

Operating Manual Paxo® line of Orlan® boilers.

Wood gasification boilers from 18-80 kW (75-275k Btu)



ISO 9001



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WARNING!

Attention to safety is critical in all phases of boiler system design, installation, operation and maintenance.

1. Safety

During installation the boiler and some components may be heavy or sharp. During operation parts of the boiler and associated plumbing can be very hot which can cause burns or fires. The proper caution and methods need to be used while loading wood when the boiler is hot.

It is the responsibility of the installing technician to see that all controls are configured and operating properly when the boiler installation is completed.

2. Boiler's Usage

Paxo® wood gasification boilers are designed to operate in the 91% to 95% overall system efficiency range when properly installed and operated.

The boiler has been independently tested and has been certified to conform to ISO 9001, TUV, and CE. Testing and certification for (North American certifications) UL 391, ETL and CSA are in progress.

Orlan® boilers are efficient and environmentally friendly. Heating your home and domestic water heating can work together with other heating systems. With its high efficiency you will need less wood for the heating season. There is no visible smoke when fully operating. Clean burning results in little or no creosote buildup with minimal risk of a chimney fire.

Wood is the main fuel for the Paxo® boilers.

Wood used as a fuel should be at max 15-20% moisture content and length about 2 inches smaller than the loading chamber.

Some alternative fuel is acceptable:

- lignite as 10-15 cm diameter blocks
- wood cut into small pieces (shavings, furniture waste and so on) is acceptable as the mix for the main fuel at 50/50% mixture.

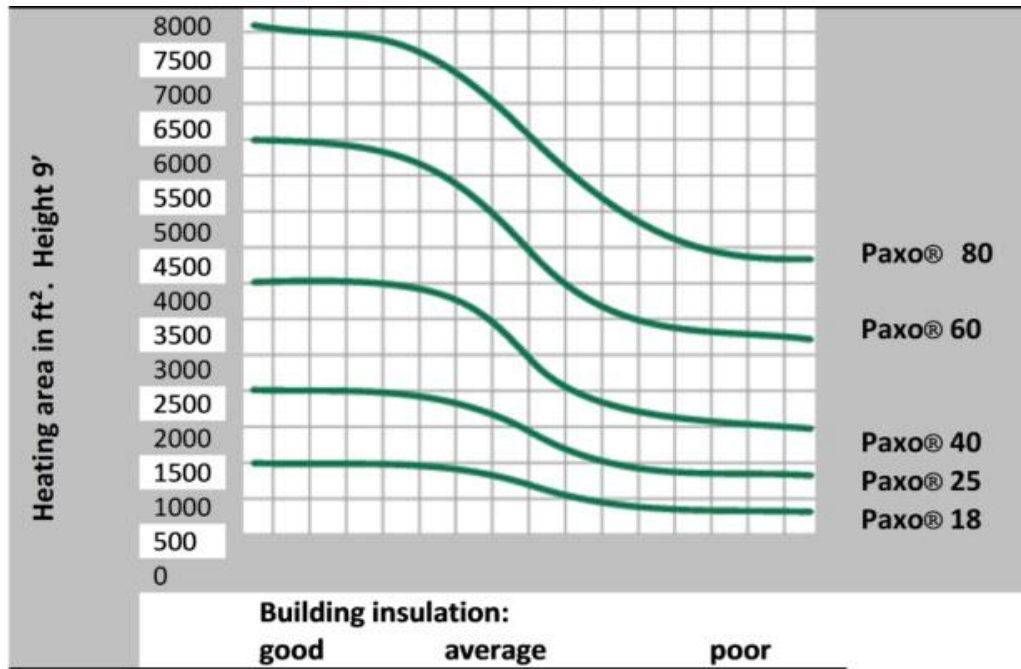


WARNING!

Use of fuel other than dry wood will result in unpredictable operation, poor efficiency and compromise the durability of the boiler. The manufacturer or/and Eco-Orlan USA LLC are not responsible for problems caused by using unapproved fuels.

3. System Design Considerations and Sizing of the Boiler

It is critical to size the Paxo® boiler properly. A proper up to date heat load calculation is strongly advised. An accurate history of the building's fuel usage over several years can help calculate the proper size boiler. Be wary of simple techniques based only on square footage. The heat load of a home can vary widely depending on the age, type of heating system, and geographical location of the home. The manufacturer provides published data for the unit; however, this cannot be your sole source of information either for sizing your system. The purchaser must use actual measurements made at the premises of where the unit will be installed and operating. Eco-Orlan USA LLC and all of its Authorized Dealers recommend consultation and sizing by a licensed professional trained in HVAC systems with proper licensing credentials appropriate for the State or Province in which the unit is to be installed. Final sizing of the unit is the sole responsibility of the purchaser.



4. Wood and the Gasification Process

Quality, moisture content and type of burned wood are very important. Hardwood is the best (beech, oak, hickory, maple etc.) The maximum moisture content of the wood used to fuel the boiler should be between 15% and 20%. Using dry softwood, such as pine, spruce etc. is possible but it will burn faster and require more frequent loading of the boiler than if hardwood is used.

Wood's moisture content can be determined with a moisture meter. As a general rule, hardwood stacked for one year under cover is usually ready for use as a fuel in the Paxo® boiler. Wood that has been properly stored for two years is the best.

Wood is a fuel which can be stocked and stored with no energy loss. Storing wood lowers its moisture and raises its heating value.

Wood is also the only combustion fuel that doesn't contribute carbon dioxide which means that during the growth and photosynthesis process it takes in the same quantity of carbon dioxide that it emits during the combustion process. Modern wood gasification boilers utilize wood's energy at efficiency three times higher than ordinary boilers and they operate similar to gas boilers. A Paxo® wood boiler is adapted for combustion of various sizes of wood granulation from sawdust to large pieces. Shavings, cuttings and slivers should be combusted with larger pieces of wood. Spring is usually the best time for buying wood (wood from winter tree clearance). During the heating season 1 cord of wood is generally needed for heating of 200 square feet.

5. Heat Storage Tank

Designed for Optimum performance of the Paxo® gasification boiler, we strongly recommend the use of hot water storage when operating your Paxo® gasification boiler. We recommend 50 liters or 13.23 Gallons of water storage per kilowatt as minimum size hot water storage. Properly installing a Heat Storage Tank can cut your wood consumption by as much as 40%. Hot water storage allows the boiler to run at ideal capacity regardless of the demand for heat from the building being heated. This enables you to continue to heat your home most efficiently throughout the warmer times of the year such as early spring and late fall. It also provides the flexibility to heat your domestic hot water in the summer season.

