

# SOLID FUEL BOILER **INSTALLATION MANUAL**



For Models:  
6100, 6130, 6150, 6200, 6300, 6490

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**ROYALL**

**Royall Wood/Coal Boiler**  
**Installation and Operating Instructions**  
**Models: 6150, 6200, 6300, 6490, 6130NS**

Congratulations on your purchase of a Royall solid fuel heating appliance!

Your Royall Wood/Coal Furnace is designed for a lifetime of durable, reliable performance and easy operation. This manual describes the installation, operation and maintenance of your Royall Wood/Coal Furnace.

**Save these instructions**

**Before installing your Royall Wood/Boiler, please read and be sure you understand the entire owner's manual and safety instructions.**

**Refer to markings on the appliance for additional instructions.**

Royall Wood/Coal Boiler has been designed to use independently or as an add-on to an existing central heating system. The installation of any furnace ***is not a do-it-yourself project***. To ensure the Royall Wood/Coal Boiler will operate safely and efficiently, **the installation must be performed by a qualified installer with specific knowledge of central heating systems.**

With proper installation and maintenance, your Royall Wood/Coal Boiler will give you years of trouble free service.

Thank you for choosing the Royall brand products for your home heating needs.

We are constantly improving and updating our products in order to provide the highest quality and value possible. Ark Alloy, LLC, the manufacturer of this product, reserves the right to alter its products, their specifications and/or prices without notice.

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## Safety Instructions

**NOTICE: ALL STATE OR LOCAL CODES take precedence and MUST be observed.**

These models have been certified complaint to UL391-06 through independent testing. Additionally, some of these recommendations align with the National Fire Protection Assign. Code 211. Before installing or starting operation, read and familiarize yourself with all instructions. Installation is to be performed only by qualified licensed heating professional.

**Warning: Failure to follow these safety instructions may result in property damage, bodily injury or even death**

<ul style="list-style-type: none"> <li>Read this entire manual before installing, operating or maintaining this product. Proper installation of this heating appliance is crucial for safe and efficient operation. Save these instructions for later use.</li> </ul>	<ul style="list-style-type: none"> <li><b>Do Not</b> use chemicals, kerosene or other flammable liquids to start a fire; severe burns could result.</li> <li><b>Do Not</b> store combustible liquids or materials near the appliance.</li> </ul>
<ul style="list-style-type: none"> <li><b><i>This heating appliance must be installed in accordance with local, state, and national codes and regulations.</i></b> Contact your local building or fire officials about installation restrictions and inspection requirements in your area.</li> </ul>	<ul style="list-style-type: none"> <li><b>Do Not</b> store wood within the minimum clearance to combustibles.</li> <li><b>Do Not</b> burn garbage, gasoline, naphtha or engine oil for any reason.</li> <li><b>Do Not</b> use with an automatic stocker.</li> </ul>
<ul style="list-style-type: none"> <li><b><i>Do not connect this heating appliance to a chimney flue service any other appliance.</i></b></li> </ul>	<ul style="list-style-type: none"> <li><b>Do Not</b> start a fire if flammable vapors or dust are present. An explosion could result.</li> </ul>
<ul style="list-style-type: none"> <li><b>Do not install this heating appliance in a mobile or manufactured home—this can be dangerous and will void your warranty.</b> This heating appliance has not been tested to meet the strict requirements necessary for installation into a mobile or manufactured home.</li> </ul>	<ul style="list-style-type: none"> <li><b>Do Not</b> burn tires, telephone poles, railroad ties or yard waste. In many areas this is illegal and will damage the appliance. Burning anything other than approved fuels will void any warranties.</li> <li><b>Do Not</b> install in a garage due to routine presence of flammables.</li> </ul>
<ul style="list-style-type: none"> <li>Install in an area with adequate air for combustion and ventilation. The use of outside air may be required for safe operation of this heating appliance. Contact your local building or fire officials about combustion air requirements in your area.</li> <li><b>Do Not</b> use petroleum-based cleaning or sealing compounds in the heating system. Pump and valve water seal deterioration will occur. This can result in substantial property damage.</li> </ul>	<ul style="list-style-type: none"> <li><b>Do Not</b> operate with a flue draft exceeding .06" of water column pressure. Most anti-freeze is glycol based. Never store glycol of any kind near the appliance or any potential ignition source. All glycol is flammable when exposed to high temperatures. If glycol is allowed to accumulate in or around the appliance or any other potential ignition source, a fire can develop.</li> </ul>
<ul style="list-style-type: none"> <li>Disconnect all power to the Royall heating appliance at the breaker box or service panel before performing routine maintenance and service. Allow the heating appliance to cool before servicing.</li> </ul>	<ul style="list-style-type: none"> <li><b>Never</b> use automotive anti-freeze or ethylene glycol in the system. Using these glycols can destroy rubber pump and valve seals leading to hazardous leakage and system damage. Monitor and inspect the system and appliance regularly for leakage.</li> </ul>
<ul style="list-style-type: none"> <li><b>Never</b> fire a boiler that is low on water.</li> <li><b>Never</b> add water to a hot boiler.</li> <li><b>Do Not</b> use "homemade cures" or "boiler patent medicines." Serious damage to the appliance, personal injury and/or property may result. To avoid electric shock,</li> </ul>	<ul style="list-style-type: none"> <li><b>Never</b> operate without properly installed pressure relief valve (watts M335 or Apollo 407-1035 or equivalent) which discharge water and relieve pressure at 30 psi. Use only a boiler relief valve designed to lift at 30 psi. Failure to use proper valve could result in</li> </ul>

<p>disconnect electrical supply before performing maintenance. This appliance requires electricity whenever in operation. Operation without electricity could result in the appliance overheating. If power outages are anticipated, a back-up electrical generator is recommended</p>	<p>an explosion, injury or property damage</p> <ul style="list-style-type: none"> <li>The fuel loading and ash removal doors must be closed tightly during operation. All seals must be maintained in good condition.</li> </ul>
<ul style="list-style-type: none"> <li>The Royall Wood/Coal Boiler is designed to burn air-dried wood, or anthracite or bituminous coal only. <i>Burning any other type of fuel voids your Royall Warranty.</i></li> </ul>	<ul style="list-style-type: none"> <li>Use caution when opening fuel loading door. Open fuel loading door rapidly can cause smoke or flame to flash out the door. See <i>Operation</i> for further instructions.</li> </ul>
<ul style="list-style-type: none"> <li><b>Do not burn:</b> Treated wood, colored paper, garbage, cardboard, solvents, or trash-burning these may result in toxic fumes, or produce soot and large flakes of char or fly ash. <i>Burning treated wood, colored paper, garbage, cardboard, solvents or trash can be dangerous and will void your Royall warranty.</i></li> </ul>	<ul style="list-style-type: none"> <li>Do not place clothing or other flammable materials on this heating appliance or within marked clearances to combustibles.</li> <li>Establish a routine for the storage of fuel, care of the heating appliance and firing techniques.</li> </ul>
<ul style="list-style-type: none"> <li>Dispose of ashes with care. Ashes should be placed in a metal container with a tight fitting metal lid. The closed container of ashes should be placed on a noncombustible floor or on the ground, well away from all combustible materials, pending final disposal.</li> </ul> <p>All coal contains small amounts of dangerous elements. Therefore it is essential that all coal ash be disposed of in municipally designated area.</p>	<ul style="list-style-type: none"> <li><b>CAUTION – Hot Surfaces:</b> Keep children away! Do not touch heating appliance during operation.</li> <li>A working smoke detector <b>must</b> be installed in the same room as this heating appliance. For additional safety, Royall Products also recommends installing working smoke detectors and carbon monoxide warning device in the living area of the home.</li> <li>Always keep a working fire extinguisher on hand in case of fire.</li> </ul>

**When system is COLD, CAREFULLY OPEN/TEST/INSPECT the pressure relief valve at least annually to ensure waterways are clear. IF SYSTEM IS HOT, avoid contact with the scolding water that will be released. Failure to check valve could result in an over pressure condition. This provides risk of rupture in the system and significant risk of severe injury or damage.**

**WARNING: Failure to follow these safety instructions may result in property damage, bodily injury or even death.**

The National Fire Protection Association has information available on the safe use of solid-fuel heating appliances. You can contact the NFPA at: National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471 or [www.nfpa.org](http://www.nfpa.org).

**APPLIANCE OPERATION:**

Before opening the fuel door to a fired system, ensure that the draft blower is OFF, the damper rod is pulled out, wait 5-10 seconds, and ALWAYS hesitate momentarily between the first and second latches when opening doors to allow unburned gases to ignite. Failure to do so could result in severe burns.

**DO NOT**

- **Block flow of combustion or ventilation air to the appliance.**
- **Turn off the water circulation pump or prevent fluid flow during operation. An over pressurized condition could result.**
- **Restrict access to the rear of the unit for maintenance.**
- **DO NOT attempt to supply fuel to these units with an automatic stoker device.**

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## **PRESSURIZED BOILER SPECIFICATIONS**

<b>Model Number</b>	<b>Estimated BTU</b>	<b>Weight</b>	<b>FireBox Capacity</b>	<b>Log Length</b>	<b>Door Size</b>	<b>Flue Size</b>	<b>Water Capacity</b>	<b>BOILER (H/W/L)</b>	<b>SHELTER H/W/L</b>
6130NS	130,000	780	6.25 cu	26"	10 x 14	6"	23 gal	51 x 26 x 38.5	N/A
6150NS	150,000	1,204	8.1 cu	26"	10 x 14	6"	30 gal	51 x 26 x 38.5	N/A
6200NS	200,000	1,534	13.0 cu	26"	17 x 17	6"	90 gal	59 x 35 x 52	N/A
6300NS	300,000	1824	17.7 cu	43"	17 x 17	6"	135 gal	59 x 35 x 52	N/A
6490NS	490,000	2,600	50 cu	56"	24 x 32	10"	260 gal	74 x 50 x 63	N/A
6150 OD	150,000	2,054	8.1 cu	26"	10 x 14	6"	30 gal	51 x 26 x 38.5	77.5 x 47 x 60
6200 OD	200,000	2,384	13.0 cu	26"	17 x 17	6"	90 gal	59 x 35 x 52	77.5 x 49 x 83
6300 OD	300,000	2,715	17.7 cu	43"	17 x 17	6"	135 gal	59 x 35 x 52	77.5 x 49 x 83
6490 OD	490,000	3,900	50 cu	56"	24 x 32	8"	260 gal	74 x 50 x 63	90 x 62 x 81



## Product Description

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The Royall Indoor/Outdoor Solid Fuel Boilers are designed to burn either seasoned, split cord wood or coal. A water circulating pump moves the heated water to a heat exchanging device. This can be a base board radiator, finned based board radiator, water to air exchanger, or existing boiler system; with the correct safety apparatus installed to local codes.

The wood fire combustion process is controlled by an aquastat that senses existing water temperature. The aquastat is set to the desired high temperature set point and will energize the solid fuel draft fan when the water temperature drops 10 degrees below the high temperature set point. When the water reaches the high temperature set point the aquastat shuts off the electrical power to the solid fuel draft blower. It is not necessary to connect a thermostat wire from the heating structure to the boiler. The boiler will sustain the desired temperature water so that is available to the heated structure when needed. The operator uses the high temperature setting and fuel load size to match the unit's heat output with the heated structure needs. If heat is not needed by the structure or lost in the system through normal heat loss related to the effectiveness of the system insulation.

A master switch should be incorporated such that all power to unit can be controlled. A fan switch or light switch should be incorporated to allow manual shut off during fuel loading and fire box maintenance.

A two position safety latch is installed on the fuel door and the ash pan door. Initial release of the latch should be followed by a brief hesitation to allow ignition of unburned gases. Force from the unburned gases igniting can cause the door to abruptly swing open to the 2<sup>nd</sup> position of the latch which stops further opening forcing the ignition flame and gases to exit the flue instead of out the door.

These units should only be installed and operated as closed (pressurized) systems. An expansion tank is required to provide safe changes in water volume related to system temperature change. A pressure relief valve is installed on the unit to safely reduce system pressure if it ever exceeds 30 psi. The appliance is hydrostatically tested at the factory to 60 psi.

The solid fuel boiler can deliver hot water to an existing gas, oil or electric boiler or can operate independently via a bypass loop. Water must be continuously pumped through the appliance. The room thermostat cycles the existing boiler, starting the water pump. If the solid fuel boiler is out of wood, the primary boiler aquastat will signal the primary firing system to take over and maintain system temperature.

**An over temperature relief zone is required.** To signal a relief zone exchanger a surface aquastat can be used as a safety limit control. If the water temperature passing through the pipe where the surfaces aquastat is mounted rises above the set point (should be the same or slightly above the high temperature setting of the boiler when attached to the hot supply line). This signal will override the normal setting for the exchanger and relieve the system of excess heat. This reduces risk of over pressurizing the system.

## Component Description

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**8" Chimney.** Top Vent. Venting must be provided using a lined masonry chimney or a listed UL103 type HT chimney. The chimney exhausts smoke and flue gases that are a natural result of combustion and provides "draft" to the boiler. Draft is the force that moves air from the burn chamber up through the chimney. See *Venting* for further instructions.

**Sliding Smoke Baffle.** When open, the sliding smoke baffle shows and flue gases to flow into the chimney connector without restriction. When closed, smoke and flue gases are diverted around the sliding smoke baffle, creating a longer path for the heated air and allowing your boiler to extract the maximum amount of heat from the fire.

**2" Hot Water Outlet.** Your Royall Wood/Coal Boiler is equipped with one hot water outlet, located on the top of the back of the appliance, which supplies heated water to your heating system.

**Corrosion Inhibitor.** It is recommended that the system water be tested and PH levels maintained between 8.5 and 11.1. Use of a corrosion inhibitor is recommended. Treatment reduces premature failure due to corrosion and can help provide efficient heat transfer by minimizing scale. Treatments should be designed for use in hydronic (boiler) systems. Individual water conditions may require unique additives. Unit failure due to severe short term corrosion is not covered by warranty.

**Cast Iron Doors.** Heavy cast iron fuel loading and ash removal doors are secured to the boiler using door pins (4 included). The door gaskets provide an airtight seal and should be inspected regularly to ensure that they are in good condition at all times. The gasket must be replaced if it becomes damaged or worn. Do not operate the heating appliance with the fuel loading or ash removal doors open.

**Cast Iron Shaker Grates.** This is where you build your wood or coal fire. The handle to the Shaker Grates is located on the front of the Royall Wood/Coal Boiler, above the ash door.

**Aquastat-Immersion Control.** Provides boiler water regulation by controlling the high and low water temperature limit.

**Pressure-Temperature Gauge.** Shows the water pressure and water temperature on your boiler.

**Pressure Relief Valve.** A safety feature, the pressure relief valve will release excess pressure with your Royall Wood/Coal Boiler. See *Plumbing* for further instructions.

**Firebrick.** 2000°, heat retentive firebricks protect the sides of the boiler's burn chamber.

**Ball Valves.** Install ball valves in the lines to isolate various components or sections. They will eliminate the need to drain and refill the entire system should joints need to be resoldered or plumbing modified. Normally, isolation pump flanges are supplied with the pump. These have built in ball valves that can be opened or closed, allowing the pump to be replaced with draining the system. It is recommended that isolation ball valves be installed at the boiler to assist in maintenance.

## **Component Description**

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**Ash Removal Pan.** Designed for easy cleanup of fine ash accumulation. Do not operate the heating appliance with the ash removal door open; keep it closed except to remove ashes. The ash removal gasket provides airtight seal and should be inspected to ensure that it is in good condition at all times. The gasket must be replaced if it becomes damaged or worn.

**Cold Water Inlet (Return).** Cold water inlets return cooled water back to your Boiler. It is located on the bottom on the back of the boiler.

**Combustion Blower.** This blower will supply air for combustion by forcing air into the burn chamber when your wall thermostat calls for heat.

## WHAT IS ASME?

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Royall Wood/Coal Boiler is built and tested to the exacting standards of the American Society of Mechanical Engineers (ASME) Code Section 4, Construction of Heating Boilers, under the National Board "H" stamp.

Royall Wood/Coal Boiler is constructed of certified, high-grade  $\frac{1}{4}$ " steel plate and is welded by experienced, ASME-certified welders, to ensure safety and durability. For additional safety, a 30 PSI pressure relief valve is included with every Royall boiler. You can rest easy knowing that Royall boilers conform to an internationally recognized standard for safety and quality.

*The following information was taken from [www.ASME.org](http://www.ASME.org) and is reproduced here for informational purposes only. Please visit [www.ASME.org](http://www.ASME.org) for more information about the ASME and codes and standards.*

Founded in 1880 as the American Society of Mechanical Engineers, ASME is a not-for-profit professional organization that promotes the art, science and practice of mechanical and multidisciplinary engineering and allied sciences throughout the world. The core values of ASME are rooted in its mission to better enable mechanical engineering practitioners to contribute to the well-being of humankind.

### About Codes & Standards

What is a standard?

A standard can be defined as a set of technical definitions and guidelines, "how to" instructions for designers, manufacturers and users. Standards promote safety, reliability, productivity and efficiency in almost every industry that relies on engineering components or equipment. Standards can run from a few paragraphs to hundreds of pages, and are written by experts with knowledge and expertise in a particular field who sit on many committees.

Are standards mandatory?

Standards are considered voluntary because they serve as guidelines, but do not of themselves have the force of law. ASME cannot force any manufacturer, inspector, or installer to follow ASME standards. Their use is voluntary.

Standards become mandatory when they have been incorporated into a business contract or incorporated into regulations.

What is a code?

A code is a standard that has been adopted by one or more government bodies and has the force of law.

Why are standards effective?

Standards are a vehicle of communication for producers and users. They serve as a common language, defining quality and establishing safety criteria. Costs are lower if procedures are standardized; training is also simplified.

Interchangeable is another reason. It is not uncommon for a consumer to buy a nut in California for a bolt purchased in New Jersey.

ASME.org. 2009. American Society of Mechanical Engineers. 19 May 2009 <<http://www.asme.org>>

# Fuel Requirements

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## BURN AIR-DRIED WOOD, OR ANTHROCITE OR BITUMINOUS COAL ONLY



**Risk of Fire: Do not store fuel or other combustible material within the marked installation clearances.**

It is important to use fuel that is clean, dry and consistent. Solid-fuel boilers, such as your Royall Wood/Coal Boiler, naturally produce ash as a byproduct of the burning process. Even with the Royall heating appliance's highly efficient design, your heating appliance will still produce some amount of ash which will need to be cleaned periodically. The type and quality of fuel you burn affects the amount of ash produced and the performance of your heating appliance. To assist you in determining which fuel to use, here are some guidelines to consider:

### Wood

Burning wood for heat is as old as civilization itself. More than any other major fuel, wood provides us with energy independence—an easily available, locally produced and renewable source of heat on which we can rely.

<ul style="list-style-type: none"> <li>The Royall Wood/Coal Boiler has been tested for operation with air-dried wood.</li> </ul>	<ul style="list-style-type: none"> <li><b>DANGER-Risk of Fire or Explosion:</b> Do not burn garbage, gasoline, naphtha, drain or engine oil, or other flammable liquids or inappropriate materials in this heating appliance.</li> </ul>
<ul style="list-style-type: none"> <li>Wood should be seasoned (dried) for at least 12 months before burning. Properly seasoned wood should have about 20% - 25% moisture content. To properly season wood, split the logs as soon as possible and loosely stack them in a dry spot for at least 12 months.</li> </ul>	<ul style="list-style-type: none"> <li><b>DO NOT BURN:</b> Treated wood, colored paper, garbage, cardboard, solvents, or trash—burning these may result in toxic fumes, or produce soot and large flakes of char or fly ash. <i>Burning treated wood, colored paper, garbage, cardboard, solvents or trash can be dangerous and will void your Royall warranty.</i></li> </ul>
<p>You should not burn wet or green wood in your Boiler. Burning wet or green wood in your Boiler will not only reduce the efficiency of your appliance, but also increases the risk of dangerous creosote build-up in your appliance and chimney.</p>	<ul style="list-style-type: none"> <li>With this in mind, choosing the kind of firewood that is best for you depends on what is available in your area. If hardwoods are unavailable in your area, you can control the burn rate by using larger pieces of wood.</li> </ul>
<ul style="list-style-type: none"> <li>Softwoods, such as pine and fir, are easily ignited and burn rapidly with hot flames. With softwoods, you will spend more time reloading your Royall Wood/Coal Boiler, and will have much more difficulty achieving and overnight burn. For a longer lasting fire, it is best to use more dense hardwoods.</li> </ul>	<p><b>Storage</b></p> <ul style="list-style-type: none"> <li>Store all fuel in a dry location away from the elements. Never burn wet or green wood.</li> <li>Do not store fuel within the heating appliance installation clearances or within the space required for refueling, ash removal and other routine maintenance operations.</li> </ul>
<ul style="list-style-type: none"> <li>Ideally, you should burn a mixture of hardwoods and softwoods, using the hotter, faster burning softwoods to start your fire, and the denser hardwoods to maintain a longer-lasting fire.</li> </ul>	

## Fuel Requirements

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### Coal

One of the world's most widely-used fuel sources, coal can provide the energy, independence and low fuel prices sought by owners of solid-fuel heating appliances.

