the high setting and slowly open the manual gas valve. The pool heater should not try to fire when the filter pump is off.

If the pool heater is installed more than three feet above the pool level, install an eyeball fitting on the end of the return line to the pool to create adequate back pressure that the pool heater to operate the pressure flow safety switch. Never reduce the factory setting of the pressure switch. For special installation problems, consult the factory.

# SECTION 3. Operation

## 3A. Initial Start-Up

### 3A-1. Initial Filter Cycle on a New Pool

On a newly constructed pool, be sure to run the filter pump long enough to completely "turn-over" the pool water before turning on the pool heater. This will insure that any dirt and residue from the construction will be removed. The filter may clog rapidly during this period, causing the pool heater to severely cycle if it is on.

### 3A-2. Starting Instructions

1. Check the following installation details before proceeding:
   a. Has the required air supply been provided?
   b. Is the boiler properly vented?
2. Be sure the filter is clean.
3. Start the filter pump.

   Before placing the boiler in operation, the automatic safety shutoff devices must be checked. Once the unit is connected to the gas piping and after all of the requirements in Section 2 have been met, follow this procedure:

   a. Before beginning the tests, make sure the main manual gas valve, and any other firing valves are in the OFF position.

   b. Make sure the power switch on the boiler is in the “ON” position. After placing the manual pilot valves in the open position, and resetting all safety devices (high limit, pressure switch, Low-Water-Cutoff, etc.), pilots can be lit following the procedure located on the boiler rating plate.

   c. Once the pilots are lit and have been established for five minutes, the flame failure response time should be checked as follows:

   **System 16:** (Electronically supervised standing pilot system standard on propane gas). Extinguish the pilot flame by placing the manual pilot valve in the closed position, and, at the same time, begin recording the time it takes for the output signal from the electronic ignition control to be interrupted. Refer to the electrical drawing supplied with the boiler for wiring details. The signal interruption can be detected either with a test light or a voltmeter. Because the ignition controls are in series, the control just upstream of the gas valves should be tested first. Under no circumstances should the response time exceed 5 seconds.

   **System 18:** (Intermittent ignition supplied only for natural gas). With this system, pilots are automatically lit when the thermostat calls for heat. The pilots are permitted a trial period for ignition, then the system is locked out if it fails to light. To retry ignition, power to the pool heater must be momentarily interrupted. After the pilot is initially lit, the trial for ignition time should be checked by turning off pilot gas, and, at the same time, monitoring the time it takes for the audible sparking at the pilot burner to stop. Under no circumstances should the trial for ignition exceed 15 seconds because electronic ignition controls are in series. The control just upstream of the gas valves should be tested first (refer to the electrical drawing supplied with the unit).
   Once the trial for ignition period has been checked, the controls should be reset and the flame failure response time checked by following the procedure given for system 16.
4. With the pilots lit, initial activation of the main burners can be achieved by slowly opening the main manual valve. The result should be a smooth lighting of the main burners.

### 3A-3. Hi-Limit Checkout

After running the pool heater for a long enough period to bring the water temperature within the range of the hi-limit, slowly back off the high limit setting until the unit shuts off. The main burners should re-ignite when the hi-limit is turned back up to its original setting.

The high limit should now be reset and the pool heater run until it shuts off automatically on high limit.

Now that all tests of the safety shutoff devices have been completed, refer to Section 3B for the proper settings of temperature controls.

**NOTE:** Should any of the controls fail to function properly, consult the factory or your gas company representative.

## 3B. To Start Up System (See Section 3A for Initial Start Up)

**Start up pool heater:**

1. Be certain system pump is running.
2. Lighting instructions are provided on the rating plate and in the User's Manual and are as follows:
   a. Turn off main electrical switch.
   b. Turn off all manual gas valves and wait five minutes.
   c. Set aquastat or thermostat to lowest setting.
   d. Turn manual pilot valve to "ON." For standing pilot system, press on pilot relay knob, light pilot and keep relay knob depressed for one minute then release. Once the pilot is lit, the power will be supplied to the gas valve(s) upon activation of the aquastat.
   e. Slowly turn manual gas valve to "ON."
   f. Reset all safety switches (manual reset high limit, low water cutoff, etc.).
   g. Turn on main electric switch.
   h. Set temperature controller (aquastat) to desired temperature. Pilot will light automatically (intermittent ignition pilot system) and ignite main burners whenever the aquastat calls for heat.
   i. Adjust the pool aquastat as follows:

When the pool water has reached the desired temperature, as measured with an accurate thermometer, decrease the aquastat setting with a small screwdriver until the pool heater shuts off. The pool heater will maintain the existing pool water temperature automatically.

## 3C. To Turn Off Pool heater

1. Turn off main electrical switch.
2. Close all manual gas valves.

## 3D. Spring and Fall Operation

When the pool is not going to be used for a long period of time, turn the aquastat down to approximately 70° F. This will prevent the pool and surrounding ground from becoming chilled, save on fuel costs, and also permit the pool water temperature to be raised back to swimming temperature in a shorter period of time.

The pool water temperature should not be maintained below 70° F. Colder water will cause condensation to form on the heat exchanger when the pool heater does fire. Prolonged operation at a lower temperature will cause the pool heater to foul externally. See "Improper Use of Pool heater."

## 3E. Winter Operation

To shut down the pool heater for longer periods, turn both the manual gas valve and pilot gas valve to OFF. Where the danger of freezing does not exist, the normal filter cycle should be continued all year long to circulate water through the system even when the pool heater is turned off or shut down completely.

### 3E-1. Draining Pool heater Before Freezing

If the pool heater is located where it will be exposed to freezing temperatures, it should be drained before the first frost. Drain the pool heater by removing the drain plug on the bottom of the front header casting. Leave the plug out until time to use the pool heater again. The pool heater must be level for proper drainage. If compressed air is used to blow out the lines, it is still necessary to follow the same procedure. Keeping the pool heated by continuously running the pool heater may not be adequate protection due to the possibility of a pump or power failure.

### 3E-2. Improper Use of the Pool heater

This pool heater is not designed for continuous use as an anti freezing device for pools.

Operating the pool heater at water temperatures below 70° F will cause the heat exchanger fins to be partially blocked with condensation, resulting in incomplete combustion. Prolonged operation under these conditions will result in sooting of the heat exchanger which can seriously damage the pool heater and cause a fire hazard.

## 3F. Time Clock Operation

During the initial warm-up period, the pool heater must run continuously. Therefore, remove all time clock stops until the pool water reaches a temperature of at least 70° F.

When resetting the time clocks, be sure to allow the filter pump and pool heater enough time to maintain the pool water at the desired temperature.