6. Gasification

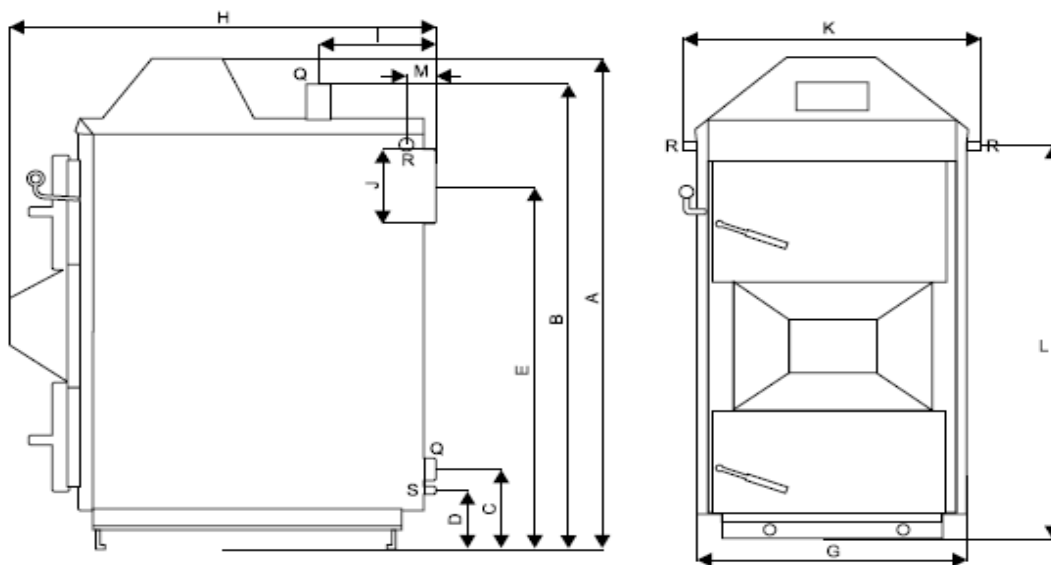
- wood burned in gasification boilers gives almost three times more heat than ordinary boilers or chimneys
- nearly zero balance of CO₂ because the amount of carbon dioxide in emissions is very close to the amount of the CO₂ gas consumed with the plants growth
- the content of the emissions from a wood gasification boiler is nearly the same as the emissions of gas boiler
- wood combustion at up to 2000°F (pyrolysis- dry wood distillation) greatly limits the amount of the harmful components in the emissions



Dry wood is burned in the (top) primary combustion chamber, where heat from the flame breaks the wood structure down into charcoal and then into combustible gas. This gas passes through the ceramic nozzle (or nozzles, depending on the model) at the bottom of the primary combustion chamber, where it is mixed with superheated air and burned cleanly at high temperatures (up to 2000°F) in the refractory-lined bottom chamber. This clean-burning flame produces little or no smoke. This hot gas then exits the boiler through the heat exchanger tubes and into the chimney.

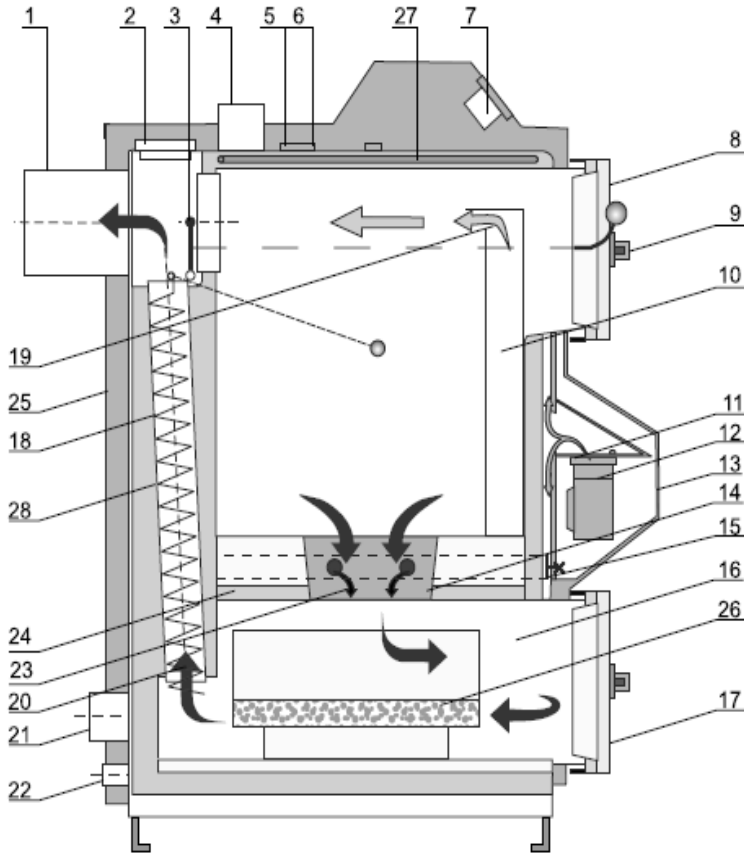
Gas which was 2000°F in the secondary chamber is typically only 300 to 400°F when it reaches the chimney, meaning that 1,600 to 1,700°F is being transferred into the hot water jacket through the heat exchanger tubes.

7. Technical Data



Parameters	units	Paxo® 18	Paxo® 25	Paxo® 40	Paxo® 60	Paxo® 80
Power range	Btu	75k	85k	137k	205k	275k
Power	kW	4-18	5-31	8-40	15-60	25-80
Efficiency	%	85	91	91	91	91
Weight	Lb	1020	1280	1390	2070	2712
Height	A inch	44	51.75	62	62	60.5
Height of heating water outlet	B inch	47.6	48.5	56	58	60
Height of heating water inlet (Flange)	C inch	8.5	8.3	6.0	7.9	7.9
Height of outlet valve	D inch	5.7	5.1	5.7	5.1	5.1
Height of chimney flue	E inch	34.3	37.4	50	45.7	45.7
Width including handle	F inch	24.8	29.25	29.25	35.25	35.25
Width including casing	G inch	24	27	27	32.5	32.5
Depth	H inch	37.8	41	40.75	51.5	65
Hot water outlet	I inch	13.4	12.6	12.6	24.0	24.0
Diameter of chimney flue	J inch	8.0	8.0	8.0	8.0	8.0
Width with coil	K inch	26	28.3	28.3	33.9	33.9
Height of coil connection	L inch	39	43.3	52.4	51.6	51.2
Coil outlet	M inch	10.2	5.9	10.2	14.4	12.4
Diameter of feeding and return ferrule	Q inch	2	2	2	2	2
Diameter of the coil ferrule	R inch	¾"	¾"	¾"	¾"	¾"
Diameter of the drain valve	S inch	0.5	0.5	0.5	0.5	0.5
Water capacity	Gal	14.5	20	25	47	54
Loading chamber capacity (gasification)	ft ³		4.1	6.5	10.9	16.4
Power consumption	W	50	50	50	100	100
Maximum length of logs	inch	20	20	20	25	39
Maximum log diameter	inch	7	7	7	7	7
Moisture content of wood:						
-recommended	%	15-25				
-acceptable	%	15-35				
Average flue gas temperature	°F	340				
Maximum working pressure	PSI	25				
Required chimney draught	Pa	15-20 Pa = .06-.08 inches of water				
Voltage/frequency	V/Hz	120V/60Hz				