<ul style="list-style-type: none"> <li>The Royall Wood/Coal Boiler has been tested for operation with anthracite (hard) or bituminous (soft) coal.</li> </ul>	<ul style="list-style-type: none"> <li></li> </ul>
<ul style="list-style-type: none"> <li><b>Anthracite:</b> Also known as Hard Coal, anthracite is a hard, lustrous coal with a high carbon content that burns with a clean blue, nearly smokeless, flame.</li> </ul>	<ul style="list-style-type: none"> <li><b>DANGER—Risk of Fire or Explosion:</b> Do not burn garbage, gasoline, naphtha, drain or engine oil, or other flammable liquids or inappropriate materials in this heating appliance.</li> </ul>
<ul style="list-style-type: none"> <li><b>Bituminous:</b> Also known as Soft Coal, bituminous coal is a soft type of coal that has a high sulfur content and burns with a yellow, smoky flame.</li> </ul>	<ul style="list-style-type: none"> <li><b>DO NOT BURN:</b> Treated wood, colored paper, garbage, cardboard, solvents, or trash—burning these may result in toxic fumes, or produce soot and large flakes of char or fly ash.</li> </ul>
<ul style="list-style-type: none"> <li>Bituminous coal tends to contain more impurities and sulfur than anthracite coal, which may decrease the expected lifespan of your Royall solid-fuel heating appliance and its components. If you choose to burn bituminous coal, be sure to select only high-grade bituminous coal.</li> </ul>	<p><i>Burning treated wood, colored paper, garbage, cardboard, solvents or trash can be dangerous and will void your Royall warranty.</i></p> <p><b>Storage</b></p> <ul style="list-style-type: none"> <li>Store all fuel in a dry location away from the elements. Never burn wet coal.</li> </ul>
<ul style="list-style-type: none"> <li><b>Coal Size:</b> Your Royall Wood/Coal Boiler is designed to use coal that is Nut size or larger.</li> </ul>	<ul style="list-style-type: none"> <li>Do not store fuel within the heating appliance installation clearances or within the space required for refueling, ash removal and other routine maintenance operations.</li> </ul>

# Preinstallation Consideration

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## IMPORTANT NOTE:

- CHECK WITH INSURANCE COMPANY PRIOR TO INSTALLATION. IT IS THE OWNER'S RESPONSIBILITY TO ENSURE THAT THE APPLIANCE IS ACCEPTABLE TO THEIR INSURANCE CARRIER.
- VERIFY LOCAL CODES AND ORDINANCES PRIOR TO INSTALLATION. IT IS THE OWNER'S RESPONSIBILITY TO ENSURE THAT THE APPLIANCE MEETS ALL LOCAL CODES AND ORDINANCES WHICH TAKE PREEDENCE AND MUST BE OBSERVED PROVIDING THEY ARE MORE RESTRICTIVE.

## INSTALLATION MUST BE PERFORMED BY A QUALIFIED INSTALLER

1. When placing the Solid Fuel INDOOR Boiler, the following should be considered:
  - a. Review the minimum clearances to combustibles on page
  - b. Review the recommended stack heights on page
  - c. Do not locate near any combustible materials, gasoline or other flammable liquids or gases.
  - d. Check with insurance company and observe local codes and ordinances.
  - e. The unit requires 115V 15 Amp electrical services for operation.

Before the position of the Boiler can be decided, a few questions should be considered.

<p>1. Will this heating appliance be used as a primary (central) boiler, or will it be installed as an add-on to your existing hydronic heating system?</p>	<p>5. Are there any local, state or national codes or regulations governing the use and placement of this heating appliance?</p>
<p>2. Can the Royall heating appliance be vented properly?</p> <ul style="list-style-type: none"> <li>• Is your chimney appropriate for this application? This heating appliance requires installation into a lined masonry chimney or and 8" UL103 Type HT all-fuel factory-built chimney. <b>Do not connect this unit to any chimney flue serving any other appliance.</b> See <i>Venting</i> for further instructions.</li> <li>• Has your chimney been inspected? For your safety, it is important your chimney be clean and free from defect or damage prior to installing your heating appliance</li> </ul>	<p>6. Can the heating appliance be installed safely?</p> <ul style="list-style-type: none"> <li>• The heating appliance should not be installed in a location where it could be come into contact with curtains, drapes, walls, carpeting, or other combustible surfaces, and must not be installed in a sleeping room.</li> <li>• The clearances specified in this manual are minimum clearances. Any reduction must be approved by the regulatory authority and is not recommended by Ark Alloy, LLC.</li> <li>• Will your desired location require floor protections?</li> </ul>
<p>3. Will your preferred heating system require the use of storage tanks or mixing valves? Some systems, such as in-floor heating, cannot withstand the high water temperatures produced by the Royall Wood/Coal Boiler and may require the heated water to be mixed with cool water before it can be delivered into the home.</p>	<p>7. How close is the electrical source? The power source must conform to the requirements shown in <i>Specifications</i>.</p> <p>8. Will the heating appliance be easily accessible for cleaning, refueling, maintenance, and repair?</p>
<p>4. This heating appliance may require an outside air source for combustion air. Will this be easily accessed in your desired location?</p>	<p>9. Are there any structural reasons why the heating appliance cannot be placed where you want?</p>

# INSTALLATION TIPS

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## Avoiding Air Locks

All Royall Solid Fuel Boilers are designed not to exceed 30 psi, and will vent to the atmosphere if necessary. Air trapped in the lines prevent circulation. Poor circulation is a common start up problem. Reduced flow can be difficult to detect because the pipes will feel hot. It is essential to provide a means for the air in the lines to escape as the system is being filled. Design piping to avoid high point where air can be trapped or install air bleeding vents at those locations. Various vent fittings are available such as vented brass elbows or baseboard tees. Vents should be open during the fill process. Close the vents when bubble-free water runs out. The auto air vents on top of the air scoop should remain open at all times.

**DANGER: Improper venting can lead to risk of generating high temperature or steam which can destroy hard and flexible plastic piping due to increased temperature.**

## Ball Valves

Install ball valves in the lines to isolate various components or sections. The ball valves will eliminate the need to drain and refill the entire system should joints need to be resoldered or plumbing modified. Normally, isolate pump flanges are supplied with the pump. These have built in ball valves that can be opened or closed, allowing the pump to be replaced without draining the system. It is recommended that isolation ball valves be installed at the boiler to assist in maintenance.

## Water Supply

A tee and additional drain valve installed in the system will assist in filling the appliance. Typically the existing boiler system has a keep fill connection already installed. The boiler should be filled the first time according to the initial fill manual section. Ensure that you can adequately monitor system pressure while filling. Ideally, system pressure should be visible from the valve being used to fill the system. Unless a back flow preventer is used with a keep full valve, you will need to disconnect the water supply. Normal routines should include inspecting the entire system for leaks.

## Corrosion Inhibitor

It is recommended that the system water be tested and PH levels maintained between 8.5 & 11, use of corrosion inhibitor is recommended. Treatment reduces premature failure due to corrosion and can help provided efficient heat transfer by minimizing scale. Treatments should be designed for use in hydronic (boiler) system. Individual water conditions may require unique additives. Unit failure due to severe short term corrosion is not covered by the warranty.

## Relief Valves

**WARNING: A pressure relief valve must be piped into the appliance such that it cannot be isolated from the appliance. Open plumbing (no fitting at the end) should be added to the valve so that release will safely discharge scalding water near the floor.**



# Inspecting Contents

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## COMPONENTS SHIPPED LOOSE INSIDE:

### ROYALL INDOOR FURNACE

1. Fire Brick
2. Aquastat
3. Pressure and Temperature Gauge
4. Draft Blower and Gasket
5. Pressure Relief Valve
6. Spring Handles for doors, shaker grate and damper plate
7. Owner Warranty/Registration Card
8. Installation and Operation Manual

### **BAFFLE (all boilers)**

The unit comes with a cast iron baffle installed inside the fire box. Verify that the baffle is in place directly behind the blower mounting opening.

### **GRATES (all boilers)**

The unit comes with grates installed inside the fire box. Verify that the grates are in place and operate freely.

### **DOOR GASKETS (all boilers)**

The unit comes with the door gaskets (loading and ash) installed. Verify that the gaskets are in place.

### **SMOKE DAMPER (all boilers)**

The unit comes with the smoke damper assembly installed. Verify that the damper handle moves freely, opening the smoke bypass plate.

### **ASH PAN**

The unit comes with the ash pan stored in the ash pan trough. Open the ash door and remove the ash pan. The ash pan should not be stored inside the ash trough during operation, as it will warp and be too hot to handle. Store the ash pan near the appliance.

# Installation

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## WARNING: Risk of Fire

- Do not operate with flue draft exceeding .06 in. (14.95 Pa) water column
- Do not operate with fuel loading or ash removal doors open.
- Do not store fuel or other combustible material within marked installation clearances.
- Inspect and clean flues and chimney regularly.

**CAUTION:** Do not connect the Royall heating appliance to any chimney flue serving any other appliance.

## General Requirements

*The installation of any solid fuel heating appliance is not a do-it-yourself project.* The Royall Wood/Coal Boiler should be installed by a qualified installer with specific knowledge of hydronic heating systems. Check with your fire department and building inspector for local, state, and federal codes and regulations regarding installation.

Solid-fuel heating appliance related fires are caused almost exclusively by installation, operation, or maintenance errors. A smoke detector in “working” condition **must** be a part of every Royall solid-fuel heating appliance installation—this is the most inexpensive insurance you can buy! For additional safety, Royall Products recommends installing working smoke detectors and a listed carbon monoxide warning device in the living areas of the home.

The Royall Wood/Coal Boiler is designed to be used in conjunction with a listed gas – or oil – fired boiler, or as a central boiler.

## Zones

A “heat dump” zone is required for all installations. The purpose of this zone is to circulate heated water away from the boiler when no other zones are calling for heat. In this way it will prevent your Royall Wood/Coal Boiler from overheating. However, as a safety feature, if your Boiler should overheat or build up excess pressure, it will trigger the pressure relief valve which will release water, thus relieving pressure. See *Plumbing* for further instructions.

## Foundation

The Indoor Boiler must be located on a 2” minimum thickness concrete foundation pad. At a minimum, there must be a non-combustible pad (concrete, brick, or paver) with width of the appliance extending out 48 inches from the front of the unit.

Outdoor units should be set on a concrete pad capable of supporting the unit when it is filled. A 48” non-combustible surface is recommended in front of the fuel loading door.

# Installation

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## In-Floor Heating

Many newer homes feature in-floor heating. The Royall Wood/Coal Boiler may not be suitable for such applications as it produces water temperatures in excess of 185°, which is much greater than can be withstood by most standard in-floor heating installations.

To use the Royall Wood/Coal Boiler with in-floor heating, a mixing valve may be required to lower the water temperature before it is delivered to your in-floor heating system.

## Placement

### Floor Protection

Floor protection must be provided because of possible spillage of ashes and burning fuel. The Royall Wood/Coal Boiler must be installed on a non-combustible floor or 3/8-inch thick fireproof millboard or equivalent.

The non-combustible material must be placed underneath the heating appliance, and must extend at least 18" on all sides of the heating appliance.

Additionally, the non-combustible material must extend at least 18 inches on either side of the chimney connector.

Consult your local Royall dealer for possible sources of non-combustible floor protection material acceptable for use with your Royall Wood/Coal Boiler.

### As Primary Boiler

Locate the Royall Wood/Coal Boiler as close to the new or existing chimney as possible. The Royall heating appliance should be placed so that you can easily complete operation and maintenance procedures.

Strictly adhere to all requirements pertaining to clearances to combustibles, combustion air, venting system, draft control, and thermostat installation.

### As Add-On Boiler

The Royall Wood/Coal Boiler is designed to be used in conjunction with a listed gas – or oil – fired boiler, but not all boilers will accept an add-on application. Some small boilers may not be used in an add-on installation.

Before installing your Royall Wood/Coal Boiler, consult your heating contractor and local, state, and national building codes and regulation to determine if your existing hydronic heating system is compatible with the Royall Wood/Coal Boiler.

When using your Royall Wood/Coal Boiler in an add-on application, locate the Royall Wood/Coal Boiler as close to the new or existing chimney as possible, and as close to your existing boiler as practical. However a minimum clearances of 12-inches is required between your existing boiler and your Royall Wood/Coal Boiler.

# Installation

## Clearances

### INDOOR MODELS

The Indoor boiler must be installed with these minimum clearances from NON-COMBUSTIBLE surface:

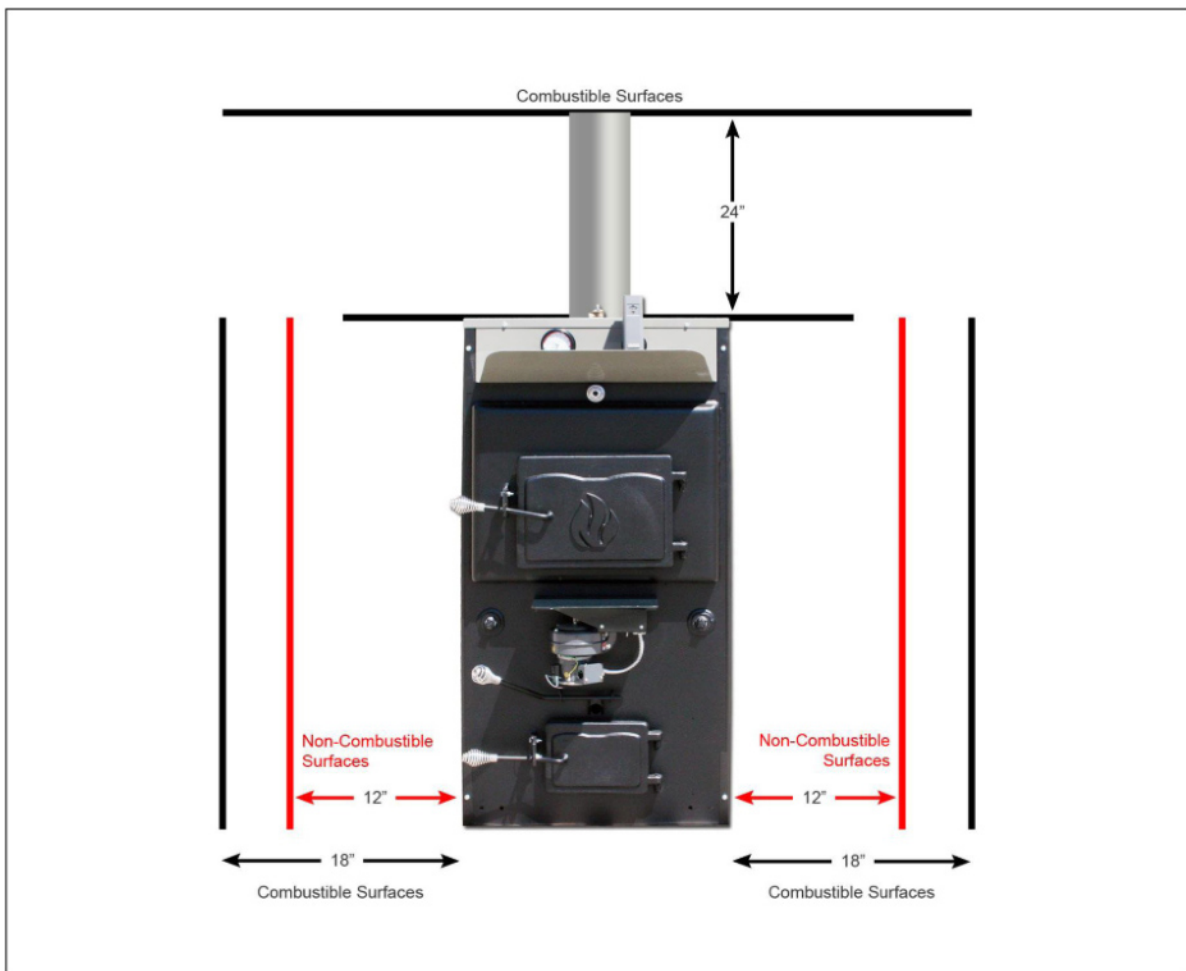
Front = 30" / Back = 30" / Sides = 12"

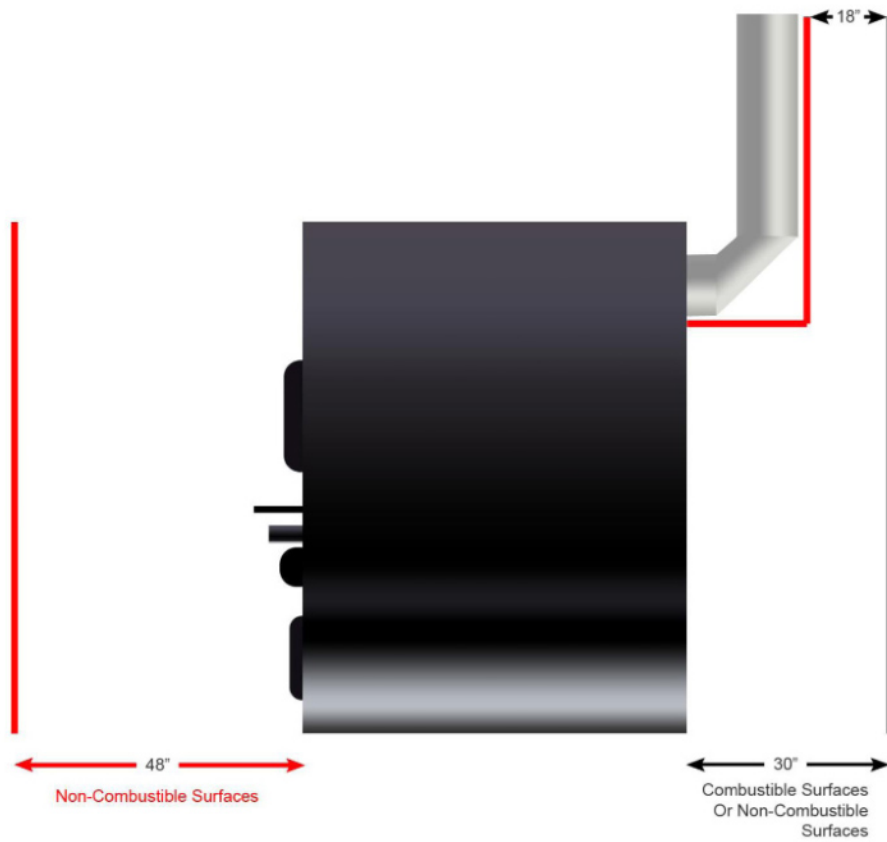
The Indoor boiler must be installed with these minimum clearances from any COMBUSTIBLE surface:

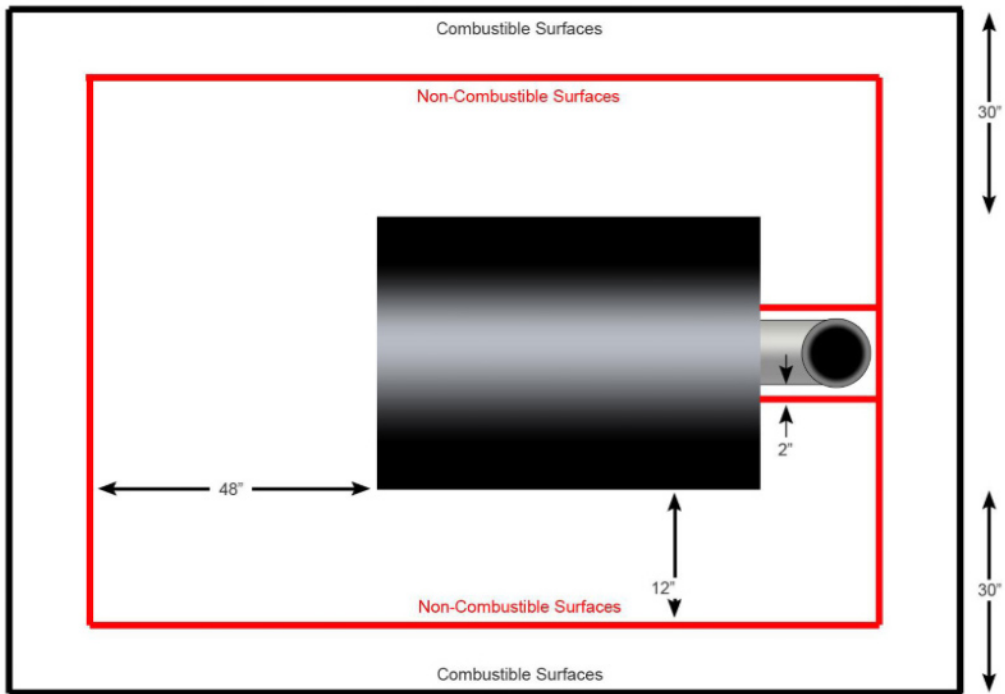
Front = 48" / Back = 30" / Smoke pipe / Sides = 18"

Recommended maintenance clearances = 18"

Back 30" / one side 36"







# Installation

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## Combustion Air Requirements

**WARNING: Failure to provide adequate combustion air can lead to increased carbon monoxide production and increased emissions of combustion gases into the building, which may cause death or serious injury.**

**The Royall Wood/Coal Boiler must have a minimum supply of 70 cubic feet of air per minute.**

All fuel-burning appliances must have air (oxygen) for proper combustion. The incomplete combustion that takes place when a solid-fuel appliance is “air-starved” causes carbon monoxide (CO) production in quantities that can be dangerous inside a building. Combustion air from outside may need to be brought in to prevent “air starvation”. Although an outside air source is strongly recommended for all installations, it may be necessary if:

- The heating appliance does not draw steadily, smells, experiences smoke roll-out, burns poorly, or backdrafts, whether or not there is combustion present.
- Any of the above symptoms are alleviated by opening a window slightly on a calm day.
- The house is equipped with a well-sealed vapor barrier and tight fitting windows and/or has any powered devices which exhaust house air, such as clothes dryers.
- A ventilation system is installed in the house.