## 3G. Spa (Hot Tub) Safety Rules

Therapeutic pools, or "spa" pools, are usually piped and controlled so that very warm or hot water, often with air injection, is forced at high velocity into a confined area of a swimming pool or into a small, separate pool. Both the energy of the water and the heat furnish certain hydrotherapeutic benefits. These pools are excellent for relaxation, body-conditioning, and for arthritic and rheumatic problems, but can be hazardous. The Consumer Product Safety Commission has recommended the following "Safety Rules for Hot Tubs."

1. Spa or hot tub water temperature should never exceed 104° F (40° C). A temperature of 100° F (38° C) is considered safe for a healthy adult. Special caution is suggested for young children.
2. Drinking of alcoholic beverages before or during spa or hot tub use can cause drowsiness which could lead to unconsciousness and subsequently result in drowning.
3. Pregnant women beware! Soaking in water above 102° F (39° C) can cause fetal damage during the first three months of pregnancy (resulting in the birth of a brain-damaged or deformed child). Pregnant women should stick to the 100° F (38° C) maximum rule.
4. Before entering the spa or hot tub, users should check the water temperature with an accurate thermometer; spa or hot tub thermostats may err in regulating water temperatures by as much as 4° F (2.2° C).
5. Persons with medical history of heart disease, circulatory problems, diabetes or blood pressure problems, diabetes or blood pressure problems should obtain their physician's advice before using spas or hot tubs.
6. Persons taking medications which induce drowsiness, such as tranquilizers, antihistamines or anticoagulants, should not use spas or hot tubs.

## 3H. Periodic Service

Inspect the heat exchanger tubes of the pool heater on a regular basis. In most areas and under most operating conditions, the pool heater will operate for years without accumulating any scale in the tubes. However, in some pools the mineral content of the water is such that completely scale-free operation is impossible. For this reason, the pool heater was designed so that all of the internal wet surfaces can be easily inspected and, if necessary, cleaned. Simple cleaning tools are available from your dealer or the factory.

In order to establish a proper inspection schedule, the tubes should be inspected after the first sixty days of operation, and again after 120 days. From the appearance of the tubes, it will be possible to determine the best regular inspection schedule.

When pool equipment is located outdoors, a certain amount of dust and moisture can infiltrate the mechanical parts of the controls. After many years, this could cause deterioration. A regular service schedule will insure longer life and safe operation of the equipment.

## 3 I. Pool Water Chemistry

Due to natural evaporation, which only removes the water and leaves the minerals, the mineral content of pool water increases daily. Also, the regular addition of algaecidal and sanitizing chemicals substantially adds to the mineral content of the pool. If the mineral content of the pool is allowed to get too high, the minerals will precipitate out of the water and deposit on the walls of the pool, the filter, and the heat exchanger tubes. For this reason, it is important that the pool be completely drained regularly (at least every two years) to reduce the chance of expensive repairs to the pool, filter system and pool heater.

It is also important to maintain the pH level of the pool water between 7.3 and 7.7 which can add years to the life of the pool finish, filter system and pool heater.

Most algaecidal and sanitizing chemicals contain sodium hypochlorite, while others contain calcium hypochlorite. Sodium is not a scaling chemical, but calcium definitely is. So when chemicals are used which contain calcium, it is even more critical that the pH level of the pool water be maintained properly, and that the pool water be completely changed when the dissolved solids indicate an excessive mineral content.

## SECTION 4. Maintenance

1. At start-up and every six (6) months thereafter, the pilot and main burner flame should be observed for proper performance (see Figures 9 and 10; see attached lighting and shutdown instructions for proper pilot flame pattern). If flame has the appearance of "sooting" tips, check for debris near orifices. Call service technician.

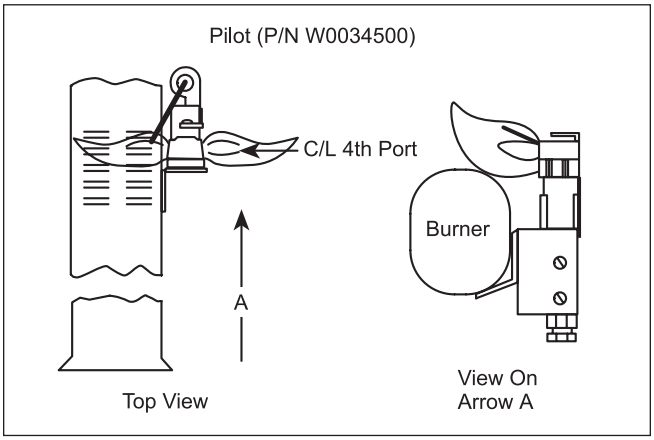



**Figure 9. Pilot Location.**

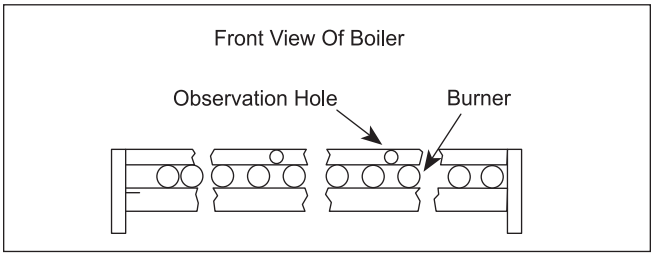



**Figure 10. Periodic Flame Observation.**

2. Inspect the venting system for obstruction, leakage, and corrosion at least once a year.
3. Keep pool heater area clear and free from combustible material, gasoline and other flammable liquids and vapors. Pool heater surfaces are hot and could ignite combustible materials.
4. Be certain all combustion air and ventilation openings are unobstructed.
5. Check for fouling on the external surfaces of the heat exchanger every six months.

***NOTE:*** *After installation and first start-up, check the heat exchanger for fouling after the following periods of operation: 24 hours, 7 days, 30 days, 90 days, and once every six months thereafter.*

Fouling on the external surfaces of the heat exchanger is caused by incomplete combustion, and is a sign of combustion air and/or venting problems. As soon as any fouling is observed, the cause of the fouling should be corrected (see Section 5 Troubleshooting). The heat exchanger can be checked with a flashlight by locating a mirror under the burners. An alternate method is to remove the venting and top panel as necessary to inspect from above. Also, check the vent system for defects at the same time.

a. If cleaning is required, shut off all electrical and gas supply to the pool heater.

b. To expose the heat exchanger:

Remove top panel covers located at the base of the front and rear flue collector panels. Remove all but the top screws on each side of the front and rear flue collector panels. The panels can be swung outward and propped up to reveal the heat exchanger. Remove all heat exchanger baffles.

c. Remove all burners:

**⚠Caution**

Black carbon or green soot on a dirty heat exchanger can, under certain conditions, be ignited by a random spark or open flame. To prevent this unlikely occurrence, dampen the soot deposits with a wet brush or fine water spray before servicing or cleaning the heat exchanger.