8. Boiler's Construction



1. Chimney flue
2. Heat exchanger cleaning cover
3. Chimney flap
4. Hot water exit
5. Thermometer- sensor
6. Safe guard thermometer- sensor
7. Control panel
8. Upper door
9. Closing/opening door handle
10. Loading chamber (gasification)
11. Fan tap
12. Fan
13. Fan casing
14. Nozzle of refractory concrete
15. Secondary air adjustment
16. Combustion chamber
17. Bottom door
18. Smoke tube heat exchanger
19. Primary air flow
20. Flue gas exit
21. Heating water entry
22. Drain valve
23. Secondary air flow
24. Water grate
25. Thermal insulation
26. Ash pit

Additionally in Paxo® SUPER:

27. Thermal safety device (cooling coil)
28. Mechanical cleaning system of the smoke exchanger tubes.

9. Installation

Paxo® wood boilers are designed to conform to and be installed in accordance with the very strict European regulations. The requirements are known as norm PN 87/B 02411 and norm PN 91/B 02411.

When installed in the United States, all applicable local codes and regulations apply.

Boiler Type	unit	Paxo® 18	Paxo® 25	Paxo® 40	Paxo® 60	Paxo® 80
Chimney flue draught	Pa	15-20 Pa = .06-.08 inches of water				
Electric protection range		IP 40				
Maximum working pressure	PSI	25				
Average fumes temperature	°F	464	340			

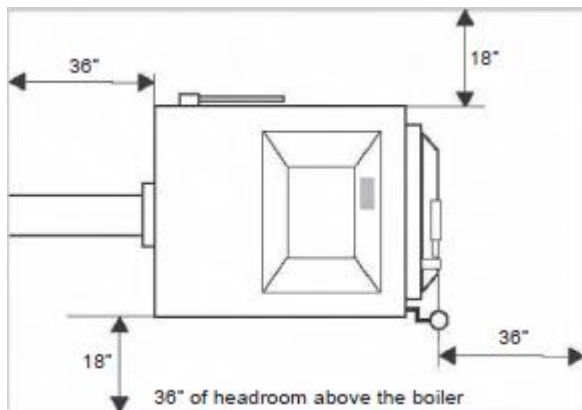
10. Location

The boiler must be located on a level concrete floor or on a similar non-flammable surface.

Wood gasification boilers are heavy. Make sure to consider the weight when planning the installation.

The boiler can be placed in a utility room, basement or outbuilding, along with wood storage. Putting the boiler in an outside location is recommended for easy access to wood storage.

Adequate space around the boiler is needed for installation, operation, cleaning and maintenance. Enough space is needed for loading the boiler and emptying the ash bin. The distance between the boiler and the surrounding walls should be sufficient to allow access to all of the boiler's parts. The boiler must be positioned to provide minimal clearances from combustibles and surfaces: left and right side = 18", top, rear and front = 36".



If the boiler is placed near inhabited rooms, so that the flue gas can easily penetrate into these rooms, a carbon monoxide alarm must be installed that can give a warning regarding possible escapes of carbon monoxide into the inhabited rooms.

As an additional precautionary measure the boiler must not be installed in an area, room or outbuilding where there are flammable liquids or combustibles. Examples include: refrigerants, paint thinner, bleach etc. It is also strongly recommended that a certified Fire Extinguisher is mounted in proximity to the boiler.

11. Chimney Specifications

The chimney or flue is one of the most critical factors in the successful operation of any solid fuel heater, including the Paxo® boiler.

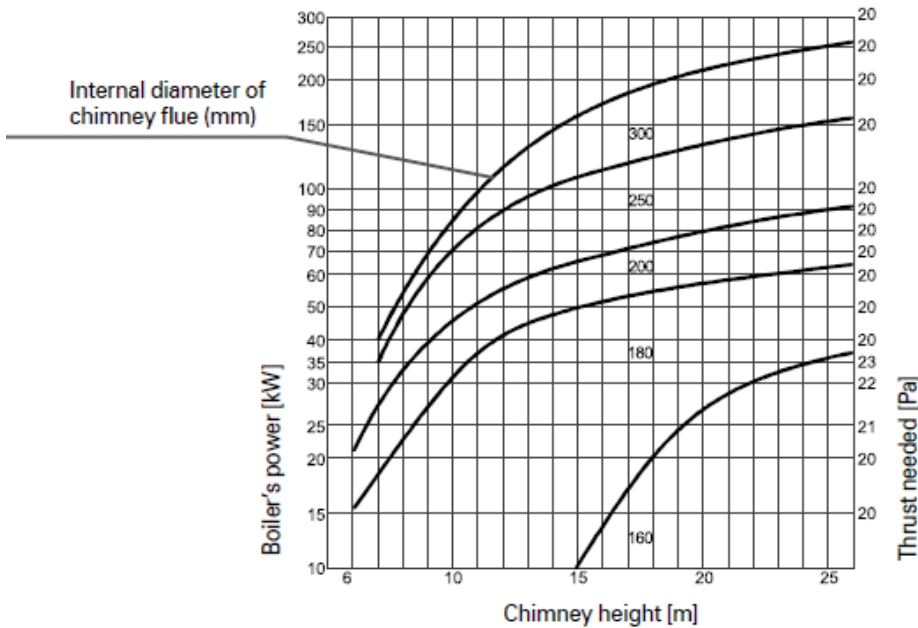
A good chimney will provide a continuous and dependable draft to pull the exhaust gases out of your boiler. The boiler must be connected to a tile-lined masonry flue or to a Type HT approved chimney. Minimum required flue size is 8"x8" with square tile or 8" diameter round tile or stainless steel. No other appliance should be connected to this flue. The boiler should be connected to the flue with the shortest, most direct run of black stove pipe. Maintain a minimum of 18" between the flue pipe and combustion surfaces.

Prior to operation, the installation should be inspected and approved by qualified professionals (for example; a chimney sweep, a licensed plumbing and heating technician, an electrician). The chimney and the connecting pipe need to be insulated for safety and to prevent condensation and a reduction in the draft caused when the gas in the chimney cools down too much. If there is still a problem with draft (too much or too little), you may need to consider draft inducing fans or draft regulators may need to be considered.

The chimney flue connected to the Paxo® boiler should conform to the specifications below.