Consult a qualified boiler installer to analyze whether the air supply in your installation environment is adequate.

# Installation

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## Assembling Your ROYALL Wood/Coal Boiler

The entire installation should be planned before putting the Boiler in place to ensure compliance with all the requirements outlined in the owner's manual.

Your new Royall Wood/Coal Boiler will have been shipped on a pallet with several boxed components that will need to be assembled prior to installation. Please see "Components" for a list of everything that was shipped along with your Royall Wood/Coal Boiler.

Once your Boiler is placed in your desired location:

1. Remove the protective plastic coating from the outer cabinet of the heating appliance before assembling.
2. **Cast Iron Hearth Plates.** Position front and rear cast iron hearth plates in burn chamber. Your primary type of fuel (wood or coal) will determine how to position the hearth plates. The purpose of proper location is to introduce the precise amount of combustion air into the burn chamber to promote the most efficient combustion for either fuel.
3. **Firebrick.** The firebrick in your Royall heating appliance will have been installed at the factory; however they may have shifted during shipment. If adjustment are needed, position the firebrick by standing up on end on the left and right of the burn chamber.
4. **Cast Iron Doors.** Mount the fuel loading door and ash removal door on the front of the heating appliance and secure with the enclosed door pins.
5. **Control Box.**
  - a. Remove the control box cover.
  - b. Mount the control box on the lower left side of the heating appliance using screws provided.

*Do not connect power to your Royall Wood/Coal Boiler until the installation is complete.*

6. **Draft System.**
  - a. Insert the conduit leading from your draft system into the control box and tighten screw to secure.
  - b. Mount the pre-wired forced air draft blower to the draft opening located above the ash removal door on the Boiler and secure using the bolts found on the draft blower.
7. **Pressure-Temperature Gauge.** Insert the Pressure-Temperature Gauge into the right-front receptacle located on the top of the Boiler.
8. **Pressure Relief Valve.** Insert the Pressure Relief Valve into either the left-middle or right-middle receptacle located on the top of the boiler. The Pressure Relief Valve must be plumbed with a discharge tube that empties into a floor drain. See *Plumbing* for further instructions.
9. **Aquastat-Immersion Control.**
  - a. Remove the cover of the prewired Aquastat-Immersion Control to adjust the High and Low temperature limits.
    - i. **High Limit.** Set the High Limit pointer to the temperature at which contacts are to open to prevent the boiler from overheating. Normal setting for the High Limit is 185-degrees. Always set the high limit 20-degrees or more above the low limit.
    - ii. **Low Limit.** Set the Low Limit pointer to the lowest water temperature you would like the boiler to maintain. Normal setting is 160-degrees. Always set the high limit 20-degrees or more above the low limit.



## Installation

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- b. Insert the probe well into the left-front receptacle located on the top of the Boiler and tighten to secure.
  - c. Squeeze the entire tube of heat-conductive grease (included) into the probe well, and then insert the Aquastat-Immersion Control probe into the probe well, and secure.
10. **4" Domestic Hot Water Coil (Optional).**
- a. Unscrew and remove the 4" plug located at the upper left on the back of the Royall Wood/Coal Boiler.
  - b. Apply pipe joint compound (not included) to the threads of the 4" domestic hot water coil.
  - c. Connect your domestic water supply according to the manufacturer's instructions.
11. **Wiring.** *Do not connect power to your Royall Wood/Coal Boiler until the installation is complete.* Once you've completed the installation of your Royall Wood/Coal Boiler, you may connect your 110V power supply in to the left side of the control box. Please see *Appendix A: Wiring Diagram*.

**DANGER: Risk of electric shock. Disconnect power at the service panel or breaker box before servicing Royall Wood/Coal Boiler.**

# Installation

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## Shroud Installation

1. Attach Shroud mount corners to Boiler using supplied hardware. Each corner is designed to fit a specific corner of the unit.
2. Attach Shroud side panels to corners. Panels will fit inside the corners.
3. Install Shroud top. Top must be installed before aquastat is installed. Attach with supplied screws.



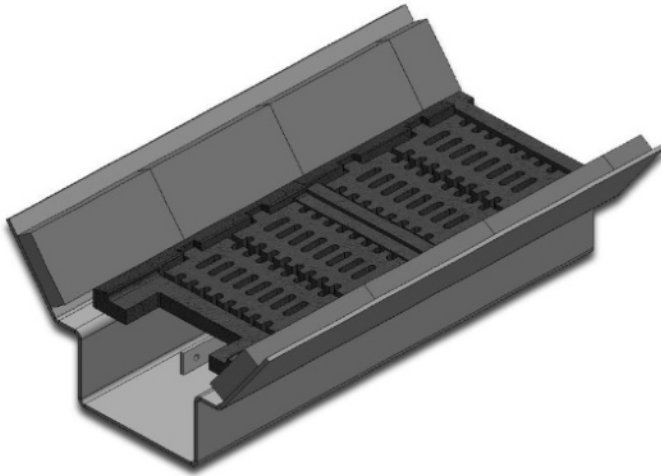
# Installation

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## Firebrick Installation

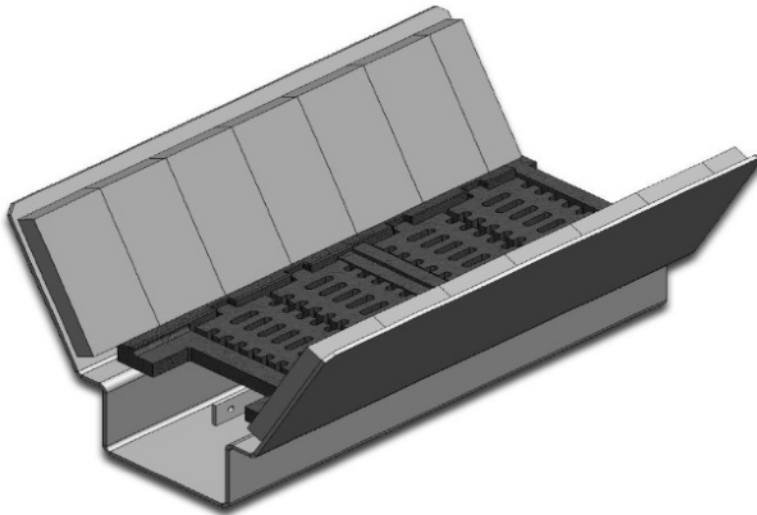
### Model 6130 (6) Full Bricks & (2) Cut Brick

Starting in the BACK lay 3 full brick then 1 cut brick. Repeat for the 2<sup>nd</sup> side.



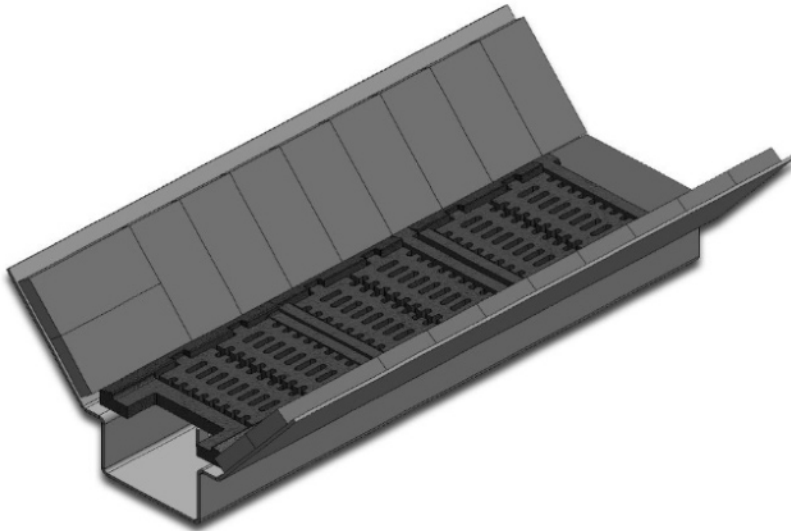
### Model 6150 & 6200 (12) Full & (2) Cut Bricks

Starting in the BACK of the unit, place ½ brick on end, then add 4 full brick on end. Last lay 2 full bricks side down. Repeat for 2<sup>nd</sup> side.



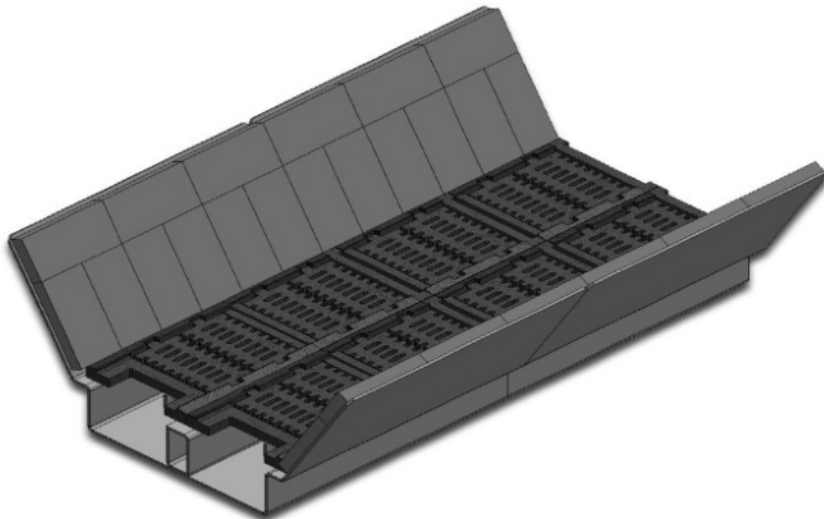
**Model 6300 (18) Full Bricks & 2 Cut Bricks**

Starting in the BACK stand 1 cut brick then 7 full brick side to side. Then lay 2 bricks stacked side to side in the front. Repeat for 2<sup>nd</sup> side.



**Model 6490 (36) Full Bricks**

Starting at the BACK stand 12 full brick side by side. Then lay 6 full brick down on top of 12 lower ones. Repeat for 2<sup>nd</sup> side.



# Installation

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## Venting System

### WARNING:

- Failure to provide correct chimney venting can lead to increased carbon monoxide production and increased emissions of combustion gases into the building, which may cause death or serious injury.
- Do not connect the Royall heating appliance to any chimney flue serving any other appliance.
- Risk of Fire: Inspect and clean flues and chimney regularly.
- Risk of Fire: Do not operate with the flue draft exceeding .06" (14.95 Pa) water column.

Consult a qualified boiler installer, your local building inspector and your fire officials to make sure the chimney and all connections conform to all local, state and national codes and regulations.

Your venting system is an extremely important part of any solid-fuel heating appliance installation and has two key functions:

1. To exhaust smoke and flue gases which are the natural result of combustion.
2. To provide "draft". The draft, along with your combustion power, provides a continuous supply of fresh air for proper combustion.

A chimney connector and chimney make up the venting system and must be properly installed and maintained to protect against a fire. Consult a chimney and venting specialist.

The Royall Wood/Coal Boiler requires installation into a lined masonry chimney or an 8-inch listed UL103 Type HT all-fuel factory-built chimney. Minimum 24 gauge black steel chimney connector is required. An existing chimney must be cleaned and inspected to be sure it is clean and free from defect or damage. All connections must comply with NFPA Standard 211 and all applicable building codes and regulations.

When installing a factory-build chimney, follow all installation instructions provided by the chimney manufacturer.

For best performance, Royall Products recommends using insulated chimney rather than triple wall or air cooled chimney.

Important venting installation clearances and points for proper operation and safety:

- The connection from the Royall Wood/Coal Boiler to the chimney must be made using 8" black steel material with a minimum 24 gauge. Do not use galvanized steel. See *Chimney Connector*.
- A minimum distance of 18 inches must be maintained between the chimney connector and combustible ceiling surfaces.
- A minimum of 18 inches must be maintained between the chimney connector and the backwall, and 20 inches between the connector and sidewalls.
- Secure all connector pipe joints with at least three sheet metal screws.
- Avoid using more than two elbows in connecting the heating appliance to the chimney.
- Any horizontal runs of connector pipe should have a minimum rise of ½-inch per linear foot. Use extra support hangers or brackets every three feet if it is absolutely necessary to have a run of more than six feet, which is not recommended.
- The chimney must be at least 3 feet higher than the highest point where it passes through the roof, and at least 2 feet higher than the highest part of the roof or structure that is within 10

# Installation

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feet of the chimney, measured horizontally. For best performance, Royall recommends a chimney height of at least 12 feet.

## Chimney Material

The Boiler must be connected to either a:

1. Class "A" masonry chimney
2. All Fuel metal insulated chimney (8")
3. Listed type "HT" double wall chimney approved for temperatures up to 1400-degrees F (8")

## Masonry Chimney

When connecting to an existing masonry chimney, an approved liner must be used in the chimney. **An unlined chimney could remain cold and cause a downward pressure which creates the environment for poor burning, incomplete combustion, or backdraft.**

## Chimney Connectors

Connectors will be required to attach appliance to chimney unless chimney is attached directly.

1. Chimney connector can either be:
  - a) 6" to 8" galvanized, black or blue steel, stove pipe with adapter only at the "T"
    - Maintain 18" clearance to combustibles.
    - Minimum thickness: .028 inches (24 gauge minimum)
  - b) 6" or 8" listed type "HT" double wall chimney.
    - Maintain 2" clearance to combustibles.
2. Boiler must be the only heating appliance connected to a single chimney flue.
3. Keep the connector as straight and short as possible.
  - a) Minimize elbows.
  - b) Maximum horizontal distance between boiler and chimney: 6 feet.
  - c) "Male" end should point back to boiler.
  - d) Horizontal runs must be pitched back to the boiler in accordance with local Building Codes (typically ¼" pitch per Foot of horizontal run minimum).
  - e) Secure each connection with a minimum of 3 screws.
4. Assemble in accordance with the vent manufacturers' instructions. Additional sections may be required to clear the peak of the structure. Do not install more than one appliance per flue.
5. When burning coal, a barometric draft damper **MUST** be installed between the boiler and the chimney to ensure adequate draft.

**DANGER: DO NOT install more than one appliance per flue. Flue gas spillage and carbon monoxide emissions can occur causing severe personal injury or death.**

**CHIMNEY MUST BE INSTALLED OR INSPECTED BY A PROFESSIONAL AND MEET ALL LOCAL AND STATE REQUIREMENTS AND CODES FOR WOOD OR COAL BURNING APPLIANCES OPERATING CONDITIONS.**

# Installation

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## Chimney Height

To prevent downdrafts, chimney, or vent without a listed cap should extend at least 3 feet above the highest point where it passes through a roof and at least 2 feet higher than any portion of a building within a horizontal distance of 10 feet. A chimney or vent must not extend less than the distances stated above.

**\*\*Check local codes or ordinances for additional requirements\*\***

Nearby structures, trees, or hills can cause downdraft conditions which force smoke to the ground. Chimney height may have to be raised to overcome downdraft conditions.

**NOTICE: Improper use or failure to maintain the boiler may cause nuisance conditions. Persons operating this solid fuel boiler are responsible for operation so as not to cause nuisance conditions. Even proper use and maintenance of the boiler, and meeting the distance and stack height recommendations and requirements in State and local regulations may not always be adequate to prevent nuisance conditions in some areas due to terrain or other factors.**

**ALL LOCAL AND STATE REGULATIONS OR CODES AND VENTING SYSTEM MANUFACTURER'S INSTRUCTIONS TAKE PRECEDENCE OVER THESE INSTRUCTIONS.**

**ALL SOLID FUEL APPLIANCES CREATE VISIBLE SMOKE DURING SOME OPERATING CONDITIONS.**

## Barometric Draft Control

**WARNING: Risk of Fire: Do not operate with the flue draft exceeding .06" (14.95 Pa) water column.**

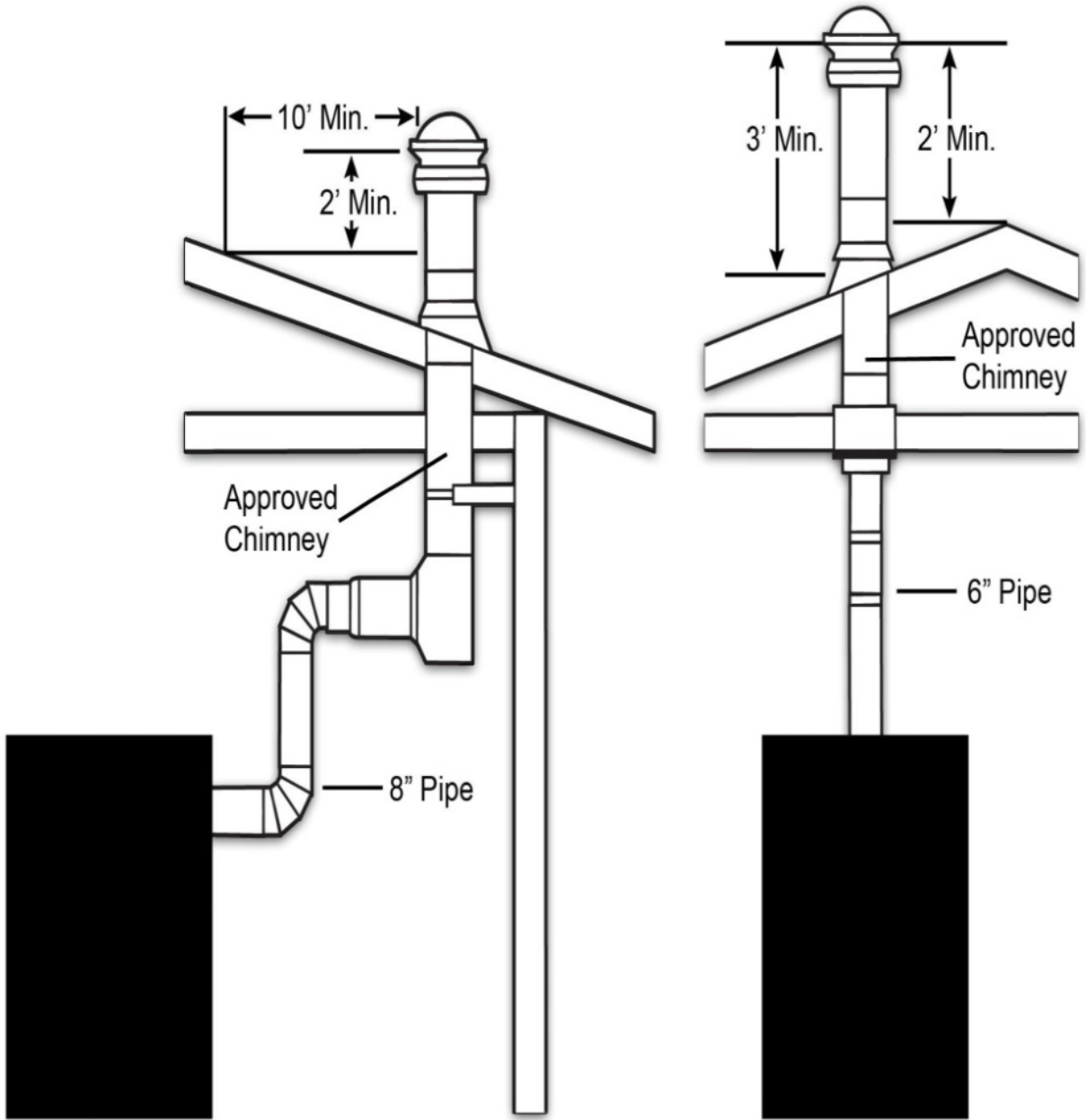
Proper draft must be provided for your Royall Wood/Coal Boiler. Draft is the force that moves air from the boiler up through the chimney. Draft is measured in inches of water column.