With a wire brush, remove soot and loose scale from the heat exchanger. Do not use water or compressed air for cleaning. Clean fallen debris from the bottom of the pool heater. Check that burner ports are clear and pilot assembly is free of debris.

d. Reassemble in reverse order:
Be sure to replace the heat exchanger baffles.

6. The gas and electric controls installed on the pool heaters are designed for both dependable operation and long life. But the safety of this equipment depends completely on their proper functioning. It is strongly recommended that the basic items be checked by a competent service technician every year, and replaced when necessary. The basic controls are:
   a. Water temperature controls.
   b. Pilot safety system.
   c. Automatic electric gas valve(s).
   d. Water pressure switch.
   e. Flow sensing safety device (when used).
7. Low water cutoffs should be inspected every six (6) months, including flushing or float types.

**NOTE:** Warranty does not cover any damage caused by lack of required maintenance or improper operating practices.

## SECTION 5.
## Troubleshooting and Analysis of Service Problems

1. For proper service and problem diagnosis of the pool heater and system, the following tools are required:
   a. Gas pressure test kit with range from zero to 14" W.C. Either a slack tub manometer or an accurate gas pressure gauge is acceptable with proper adaptors which will connect to the available fittings in the line and on the gas valve.
   b. Electric meter(s) with the following ranges:
      0 to 500 volts A.C.
      0 to 1000 ohms continuity.
   c. Millivolt meter with the following ranges:
      0 to 50 millivolts. 0 to 500 millivolts.
      0 to 1000 millivolts.
   d. Tube cleaning kit consisting of reamer, stainless steel brush, speed handle and handle extensions.
   e. Accurate thermometer and pressure gauge.
2. In addition, the pool heater should be equipped with a thermometer with proper ranges.

| **Boiler Will Not Fire** | |
|---|---|
| **Possible Cause** | **What To Do** |
| Electric Power is off. | Check to see that main power switch is ON. Use testing device to trace power to boiler junction box. |
| Operating or safety control has opened circuit to electric gas valve. | Turn off power. Use continuity tester to check continuity across terminals of each operating and safety control switch up to the electric gas valve. Replace defective control. |
| Pilot flame is out. | Relight pilot per instructions. |
| Manual reset device has tripped. | Follow instructions for start-up. Reset pilot safety and all manual reset safety switches. |
| No gas pressure to burners. | Trace gas line to service shutoff cock. If service cock is open, trace gas line to meter. If no pressure is present at meter, call for public utility service. If gas is present in heater inlet, check pressures in following sequence:<br>(1) downstream from pressure regulator,<br>(2) downstream from electric gas valve.<br>Replace or adjust as necessary. |
| Electric gas valve operator is burned out or shortened. | Disconnect wiring harness at gas valve terminals. Check continuity to actuator coil. If open circuit or short is indicated, replace coil or operator. |

| **Boiler is Pounding, Knocking, or Emitting Steam from Relief Valves** | |
|---|---|
| **Possible Cause** | **What To Do** |
| Lower or no water flow. | This condition is usually caused by lack of adequate water flow through heater. check the following:<br>1. Is the heater wired into the pump circuit so that the heater cannot fire unless the pump is running?<br>2. Check to see that all valves in system are open to be sure that water can circulate through the heater and the system.<br>3. Examine pump for clogged impeller.<br>4. Check water filter. |
| Debris from system is blocking tubes. | Remove header covers. Examine all tubes and waterways. Use new gaskets when reassembling. Clean out tubes. |
| Scale has formed in tubes. | This is always caused by heavy mineral content of the water or clogged filter. Check the water chemistry. Replace the filter and clean all the internal wet surfaces. |

| **Soot in Flueways or in Tubes, or Noxious Fumes Indicative of Bad Combustion** | |
|---|---|
| **Possible Cause** | **What To Do** |
| Combustion air supply to equipment room is inadequate. | Check air supply opening. Look for debris in screen or louvre which covers combustion air opening, or for material blocking the opening. |
| Stack or vent is blocked or restrictive. | Look for blocked stack and excessive number of elbows in stack or excessive length of horizontal runs. |
| Severe down draft is causing spillage of flue products into room. | Check for (1) proper vent cap on stack; (2) adequate height of stack above roof; (3) equipment exhausting air from inside of building. |
| Gas pressure to burners is excessive. | Check gas pressure with manometer,and adjust with heater firing at full rate. |
| Heater not fitted for the fuel being supplied. | See nameplate for correct fuel. |
| Heater installed at high altitude without proper derating. | Installations at altitudes in excess of 2000 ft. above sea level are subject to jurisdiction of the local inspection authorities. Check with the factory. |

| **Water Dripping in Firebox** | |
|---|---|
| **Possible Cause** | **What To Do** |
| Tube in heat exchanger has overheated and ruptured. | A tube failure is almost always caused by:<br>(a) Scale formation in the tube, or:<br>(b) inadequate water flow through the boiler.<br>Replace heat exchanger tube(s) and check for proper flow. |

# SECTION 6.
# Conversion of this pool heater from Indoor to Outdoor Models

Please read the following instructions with Figure 11. Figure 12 shows the conversion completed. Please follow the instructions in their numerical order, failure to do this will cause problems on assembly.

## 6A. SECTION I (See Figure 11)

1. Remove top panel. (1)
2. Remove front and rear upper panels, (2).
3. Remove front and rear wings LH & RH, (3).
4. Remove diverter assembly, (4 ).
5. Remove outer screw from upper end panel at junction with lower end panel.
6. Remove disconnect all probes and wires going to castings and gas train.
7. Remove control box assembly - front of pool heater (not shown).

## 6B. SECTION II (See Figure 12)

1. Install front LH & RH extension panels (flush with top of upper end panel). (18)
2. Install rear LH & RH extension panels (flush with top of upper end panel). (15) (pick up holes provided into LB upper and lower end panels)
3. Install front bottom panel. (21)
4. Install rear bottom panel. (14)
5. Install front inner baffles (2) 4" from ends. (17)
6. Install rear inner baffle (1) 2" from ends. (16)
7. Install front LH & RH upper spacers. (27)
8. Install rear LH & RH upper spacers. (7)
9. Install front flue collector extension (screw onto flange of lower flue collector only). (28)
10. Install rear flue collector extension (screw onto flange of lower flue collector only). (8)
11. Install rear upper panel and remaining screws from flue collector extension. (12)
12. Install middle rear panel. (13)
13. Install front panel making sure opening for removable panel is square. (19)
14. Install front stiffener (184) 2450 and up.
15. Install remaining screws from flue collector extension.
16. Install rear top half. (panel-5)
17. Install front top half. (panel-6)
18. Install front wire (26) mesh using angle (24) at top and strap (25) at bottom (mesh to be inserted under angles of wind baffle stand offs).
19. Install rear mesh same as Step 18.
20. Install front LH & RH wind baffle stand off. (23)
21. Install rear LH & RH wind baffle stand off. (23)
22. Install front and rear wind baffles. (22)
23. Install middle rear baffle stand off. (11)
24. Install middle rear baffle. (10)
25. Install wires control box parts onto control panel (not shown).
26. Install control panel assembly using holes and bushings provided in RH extension panel for probes and wires (not shown).
27. Install removable panels. (20)