1 inch = 2.54 mm

1 m = 3.28 ft



12. Combustion Air

The boiler requires fresh air for combustion. The air supply affects the quality of the burn as well as the strength of the chimney draft. If any fans are used in the room where the boiler is located, they should be installed not to create negative pressure, they should not be pulling air from the room. On the other hand, you do not want too much positive air pressure, as it can cause the boiler to burn out of control. You may need to pull outdoor combustion air into the room if there are back drafts, insufficient draft or improper combustion. That can be easily checked by opening a window or door to see if the problem goes away.

13. Boiler Set-Up

The boiler is shipped completely assembled and ready for installation and use. The boiler should be inspected inside and out for any defects or damage that may have occurred during shipping. After the boiler is placed in its permanent location and before the first firing, the refractory tunnel will need to be positioned directly under the nozzle or nozzles, so that the flame shoots directly down into the trough.

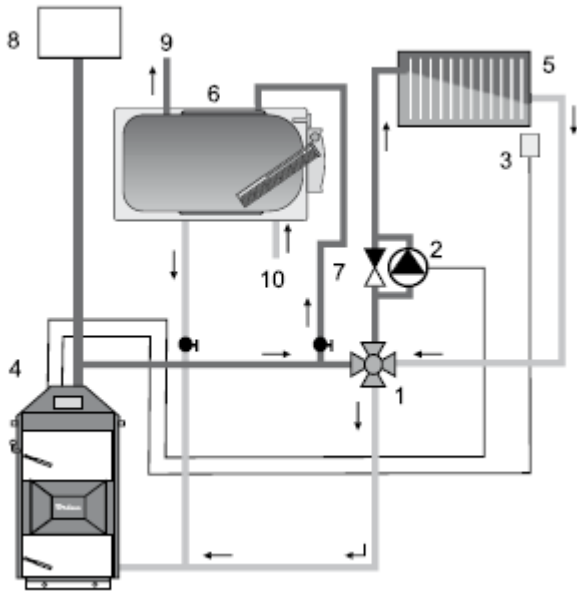
14. Piping

The direct connections to the boiler will be similar no matter which piping system you select. If you have specific questions please seek the advice of a hydronic heating professional.



WARNING!

Paxo® wood gasification boilers should be installed in accordance with local codes. The boiler should be part of a closed, pressurized system with a pressure relief valve, expansion tank and if possible, a hot water storage tank.



Scheme of the Paxo ® boiler, four-way mixing valve and water heater connected.

1. Four-way mixing valve
2. Circulating pump
3. Room thermostat
4. PAXO® BOILER
5. Radiator
6. OKCV water heater vessel
7. Differential valve
8. Pressure tank
9. Warm water outlet
10. Cold water entry

NOTICE!

Four-way mixing valve #1 should be set at 50% mixing.

15. Four-Way Mixing Valve



Mixing valves are mainly used for mixing function and boiler protection against low temperature corrosion as well as for heating of warm, operational water. The mixing function is needed when the temperature into the central heating system needs to be changed e.g. due to outside temperature changes (seasonal changes).

A four-way mixing valve is an essential component of any Paxo® boiler installation.

Four-way mixing valves can be used in gravity or pumped hydronic systems. The mixing function is based on mixing of hot water coming from the heat source (boiler) with cold water from the system depending on valve regulation arrangement. This function assures continuous regulation of the water temperature which helps for optimal fuel utilization.

The central heating system should be shut off during summer at the mixing valve to achieve fast and efficient water heating.

Four-way mixing valves are mainly used for reducing the boiler's usage cost by returning excess heat back to the boiler. They protect the boiler against low temperature corrosion by keeping a proper boiler temperature.

16. Filling the Boiler and Heating System

The recommended fluid for filling the Paxo® boiler and the system that the boiler is connected to is plain water. The easiest way to fill the boiler and the heating system is through a regulator connected to the home's domestic water supply. The regulator steps the pressure down to 12 psi, so the boiler can be filled at the appropriate pressure. This connection to the home water supply can be left open or closed with a manual valve after the system is filled. The advantages to leaving it open: any water lost is immediately made up and the system stays full of water at all times, including occasions when the pressure relief valve opens. The disadvantages to leaving the water connection open: tap water contains oxygen, which will corrode the boiler and other parts over time if enough oxygen is allowed into the system.

For freeze protection, use only non-toxic hydronic heating system antifreeze, available from plumbing and heating supply outlets and follow the directions. The use of automotive glycol is not recommended due to its toxic nature and can present a serious public health risk.



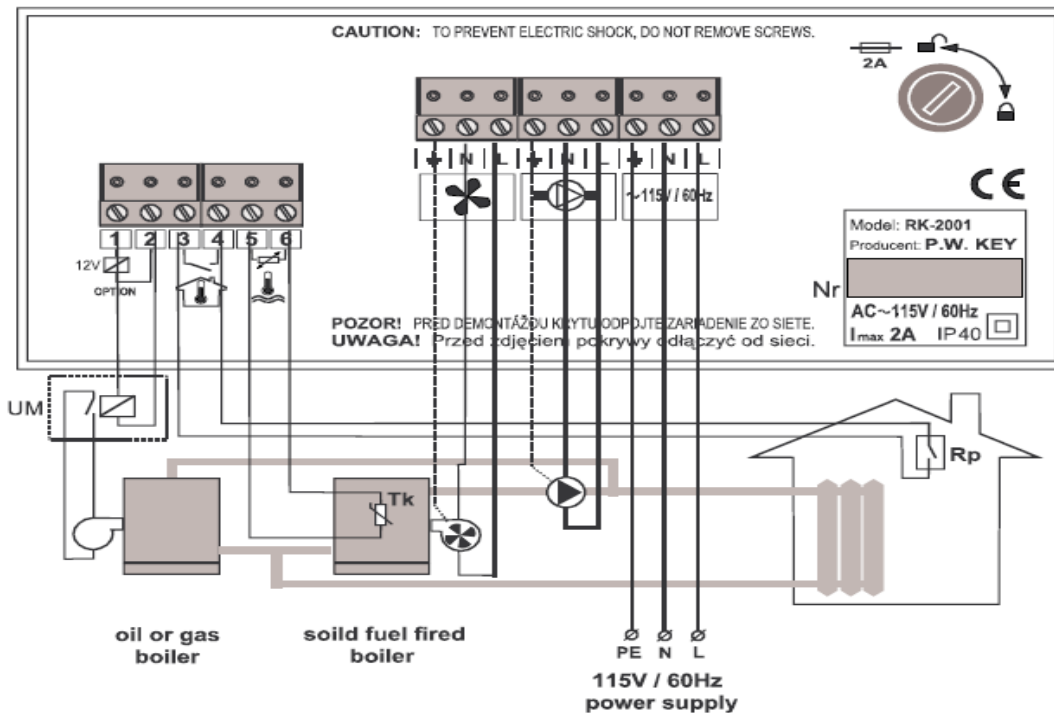
WARNING!