The amount of draft in your chimney depends on the length of the chimney, local geography, nearby obstructions and other factors. Too much draft may cause the fire to burn too fast, while inadequate draft may cause smoke to back up into the Royall heating appliance, creating a possible hazard.

A barometric draft control must be installed into the chimney connector.

Barometric draft controllers limit the draft (the suction pulling air into the solid-fuel heating appliance burn chamber). A pivoted, counterbalanced flap is pulled open by the draft when the draft reaches a critical amount. This permits air to enter the chimney, thus preventing the draft in the heating appliance from rising any higher.

After installation of the Royall Wood/Coal Boiler is complete and a fire has been built, the chimney draft should be established and maintained from .04" to .06" water column of draft. If this setting is exceeded, it could cause a solid fuel fire to burn out of control.





# Installation

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## Piping at the Appliance

### Base Board

The piping at the appliance does not change with most applications.

### Pumps

It is recommended that a system pump be installed to ensure flow through the boiler at all times. If the system is designed for continuous flow, then a system pump is not necessary. All pumps must be sized properly based on flow requirements.

### Expansion Tank

Hydronic heating systems require an expansion tank to allow water to expand/contract as it heats or cools without adversely affecting system pressure. A diaphragm type expansion tank is recommended. The tank must be installed vertically. Typically it is attached to the bottom of an air scoop. An existing hydronic system should already have an expansion tank. Though it is not necessary to add another expansion tank, ensure that the existing tank is large enough to handle both the volume of the solid fuel boiler and the volume of the existing system.

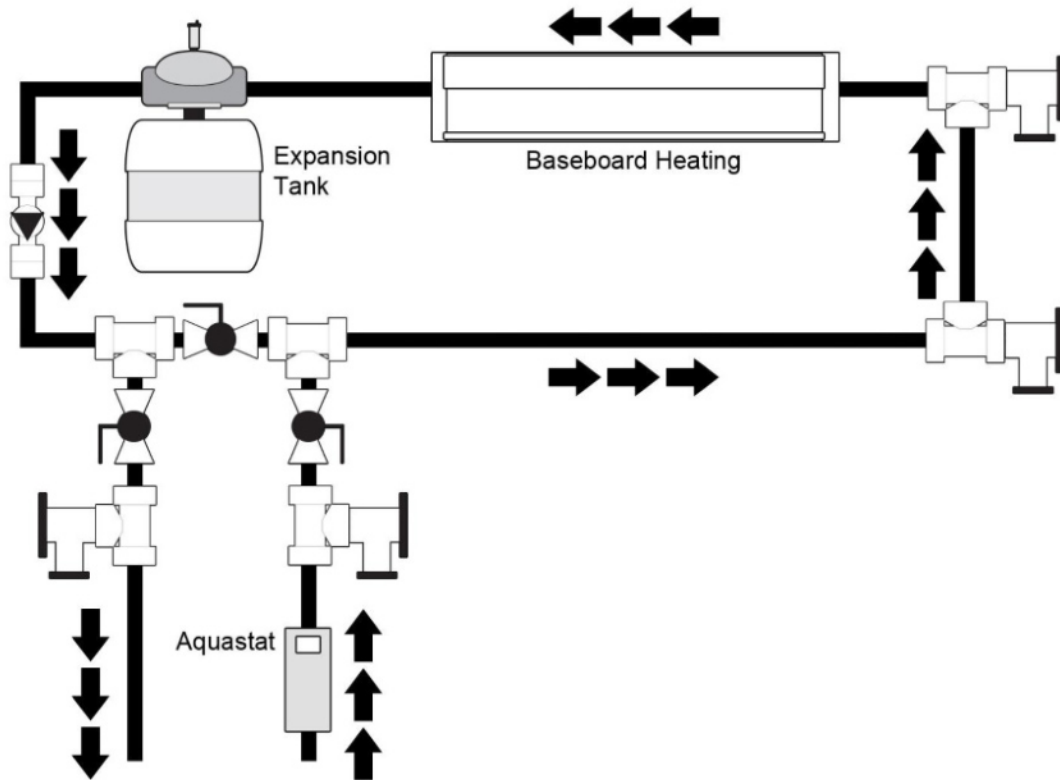
### Air Elimination

Air will collect at the high points in the system, potentially interrupting flow. An air vent should be located at high points to allow the system to be purged of air.

## Plumbing Connections

Improper points for proper plumbing:

- Use pipe of no less than 1" diameter for both the hot water outlet and the cold water inlets.
- When plumbing into your existing heating system, Royall Products recommends installing a series of three gate valves.
  - When the Royall Wood/Coal Boiler is in use, Valve #1 and #2 are open and Valve #3 is closed.
  - To isolate your Royall Wood/Coal Boiler from the heating system when not in use, close Valves #1 and #2 and open Valve #3.
  - Always remember to open Gate Valve #1 and #2 and close #3 when activating your Royall Wood/Coal Boilers again.



### Indoor Boiler: Connections

(outdoor boilers assembled at factory, indoor units shipped with components boxed and stored in fuel chamber for protection during shipping.)

Install components as follows and locate per reference chart and diagram on previous page.

#### Pressure Temperature Gauge (#2)

- Apply pipe sealer and Teflon tape to threads.
- Install in threaded coupling in upper left front of boiler.
- Tighten with proper wrench
- Do not over tighten.

#### Aquastat Well (#4) (Well Normally Factory Installed)

- Apply pipe sealer and Teflon tape to threads
- Install in threaded coupling in upper right front of boiler
- Tighten with proper wrench
- Install aquastat housing over the head of the aquastat well
- Do not over tighten.

# Installation

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## Draft Blower

- Mount the draft blower using the gasket to the front of the boiler with the three screws furnished.
- Ensure that the gasket seals tightly between the blower and the appliance flange.

## Boiler Drain Valves (#5 and #6)

- Apply pipe sealer and Teflon tape to threads.
- Install boiler drain valves in threaded flanges located in front #5 & #6 (steel plugs can be substituted).
- Tighten with proper wrench
- Do not over tighten.

## Pressure Relief Valve (#3)

- Apply pipe sealer and Teflon tape to threads.
- Install in threaded coupling in upper center back of boiler.
- Tighten pressure relief valve with proper wrench.
- Do not over tighten.

**DANGER: Before filling the system, ensure the pressure relief valve is installed. Use only a boiler relief valve set to limit pressure to 30 psi. Failure to comply with these guidelines could result in failure of the relief valve to operate, resulting in possibility of severe personal injury, death, or substantial property damage.**

### To avoid water damage or scalding due to relief valve operation:

- Discharge line must be connected to relief valve outlet and **run to a place of disposal**. Terminate the discharge line to eliminate possibility of severe burns should the valve discharge.
- Discharge line must be as short as possible and be the **same dimension as the valve discharge connection** throughout its entire length.
- Discharge line must **pitch downward** from the valve and terminate at least 6" above the floor drain where any discharge will be clearly visible.
- The discharge line shall **terminate plain (OPEN), not threaded**, with a material serviceable for temperatures of 200° F or greater (copper, black pipe, galvanized or Pex-Al-Pex).
- **Do not pipe the discharge to any place where freezing could occur.**
- **No shutoff** valve shall be installed between the relief valve and boiler, or in the discharge line. Do not plug or place any obstruction in the discharge line.
- **Test the operation of the valve** after filling and pressurizing system by lifting the lever. Ensure the valve discharges freely. If the valve fails to operate correctly, replace it with a new relief valve.

## Wire Handles (4)

Turn the wire handles on to the levers in a clockwise direction.

# Installation

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## **Low Water Cut Off (If Required)**

Some State and Local Codes and some Insurance Companies require a Low Water Cut Off device (LWCO) when the heat source is installed above radiation. If required, the LWCO must be installed at a high point in the system, in a Tee near the top of the boiler.

## **Automatic Fill Valves**

These devices help maintain water volume in the advent that the relief valve has a discharge event. It is more difficult to recognize a leak in a system with a valve continuously making up lost water. If an auto fill valve is installed, it is recommended that a routine system check for leaks be established. Also careful monitoring of the relief valve discharge area should be conducted.

## **Plumbing**

### **Temperature Relief Valve**

In certain jurisdictions, a Temperature Relief Valve may be required in addition to the Pressure Relief Valve. Consult your local Royall dealer or plumber for possible source of Temperature Relief Valves acceptable for use with your Royall Wood/Coal Boiler.

### **Expansion Tank**

All Royall Wood/Coal Boiler installation must include an expansion tank to allow water to expand or contract without adversely affecting the system pressure.

Expansion tanks must be properly sized to accommodate the water capacity of the Royall Wood/Coal Boiler. When installing the Royall Wood/Coal Boiler as an add-on to an existing system, you need not add a second expansion tank provided the existing expansion tank can accommodate the volume of both the Royall Boiler and the existing boiler. Consult your plumber to verify your expansion tank is properly sized.

### **Auto-Fill**

In order for a pressurized hot water heating system, such as the Royall Wood/Coal Boiler, to function safely and efficiently, it must be filled with water at all times and must maintain a fairly constant pressure. An auto-fill valve may be used for this purpose. If you include an auto-fill valve in your installation, be sure to choose one that is preset for 12 to 15 PSI.

Note: If your system includes an auto-fill feature, it will be more difficult to recognize leaks because the auto-fill will constantly make up lost water. It will also be difficult to recognize if your boiler has overheated and triggered the Pressure Relief Valve. Always be sure to monitor your system for signs of leaks or overheating.

# Installation

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## Pressure Relief Valve

The Pressure Relief Valve **must** be plumbed with a discharge tube that empties into a floor drain.

Once installation is complete and you've filled the boiler with water, verify the Pressure Relief Valve's proper functioning by manually opening the valve and releasing water onto the floor drain. If no water flows, do not operate the Boiler until a new Pressure Relief Valve is installed.

The Pressure Relieve Valve will automatically release water when the water pressure reaches 30 PSI. Be sure to monitor the water level in your Royall Wood/Coal Boiler, and refill when necessary. If your heating system has an auto-fill feature, be sure the auto-fill does not raise the water pressure above 15 PSI.

## Zones

A "heat dump" zone is required for all installations. The purpose of this zone is no circulate heated water away from the boiler when no other zones are calling for heat. In this it will prevent your Royall Wood/Coal Boiler from overheating. However, as a safety feature, if your Boiler should overheat or build up excess pressure, it will trigger the pressure relief valve which will release water, thus relieving pressure.

Royall Products recommends installing a normally open zone valve and a strap-on (non-immersion, surface mounted) aquastat as part of every dump zone valve installation. Consult your local Royall dealer or plumber for possible sources of appropriate valves and strap-on aquastats acceptable for use with your Royall Wood/Coal Boiler.

## In-Floor Heating

To use the Royall Wood/Coal Boiler with in-floor heating, a mixing valve may be required to lower the water temperature before it is delivered to your in-floor heating system.

# Installation

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## Safety Limit Aquastat

1. Mount directly on the supply (“Hot”) line out of the solid fuel boiler.
2. Set 15-degrees higher than aquastat on solid fuel boiler, but never over 200° F.
3. Wiring Installation:
  - a. Route low voltage wire from ‘R’ screw and ‘W’ spade on safety limit aquastat into the existing relay on boiler or to the zone valve.
  - b. If you have several zones in your heating system, wire a safety aquastat to allow circulation through the largest zone. Wire a safety limit in parallel with the thermostat of the designated “dump zone”.

## Operation

1. Water circulates continuously through the solid fuel boiler.
2. When the thermostat calls, either the zone pump turn on or the existing boiler turns on its pump, allowing water to flow to the baseboard.

## Piping Installation

1. Ensure that the expansion tank is not isolated from the Boiler.
2. Position closely spaced Tees 4 to 8 inches apart.
3. For the zone pump use either a zoning circulator (with built-in relay) or a regular pump with a zone pump control panel.

## Wiring a Zoning Circulator

1. Route wire from thermostat to ‘R’ on safety limit aquastat.
2. Route wire from ‘W’ on safety limit aquastat to ‘1’ on zoning circulator.
3. Route wire from ‘2’ on zoning circulator to thermostat.

## Safety Limit Aquastat

1. Open zone valve if boiler overheats. Set 15-degrees higher than aquastat on solid fuel boiler, but not over 200° F.

## Typical System Schematics

### Operation:

1. The solid boiler pump runs constantly, circulating water through the solid fuel boiler via the primary-secondary Tees.
2. If the thermostat calls for heat, the existing boiler will start the boiler pump. The burner will not fire as long as the start temperature is above the aquastat setting on the existing boiler.
3. If the temperature from the solid fuel boiler falls below the existing boiler aquastat setting, the existing boiler will fire as normal.
4. A safety limit aquastat (recommended) attached to the supply (“Hot”) line out of the solid fuel boiler turns on a “dump” zone in the system that is able to draw heat if the solid fuel boiler over temps.

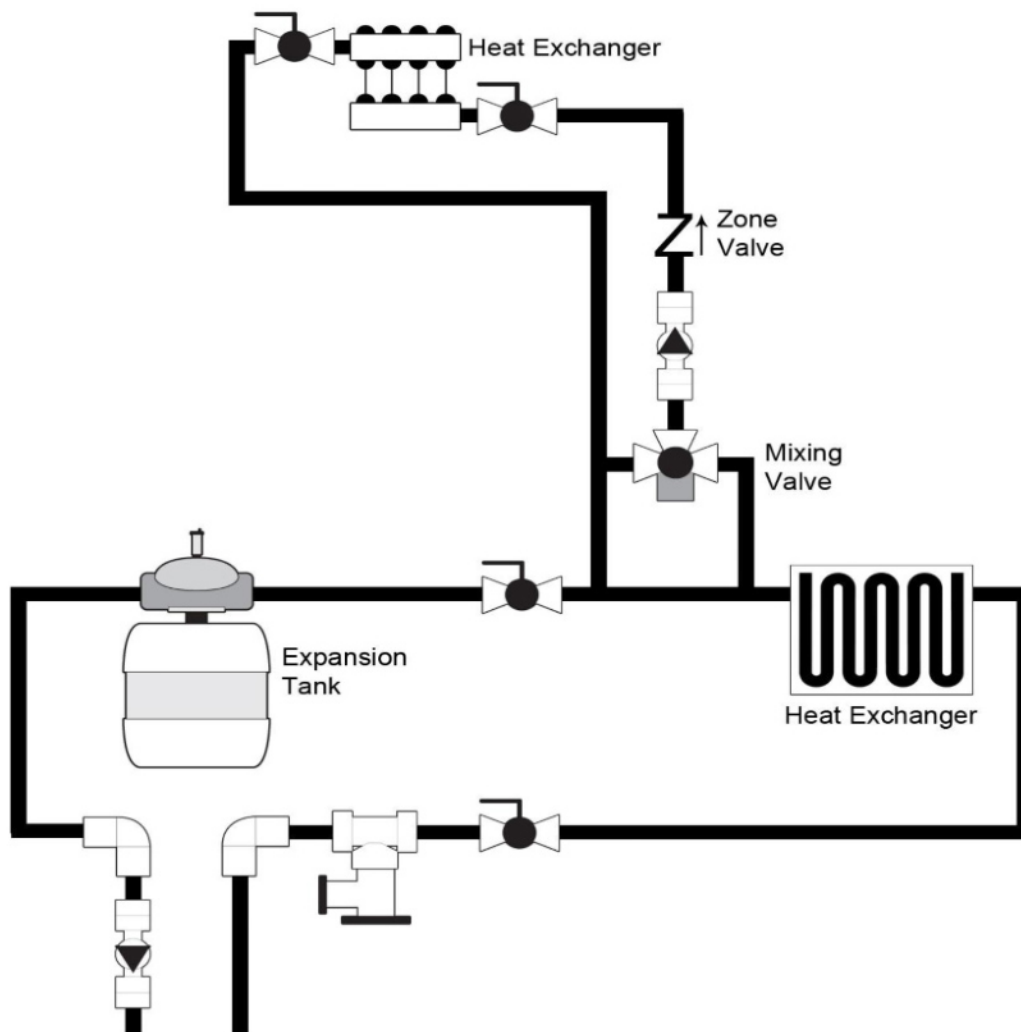
# Installation

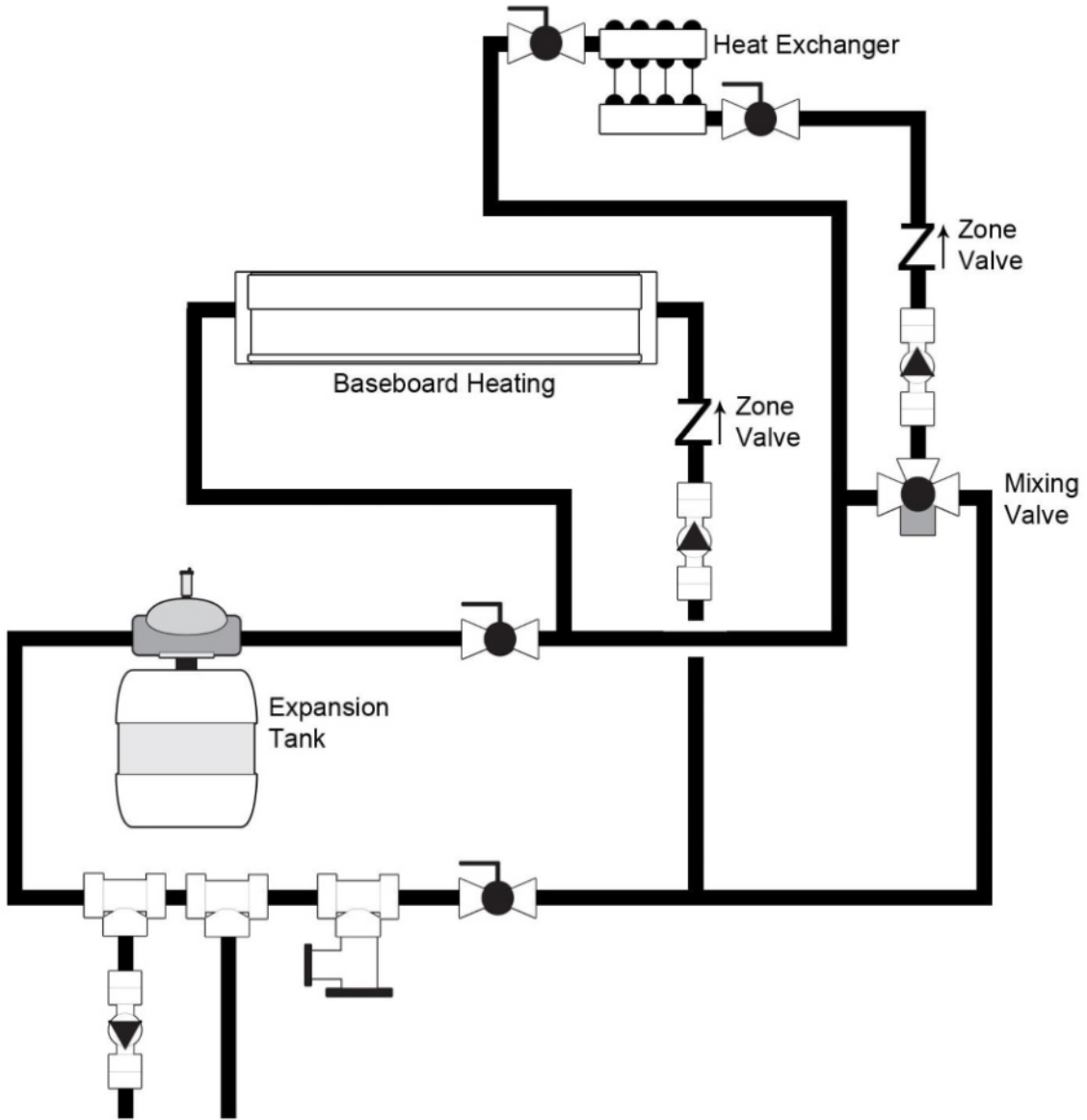
## Piping Installation

1. Installing primary-secondary Tees (4" to 8" apart) in the return ("Cold") line to the existing boiler.
2. Connect the solid fuel boiler supply and return lines as shown. Ensure that the supply ("Hot") lines is connected to the Tee closest to the return of the existing boiler.
3. Ensure that neither the existing boiler nor the solid fuel boiler are isolated from the expansion tank.