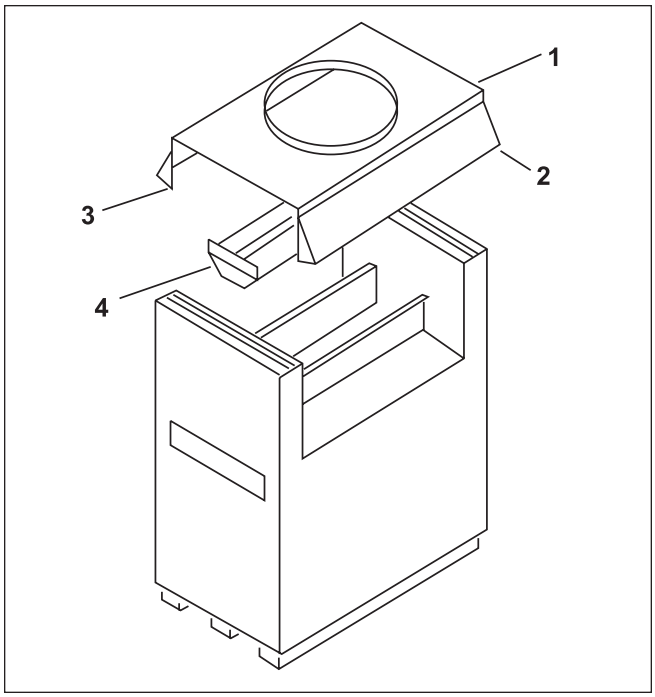



**Figure 11. Removal of Indoor Parts.**

**PARTS LIST FOR CONVERSION KIT - INDOOR TO OUTDOOR (See Figure 12)**

| Key No. | Part No. |
|---|---|
| 5 | 20017100 |
| 6 | 20016900 |
| 7 | 20015101 |
| | 20015102 |
| 8 | 20016700 |
| 9 | 20017200 |
| 10 | 20017300 |
| 11 | 20017700 |
| 12 | 20016500 |
| 13 | 20016600 |
| 14 | 20016300 |
| 15 | 20014301 |
| | 20014302 |
| 16 | 20015200 |
| 17A Left Front Baffle (Single Inlet Manifold) | 20015300 |
| 17B Right Front Baffle (Single Inlet Manifold) | 20022300 |
| 17C Left Front Baffle (Split Inlet Manifold) | 20022000 |
| 17D Right Front Baffle (Split Inlet Manifold) | 20022100 |
| 18 | 20014601 |
| | 20014602 |
| 19 | 20016100 |
| 20 | 20018000 |
| 21 | 20016200 |
| 22 | 20017200 |
| 23 | 20017600 |
| 24 | 20018200 |
| 25 | 20018300 |
| 26 | 20018600 |
| 27 | 20015001 |
| | 20015002 |
| 28 | 20016800 |