It is against code to use automotive glycol in hydronic heating systems connected to a public water supply.

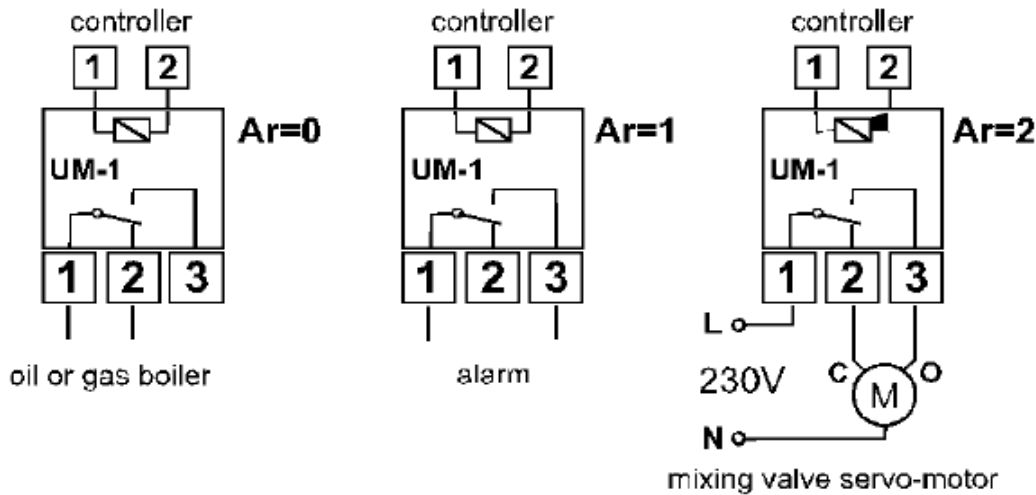
17. Wiring Schematic for the RK-2001UA Controller and the Module Connections

There are several electrical terminals on the back side of the RK-2001UA controller where a pump and room thermostat can be connected. Access is through the bottom of the controller housing which is attached to the top front boiler panel with four screws. There are numbers and graphic symbols indicating the function of the various electrical connections, switches and dials on the bottom of the controller, as shown in the diagram below.

RK-2001UA Connection Scheme



UM-1 Module Connection Scheme



18. Temperature Controller RK-2001UA



The temperature of the boiler is kept at the level set by the user, by controlling the speed of the pressure fan. The controller monitors the temperature of water in the boiler, and controls circulating pump. The controller is equipped with additional multipurpose output which allows connecting the mixing valve, the alarm signal or an additional gas or oil boiler.

Before turning on the device by master switch, connect controller, pressure fan and circulating pump power cords to appropriate sockets in the rear of the controller. Temperature sensor should be placed in measurement hole in the boiler.



WARNING! Before plugging the device to the power source check if it is properly grounded and if the screws of the connector are properly screwed.



CAUTION! The maximum total power of devices connected to the controller cannot exceed 450W.

After turning the controller **RK-2001UA** on, all the elements of the display are lit for a while to check if they are working properly. The controller returns to its last state before turning off or before the power loss.



- 1 - Master switch
- 2 - Display, indicating boiler's temperature and parameters
- 3 - Room thermostat indicator
- 4 - Boiler thermostat knob
- 5 - Circulating pump indicator
- 6 - STOP/choose parameters/erase alarms button
- 7 - START/choose parameters button
- 8 - Start programming in service mode/confirm settings button

Basic operation of the device is done by setting the desired temperature with the boiler's thermostat knob. Other functions are realized according to parameters programmed in the service mode. While changing the boiler's temperature settings with the knob, the change is displayed on the display for a few seconds (for example 180F°) and this value means the temperature, which the controller will be trying to achieve. After pressing the **START** button, the fan starts to work and the control process begins. **STOP** button stops the fan, for example allowing to add fuel to the boiler. If the controller isn't in service mode, the display shows water temperature of the boiler and the last sign on the display defines mode, which the controller currently is in: **[180-]** - STOP mode

[180F°] - WORK mode

[180r] - keeping fire in WORK mode

a) Setting up the parameters - service mode

Holding the OK button for more than 3 seconds causes change to the service mode, where you can view and change programmed parameters.

Service mode is indicated by flashing of the room thermostat indicator.

You can look through parameters with < and > arrow buttons. After choosing the desired parameter, you can switch to the change mode of the parameter by pressing the OK button - this mode is indicated by value of the parameter flashing.

Change of the parameter is possible by pressing - or + buttons.

You can confirm new settings with the OK button and after that you can choose another parameter (with <> buttons). If you want to quit the service mode, choose [End] option with < and > arrows buttons and press OK or wait 1 minute. The device will exit service mode and will start to indicate the boiler's temperature.

Service parameter's list

Display	Parameter	Min	Max	Step	Factory default
N100	fan power or max fan power when Nr 1	50	100	10%	100
N	% of fan ramp down				
Nh	degrees ramp down starts				
Nr 1	automatic fan speed control	- .0	10	1	1
Nn 5	fan work time	- .5	60	1s	5
Nu 6	fan pause time	1	99	1min	6
P144	circulating pump launch temperature	85	160	1°F	144
Ph 4	circulating pump launch hysteresis	2	20	1°F	4
Pc 2	pause time between circ. Pump 30 secs. work periods	- .1	99	1min	2
L150	min boiler temperature	85	150	5°F	150
H195	max boiler temperature	175	195	5°F	195
h 10	boiler temperature hysteresis	2	20	1°F	10
A210	boiler overheating temperature	195	210	1°F	210
Fd60	no-fuel testing time during fuel firing start	- .1	99-4h	1min	60
Fb30	no-fuel testing time during work mode	- .1	99-4h	1min	30
Ar 0	additional output: 0-FUEL, 1-ALARM, 2-MIX	0	2	1	0
Prod	return to factory settings after pressing OK				
outP	test of circ. Pump output (press OK to launch the test)	outP	out1		
outN	test of fan output (press OK to launch the test)	outN	out2		
outr	test of additional output (press OK to launch the test)	outr	out3		
End	quit service mode after pressing OK				

In the table above, the first column represents example display indications, in the next columns you have: parameter description, minimal amount, maximum amount allowed to set, step of the parameter during the setup, factory defaults, to which you can return by choosing the [Prod] option.

b) Pressure fan work parameters

Fan power [**Π100**] - this value defines power of the fan. When "Πr" parameter is set to "**0-10**" this is the maximum power of the fan which can be achieved during the automatic fan control.

Automatic fan speed control [**Πr 1**] – it's on, when this parameter is set to

"**0-10**" and causes automatic fan speed reduction when the temperature of water in the boiler reaches the desired temperature. If this parameter is set to "-", the fan automatic smooth speed control is disabled and the fan can work with power set by "Π" parameter. Setting parameter value in range from 0 to 10 means time in minutes of the smooth fan speed increase from 40% to a value of "Π" for a smooth boiler start.