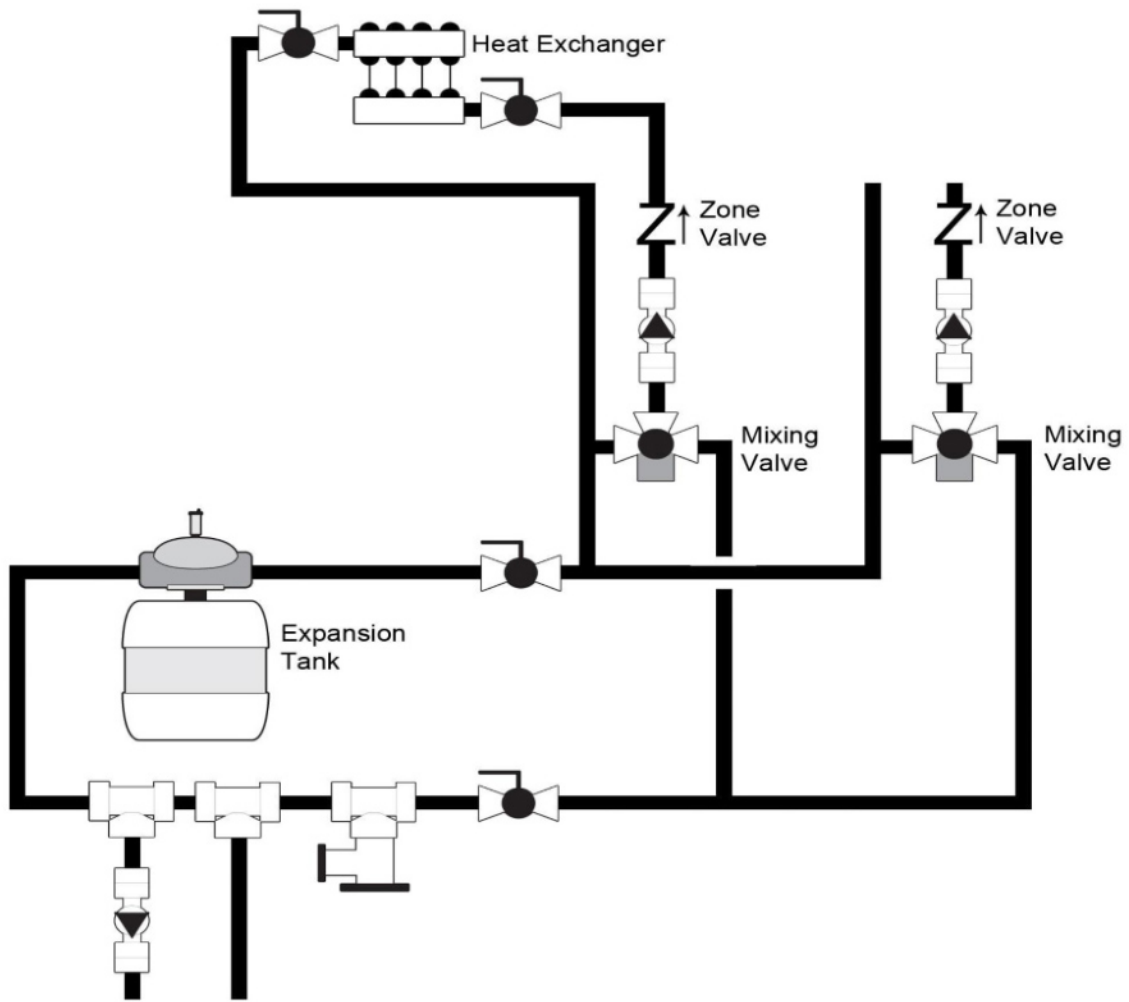
**DANGER: DO NOT remove or alter the relief valve on the existing boiler. Failure to do so could result in explosion causing severe injury, death, or property damage.**

**DANGER: For your safety, turn off electrical power supply at service entrance panel before making any electrical connections to avoid possible electric shock hazard. Failure to do so can cause serve personal injury or death.**









# Installation

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## Low Temp Radiant or Mixed Temp System

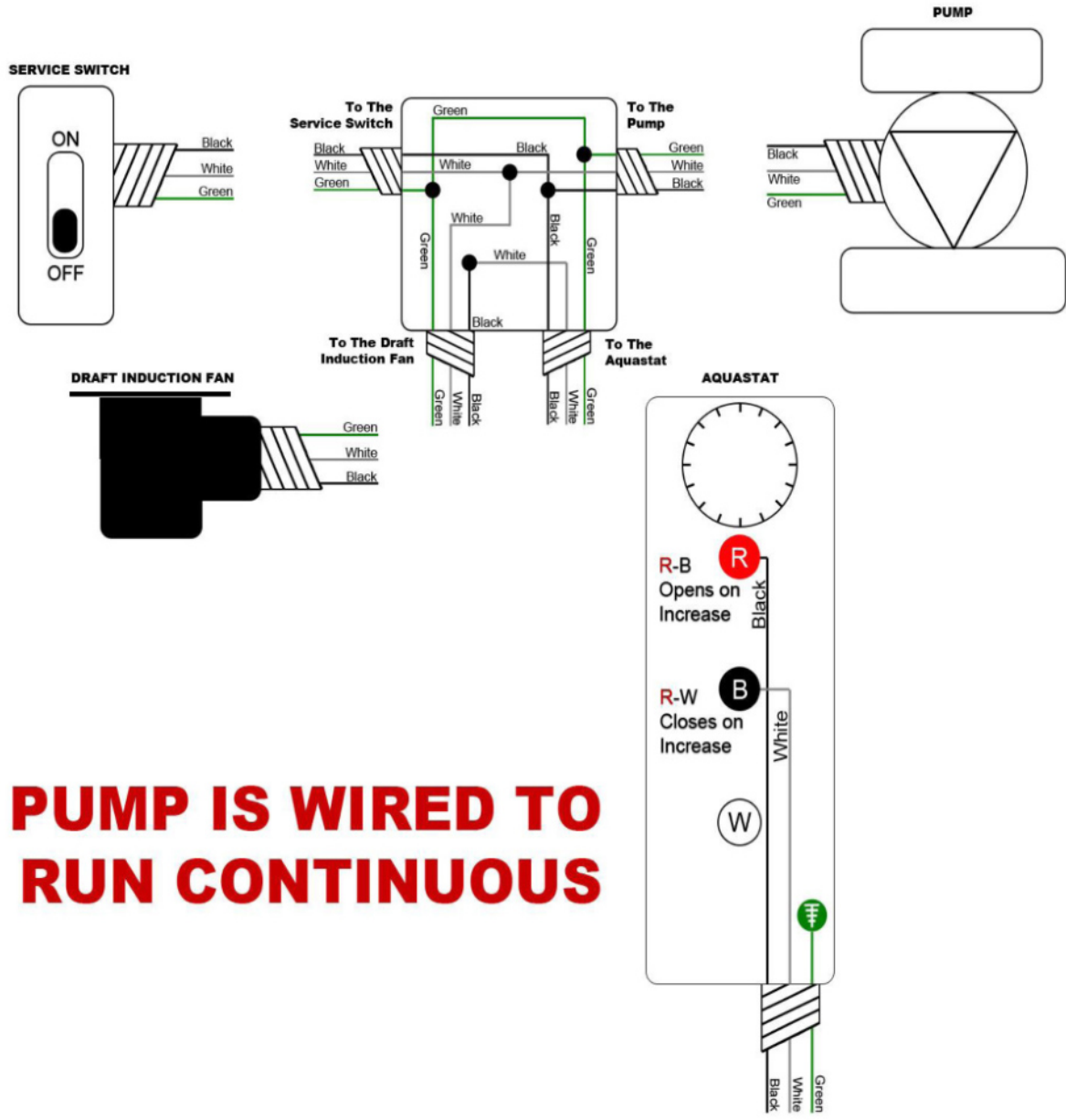
Low temperature radiant systems require some sort of tempering device, most commonly a thermostatic mixing valve. Low temperature and high temperature applications can be easily accommodated by the solid fuel boiler.

### Mixing Valve Details

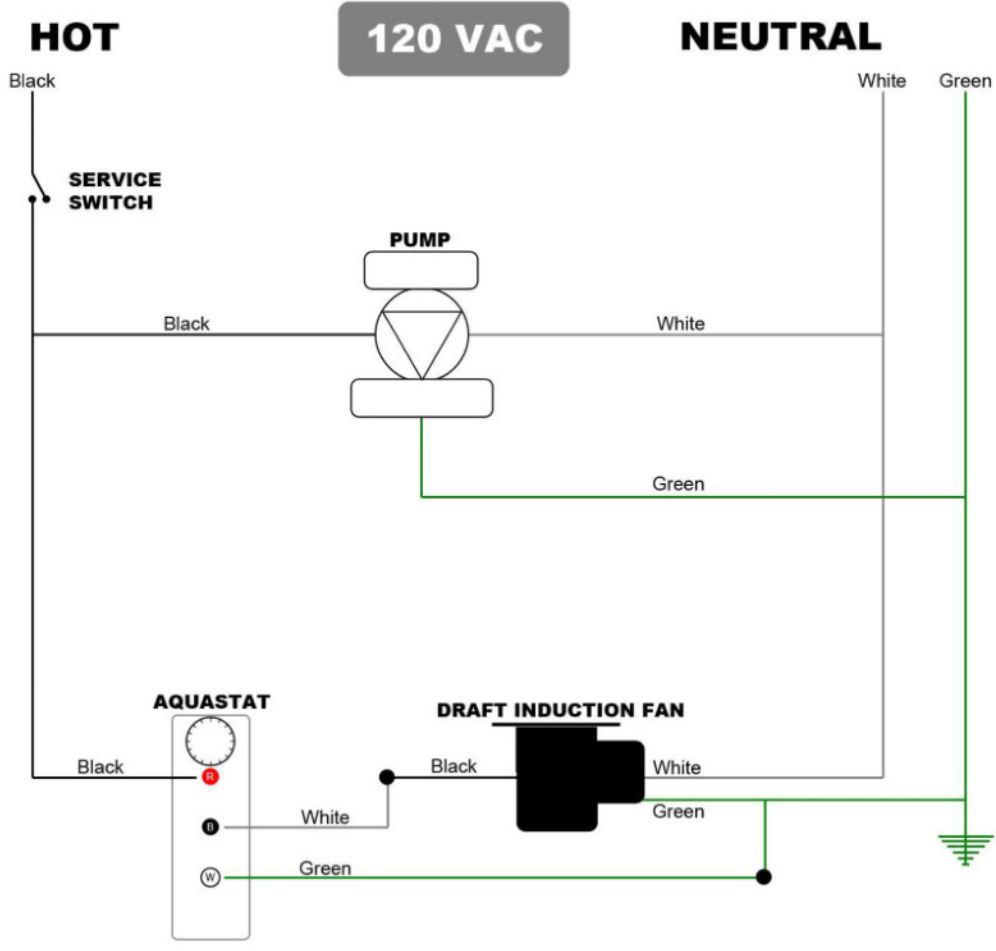
- The mixing valve **MUST** be piped such that a pump pulls water through it.
- The best location for the pump is 10" to 12" down stream of the "Mixed" port of the mixing valve. Multiple pumps in parallel require check valves on the outlet of each pump.

### Mixed Temperature Systems

- Follow the instructions for high temperature system as modified by the diagram below.
- Call Technical services with specific continuous flow through Solid Fuel design questions.



**PUMP IS WIRED TO RUN CONTINUOUS**



# Installation

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## Electrical

### Basic Electrical

For your safety, **turn off electrical power supply at service entrance panel before making any electrical connections** to avoid electric shock hazard. Failure to do so can cause severe personal injury or death.

**DANGER: Ensure power is shut off while making connections. Failure to do so may result in severe personal injury or death.**

**WARNING: To ensure that the appliance always has flow when operating, it is recommended that the pump and the appliance receive power from the same breaker. This is most important if the pump is located remote from the appliance in the structure being heated. DO NOT apply power to the pump until system has been filled. The pump is water cooled and must never be run dry due to risk of damage from overheating.**

Electrical installation must comply with:

- National Electrical Code and any other national, state, provincial or local codes or regulations.
- In Canada, CSA C22 Canadian Electrical Code Part 1, and any local codes.  
Appliance must be electrically grounded as required by National Electrical Code ANSI/NFPA 70-latest edition. Ensure ground wiring is installed per wiring diagram. Good grounding is extremely important for proper operation.

**Outdoor Models** require power to be brought into the junction box on the rear of the unit and to the water pump (not supplied). The low side of the Aquastat may be used to signal a safety heat relief zone.

### Indoor Models:

1. The following components are not included and must be provided by the installer:
  - 4 x 4 junction box
  - (2) SPST switches
2. Attach 4 x 4 junction box to the boiler.
3. Route power (115V, 60 Hz, 15 Amp) to the junction box.
4. Connect the MASTER switch:
  - Connect power "Hot" (Black) to one side.
  - Wire nut a lead from the other side to both the FAN switch and to the pump.
5. Route power from the other side of the FAN switch to the aquastat, attach to "R".
6. Route Power from the aquastat ("B") to the blower:
  - Connect Black wire to Black wire on blower
  - Connect White wire to one White wire on blower.
  - Connect Green wire to Green screw in blower junction box.
7. Connect white common wire from the blower and pump to the White wire from the power supply.  
**NOTICE: The pump will operate when the MASTER switch is in the ON position. Operating the pump without water in the system will damage the pump.**
8. Route power to the pump.

## Installation

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9. Connect pump using conduit with Black, White, and Green wire.
  - Open junction box cover
  - Remove one knockout and fasten conduit to pump junction box.
  - Connect Black wire to one White wire on pump.
  - Connect White wire to one White wire on pump
  - Connect Green wire to pump grounding screw in pump junction box.

### Setting the Analog Aquastat

(Indoor units – Outdoor factory installed)

1. Loosen screw on right side of case and remove cover.  
SET the high limit set point knob to the desired shut off water temp (never above 198-degrees). NOTE: these units have a built in 10° drop differential.
2. Insert the sensing probe into the immersion well.  
The sensing probe MUST touch the bottom of the well. Sharp bends in sensing probe wire would impair operation.
3. Fasten aquastat to the well by tightening the adapter clamp set screw in the top of the unit.
4. Replace cover

### Additional Safety Controls

#### High Temperature Limit Control

If installation is to comply with ASME or Canadian requirements, and additional high temperature limit is required. Install control in supply piping close to the appliance. Set second control to approx. 20° F above set point of first control. Maximum set point should be established to protect weakest component in the system (such as plastic piping). The boiler should be protected at no more than 240-degrees.

#### Low Water Cutoff

A low water cutoff device (LWCO) is required when the heat source is installed above radiation level or by certain state or local codes or insurance companies. If required, the LWCO must be installed code and manufacturer's instructions.

### Installation: Boiler Piping

1. **Boiler Drain Valves**
  - a. Drain valves are recommended to assist in filling and purging air. See chart in connection section indoor and outdoor locations.
  - b. Pipe in Tee at bottom of return ("Cold") pipe.
  - c. Pipe in Tees at top of both return ("Cold") and supply ("Hot") pipes.

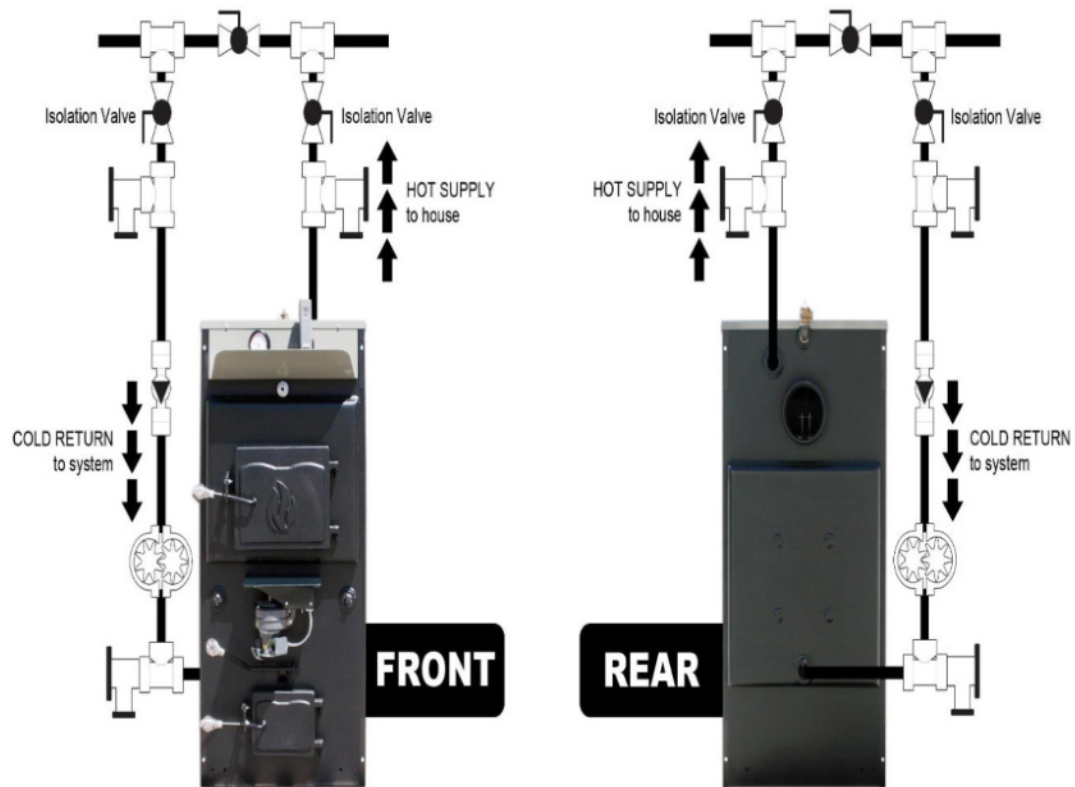
# Installation

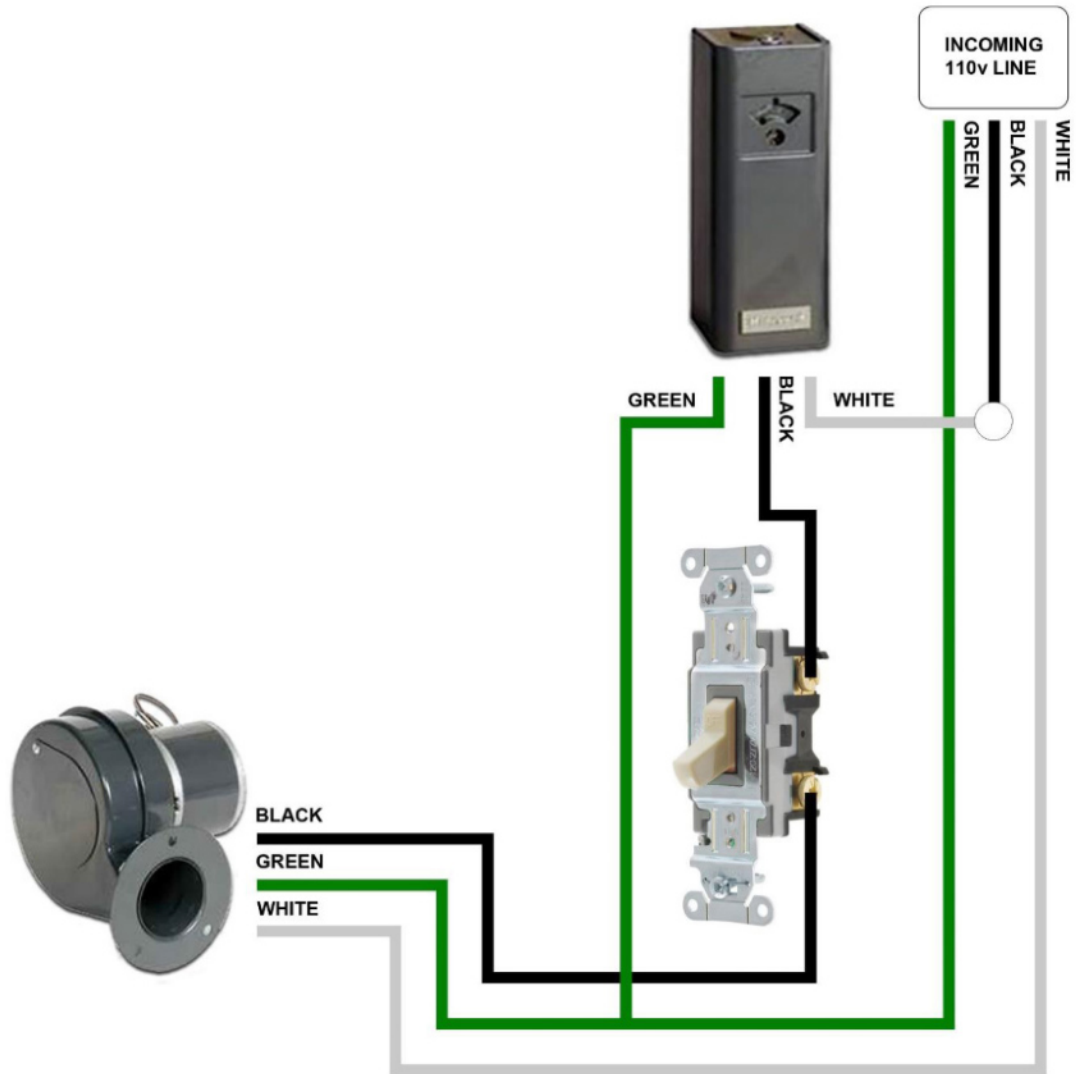
## 2. Pump

- a. A pump is required. If using isolation flanges, ensure that they are positioned so that the shut off is accessible.
- b. Pump motors are water lubricated and can burn out if incorrectly mounted. The motor canister must be horizontal.
- c. Body has an arrow on the casting that indicates direction of flow.
- d. To rotate the motor canister, remove the four motor bolts, rotate 4" to 8" Max motor and replace bolts. Ensure the junction box is NOT located underneath the circulator.
- e. When boiler is operating, pump will feel hot to the touch. This is normal.