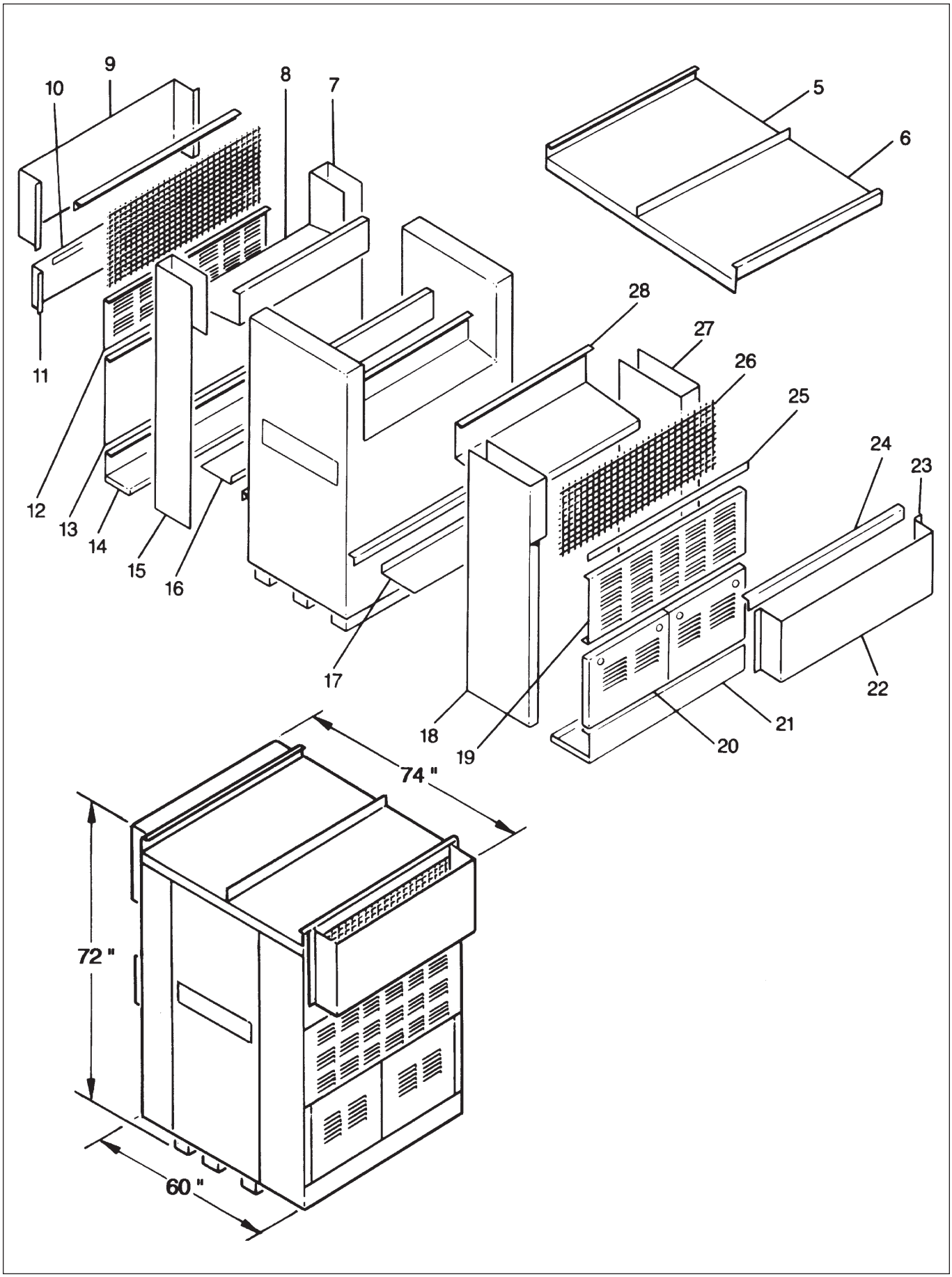
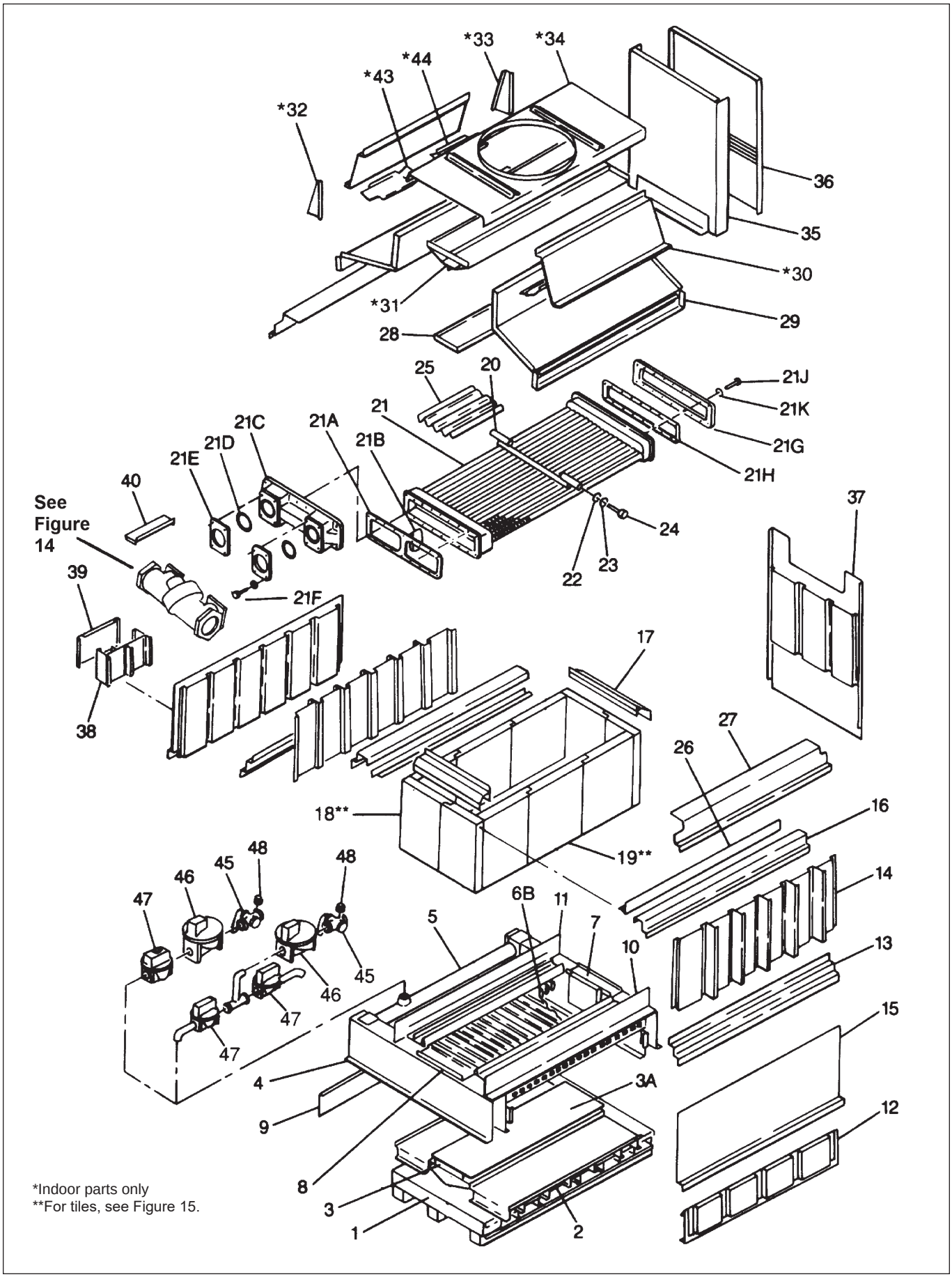