Fan work time [**Πn 5**] - time of turning the fan on for a while, to remove accumulated gases. Setting the parameter to "-" turns this function off.

c) Circulating pump parameters

Circulating pump launch temperature [**P144**] - temperature of water in the boiler, which causes start of the circulating pump.

Circulating pump works independently from the control process and is launched additionally in case of boiler overheat.

Circulating pump launch hysteresis [**Ph 4**] - this parameter defines what value should temperature decrease by, below circulating pump launch temperature, to turn the pump off.

Pause time between circulating pump 30 second work periods [**Pc 2**] - in

STOP mode or when room thermostat circuit is open; the circulating pump is launched for 30 seconds, to mix water in heating circulation. This parameter defines time between launches of the pump.

Setting the parameter to "-" turns this function off.

d) Boiler's work temperature setting

Minimal boiler temperature [L150]

Maximum boiler's temperature [H195]

Boiler temperature hysteresis [h 10] - this parameter defines what value should the temperature of water in the boiler decrease by, below temperature set with the thermostat knob, to turn the pressure fan on.

e) Boiler's overheating protection

Boiler overheating temperature [A210] – exceeding this value causes permanent turn off of the pressure fan and launch of the circulating pump, to prevent boiler overheating. Overheating mode is indicated by boiler overheating indicator and by displaying error [E 2] on the display.

It can be turned off by pressing the **STOP** button, but only when temperature decreases below boiler's overheating temperature. Pressure fan turns off also in case of damage of the boiler's temperature sensor, which is displayed on the display by error [E 1].

STB - the controller also has additional protection from overheating, which is independent from the processor. In case of a temperature increase over

200°F, the control process is turned off by turning the fan off and launching the circulating pump. The fan and the pump are joined to the control process again, when temperature reaches 190°F.

f) No fuel

No-fuel testing time during fuel firing start [Fd60] - after switching to the **WORK** mode, if water temperature doesn't reach temperature set with the thermostat in programmed time, the control process will be turned off and the display will show the message: [FUEL].

You can return to the previous mode by pressing the **STOP** button.

No-fuel testing time during work mode [Fb30] - in **WORK** mode, if temperature of water in the boiler decreases below temperature set with the thermostat, by hysteresis value, and don't reach temperature set with the thermostat in programmed time, the control process will be turned off and the display will show the message: [FUEL].

You can cancel the alarm by pressing **STOP** button.

Additional output work mode [Ar 0] - the controller has been equipped with a multipurpose output that can work in one of the following modes:

- * mode [Ar 0] - output may control the oil or gas boiler if such boiler exists in the heating circuit. After switching the controller on with the main power switch the additional boiler is turned off and it turns on again when there is no fuel in the solid fuel boiler. This function is useful in heating systems where a solid fuel boiler is used to cut the heating costs. After erasing the no fuel alarm by pressing **STOP** button the additional boiler is again turned off and the controller works again
- * mode [Ar 1] - output may control the additional alarm signaling system. Boiler temperature sensor malfunction, overheating and no fuel alarms will turn on the alarm
- * mode [Ar 2] - output may control the mixing valve servo-motor. Controlling the mixing valve requires a room thermostat to be present. The mixing valve opens and closes depending on the room thermostat input. Additionally, the mixing valve is opened in case of overheating or boiler's temperature sensor malfunction.



In case of not having a room thermostat in the system, the room thermostat input contacts must be short-circuited.

g) Device failures

The controller is constantly testing if its internal circuits and temperature sensor are working correctly. After detection of a fault, it stops the pressure fan, turns on the circulating pump and shows the proper error message on the display. In case of failure please turn off the controller, plug the circulating pump to the power source, bypassing the controller, ensure appropriate fuel firing in the boiler and contact the service technician.

When [E 1] error appears on the display, it means fault (short-circuit) in the boiler sensor circuit or temperature below 32°F.

[E 2] is displayed if boiler overheats.

[E 3] error means fault and overheating at the same time. Appearing of [E 1] error on the display without ability to cancel it by pressing **STOP** button, in spite of temperature below 190°F, may mean permanent damage of the boiler's temperature sensor (e.g. if the boiler overheated above 300°F).

h) Device removal

If the controller needs to be removed from the system:

- turn the master switch off
- disconnect the power from the boiler
- remove the controller from the slot in the boiler
- disconnect all connectors with cords from the controller

i) Specifications

Voltage: 115V ± 10% / 60Hz

Power consumption: <4VA

Temperature measurement range: 32 - 210°F ±2°F

Boiler temperature adjustment range: 85 - 195°F ±2°F

Programmable boiler overheating protection: 195 - 210°F ±2°F

Hardware boiler overheating protection: >200°F ±2°F

Circulating pump launch temperature: 85 - 160°F ±2°F

Fan out: total max 2A/115V

Dimensions: 80 x 170 x 100 mm

Producer: P.W. KEY www.pwkey.com

19. Starting and Operating the Boiler for the First Time

Before firing up the boiler for the first time, the installation should be inspected and approved by a qualified plumbing or heating technician. The system should be full of water and vented. All other settings checked and tested, especially the pressure relief valve.

When starting the boiler from a cold start, the following steps should be followed in sequence:

1. Switch off the controller power.
2. Push the bypass damper lever forward to open the burning chamber bypass.
3. Put paper, very dry kindling and a few larger pieces of dry wood into the burning chamber.
4. Start the fire.
5. Open the bottom combustion chamber door to provide a natural draft.
6. Let the fire burn for 10-15 minutes



WARNING! NEVER leave the boiler unattended in this state.

7. Add more wood.
8. Wait another 15 to 20 minutes for a charcoal layer to accumulate.
9. Close both upper and lower doors.
10. Pull the bypass damper closed (toward you) and switch on the controller power.
11. Ensure that gasification is occurring. (see explanation below ~)
12. Repeat steps 1 and 2.
13. Fill up the entire upper combustion chamber with wood.
14. Repeat steps 9 and 10

A properly sized and installed Paxo® gasification boiler should require loading every 8-12 hours, depending on the heat load and fuel being burned.

It is important to avoid obstructing the chimney bypass damper with wood in the combustion chamber when loading fuel. Ideally, reloading should occur when the fire has burned down to embers.



WARNING! Never turn on the controller power when the upper door is open. Never force the fuel loading door closed. Doing so may damage the door or other parts of the boiler.

~Gasification should begin at this point, although it may take a few minutes of operation to become fully engaged. Gasification is occurring when you hear a soft rumble above the sound of the blower, and little or no smoke is being produced from the chimney. Flame (and no smoke) is visible coming from the nozzle when you open the gasification (bottom) chamber door. Blue smoke coming from the chimney after gasification is initiated indicates wood that is either too wet or a nozzle that is not covered with coals. If you know the wood is dry and you're seeing blue smoke, turn off the fan, open the bypass damper, open the fuel loading door and move the wood around with the poker to better position the coals over the nozzle/nozzles.