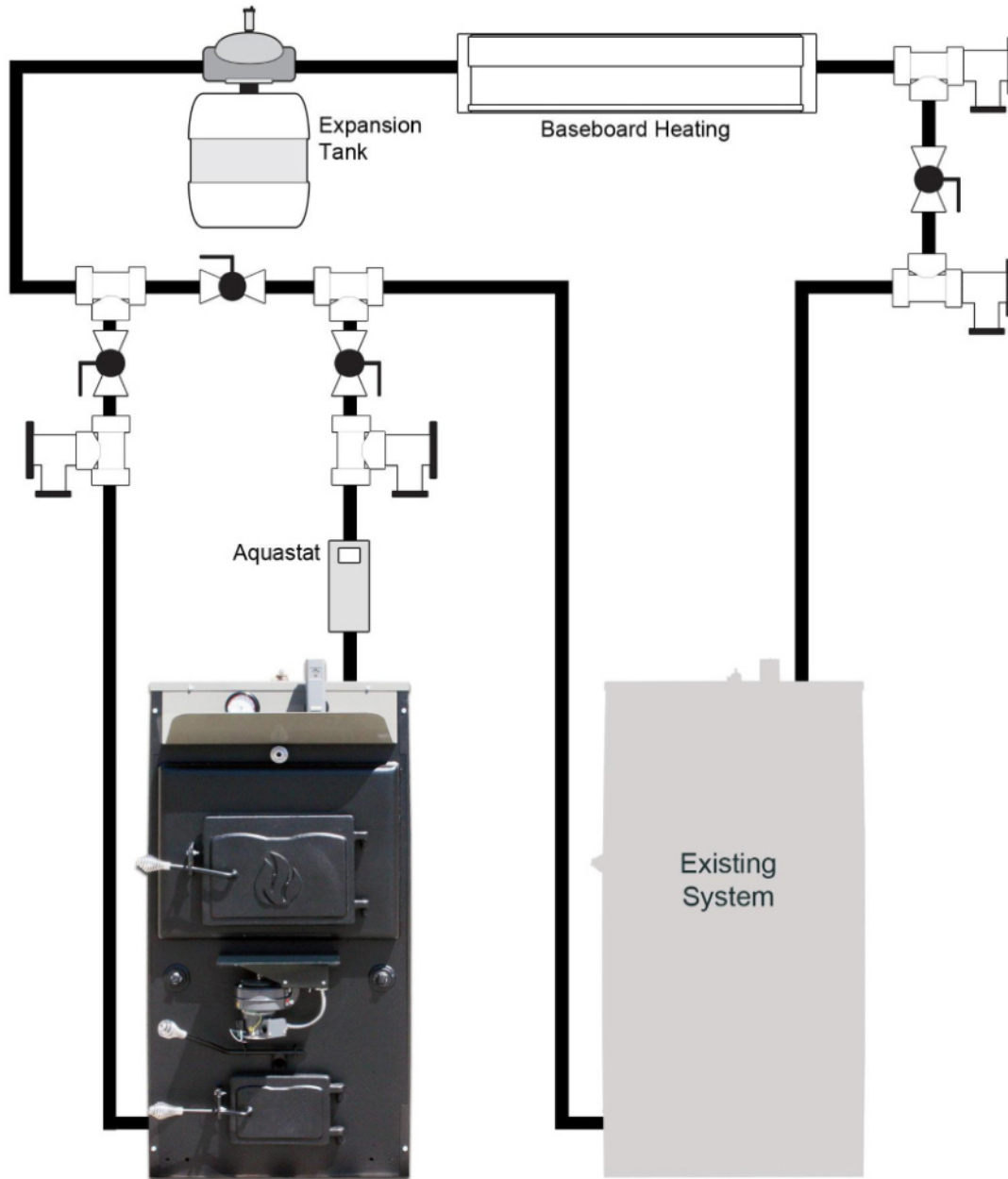
## 3. Primary-Secondary Piping

- a. Primary-Secondary piping is recommended to ensure continuous flow through the boiler.
- b. Tee should be no more than 4-8 inches apart.
- c. A full port ball valve may be installed between the Tees (as shown) to assist in filling. It must not disturb the flow between the Tees when in the open position.









# Installation

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## Initial System Fill

### 1. Fill, Isolate, and Pressure Test

Although the solid fuel boiler is factory pressure tested, it should be tested in the field to ensure that no damage has occurred during shipping. Isolate the solid fuel boiler from the system prior to pressure testing.

- A. Shut off isolation valves "B" and "C".
- B. Shut drain valve "G".
- C. Open drain valves "D" and "E".
- D. Keep fill valve or attach hose to drain valve "G" (either side is acceptable).  
Connect the other end of the hose to a water source with pressure between 30 and 40 psi.
- E. Slowly open drain valve "G" to fill the boiler.
- F. When water flows freely from both drain valves "D" and "E". Shut drain valves "G", "D" and "E".
- G. Slowly open drain valve "D" and closely watch the pressure gauge.
- H. Shut drain valve "G" when test pressure on pressure gauge reaches no more than 29 psi. the pressure relief valve will discharge if pressure exceeds 30 psi.

**DANGER: The person pressurizing the appliance must either be able to see the pressure gauge or must be in direct communications with someone who can see the pressure gauge. DO NOT EXCEED 45 PSI. Failure can result in severe personal injury, death, or substantial property damage.**

- I. Test for no longer than 10 minutes at 29 psi. Ensure constant gauge pressure has been maintained throughout test. Check for leaks, Repair if necessary.

**WARNING: Leaks must be repaired at once. Failure to do so can damage boiler, resulting in substantial property damage. Do not leave Appliance unattended. A cold water fill could expand as it heat up and cause excessive pressure, resulting in severe personal injury, death or substantial property damage.**

- J. Disconnect hose from water source and slowly open drain valve "H" to lower boiler pressure to 15 psi.

**DANGER: The Relief Valve must be Installed in the system prior to operation. Failure can result in severe personal injury, death, or substantial property damage.**

### Test Water Quality

Test system water pH to determine if water treatment is necessary. Heating system water pH of 8.5 to 11.0 is recommended. Swimming pool pH test kits are readily available from other sources. Consult local water treatment companies for unusually hard water areas (above 7 grains hardness) or low pH water condition (below 7.0). Use only water treatment designed for hydronic systems. For systems with poor water quality a corrosion inhibitor is required to be maintained to stay within the warranty.

# Installation

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## Re-Fill System with Water and Bleed Air

It is recommended to fill the system initially with water (even if non-toxic antifreeze will be used later) unless the temperatures are below freezing temperature make it impractical. This will make it easier to drain and refill if it is necessary to repair leaks or bleed out air. It is important to bleed air correctly when filling the appliance. Do not have appliance pump running during filling and bleeding.

- A. Re-attach garden hose to water supply and drain valve "G".
- B. Crack open drain valve "D" purging any air trapped at the top of the boiler.
- C. Crack open drain valve "C" and repeat purging.
- D. Slowly open Drain Valve "G" until Boiler pressure indicates 10 psi.
- E. Open Isolation Valves "B" and "C".
- F. Verify that solid fuel boiler pump isolation flanges are open and start the solid fuel pump. Verify that it is running by placing the blade of a screw driver against the pump motor, and the butt against your ear.
- G. Open (do not remove) small cap on auto air vent. The pump will circulate water and any air should escape out the auto air vent. Pressure may drop from air escaping. Add more water with the garden hose or keep fill valve. When adding more water, fill garden hose with water before attaching to the appliance to prevent from pushing more air into system.

## Inspect System for Leaks

After filling the appliance and system with water, inspect all piping throughout the system for leaks. If found, repair immediately. Repeat this inspection after the boiler has been started and the system has heated up.

**WARNING: LEAKS MUST BE PREPARED AT ONCE. Failure to do so can damage the appliance, resulting in substantial property damage. Do not use PETROLEUM-BASED CLEANING OR SEALING COMPOUNDS in the heating system. Severe damage to the appliance can occur, resulting in substantial property damage.**

# Operation

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## WARNING: Risk of Fire:

- Do not operate with flue draft exceeding .06 (14.95 Pa) of water column.
- Do not operate with fuel loading or ash removal doors open.
- Do not store fuel or other combustible material within marked installation clearances.
- Inspect and clean flues and chimney regularly.

**CAUTION – HOT SURFACES:** Keep children away! Do not touch Boiler during operation.

Please read this manual in its entirety prior to the first firing of your Royall Wood/Coal Boiler. It is very important that you follow these suggestions and limitations in order to maintain your warranty and to guarantee the long life of your Royall Wood/Coal Boiler.

The Royall Wood/Coal Boiler is designed to burn for about 6 to 8 hours per load of wood or coal. If the Royall heating appliance is being fired hot constantly with full flames and operating at only a 2 to 4 hour burn cycle, **it is being overfired**. Your home heating needs may be too great for the size of heating appliance can be detected upon inspection **and will void your warranty**.

Keep the Boiler and pipes in the heating system filled with water at all times to reduce the possibility of rust and corrosion. **Never** fire a boiler that is low on water. The heating surface can be damaged if the water level is too low. Always add water to a boiler gradually. **Never** add water to a hot appliance.

For greatest efficiency, you may sometimes need to allow your existing conventional heating system to assist your Royall Wood/Coal Boiler in the coldest weather.

During the warmer seasons of spring and fall, you should control the heat output by limiting the amount of fuel, rather than the air supply. Shorter, hotter fires will allow your Royall Wood/Coal Boiler to operate at maximum efficiency and with minimum emissions.

For best combustion efficiency, chimney temperature should be 350 – degrees F to 450-degrees F. Royall Products recommends installing a magnetic chimney thermometer to monitor chimney temperature.

## Gate Valves

When plumbing into your existing heating system, Royall Products recommends installing a series of three gate valves. The three gate valves are to be used in the event you do not use your Royall Wood/Coal Boiler for an extended period (one or more weeks).

- When the Royall Wood/Coal Boiler is in use, Valve #1 and #2 are open and Valve #3 is closed.
- To isolate your Royall Wood/Coal Boiler from the heating system when not in use, close Gate Valves #1 and #2, and open Valve #3.
- Always remember to open Gate Valves #1 and #2, and close #3 when activating your Royall Wood/Coal Boiler again.

	Gate Valve 1	Gate Valve 2	Gate Valve 3
Normal Usage	Open	Open	Closed
Extended Non-Use	Closed	Closed	Open

# Operation

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## First Fire

Before lighting your first fire, inspect your Royall Wood/Coal Boiler to ensure that it has been properly installed and that all safety requirements have been met. During your inspection, pay particular attention to the clearances to combustibles, venting, and thermostat installation instructions.

Verify the Pressure Relief Valve's proper functioning by manually opening the valve and releasing water into the floor drain. If no water flows, do not operate the Boiler until a new Pressure Relief Valve is installed.

Check to make sure that your combustion blower is in proper working order. You can check the forced draft blower by turning the wall thermostat supplied with your Royall heating appliance to a high temperature. If your forced draft blower turns on, you may set the wall thermostat to the desired setting.

Next, make sure that the burn chamber is clear of all objects.

Do not fully load your Royall Wood/Coal Boiler until you become familiar with the operation of your Royall Wood/Coal Boiler.

Some odors may be given off a new Royall Wood/Coal Boiler during the initial few hours of burning while the steel and the paint are being cured. Ventilating the room until the odors disappear is recommended.

## Typical Operation Cycle

After a fire has been established and the operating temperature has been reached, only the wall thermostat need to be set to maintain the desired temperature. Your draft system is controlled primarily by the wall thermostat; therefore it is crucial to ensure proper placement and installation of the wall thermostat.

- When your home cools, the wall thermostat located in the living area of the home activates the combustion blower, forcing combustion air into your burn chamber.
- As the fire burns hotter, the temperature of your heating water increases and activates your circulation system to deliver heat to your home.
- When the thermostat is satisfied, it will deactivate your forced draft control system, allowing the fire to cool until the next time your thermostat calls for heat.

Your Royall Wood/Coal Boiler can run efficiently over extended periods of time and at different heat output levels as long as the fuel supply is uninterrupted and cleaning and maintenance are performed routinely.

## Overfire

*Do not overfire.* Using too much wood or coal, burning trash in the Boiler, or operating with a flue draft that exceeds .06 inches water column, may result in overfiring – a dangerous condition which could produce excessive heat and pressure within the Royall Wood/Coal Boiler, or could ignite creosote within the chimney or Boiler. Forced firing or abuse can be detected upon inspection *and will void your warranty.*

As a safety feature, if your Boiler should overheat, it will trigger the pressure relief valve and release water to relieve pressure. If this should occur, allow the Boiler to cool completely before refilling. *Never* fire a boiler that is low on water. *Never* add water to a hot boiler.

# Operation

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## Power Failure Instructions

If operating during a power failure, your Royall Wood/Coal Boiler could overheat, creating a possible hazard and may result in property damage or bodily injury. Do not operate the Royall Wood/Coal Boiler during a power failure – *this can be dangerous and will void your warranty.*

After power is restored, verify that there is power to the Royall Wood/Coal Boiler, and restart using the procedures described in *Starting a Fire*.

## Before Starting a Fire

- ENSURE the isolation valves are open.
- Start the pump. The pump is lubricated with water. **DO NOT** run dry.
- Cycle the FAN switch to check for proper draft blower operation.
- Inspect the loading door gasket before lighting the first fire and a few days after, looking for any indications of a poor seal.

**DANGER: DO NOT use gasoline, kerosene, or other flammable liquids. These could cause a flash fire or explosion resulting in serious personal injury and property damage.**

**DANGER: DO NOT BURN GARBAGE, HOUSEHOLD WASTE, OR YARD WASTE. In most areas this is illegal. The unit is designed to burn seasoned split cord wood or coal, burning other materials can reduced the life of the unit and will void the warranty.**

## Boiler Control

### Firing the Solid Fuel Boiler

- **NEVER** start a fire without water in the system. Damage to the appliance and controls will result.
- Load the appliance with regard to the required heat load. On mild days, load less fuel in to the appliance. A small, intense fire will burn cleaner, more efficiently and with less creosote formation than a large smoldering fire.

### Lighting the Initial Fire (Same for Wood or Coal)

1. Remove ash pan from unit store nearby.
2. Place the FAN switch in the OFF position.
3. Pull smoke bypass damper rod out.
4. Build a **SMALL** fire using paper and kindling. Softwoods make good kindling due to the resin they contain and the fact that they split easily. Hardwood are better on top of the kindling to give a longer lasting fire.
5. When the fire is burning well add larger pieces of wood.
6. If burning coal,
  - a. After the wood fire is burning well, place larger pieces of wood to form a stable base for the coal. It will take ten to twenty minutes before they are thoroughly ignited and ready for the coal. Adding the coal too soon could cut the air supply and smother the fire.

## Operation

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- b. Add a thin layer of coal, preferably smaller chunks to the wood fire, being careful not to disturb it too much or cut off the draft.
  - c. After the coal is ignited and burning well, add a second heavier layer until it is even with the top to the firebrick. Ensure that a red spot of glowing coals is visible after adding new coal. Do not smother the fire. This will also help ignite the gases given off by the new charge. A deep charge will give more even heat and a longer burn time. It may take one to two hours before the whole bed is fully ignited.
7. Allow the water temperature to rise. When the water temperature reaches 120° F, set the draft control aquastat to 110° F. The draft fan should stop and the shutter close. Reset to desired operating temperature. Note: Temps below 165-degrees F may result in excessive creosote build-up.
8. **Auxiliary "Dump Zone"** A safety limit aquastat should be used. Set the safety limit aquastat below water temperature. In a hot water base board system the zone valves should open and the circulation pump should start. Reset to 15° above the solid fuel boiler aquastat setting. Never set safety limit aquastat above 200° F.
9. Monitor water pressure. Maintain about 15 psi (hot water pressure) by adding water as air is purged from the system. It may take several days operation to purge all the air. ENSURE the vent opening on the automatic air vent is clear and the cap is loose to allow air to escape. This vent always stays open with the cap halfway unthreaded. Condensation in the fire box will occur for the first 3 or 4 days of operation resulting in water or water/creosote combination running out of the ash door. This should clear up in less than a week. You may want to place a pan under ash door to keep concrete clean.
10. When firing boiler remove ash pan, place next to boiler for safety reasons.

# Operation

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## BURN AIR-DRIED WOOD, OR ANTHRACITE OR BITUMINOUS COAL ONLY

### Burning Wood

All home chimneys and hookups are different. After a few fires, you will find the best way to start a fire in your Royall Wood/Coal Boiler.

Your Royall Wood/Coal Boiler is capable of holding very large logs. **Do not** try to add a log that is larger than what you can easily place in the Royall Wood/Coal Boiler. You will get the best efficiency when you add only the amount of wood needed for a 6 to 8 hour burn. Note: A full load is not always the best solution for your needs.

### Starting a Wood Fire

1. Pull the sliding smoke baffle out to open.
2. Place a small amount of crumpled paper in the center of your Royall Wood/Coal Boiler. Crisscross a couple of handfuls of dry,  $\frac{3}{4}$ " thick kindling wood, then several small pieces of firewood.

**Be sure the sliding smoke baffle is fully open.**

3. It will take 5 to 10 minutes for the fire to establish itself. Once you have some red-hot burning embers, add larger pieces of wood.
  - a. Vary the position of the wood in the burn chamber to maximize the exposed surface area of each piece of wood.
  - b. Only use wood properly sized for your unit's burn chamber.

**Never overload your burn chamber. Do not load wood more than 8 inches above the top of the firebrick.**

4. Push in the sliding smoke baffle after loading your Royall Wood/Coal Boiler and the fire has been established.
5. The burn time is controlled by the 24-V Wall Thermostat and the forced air draft control on the Boiler.

### Refueling

1. Place the FAN switch in the OFF position.
2. Pull smoke bypass damper rod out and wait one minute.
3. Open the fuel loading door slowly. Pausing 3-5 seconds at double latch point.
4. Work ashes down through the grate with a poker and shaker grate. Ensure that a 4" – 6" deep coal bed remains.
5. Fill fire box "full" with wood. Do not load past the top of the loading door opening.
6. Close fuel loading door.
7. Open the ash door. Insert the ash pan and scoop out ashes.
8. Empty ashes into a safe container. **DO NOT STORE THE ASH PAN IN THE UNIT DURING OPERATION.**
9. Ensure that the ash door is tightly closed.



# Operation

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10. Place the FAN switch in the ON position.
11. Push the smoke bypass damper rod in.

**\*\*\*DO NOT LOAD WOOD ABOVE THE LOADING DOOR OPENING\*\*\***

## Burning Coal

### Starting a Coal Fire

You will get the best efficiency when you add only the amount of coal needed for a 6 to 8 hour burn. A full load is not always the best solution for your needs.

Burning coal will provide a lesson in patience. Take the time necessary to experiment and understand the operation of your Royall Wood/Coal Boiler.