**Figure 12. Outdoor Parts. Referenced on page 14.**

# SECTION 7.
# Parts Description and Order Numbers

| Key No. | Description | Size 2000 I | Size 2450 I 2200 E | Size 3050 I 2800 E | Size 3500 I 3200 E | Size 4050 I 3600 E | Size 4500 I 4000 E | Size 5000 I 4500 E |
|---|---|---|---|---|---|---|---|---|
| 1. | Base Weldment Assembly | 20067201 | 20067202 | 20067203 | 20067204 | 20067205 | 20067206 | 20067207 |
| 2. | Base Assembly | 20011001 | 20011002 | 20011003 | 20011004 | 20011005 | 20011006 | 20011007 |
| 3. | Center Heat Shield Assembly | 20005701 | 20005702 | 20005703 | 20005704 | 20005705 | 20005706 | 20005707 |
| 3a. | Center Heat Shield Panel | 20005601 | 20005602 | 20005603 | 20005604 | 20005605 | 20005606 (2) | 20005607 (2) |
| 4. | End Tile Rail Support, Left | 20011101 | 20011101 | 20011101 | 20011101 | 20011101 | 20011101 | 20011101 |
| 4a. | End Tile Rail Support, Right | 20011102 | 20011102 | 20011102 | 20011102 | 20011102 | 20011102 | 20011102 |
| 5. | Manifold Assy., Single<br>Manifold Assy., Split | 20064301<br>20064302 | 20064201<br>20064202 | 20064401<br>20064402 | 20064501<br>20064502 | 20064600<br>20064600 | 20064700<br>20064700 | 20064800<br>20064800 |
| 6a. | Pilot Burner/Bracket Welder | 20012600 | 20012600 | 20012600 (2) | 20012600 (2) | 20012600 (2) | 20012600 (2) | 20012600 (2) |
| 6b. | Main Burner (without pilot bracket) | L2005800 (22) | L2005800 (27) | L2005800 (32) | L2005800 (37) | L2005800 (44) | L2005800 (48) | L2005800 (54) |
| 7. | Inner Shield | 20002300 (2) | 20002300 (2) | 20002300 (2) | 20002300 (2) | 20002300 (2) | 20002300 (2) | 20002300 (2) |
| 8. | End Tile Channel | 20002600 (2) | 20002600 (2) | 20002600 (2) | 20002600 (2) | 20002600 (2) | 20002600 (2) | 20002600 (2) |
| 9. | Front Lower Closure | 20004301 | 20004302 | 20004303 | 20004304 | 20004305 | 20004306 | 20004307 |
| 10. | Rear Tile Rail Assembly | 20011401 | 20011402 | 20011403 | 20011404 | 20011405 | 20011406 | 20011407 |
| 11. | Front Tile Rail Assembly | 20011301 | 20011302 | 20011303 | 20011304 | 20011305 | 20011306 | 20011307 |
| 12. | Rear Closure Assembly | 20012401 | 20012402 | 20012403 | 20012404 | 20012405 | 20012406 | 20012407 |
| 13. | Heat Shield Support Bracket | 20003201 (2) | 20003202 (2) | 20003203 (2) | 20003204 (2) | 20003205 (2) | 20003206 (2) | 20003207 (2) |
| 14. | Tile Heat Shield Assembly | 20012101 (2) | 20012102 (2) | 20012103 (2) | 20012104 (2) | 20012105 (2) | 20012106 (2) | 20012107 (2) |
| 15. | Lower Panel Assembly F & R | 20011601 (2) | 20011602 (2) | 20011603 (2) | 20011604 (2) | 20011605 (2) | 20011606 (2) | 20011607 (2) |
| 16. | Tile Cover | 20005801 (2) | 20005802 (2) | 20005803 (2) | 20005804 (2) | 20005805 (2) | 20005806 (2) | 20005807 (2) |
| 17. | Saddle Assembly End Tile | 10533601 (2) | 10533601 (2) | 10533601 (2) | 10533601 (2) | 10533601 (2) | 10533601 (2) | 10533601 (2) |
| 18-19. | Tile Assembly | See Tile Drawing on Page 17 | | | | | | |
| 20. | Center Support Assembly | 20004900 | 20004900 | 20004900 | 20004900 | 20004900 | 20004900 | 20004900 |
| 21. | Heat Exchanger Assembly | 20001301 | 20001302 | 20001303 | 20001304 | 20001305 | 20001306 | 20001307 |
| 21a. | Gasket, Header | S0095300 | S0095300 | S0095300 | S0095300 | S0095300 | S0095300 | S0095300 |
| 21b. | Water Barrier | 10397500 | 10397500 | 10397500 | 10397500 | 10397500 | 10397500 | 10397500 |
| 21c. | Double Pass Header | 10416200 | 10416200 | 10416200 | 10416200 | 10416200 | 10416200 | 10416200 |
| 21d. | Gasket, Flange | S0095600 (2) | S0095600 (2) | S0095600 (2) | S0095600 (2) | S0095600 (2) | S0095600 (2) | S0095600 (2) |
| 21e. | Flange | 10417400 (2) | 10417400 (2) | 10417400 (2) | 10417400 (2) | 10417400 (2) | 10417400 (2) | 10417400 (2) |
| 21f. | Cap Screw-Hex. Hd. ½" - 13UNC x 2" | F0024500 (8) | F0024500 (8) | F0024500 (8) | F0024500 (8) | F0024500 (8) | F0024500 (8) | F0024500 (8) |
| 21g. | Return Header | 10416100 | 10416100 | 10416100 | 10416100 | 10416100 | 10416100 | 10416100 |
| 21h. | Gasket, Header | S0095300 | S0095300 | S0095300 | S0095300 | S0095300 | S0095300 | S0095300 |
| 21j. | Cap Screw-Hex. Hd. ½" - 13UNC x 1½" | F0013300 (36) | F0013300 (36) | F0013300 (36) | F0013300 (36) | F0013300 (36) | F0013300 (36) | F0013300 (36) |
| 21k. | Washer - ½" | F0010300 (36) | F0010300 (36) | F0010300 (36) | F0010300 (36) | F0010300 (36) | F0010300 (36) | F0010300 (36) |

I=Indoor, E=Outdoor. Quantity is 1, unless otherwise noted.




*Indoor parts only
**For tiles, see Figure 15.