WARNING!
The yellow "no fuel" light indicates when the boiler needs to be reloaded.

20. Boiler Shutdown

The boiler turns off in two ways: manually when the power switch on the controller is turned off, or automatically when the wood supply has burned out. NEVER turn the controller off for extended periods of time when the boiler contains burning fuel. Doing so could cause the boiler to overheat. If you want to shut down the boiler, set the controller set point to minimum and let the fuel burn out.

21. Operating Temperature

Maintaining the proper temperature of the water in the boiler during operation is very important. For proper gasification to occur, the boiler water temperature should be 140°F or greater.

At times, such as when there is a large need for heat, the return water temperature may become too low. This can result in poor gasification and decreased efficiency, as well as creosote buildup in the gasification chamber, heat exchanger tubes and chimney. Low temperature return water entering the boiler can also shorten the life of the boiler. The return water temperature should not be allowed to drop below 140°F. This can be achieved with a properly installed 3-way or 4-way mixing valve.

22. Primary, Secondary and Blower Air Inlet Settings

A critical phase of successful set up of a Paxo® boiler for operation involves setting three air supply openings:

1. Primary Air Setting
2. Secondary Air Setting
3. Blower Air Inlet Setting

Charts below will help you determine how to set each one, depending on the model of your boiler and the variables affecting its operation like wood moisture content and chimney draft.

Paxo ® boiler Air Adjustment Guide

Model/ Btu output	Primary air opening (mm)									
	Chimney draft 0.04 IWC					Chimney draft 0.08 IWC				
	Wood Moisture %					Wood Moisture %				
	15	20	25	30	35	15	20	25	30	35
Paxo® 18 75,000 Btu	9	9	10	11	12	9	9	9	10	11
Paxo® 25 85,000 Btu	9	9	10	11	12	9	9	9	10	11
Paxo® 40 137,000 Btu	9	10	10	11	12	9	9	10	10	11
Paxo® 60 205,000 Btu	9	9	10	11	12	9	9	9	10	11
Paxo® 80 275,000 Btu	9	9	10	11	12	9	9	9	10	11

Model/ Btu output	Number of turns for secondary air									
	Chimney draft 0.04 IWC					Chimney draft 0.08 IWC				
	Wood Moisture %					Wood Moisture %				
	15	20	25	30	35	15	20	25	30	35
Paxo® 18 75,000 Btu	3	3	3	3.5	4	3	3	3	3	3.5
Paxo® 25 85,000 Btu	3	3	3.5	3.5	4	3	3	3	3.5	4
Paxo® 40 137,000 Btu	3	3	3.5	4	4	3	3	3.5	3.5	4
Paxo® 60 205,000 Btu	3	3	3.5	4	4	3	3	3	3.5	4
Paxo® 80 275,000 Btu	3	3	3.5	4	4	3	3	3.5	3.5	4

Model/ Btu output	% of air blower opening									
	Chimney draft 0.04 IWC					Chimney draft 0.08 IWC				
	Wood Moisture %					Wood Moisture %				
	15	20	25	30	35	15	20	25	30	35
Paxo® 18 75,000 Btu	30	30	30	30	40	30	30	30	30	30
Paxo® 25 85,000 Btu	50	50	50	60	70	50	50	50	50	60
Paxo® 40 137,000 Btu	100	100	100	100	100	100	100	100	100	100
Paxo® 60 205,000 Btu	50	50	60	70	80	50	50	50	60	70
Paxo® 80 275,000 Btu	100	100	100	100	100	100	100	100	100	100

23. Air Controls Functions

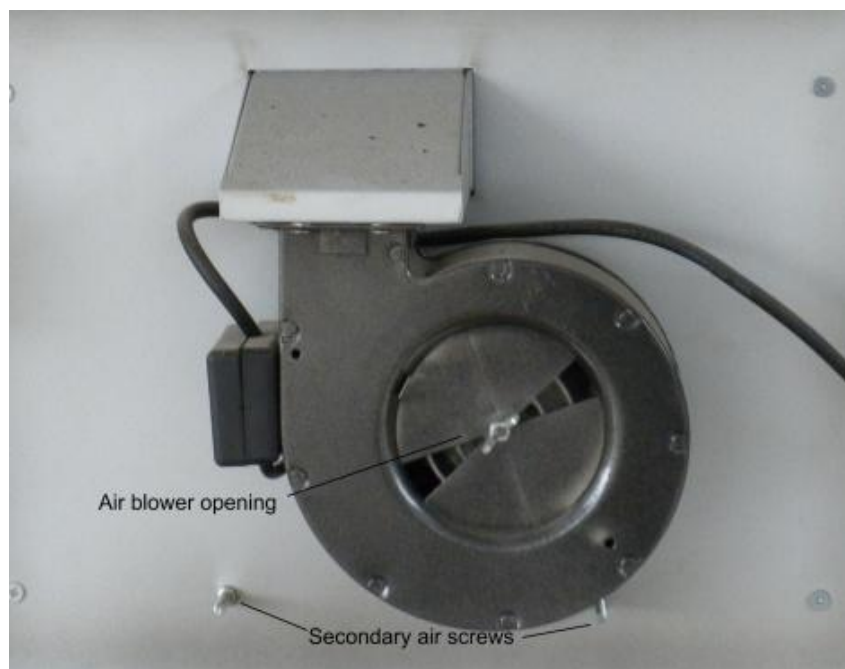
The sliders on the blower/blowers depending on the model, determine how much air is available to both primary and secondary combustion chambers. These openings are the sole source of air for all combustion in the Paxo® boiler.