Please keep the following point in mind when burning coal:

1. **A barometric draft damper MUST be installed between the solid fuel boiler and the chimney.**
2. Determine and research what types of coal are commonly available in your area. You will get more heat and longer burn periods if you are educated on how to burn the type of coal available to you. Number 3 "hard" coal tends to work best.
3. When burning any type of coal in the boiler do not fill the fire box above the firebrick. Some types of coal have a high temperature and can cause damage to the boiler if filled above the brick.
4. Most coal requires more air for combustion than wood. This due to the higher kindling temperature needed to burn these types of coal. It usually takes two or three days to determine the correct positioning of the blower damper to produce a satisfactory burn.
5. **Never** completely cover the live fire with fresh coal. Always leave a generous area of burning coal at the top and rear of the fire.
6. Always keep the ash pan clean. Coal firing produces much more ash than wood. These ashes must be removed often (possibly daily) in order to avoid piling up too closely to the grates.

Removal of the coal ash will allow for passage of primary air to the coal bed and prevent damage or warpage to the grates.

#### **Dispose of ashes with care:**

Ashes should be placed in a metal container with a tight fitting metal lid. The closed container of ashes should be placed on a noncombustible floor or on the ground, well away from all combustible materials, pending final disposal.

All coal contains small amounts of dangerous elements. Therefore it is essential that your coal ash be disposed of in municipally designated areas.

## Operation

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7. A coal fire should not be poked or broken up, as this tends to bring ash to the surface of the coal bed where it may fuse. If the ash fuses, clinkers will form. It may be necessary to remove all unburned material and ash from the burn chamber to remove the clinkers. These should be carefully removed using tongs, and always put into an airtight metal container.
8. If the fire goes out or does not hold overnight, check for the following:
  - a. Poor Draft
  - b. Incorrect damper settings.
  - c. Improper firing methods for the coal being used.
  - d. Coal is not sized to the boiler (see *Fuel Requirements –Coal*)
  - e. Ashes, if allowed to accumulate in the ash pan, will not allow the passage of required air for combustion. Keep the ash pan clean.

### Refueling

1. Place the FAN switch in the OFF position.
2. Pull smoke bypass damper rod out and wait one minute.
3. Open the fuel loading door slowly.

When recharging, fresh coal tends to give off large quantities of volatile gas which may accumulate and possibly ignite, causing a backpuff. Always open the fuel loading door slowly to prevent backpuffing.

**Never stand in front of the fuel loading door when refueling; always stand to the side.**

4. Pull the glowing coal to the front of the fire box. Try not to disturb the fire too much.
5. Add new coal to the back of the fire box, being careful not to seal off the top. It is important to leave a red spot of glowing coals visible after adding new coal to ensure that the fire has not been smothered.
6. After the new coal is well ignited add more coal to the front area that was left visible.
7. When refueling process is completed you should have a bed of coal even with the firebrick at both sides of the fire box and heaped to the center of the fire box.
8. Close fuel loading door.
9. Gently move the shaker grate handle. A few short movements are better than a long movement of the Grate. The object is to remove a small amount of the ashes without disturbing the fire. The fire should just be settled down about a half an inch or an inch in the fire box until the first live coals start to fall. The fire may go out if you shake it too much. It is not necessary to shake down the ashes each time you refuel.
10. Open the ash door. Insert the ash pan and scoop out ashes.
11. Empty ashes into a safe container. Do not store the ash pan in the unit during operation.
12. Ensure that the ash door is tightly closed.
13. Place the FAN switch in the ON position.
14. Push the smoke bypass damper rod in.

# Operation

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## Bituminous Recharging

Because bituminous coal has higher sulfur content, bituminous recharging is slightly different from anthracite recharging.

To refuel/recharge the bituminous coal fire in your Royall Wood/Coal Boiler:

1. Pull the sliding smoke baffle out.
2. Gently shake the grates down.
3. Open the fuel loading door slowly: open the door about 1" to 2" then wait about 15 to 20 seconds before opening fully.

When recharging, fresh coal tends to give off large quantities of volatile gas which may accumulate and possibly ignite, causing a backpuff. Always open the fuel loading door slowly to prevent backpuffing.

***Never stand in front of the fuel loading door when refueling; always stand to the side.***

4. If the coal fire has died down before recharging, a fresh supply of kindling will need to be added. Only add fresh coal to a deep, hot bed of coals.
5. Push the hot coals to the rear of the burn chamber and position fresh coal on the grate in front of the banked coal. Be careful not to smother your existing coals.

***Never overload your burn chamber. Do not load coal above the top of the firebrick.***

6. Close the fuel loading door and sliding smoke baffle.

## Creosote Formation

All solid fuel devices create some creosote.

1. When wood is burned slowly, it produces tar and other organic vapors, which combine with expelled moisture to form creosote.
2. Creosote vapors condense in the relatively cool chimney flue of a slow burning fire.
3. As a result, creosote residue accumulates inside the flue. Check daily to determine cleaning schedule.
4. When ignited this creosote makes an extremely hot fire.
5. The chimney connector and chimney should be inspected at least twice monthly during the heating season to determine if a creosote buildup has occurred.
6. If creosote has accumulated it should be removed to reduce the risk of a chimney fire.  
Note: Hotter fires deposit less creosote. Creosote formation can be high during fall and spring, thus require more frequent cleaning compared to the coldest months. Be prepared to handle a chimney fire (see *Emergency Action* section).

## Operation

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**“Heat Savers” added to the chimney are not recommended as they can increase creosote problems disposal of ashes.**

1. Ashes should be placed in a metal container with a tight fitting lid.
2. The closed container of ashes should be placed on a noncombustible floor or on the ground, well away from all combustible materials, pending final disposal.
3. If the ashes are disposed of by burial in soil or otherwise locally dispersed, they should be retained in the closed container until all cinders have thoroughly cooled.

**WARNING: DO NOT STORE THE ASH PAN IN THE UNIT DURIN OPERATION. Improper use or failure to maintain a solid fuel boiler may cause nuisance conditions. Persons operating this appliance are responsible for its operation, so as not to cause nuisance conditions. Even proper use and maintenance of a solid fuel boiler, meeting the distance and stack height recommendations and meeting all requirements in State and Local Regulations may not always be adequate to prevent nuisance conditions in some areas due to terrain or other factors.**

### Banking

Banking allows you to recharge your coal fire in such a manner as to retain a hot coal bed throughout the night.

Approximately on hour before retiring for the night, push the coals to the rear of the burn chamber with the coal tapered down in the front.

Be careful not to smother your existing coals.

## **Emergency Action**

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### **Over Heating**

1. Manually turn off the draft fan at the fan switch (place switch in OFF position).
2. The pump must have power to remove heat from the appliance.
3. Turn the thermostats fully up in the structure being heated by boiler to remove heat from the appliance as fast as possible.
4. Allow the appliance to cool down.
5. Once the unit has cooled down:
  - Determine and correct the cause of the overheating
  - Refill the system if necessary

### **Chimney Fire**

1. **CALL 911 – INDDOR UNITS ONLY.**
2. **EVACUATE THE BUILDING. INDOOR UNITS ONLY**
3. Manually turn off the draft fan at the FAN switch and close damper plate.
4. Leave the doors securely closed.
5. **DO NOT TURN OFF THE SWITCH MASTER.** The pump must have power to remove heat from the appliance.

### **Loss of Electrical Power**

1. Shut blower damper plate fully.
2. Restore Electrical Power.
3. If electrical power is off for a long duration, the appliance may over heat. Remove fuel and coals from the fire box. Place removed fuel away from combustibles.

## Maintenance

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Periodic maintenance is required to continue the performance of your Royall Wood/Coal Boiler. As with any solid-fuel heating appliance, the need for and frequency of cleaning depends on the amount and quality of fuel burned, the quality of the fire, and the length of time since the last cleaning. Weekly cleaning may be required in warmer weather, whereas monthly cleaning may be enough in colder weather.

Keeping the solid fuel boiler in good repair will result in more efficient operation and longer appliance life. You are responsible for safely maintaining the unit. Follow the **service and Maintenance** procedures given throughout this manual and in component literature shipped with the appliance.

Before the first fire in each new heating season, check all installations and accessories to ensure a safe burning process.

**DANGER: Risk of electric shock. Disconnect power at the service panel or breaker box before servicing Royall Wood/Coal Boiler.**

**DANGER: Failure to perform the service and maintenance could result in damage to the boiler or system. Failure to follow the directions in this manual and component literature could result in severe personal injury, death, or substantial property damage.**

**CAUTION: Keep the area around the Royall Wood/Coal Boiler clean and free of dust and debris.**

### Creosote – Formation and Need for Removal

When wood is burned slowly, it produces tar and other organic vapors, which combine with expelled moisture to form creosote. The creosote vapors condense in the relatively cool chimney flue of the slow-burning fire. As a result, creosote residue accumulates on the flue lining. When ignited, this creosote makes an extremely hot fire, the results of which can be tragic.

Check daily for creosote build-up until experience shows how often cleaning is necessary. The chimney connector and chimney should be inspected at least twice monthly during the heating season to determine if a creosote build-up has occurred. If creosote has accumulated, it should be removed to reduce the risk of a chimney fire.

Be aware that the hotter the fire, the less creosote is deposited, and that weekly cleaning may be necessary in mild weather, even though monthly cleaning may be enough in the coldest months.

Have a clearly understood plan to handle a chimney fire.

### Disposal of Ashes

Ashes should be placed in a metal container with a tight fitting metal lid. The closed container of ashes should be placed on a noncombustible floor on the ground, well away from all combustible materials, pending final disposal.

## Maintenance

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If the ashes are disposed of by burial in soil or otherwise locally dispersed, they should be retained in the closed container until all ash and cinders have thoroughly cooled. Do not place any other waste materials in this container.

All coal contains small amounts of dangerous elements. Therefore it is essential that your coal ash be disposed of in municipally designated area.

NOTE: EMBERS REMAIN HOT FOR MANY DAYS.  
STORE IN A SAFE PLACE AWAY FROM  
COMBUSTIBLES.

Never use a conventional vacuum cleaner or a shop vacuum to remove ashes from a solid-fuel heating appliance. Ashes remain hot for many days, and when trapped in a conventional vacuum can cause a fire hazard. Only use a vacuum designed for the safe cleaning and removal of ashes.

## Gasket Replacement

The cast iron fuel loading and ash removal doors of your Royall Wood/Coal Boiler are equipped with gaskets to ensure safe operation and an airtight seal. When these gaskets become worn or damaged, you will need to replace them.

To replace the gaskets you will need ¾-inch, high temperature rope gasket, available from your Royall dealer or hardware store.

1. Remove the door and lay it face down on a clean, flat surface.
2. Find the ends of the gasket and pull it off.
3. Using a screwdriver, remove any excess gasket cement from the gasket channel.
4. If desired, a small drop of gasket cement may be applied to the corners of the gasket channel.
5. Lay the new door gasket in the channel, cutting off any excess gasket rope.
6. Reattach the door. If gasket cement was applied, keep the door closed until the cement has fully dried.

# Operation

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## Routine Maintenance

Please use the following timeline as a guide to determine how much maintenance your Royall Wood/Coal Boiler requires to operate at peak performance. Failure to clean and maintain this Boiler as indicated can result in poor performance and safety hazards.

**CAUTION: Inspect flue pipes, joints and seals regularly to ensure that smoke and flue gases are not drawing into the home.**

### Daily

Until a pattern of cleaning requirement is established, inspect and, if necessary, clean the following components daily:

- Fuel Supply, refilling as necessary
- Water Level, refilling as necessary
- Flue Pipes, including joints and seals, should be inspected to ensure that smoke and flue gases are not drawn in and circulated by the air-circulation system.
- The ash removal pan should be emptied and cleaned regularly. Ash content is a good indicator of fuel efficiency and quality. High quality fuel will produce less ash and fewer clinkers than lower quality fuel. Never allow ash to build up to the level of the grates.
- Grates: For best performance level the wood/coal distribution on the grates prior to each loading. (A garden hoe works well). There should be very little ashes on top of the grates. Ash build up will restrict air going through the grate, promoting incomplete combustion and creosote formation.

### Every 2 – 3 Days/Weekly

Once a pattern of cleaning requirement is established, the following components should still be monitored on a regular basis:

- Burn chamber
- Ash removal pan
- Water Level
- Flue pipes, joints and seals

### Monthly

- The water level on your Royall Wood/Coal Boiler should be monitored on a regular basis and refilled when necessary.
- Examine door gasket and draft fan shutter. Ensure airtight seal. Replace as required.

### Every 3 Months

Until you are familiar with how ash and creosote accumulate with your operating practices, we recommend inspecting your Royall Wood/Coal Boiler at least once per ton of fuel burned. Particular attention should be given to:



## Operation

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- Draft Control system (blowers, etc.)
- Gaskets (Fuel Loading and Ash Removal Doors)
- Water Level
- Fresh air intake

Clean heat exchanger and baseboard radiators. Dust and dirt build-up reduces heat transfer.

Place a few drops of S.A.E. 20 motor oil on each of the two oil cups on the blower motor.

**WARNING: Use only S.A.E 20 motor oil to lubricate the motor. Do not use universal household oils. Motor could be damaged, resulting in possible severe property damage.**

### End of Season

**CAUTION: Cleaning the flue pipe and chimney is especially important at the end of the heating season to minimize corrosion during the summer months caused by accumulated ash.**

It is important to give the entire Royall Wood/Coal Boiler a thorough cleaning:

- Turn off the power supply at the appropriate circuit breaker.
- Your venting system should be inspected and cleaned annually. Clean and remove fly ash from chimney connector, flue pipes and chimney. Soot build-up should be removed to prevent the risk of a chimney fire and to minimize corrosion during the summer months.
- Scoop out any unburned fuel from the fire chamber by using a putty knife or wire brush. Coat inside of the fire box with a light coat of motor oil to protect steel during the off season.
  - Do not allow fuel or ash to sit in the Royall Wood/Coal Boiler over the summer months. Fuel and ash can accumulate moisture over the summer months having a corrosive effect on metal and cast iron parts, and causing the fuel to mold.
- Oil door hinges and latch guide.
- Shut all isolation valves. Ensure transfer line connections are tight.

### Beginning of Season

- Remove cap from chimney and inspect the chimney. Ensure chimney is not blocked (check for animal or birds' nests).
- Oil door hinges and latch. Inspect the gaskets on the doors. Verify that door seals tightly (apply thin coat of lipstick to loading flange, shut door, reopen and inspect marking on the gasket).
- Open all isolation valves.
- The circulator shipped with the appliance is water-lubricated. No oiling is required. Check other circulators. Over-boiling will damage the circulator.
- Verify cold pressure is approximately 5 psi. Fill if necessary.

## Operation

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- Verify heating system water pH of 8.5 to 11.0. Adjust as necessary. Add corrosion inhibitor package to raise pH. Add scale inhibitor as testing indicates.
- Verify level per manufacturer's instructions on the Corrosion Inhibitor.
- Turn on power supply at the appropriate circuit breaker. Ensure that the pump is running.
- Inspect and test the aquastat. Verify operation by turning aquastat temperature below the appliance temperature. The boiler should cycle off. Return aquastat to original setting.
- Inspect automatic air vents. The cap must be unscrewed one turn to allow air to escape. If the air vent is leaking, remove cap and briefly push valve and then release to clean the valve set. Replace cap by twisting all the way onto valve and then unscrewing one turn.
- Review start-up Procedures.
- Review all safety Precautions.
- Verify that area is free of any combustible materials, gasoline and other flammable vapors and liquids or rags.

**DANGER: Do not use petroleum-based cleaning or sealing compounds in the heating system. Severe damage to the heating system will occur, resulting in substantial property damage.**

**WARNING: Eliminate all system leaks. Continual fresh makeup water will reduce appliance life. Minerals can build up in the appliance, reducing heat transfer, overheating the metal. Leaking water may also cause severe property damage.**

**DANGER: Electrical shock hazard: Turn off power to the appliance before any service operation on the appliance except as noted otherwise in this instruction manual. Failure to turn off electrical power could result in electrical shock, causing severe personal injury or death.**

### Pressure (Safety) Relief Valve

Failure to re-inspect the pressure relief valve as directed could result in unsafe pressure buildup, which can result in severe personal injury, death or substantial property damage.

**AT Least Once a Year:** Pressure relief valves *must be operated* to ensure that waterways are clear. Certain naturally occurring mineral deposits may adhere to the valve, rendering it inoperative. When manually operating the lever, water will discharge and precautions must be taken to avoid contact with hot water and to avoid water damage. Before operating lever, check to see that a discharge line is connected to this valve directing the flow of hot water from the valve to a proper place of disposal, otherwise severe personal injury may result.

IF NO WATER FLOW, VALVE IS INOPERATIVE. SHUT DOWN THE APPLIANCE UNTIL A NEW RELIEF VALVE HAS BEEN INSTALLED.

**At Least Once Every Three Years:** Safety Relief Valves should be re-inspected by a licensed plumbing contractor or authorized inspection agency, to ensure that the product has not been affected by corrosive water conditions and to ensure that the valve and discharge line have not been altered or tampered with illegally. Certain naturally occurring conditions are not detectable unless the valve and

## **Operation**

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its components are physically removed and inspected. This inspection must only be conducted by a plumbing contractor or authorized inspection agency – not by the owner.

VERIFY SYSTEM PRESSURE FOLLOWING TESTING OF RELIEF VALVES. ADD WATER TO SYSTEM AS NECESSARY.

## Troubleshooting

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**DANGER:** Failure to inspect and repair the above conditions can result in severe personal injury or death.

### Troubleshoot Guide

Many problems in the Royall Wood/Coal Boiler can be traced to a few common place causes and are easily fixed. Before making any repairs or replacing any components, be sure to check for these common problems:

#### Fuel

- Wet or dirty fuel

**Solution:** Empty and clean the burn chamber. Refill using only high quality, clean, dry fuel as outlined in *Fuel Requirements*.

#### Improper Draft

- Too little or too much draft
- Insufficient combustion air

**Solution:** Be sure to maintain your Royall Wood/Coal Boiler's cleanliness by emptying the ash removal pan regularly. See *Operation* for further information.

#### Ash buildup in the ash removal pan

**Solution:** Be sure to maintain your Royall Wood/Coal Boiler's cleanliness by emptying the ash removal pan regularly. See *Maintenance* for further information.

We also recommend establishing a routine of inspecting gaskets and replacing when necessary. Maintaining your Royall heating appliance's cleanliness and adjusting the draft controls will remedy many problems.

# Troubleshooting

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## 1. Problem: Losing Pressure in System.

- a. Air bleeding out of system will cause pressure loss. When the appliance is first filled, it may take 3 – 4 days to purge all the air. Add water as needed until pressure stabilizes.
- b. An undersized expansion tank will cause large pressure changes as the system water temperature changes.
- c. If pressure consistently drops, it indicates a leak in system. Check joints, fittings, relief valves, etc.

## 2. Problem: Unit Over Heats.

- a. Air leaks can cause appliance to overheat. Ensure loading and ash door are sealing properly.
- b. Chimney may be creating a natural draw even when the draft blower is not running. Consider installing a shutter on the draft blower.
- c. Fan control aquastat or safety limit aquastat may be set too high. Fan control aquastat must not be set over 180° F. Maximum setting for safety limit aquastat is 190° F.
- d. Water is not circulating. If pump is not running or an isolation valve is shut, or an air lock is stopping circulation, appliance can overheat.

## 3. Problem: Not Enough Heat Out of the Appliance.

*If the appliance reaches operating temperature and draft fan shut off, it is working properly. (if draft fan does not shut off, see Problem 4)*

*Check the following:*

- A. System water flow rate too low. This can be caused by:
  - The circulating pump may not have enough capacity.
  - There could be an air lock in the system (See Problem 5).
- B. The fan control aquastat may be set too low. Set aquastat up 10° but not over 180° F.
- C. The house heating system may not be extracting enough heat from the water. Dust buildup on the baseboard fins or forced air heat exchanger system will reduce heat output.
- D. The house heating system may not have enough capacity. More baseboards may need to be added to a hot water system. In a forced air system, more airflow through the heat exchanger will boost output.
- E. The fuel quality might be poor. Split, seasoned, hardwoods are recommended.

## 4. Problem: Water Temperature Does Not Reach Fan Control Aquastat Setting. (Draft Fan Runs Continuously).

- a. Wood may be too wet or green. Try mixing woods.
- b. Check for obstructions in draft fan.
- c. A defective solenoid may cause flapper on fan not to open when fan comes on.
- d. A partially clogged chimney or exhaust plenum may be restricting air flow in the appliance.

## Troubleshooting

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- e. A buildup of ashes on in the ash trough can restrict the exhaust of combustion air.
- f. A buildup of ashes on top of the grates can restrict combustion air.
- g. Heat is being lost through underground pipes. Temperature coming into house should be no more than 2 -3 –degrees different than temperature of water leaving the appliance.
- h. Appliance is undersized for building being heated.