**Figure 13. Parts Identification.**

| Key No. | Description | Size 2000 I | Size 2450 I 2200 E | Size 3050 I 2800 E | Size 3500 I 3200 E | Size 4050 I 3600 E | Size 4500 I 4000 E | Size 5000 I 4500 E |
|---|---|---|---|---|---|---|---|---|
| 22. | Lock Washer - 3/8" | F0010800 (2) | F0010800 (2) | F0010800 (2) | F0010800 (2) | F0010800 (2) | F0010800 (2) | F0010800 (2) |
| 23. | Washer - 3/8" | F0011100 (2) | F0011100 (2) | F0011100 (2) | F0011100 (2) | F0011100 (2) | F0011100 (2) | F0011100 (2) |
| 24. | Cap Screw 3/8" - 16UNC x ¾ " | F0015900 (2) | F0015900 (2) | F0015900 (2) | F0015900 (2) | F0015900 (2) | F0015900 (2) | F0015900 (2) |
| 25. | Heat Exchanger Baffle Assembly | 20010900 (68) | 20010900 (68) | 20010900 (68) | 20010900 (102) | 20010900 (102) | 20010900 (102) | 20010900 (102) |
| 26. | Heat Exchanger Baffle F & R | 10534310 (2) | 10534311 (2) | 10534312 (2) | 10534313 (2) | 10534314 (2) | 10534315 (2) | 10534316 (2) |
| 27. | Front & Rear Closure | 20006401 (2) | 20006402 (2) | 20006403 (2) | 20006404 (2) | 20006405 (2) | 20006406 (2) | 20006407 (2) |
| 28. | Inside Baffle Assembly Indoor | 20012501 | 20012502 | 20012503 | 20012504 | 20012505 | 20012506 | 20012507 |
| | Outdoor | N/A | 20012509 | 20012510 | 20012511 | 20012512 | 20012513 | 20012514 |
| 29. | Flue Panel Assembly, F&R | 20011501 (2) | 20011502 (2) | 20011503 (2) | 20011504 (2) | 20011505 (2) | 20011506 (2) | 20011507 (2) |
| 30. | Upper Panel F & R (indoor only) | 20011701 (2) | 20011702 (2) | 20011703 (2) | 20011704 (2) | 20011705 (2) | 20011706 (2) | 20011707 (2) |
| 31. | Flue Diverter Assembly (indoor only) | 20012201 | 20012202 | 20012203 | 20012204 | 20012205 | 20012206 | 20012207 |
| 32. | Upper Wing F & R, Left (indoor only) | 20006301 (2) | 20006301 (2) | 20006301 (2) | 20006301 (2) | 20006301 (2) | 20006301 (2) | 20006301 (2) |
| 33. | Upper Wing F & R, Right (indoor only) | 20006302 (2) | 20006302 (2) | 20006302 (2) | 20006302 (2) | 20006302 (2) | 20006302 (2) | 20006302 (2) |
| 34. | Top Panel Assembly (indoor only) | 20012301 | 20012302 | 20012303 | 20012304 | 20012305 | 20012306 | 20012307 |
| 35. | Flue End Assembly | 20012000 (2) | 20012000 (2) | 20012000 (2) | 20012000 (2) | 20012000 (2) | 20012000 (2) | 20012000 (2) |
| 36. | Upper End Assembly | 20011900 (2) | 20011900 (2) | 20011900 (2) | 20011900 (2) | 20011900 (2) | 20011900 (2) | 20011900 (2) |
| 37. | Lower End Panel Assembly | 20011800 (2) | 20011800 (2) | 20011800 (2) | 20011800 (2) | 20011800 (2) | 20011800 (2) | 20011800 (2) |
| 38. | Control Mounting Panel | 20013700 | 20013700 | 20013700 | 20013700 | 20013700 | 20013700 | 20013700 |
| 39. | Control Cover - Front | 20018700 | 20018700 | 20018700 | 20018700 | 20018700 | 20018700 | 20018700 |
| 40. | Control Box Cover Top | 20011200 | 20011200 | 20011200 | 20011200 | 20011200 | 20011200 | 20011200 |
| 41. | Pilot Lead Assembly (Johnson) Standing Pilot, Nat/Propane | 20035403 | 20035403 | 20035403 (2) | 20035403 (2) | 20035403 (2) | 20035403 (2) | 20035403 (2) |
| | Pilot Lead Assembly (Honeywell) Standing Pilot, Nat/Propane | 20035404 | 20035404 | 20035404 (2) | 20035404 (2) | 20035404 (2) | 20035404 (2) | 20035404 (2) |
| | Pilot Lead Assembly (Johnson) IID Pilot, Nat | 20035401 | 20035401 | 20035401 (2) | 20035401 (2) | 20035401 (2) | 20035401 (2) | 20035401 (2) |
| | Pilot Lead Assembly (Honeywell) IID Pilot, Nat | 20035402 | 20035402 | 20035402 (2) | 20035402 (2) | 20035402 (2) | 20035402 (2) | 20035402 (2) |
| 42. | Pilot Shield | 20016400 | 20016400 | 20016400 (2) | 20016400 (2) | 20016400 (2) | 20016400 (2) | 20016400 (2) |
| 43. | Draft Hood Relief Baffle - Right (indoor only) | 20013801 (2) | 20013801 (2) | 20013801 (2) | 20013801 (2) | 20013802 (2) | 20013803 (2) | 20013804 (2) |
| 44. | Draft Hood Relief Baffle - Right (indoor only) | 20013805 (2) | 20013805 (2) | 20013805 (2) | 20013805 (2) | 20013806 (2) | 20013807 (2) | 20013808 (2) |
| 45. | Manual Valve | V0001800 | V0001800 | V2013800 | V2013800 | V2013800 | V2013900 | V2013900 |
| 46. | Safety Valve (U.S.) | V0046800 | V0046800 | V0046900 | V0046900 | V0046900 | V2000500 | V2000500 |
| | Lubricated Plug Valve (Canada) | V0020500 | V0020500 | V0020600 | V0020500 (2) | V0020500 (2) | V0020500 (2) | V0020500 (2) |
| 47. | Operating Valve | V0047800 | V0047800 | V0047900 | V0047700 (2) | V0047800 (2) | V0047800 (2) | V0047800 (2) |

I=Indoor, E=Outdoor. Quantity is 1, unless otherwise noted.

| Key No. | Description | Size 2000 I | Size 2450 I 2200 E | Size 3050 I 2800 E | Size 3500 I 3200 E | Size 4050 I 3600 E | Size 4500 I 4000 E | Size 5000 I 4500 E |
|---|---|---|---|---|---|---|---|---|
| 48. | Manual Pilot Valve | W0002100 | W0002100 | W0002100 (2) | W0002100 (2) | W0002100 (2) | W0002100 (2) | W0002100 (2) |
| 49(a). | Pilot Valve (I.I.D.) (not shown) | W0019300 | W0019300 | W0019300 (2) | W0019300 (2) | W0019300 (2) | W0019300 (2) | W0019300 (2) |
| 49(b). | Pilot Relay (Standing Pilot) (not shown) | W003000 | W003000 | W003000 (2) | W003000 (2) | W003000 (2) | W003000 (2) | W003000 (2) |
| 50. | Pilot Burner (Johnson) Standing Pilot, Nat | W0034700 | W0034700 | W0034700 (2) | W0034700 (2) | W0034700 (2) | W0034700 (2) | W0034700 (2) |
| | Pilot Burner (Honeywell) Standing Pilot, Nat | W0034800 | W0034800 | W0034800 (2) | W0034800 (2) | W0034800 (2) | W0034800 (2) | W0034800 (2) |
| 51. | Pilot Burner (Johnson) Standing Pilot, Propane | W0034600 | W0034600 | W0034600 (2) | W0034600 (2) | W0034600 (2) | W0034600 (2) | W0034600 (2) |
| | Pilot burner (Honeywell) Standing Pilot, Propane | W0034400 | W0034400 | W0034400 (2) | W0034400 (2) | W0034400 (2) | W0034400 (2) | W0034400 (2) |
| 52. | Pilot Burner (Johnson) IID Pilot, Nat | W0034500 | W0034500 | W0034500 (2) | W0034500 (2) | W0034500 (2) | W0034500 (2) | W0034500 (2) |
| | Pilot Burner (Honeywell) IID Pilot, Nat | W0034300 | W0034300 | W0034300 (2) | W0034300 (2) | W0034300 (2) | W0034300 (2) | W0034300 (2) |