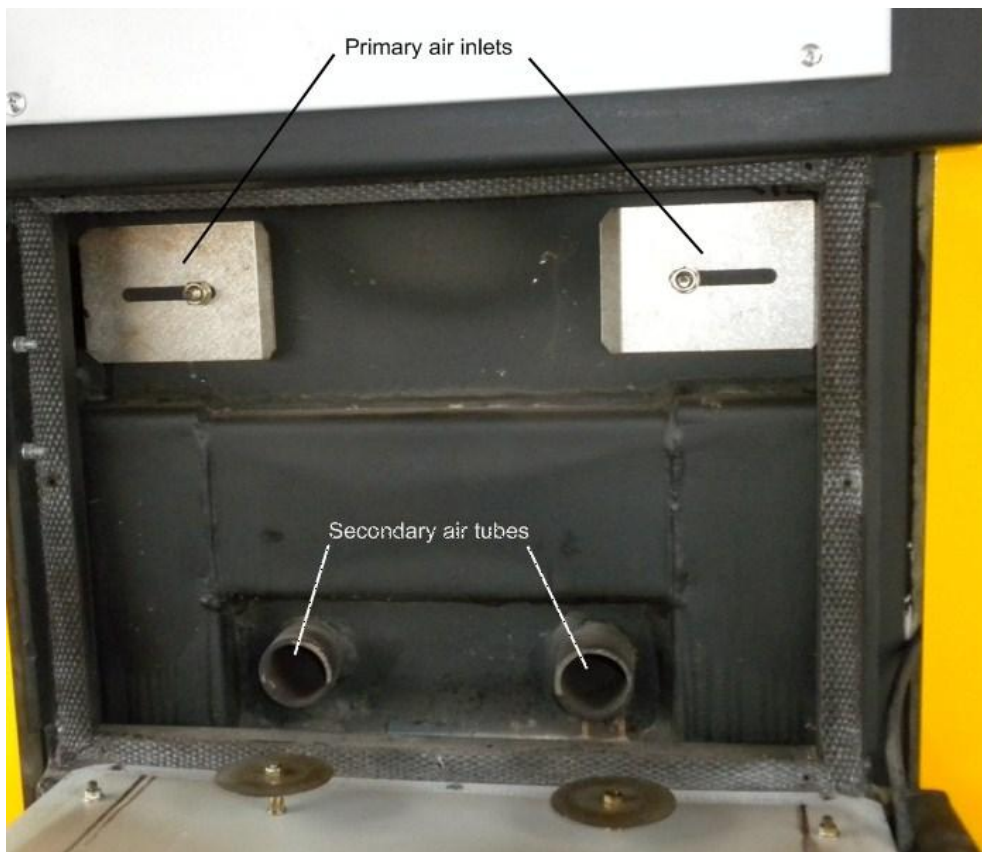
The primary air inlets determine how much air is available in the primary (upper) combustion chamber, where the fuel undergoes pyrolysis.

The secondary air inlets regulate how much air goes into the steel tubes, where it is superheated before being used by the nozzle/nozzles to achieve secondary gasification.

Proper air adjustment is critical to achieve the most efficient boiler's performance. If dry wood is used for burning and it is positioned properly over the nozzle, but there is smoke coming out of the chimney, usually it indicates that not enough air is reaching the secondary air tubes.

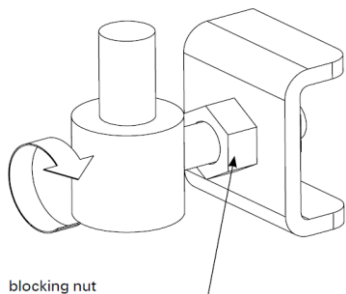
The steel plate upon which the fan or fans is mounted can be removed with 12 sheet metal screws to gain access to the primary air inlet sliders. When placing the steel plate back, make sure to apply even pressure to all the screws to form a consistent seal. Without a consistent seal, smoke will leak around the gasket and into the boiler room.





24. Maintaining Tight Seals

It is very important to maintain tight seals on the doors, heat exchanger cover plate and the firebox bypass chimney damper. Poor seals can result in smoke and gases leaking out of the boiler and lead to uncontrolled burning which may cause the boiler to overheat. The fiberglass rope used to seal both doors and the heat exchanger cover should be inspected regularly and treated with graphite or some other lubricant like motor oil or WD-40 as needed, to keep them flexible. Over time the rope seals on the doors can become flattened through normal use. When this occurs, the door hinges can be adjusted to compensate for the new shape of the sealing rope. To do that, remove the door, loosen the cap, turn the hinge 360°, and tighten the blocking nut to block the hinge retaining screw. The upper and lower hinges should be adjusted at the same time.



25. Off Season Preparation

Acids produced during the wood burning process can form when exposed to moisture inside the firebox, heat exchanger tubes and secondary combustion chamber. It is important that the boiler be properly prepared for the off season (summer) idle period. The upper and lower combustion chambers, heat exchanger tubes and chimney bypass damper should all be thoroughly cleaned of creosote, soot and ash. After the boiler is cleaned, both doors should be left open to avoid condensation.



WARNING!

Chimney inspection and maintenance is a critical part of any wood burning maintenance schedule. Inspect it at least once annually - preferably at the start of heating season. Clean as needed.

26. Disposal and Recycling of Boiler Components

Paxo® boilers contain steel, electronic components, insulation and other materials that may be subject to local, state or federal regulations as to their proper disposal. When retiring your boiler from service, make sure that all applicable laws, rules and regulations are observed. When in doubt, check with your local regulating authority for scrapping and disposal guidelines.

27. Troubleshooting Table

Problem	Probable Cause	Suggested Solution
Smoke comes out of the cleaning cover	Leak on a seal rope	Repair/replace rope or call service - not covered by warranty
	Seal rope worn	Rope's replacement - not covered by warranty
	Cover warped – overheating	Replace cover - not covered by warranty
Smoke comes out while loading (a little smoke is acceptable)	Strong wind blows the smoke back into the chimney	Consider installing a special chimney cap – not covered by warranty
	Inadequate chimney	Consult a chimney maintenance professional
Smoke comes out of the loading door when closed	Leak on a seal rope	Adjust the door hinge
	Seal rope worn	Replace rope or call service – not covered by warranty
Boiler doesn't reach the temperature needed	Wood too moist	Use properly seasoned wood
	Primary or secondary air conduit choked	Call service – not covered by warranty
	Wrong regulation of the air and wood gas	Call service – not covered by warranty
	Nozzle damaged	Replacement part – not covered by warranty
	Fan's gasket damaged	Replacement part – not covered by warranty
Regulator doesn't work	Fan damaged	Replacement part – not covered by warranty
	No power	Check the wiring and circuit breakers
	Fuse damaged	Replace fuse – not covered by warranty
	Live wire conduit damaged	Inspect and repair wire
Blower fan doesn't work	Regulator or temperature sensor damaged	Call service
	Thermal protection engages	Investigate reasons for boiler overheating
	No power in regulator	Check fuse and wiring
	Fan/ regulator damaged	Call service
Blower fan makes noise	Fan blocked	Inspect and clean the fan
	Bearings damaged	Call service – fan replacement
	Condenser damaged	
	Fan clips loosened	Check, tighten the clips
Blower fan works poorly	Fan blades dirty	Clean and check
	Debris in fan cover	
	Dirty fan blades	Clean and check
Explosion or puffing in the firebox	Creosote on the fan cover	
	Chimney draft too low (below 0.40"wc)	Rebuild chimney. Consider use of WKO exhaust fan
	Chimney draft too intensive (over 0.80"wc)	Use exhaust regulator
	Wood too small and too dry	Mix with larger fuel to increase moisture content - should be between 15-35%
	Clogged heat exchanger tubes	Clean the exchanger or call service – not covered by warranty