### 5. Problem: No Water Flow

- a. Air could be trapped in the line.
  - Repeat filling and venting procedures
  - Temporarily add more water to system to bring pressure to around 25 psi. This will compress any air bubbles allowing them to more readily move to the air vents.
- b. Pump is not running. You should be able to feel the vibration of pump when it running.
  - Defective pump—check if installed properly. If installed incorrectly, pump will burn out. With 180° water circulating through pump, it will be hot to the touch.
  - Pump is not wired correctly. Refer to wiring diagram.
- c. Pump flanges are closed. Flanges are open when screw slot is parallel with the pipe.
- d. The system is frozen somewhere.

### 6. Problem: Excessive Creosote is Building Up in Ash Trough

- a. Ash build up above grates or in ash trough area will cause restrictions in combustion air.
- b. Appliance may not be burning hot enough.
  - Set fan control Aquastat to 180° F.
  - Set differential on fan control Aquastat to 20° (if adjustable). This will let water temperature drop 20° before fan is started, causing a longer burn cycle.
- c. Verify that the fuel is properly seasoned (20 -25% moisture content).
- d. Try burning small pieces of extra dry wood for a few days. Large pieces of wood can cause creosote.
- e. If problem persists call your installer or local Royall Representative.

### 7. Problem: Smoke “Puffs” From The Unit.

- a. Wood may be too wet or green. Try mixing woods.
- b. Check for obstructions in draft path (Blower, Chimney Connector, and Chimney).
- c. A partially clogged chimney or exhaust plenum may be restricting air flow in the appliance.
- d. A buildup of ashes in the ash trough can restrict the exhaust of combustion air.
- e. A buildup of ashes on top of the grates can restrict combustion air.
- f. Ensure that the Chimney has adequate draft (.06”W.C. minimum).
- g. Ensure that no other appliances are connected to the Chimney.
- h. A “Cold” Chimney could force cooler exhaust gases back into the Boiler. Verify that the Chimney is properly installed and insulated.
- i. Check for possible Chimney “down draft” from taller surrounding trees, buildings or objects. It might be possible to correct with a Chimney cap.

### 8. Problem: Excessive Smoke or Flames Coming Out of Loading Door During Refueling

## Troubleshooting

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- a. Fully open the smoke damper rod prior to opening the fuel loading door.
- b. Open fuel door  $\frac{1}{2}$ ", then wait 30 seconds for draft to increase prior to fully opening the door (SLOWLY).
- c. Chimney could have insufficient draft:
  - Ensure that chimney draft is .06" w.c. or greater
  - Check the length of flue pipe to chimney. The appliance should be located within 6 feet of the chimney.
  - Ensure that the chimney cap is not too close to the top of the chimney, restricting air flow.
  - Clean chimney and chimney connector.
  - Raise chimney height to increase draft

# Troubleshooting

## Detailed Troubleshooting

Once you have exhausted the above common problems, if you are still experiencing trouble with your Royall Wood/Coal Boiler, you may wish to consult the following list of problems, or consult with your Royall dealer for further assistance.

Problem(s)	Cause(s) / Solution(s)
Fire won't start or starts but won't stay lit, or does not hold out overnight	<ul style="list-style-type: none"> <li>• Make sure all door are closed tightly and all gaskets are in good condition.</li> <li>• Ashes, if allowed to accumulate in the ash removal pan, will block the passage of combustion air. Verify that your ash removal pan is clean. Never allow ashes to build up to the level of the grates.</li> <li>• Your exhaust or combustion air systems may be blocked. Verify all vents and pipes are free from obstruction and the draft controls are operating correctly.</li> <li>• Check your chimney for downdraft caused by taller surrounding trees or building. The chimney may have to be extended or a chimney vent cap installed. Please contact your Royall dealer or heating contractor.</li> </ul>
Fire is weak, lazy, or dirty, or start up is slow or smoky	<ul style="list-style-type: none"> <li>• Your exhaust or combustion air systems may be blocked. Verify all vents and pipes are free from obstruction and the draft controls are operating correctly.</li> <li>• Your home may have a negative pressure. If your home is too airtight, the Royall heating appliance cannot get enough combustion air to burn properly. You may need to bring outside air to the Royall heating appliance. Please contact your Royall dealer or heating contractor.</li> <li>• Check your chimney for downdraft caused by taller surrounding tree or buildings. The chimney may have to be extended or a chimney vent cap installed. Please contact your Royall dealer or heating contractor.</li> </ul>
Poor combustion or difficulty maintaining a "pilot" fire	<ul style="list-style-type: none"> <li>• Check the quality of your fuel. Refer to the <i>Fuel Requirements</i> section.</li> <li>• Your home may have a negative pressure. If your home is too airtight, the Royall heating appliance cannot get enough combustion air to burn properly. You may need to bring outside air to the Royall heating appliance. Please contact your Royall dealer or heating contractor.</li> </ul>
Excessive Fire	<ul style="list-style-type: none"> <li>• The chimney draft may be excessive. Adjust the barometric damper to maintain flue draft settings from 0.04" to 0.06" of water column. Do not operate with a flue draft exceeding .06" (14.95 Pa) water column</li> </ul>
The Royall heating appliance is	<ul style="list-style-type: none"> <li>• Your Royall heating appliance may have been installed</li> </ul>



overheating or is burning without regard to the thermostat	<p>incorrectly. Please contact your Royall dealer or heating contractor.</p> <ul style="list-style-type: none"> <li>• The thermostat or thermostat wiring may be faulty. Please contact your Royall dealer or heating contractor.</li> <li>• Your “heat dump” zone may have been closed off. Verify that your “heat dump” zone is open and all heat delivery systems are operating correctly.</li> </ul>
Excessive Creosote	<ul style="list-style-type: none"> <li>• During warmer weather, you may need to adjust your firing practices. For maximum efficiency and minimum emissions, try shorter, hotter fires rather than large, slow-burning fires.</li> <li>• Your venting may be improperly installed. Verify that the Royall heating appliance is vented according to the instructions found in the <i>Installation</i> section. Please contact your Royall dealer or heating contractor.</li> </ul>
Smoke is visible or you smell fumes in your home	<ul style="list-style-type: none"> <li>• Make sure the fuel loading and ash removal doors are closed tightly and all gaskets are in good condition.</li> <li>• Your exhaust or combustion air systems may be blocked. Verify all vents and pipes are free from obstruction and the draft controls are operating correctly.</li> <li>• Your venting may be improperly installed. If the Royall heating appliance is smoking from vents or from the draft controls, immediately shut down the Royall heating appliance, ventilate the area, and contact your Royall dealer or heating contractor.</li> </ul>
Too much ash	<ul style="list-style-type: none"> <li>• Check the quality of your fuel. Refer to the <i>Fuel Requirements</i> section.</li> </ul>
Ash, soot, or fuel dust in the home	<ul style="list-style-type: none"> <li>• Verify all doors are closed tightly and all gaskets are in good condition.</li> <li>• Always be sure to handle ashes and fuel with care and open doors slowly.</li> <li>• Be sure to check the exhaust system for leaks and repair as necessary.</li> </ul>
Partially burned or unburned fuel in the combustion area	<ul style="list-style-type: none"> <li>• More air for proper combustion may be needed. Verify that your draft controls are working properly and that your exhaust and combustion air systems are clean and free from obstruction.</li> </ul>
The Royall heating appliance burns too much fuel, or the fuel burns off too quickly	<ul style="list-style-type: none"> <li>• The chimney draft may be excessive. Adjust the barometric damper to maintain flue draft settings from 0.04” to 0.06” of water column. Do not operate with a flue draft exceeding .06” (14.95 Pa) water column.</li> </ul>
The Royall heating appliance will not heat the whole house or doesn’t produce as much heat as when first installed	<ul style="list-style-type: none"> <li>• Verify that the venting and draft control system are clean and free from obstruction. Verify that all heat delivery systems are operating correctly.</li> </ul>
The water level is low	<ul style="list-style-type: none"> <li>• Excessive pressure in your Royall Wood/Coal Boiler may have triggered your Pressure Relief Valve. Allow the Boiler</li> </ul>

	<p>to cool and refill as necessary. <i>Never</i> fire a boiler that is low on water. <i>Never</i> add water to a hot boiler.</p> <ul style="list-style-type: none"> <li>• If your heating system features auto-fill, verify that the auto-fill does not raise the water pressure above 15 PSI, as this could trigger the Pressure Relief Valve when the water temperature rises.</li> <li>• Check for leaks in your Royall Wood/Coal Boiler and in your plumbing system.</li> </ul>
The Royall Wood/Coal Boiler requires frequent refilling	<ul style="list-style-type: none"> <li>• Your Pressure Relief Valve may be installed incorrectly, or may be faulty. Please contact your Royall dealer or heating contractor.</li> <li>• Check for leaks in your Royall Wood/Coal Boiler and in your plumbing system.</li> </ul>
The Royall heating appliance has power but is not responding	<ul style="list-style-type: none"> <li>• Check the power supply for adequate voltage. See the <i>Installation</i> section for power supply requirements.</li> <li>• Your Royall heating appliance, its electrical components, and/or thermostat may have been installed incorrectly. Please contact your Royall dealer or heating contractor.</li> </ul>
The user is shocked when touching the Royall heating appliance	<ul style="list-style-type: none"> <li>• Your Royall heating appliance may not have been properly grounded or may have loose wires or wiring components. Disconnect power to the Royall heating appliance at the breaker box or service panel and verify all connections. Please contact your Royall dealer or heating contractor.</li> <li>• Your Royall heating appliance may have experienced a power surge or power short. Please contact your Royall dealer or heating contractor.</li> </ul>

## Appendix A: Parts List

Part Number	Part Description
BOI50196	RB-ROCKER BAR 6130/6150/6200
BOI50644	WOOD GUARD
BOI50788	LATCH-G HOOK
BOI51169	RB-ROBKER BAR 6300NS/6300OD
BOI51170	RB-ROCKER BAR 6490NS/6490OD
BOI51265	RB-DAMPER PLATE ALL/EXCEPT 6490
BOI51366	RB-DAMPER PLATE 6490
BOI51267	RB-DAMPER ROD 6490
BOI51268	RB-DAMPER ROD 6300
BOI51269	RB-DAMPER ROD 6130/6150/6200
BOI51270	RB-SHAKER HANDLE ROD
BOI70927	RB-2.5" TEMPERATURE GAUGE
BOI71240	RB-AQUASTAT WELL
BOI71241	RB-AIR SEPERATOR B & G
BOI71242	RB-AIR SEPERATOR HONEYWELL
BOI71243	RB-AQUASTAT-HI LIMIT MAN/RESET
BOI71245	RB-AQUASTAT DUAL ZONE
BOI71246	RB-AQUASTAT SINGLE ZONE
BOI71247	RB-AQUASTAT (STRAP-ON) SINGLE ZONE
BOI71248	RB-BACK FLOW PREVENTER
BOI71249	RB-BLACK SILICONE SEALANT
BOI71250	RB-PUMP ISOLATION FLANGES
BOI71251	RB-FAN BLADE 12" FOR HANGING UNIT
BOI71252	RB-FAN BLADE 14" FOR 16" HU
BOI71253	RB-18" FAN BLADE-20/24" HANG UNIT
BOI71254	RB-FAN BLADE 20" FOR HANG UNIT
BOI71255	RB-BRACKET FOR CAPACITOR
BOI17256	RB-CAPACITOR FOR LARGE MOTOR
BOI71257	RB-MOTOR FOR LARGE HANGING UNIT
BOI71258	RB-MOTOR FOR SMALL HANGING UNIT
BOI71259	RB-UNFACED R19 INSULATION
BOI71260	RB-COMBO KEEPFULL/BACKFLOW PREVENTOR
BOI71261	RB-AUTOFILL VALVE
BOI71262	RB-RUBBER FLAP FOR POSITIVE SHUT-OFF
BOI71263	RB-PRESSURE RELIEF VALVE
BOI71264	RB-PRESSURE/TEMPERATURE GAUGE
BOI71265	RB-PRESSURE/TEMPERSURE GAUGE ALT.
BOI71266	RB CIRCULATION PUMP B&G NRF-22
BOI71267	RB-CURCULATION PUMP 1 SPEED
BOI71268	RB-CIRCULATION PUMP 3 SPEED
BOI71269	RB PUMP 3 SPEED HEAVY DUTY 1/6 HP
BOI71270	RB-ZONE PUMP
BOI71271	RB-WATER TREATMENT
BOI71272	RB-BOILER SEAL
BOI71273	RB-SHELTER LIGHT ASSEMBLY
BOI71274	RB-SHELTER SIDNG, LONG LENGTH
BOI71275	RB-SHELTER SIDING, MEDIUM LENGTH

BOI71276	RB-SOLENOID FOR POSITIVE SHUT-OFF
BOI71277	RB-HEAVY DUTY SOLENOID-H2O STOVE
BOI71278	RB-EXPANSION TANK 6130 & 6150
BOI71279	RB-EXPANSION TANK 6200/6300
BOI71280	RB-EXPANSION TANK 6200/6300
BOI71281	RB-EXPANSION TANK 6490
BOI80116	RB-POSITIVE SHUT-OFF ASSEMBLY ONLY
BOI80117	RB-75CFM W/ POSITIVE SHUT-OFF
BOI80118	RB-146CFM W/POSITIVE SHUT-OFF
BOI80119	RB-50CFM W/POSITIVE SHUT-OFF
EXCBOILER COIL	INDOOR BOILER COIL 2-1/2"

## Appendix B: Warranty Claim Provider

We make every effort to ensure that all **Royall** heating appliances and components adhere to our strict standards and safety. However, should you receive a product or component that doesn't function as intended, please follow the instructions below for making a warranty claim. We will replace or repair the part, as outlined in the applicable warranty, as soon as possible to keep your **Royall** heating appliance functioning safely and efficiently as intended.

Please register online at <http://www.Royallboilers.com/>

<u>Parts</u>	<u>Units</u>
To make a warranty claim on faulty parts provided with a Royall heating appliance, please contact your Royall dealer.	To make a warranty claim on a faulty Royall heating appliance, please contact your Royall dealer.
If your Royall dealer is unavailable:	If your Royall dealer is unavailable please contact us at 800-944-2516
1. Please complete a <i>Warranty Claim Form</i> and return it to us. All warranty claim requests <b>must</b> be made in writing; <b>verbal warranty claim requests will not be processed.</b>	When contacting Royall for a warranty claim on a faulty Royall heating appliance, please have the following information ready: <ul style="list-style-type: none"> <li>• Model number</li> <li>• Serial Number</li> <li>• Purchase Date</li> <li>• Purchaser Name, Address, and Telephone</li> </ul>
The following information is <b>required</b> when submitting a warranty claim: <ul style="list-style-type: none"> <li>• Model number</li> <li>• Serial Number</li> <li>• Purchase Date</li> <li>• Purchase Name, Address, and Telephone</li> </ul>	Additionally, if you have not mailed in your <i>Warranty Registration Card</i> , we will require a completed <i>Warranty Registration Card</i> to be returned to us along with dated proof of purchase (i.e. a copy of the receipt or invoice).
2. Additionally, if you have not mailed in your <i>Warranty Registration Card</i> to be returned to us along with dated proof of purchase (i.e. a copy of your receipt or invoice.) We may also request a copy of the Service & Maintenance Log located in the Appendix of your Owner's Manual. Without this information, we will not be able to complete your requested warranty claim.	We may also request a copy of the Service & Maintenance Log located in the Appendix of your Owner's Manual.  Without this information, we will not be able to complete your requested warranty claim.  All transportation charges are to be paid for by the purchaser.
Once we receive your completed <i>Warranty Claim Form</i> and <i>Warranty Registration Card</i> , we will ship a replacement for the faulty part(s). All transportation charges are to be paid for by the purchase. However, if a faulty part is to be returned to us, we will provide return-shipping via a call-tag.	

# Limited Warranty

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## LIMITED WARRANTY

### Who is covered?

You are covered under this warranty if you are the original purchaser of a new Royall solid-fuel heating appliance and your purchase was made through an authorized distributor/dealer of the Royall solid-fuel heating appliance.

### How long does the coverage last?

The term of this warranty begins on the date of original purchase as evidenced by your purchase receipt, subject to the terms, conditions and restrictions of this agreement. Coverage is extended to you for the following time periods:

- **Burn chamber.** The burn chamber is warranted for six (6) years on a prorated basis. The replacement value will decrease each year until the maximum life of the warranty exhausts any replacement value. Replacement value is reduced according to the following schedule and will be calculated on the cost of the burn chamber at the time the part is repaired or replaced. We will provide you with a credit to be applied towards the cost of the repair or replacement part.

Year 1	Full Warranty
Year 2	80% Credit
Year 3	60% Credit
Year 4	40% Credit
Year 5	25% Credit
Year 6	15% Credit

- **Castings.** The castings are warranted for one (1) year and include the fuel loading door, ash removal door, hearth plates, and grates.
- **Electrical Components.** The electrical components are warranted for one (1) year and include, but are not limited to, the draft damper control motor or combustion fan, and all components of the control box.

### What is covered by this warranty?

This warranty covers any defects in materials or workmanship in your new Royall solid-fuel heating appliance.

### What is not covered by this warranty?

This limited warranty does not apply:

- If your appliance has not been installed, operated and maintained in strict accordance with instructions provided in the Installation, Operation and Maintenance Manual.
- If any part has been damaged in shipment, modified, altered, tampered with, abused, or has been subject to accident or misuse.
- If your appliance has been altered or repaired in a manner which, in our sole judgment, affects its performance, stability or reliability.

- If parts not made or supplied by us have been used in connection with the appliance, if in our sole judgment, such use affects its performance, stability or reliability.
- To transportation charges on appliances and appliance parts submitted for repair or replacement under this warranty.
- To expendable, replaceable or wear items, such as firebrick, gaskets/seals, paint, handles and other items that in our judgment are expendable, replaceable or wear items.
- To any heating system or systems to which the appliance may be attached.
- To any of the smoke pipes, heat pipes, chimney, hardware, ducting, vents, or other accessories used for the installation and venting or ducting of the appliance.

We are not responsible for installation and will not be liable in any respect under the terms of the warranty for injury or damage to the building structure in which the appliance has been installed, or to the person or persons and property therein, arising out of the use, or installation of the Royall appliance. The appliance must be installed in compliance with the state, local national building and fire codes and regulations of the area and in strict adherence to the Manufacturer's recommendations.

**What will we do to correct problems?**

We will repair, or at our option, replace any Royall solid-fuel heating appliance or appliance part, which upon inspection shows a defect in materials or workmanship.

**How can you get service?**

If warranty service is needed during the warranty period, notify your authorized ENERGY KING dealer. If there is no Royall dealer in your area, contact Ark Alloy, LLC, directly. Provide your name, address, phone number, serial number and model number of the furnace, date of purchase, name and address of installer and a description of the problem.

**Disclaimer of Implied Warranties & Consequential Damages**

Our obligation under this limited warranty, to the extent allowed by law, is in lieu of all warranties, implied or expressed, including implied warranties of merchantability and fitness for a particular purpose and any liability for incidental and consequential damages with respect to the sale or use of the items warranted. Such incidental and consequential damages shall include but not be limited to: transportation / freight charges, cost of installation, duty, taxes, charges for service or adjustment, loss of income, rental or substitute equipment, and expenses due to loss, damage, detention or delay in the delivery of equipment or parts resulting from acts beyond our control.

Some states do not allow the exclusion or limitation of incidental or consequential damages, or limitation of implied warranties, so the limitations or exclusions in this limited warranty may not apply to you.

NO EMPLOYEE OR REPRESENTATIVE OF ARK ALLOY, LLC, IS AUTHORIZED TO CHANGE THIS LIMITED WARRANTY IN ANY WAY OR GRANT ANY OTHER WARRANTY UNLESS SUCH CHANGE IS MADE IN WRITING BY AN OFFICER OF ARK ALLOY, LLC, AT ITS HOME OFFICE.

#### **YOUR RESPONSIBILITY UNDER THE WARRANTY**

It is your responsibility to ensure that the appliance is installed in compliance with local, state and national building and fire codes regulating installation and inspection.

It is your responsibility to complete the warranty card and return it to the address indicated within 30 days of the purchase. You must also keep your receipt as proof of date of purchase. Failure to do so will mean that you may not later make a claim under this warranty.

It is your responsibility to read the Installation, Operation & Maintenance Manual and to install, operate and maintain the appliance in accordance with all instructions and safety procedures. Failure to do so is a misuse of the appliance.

It is your responsibility to inspect the appliance and to have any part(s) repaired or replaced when continued operation would cause damage or excessive wear to other parts or cause a safety hazard.

It is your responsibility for any cost incurred by the distributor/dealer for travel to transportation of the product for the purpose of performing a warranty obligation or inspection.