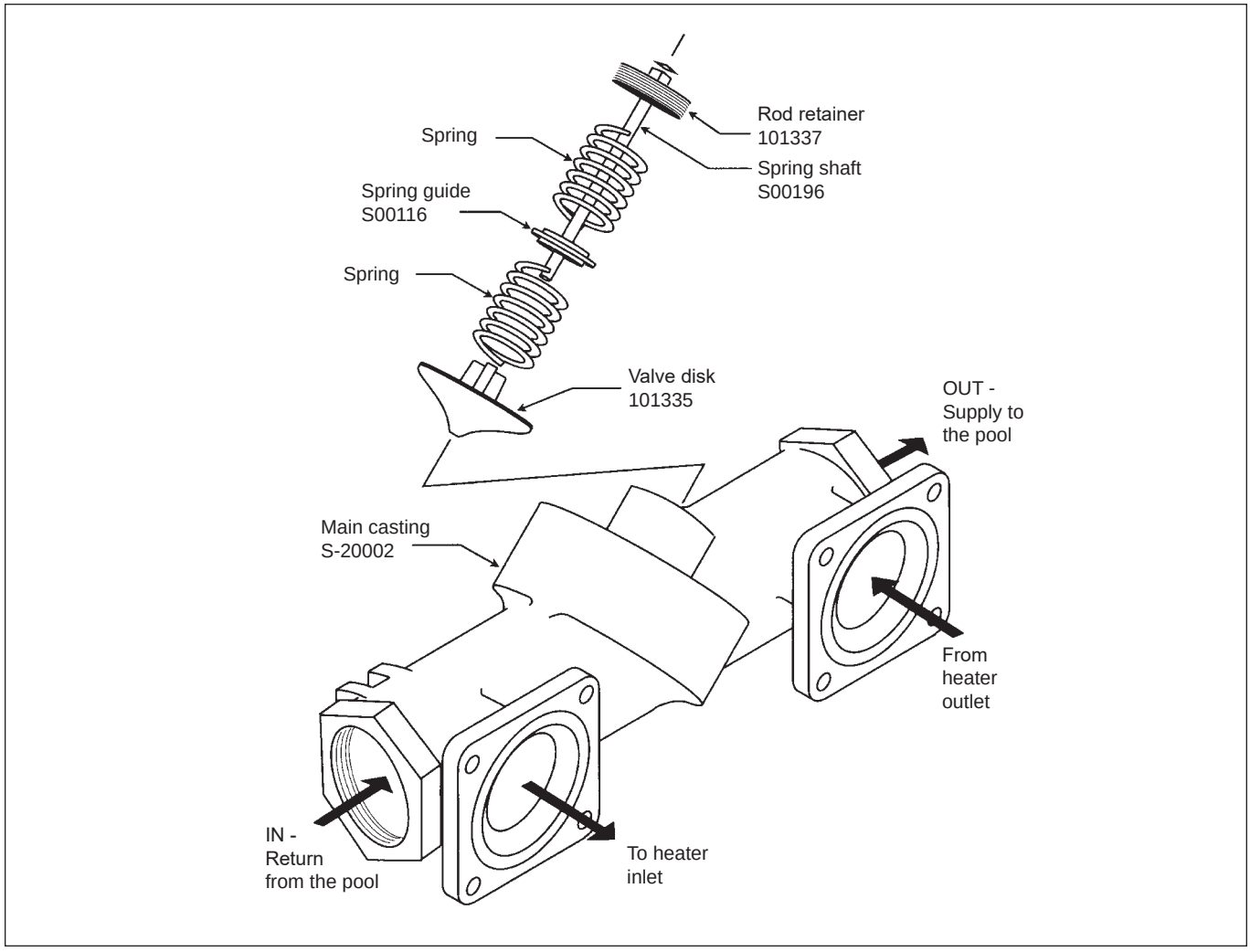



**Figure 14. Built-in Automatic Control Valve.**

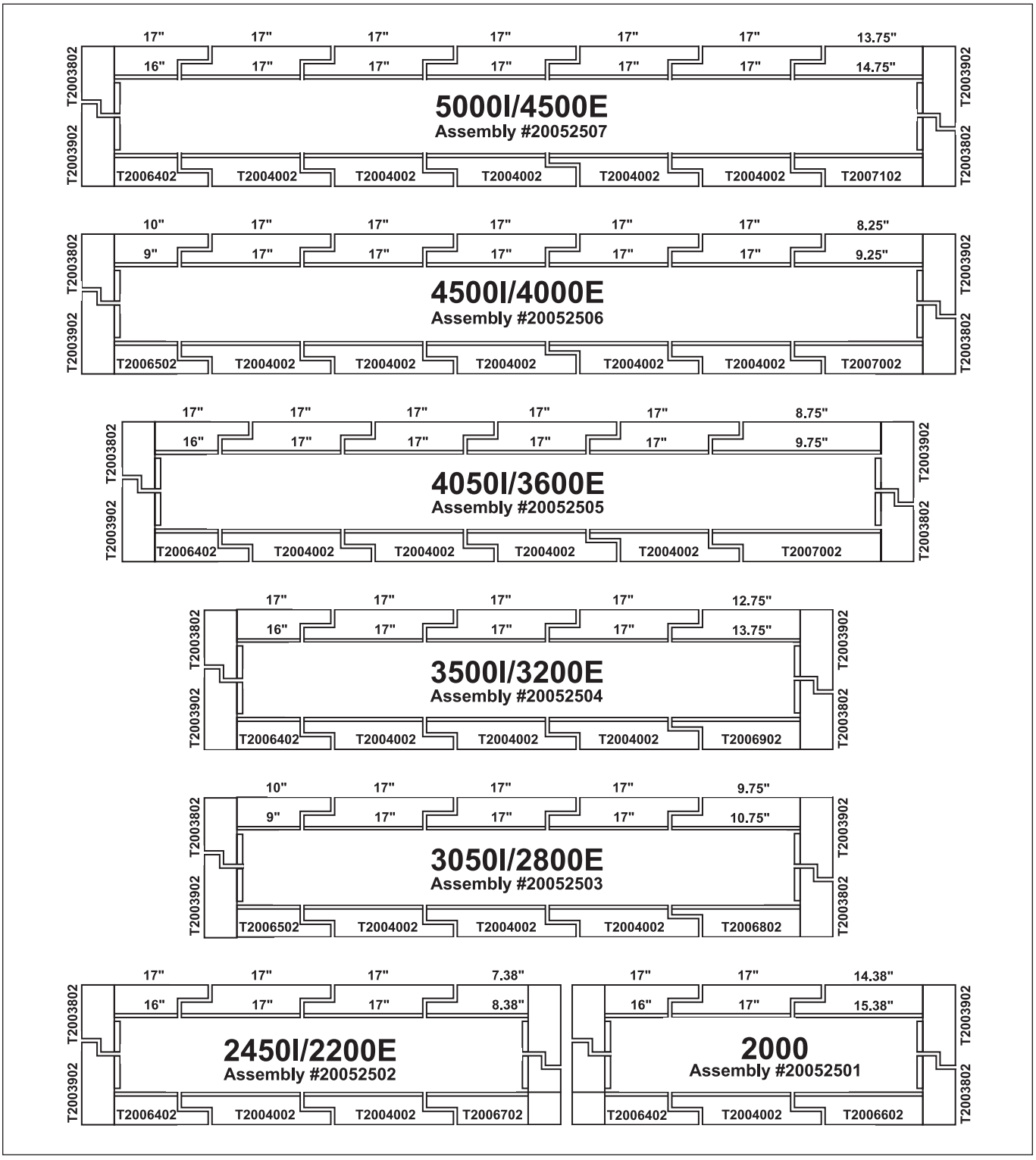



**Figure 15. Tile Assembly.**

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