



Owner's Manual

Wood gasification boilers from 18-80 kW (85-275 kBtu)



Orlan®

ISO 9001



Contents

1.	Using the boiler	3
2.	Understanding wood gasification	3
3.	Installation guidelines and clearances	4
	3.1. Clearance diagram	4
	3.2. Chimney specifications	5
4.	Controller specifications and features	5
	4.1. Technical data for the RK 2001 controller	5
	4.2. How the controller works	6
	4.3. Connecting a pump or room thermostat to the RK2001 controller	7
5.	Technical data for the EKO boiler line	8
6.	Connecting and operating the EKO boiler	9
	6.1. Installation guidelines	9
	6.2. Conditions for successful wood gasification	9
	6.3. Wood fuel considerations	10
	6.4. Hot water storage	11
	6.5. Starting and operating the boiler for the first time	11
	6.6. Fuel loading	12
	6.7. Boiler shutdown	12
	6.8. Operating temperature	13
	6.9. Protecting the boiler during a pump or power failure	13
7.	Boiler maintenance	14
	7.1. Offseason preparation	14
	7.2. Maintaining the fan	14
	7.3. Routine cleaning	14
	7.4. Maintaining tight seals	15
	7.5. Standard cleaning tools	15
	7.5. Cleaning the EKO Super 1 model	16
8.	Troubleshooting guide	16
9.	Disposal and recycling of boiler components	17

1. Using the Boiler

Dry, seasoned wood is the recommended main fuel source for the EKO boiler. Optimum wood moisture should be between 20 and 25 percent. The length of the wood pieces should be about two inches shorter than the depth of the burning chamber.



Warning!

Using fuel types other than the dry wood specified above may result in unpredictable operation and poor efficiency. Neither the manufacturer nor New Horizon Corp. are responsible for problems resulting from the use of unapproved fuels.



Warning!

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



Warning!

The main circulating pump on the system should be connected directly to the RK 2001 controller to assure proper operation and water circulation. This will help prevent overheating and result in the best performance.

2. Understanding Wood Gasification

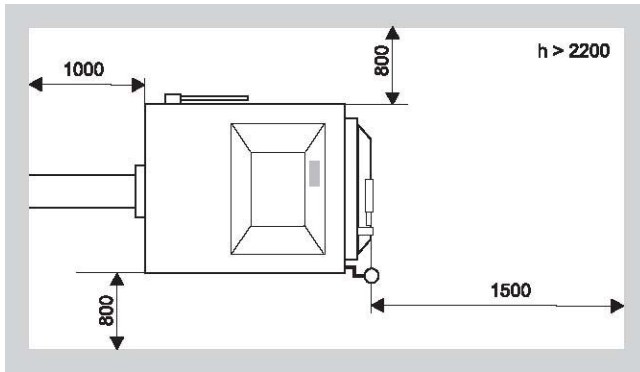
Wood gasification boilers work by the pyrolytic wood distillation process, whereby heat is used to break down the wood structure into charcoal and eventually, into combustible gas. This is done by limiting the air intake during the initial combustion process. When the resulting wood gas passes through the ceramic nozzle at the bottom of the top combustion chamber, it is mixed with air and burned cleanly at high temperatures (up to 2,000 degrees, Fahrenheit) in the bottom chamber. A hot, clean-burning flame is produced, with little or no smoke. This hot gas exits the boiler through the heat exchanger tubes and into the chimney. If burning pellets or other wood particles of the proper moisture content, be sure to place this material on top of larger pieces of wood to avoid clogging the ceramic nozzle.

3. Installation Guidelines and Clearances

Orlan EKO boilers are designed to conform to, and be installed in accordance with, the stringent European regulations known as PN 87/B 02411 and PN-91/B-02413. When installed in the United States, all applicable local codes and regulations should be observed. **Note:** New Horizon recommends the use of a triple insulated, Class A stainless steel chimney. The company does not take responsibility for installations utilizing any other type of chimney.

1. The chimney flue connected to the EKO boiler should conform to the specifications indicated by the chart on page 5.
2. The boiler room should be large enough to allow the boiler to be cleaned and maintained (>2.2 m).
3. The distance between the boiler and the surrounding walls should be sufficient to allow access to all of the boiler's parts, as specified in the clearance diagram below.
4. The boiler room should not contain any wiring or electric components not required for the operation of the boiler.

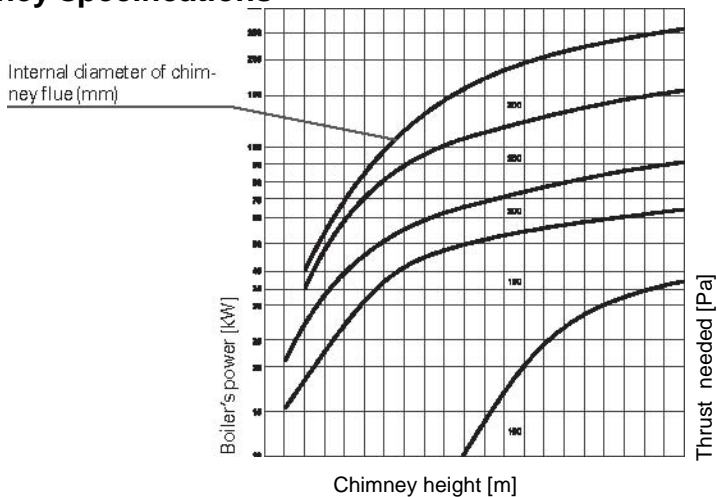
3.1. Clearance diagram



Prior to operation, the installation should be inspected and approved by qualified professionals (i.e., a chimney sweep, a licensed plumbing & heating contractor, electrician, etc.).

The installation of a hot water storage tank is recommended.

3.2. Chimney specifications

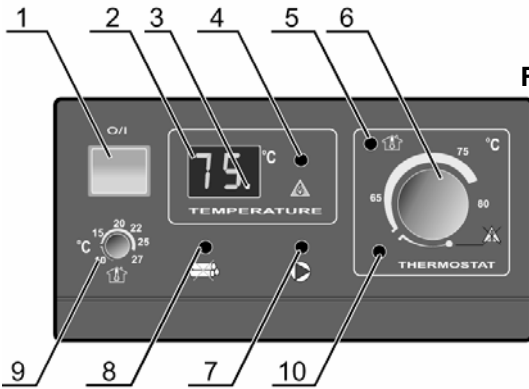


4. Controller Specifications and Features

Since 2006, all Orlan EKO wood gasification boilers have been equipped with the RK 2001 controller.

4.1. Technical data for the RK 2001 controller

Power	230V +/- 10%
Rate supply voltage (with no fan)	< 4VA
Temperature measurement range	0 do 99 +/- 1 °C
Temperature measurement sensors	KTY 81 210
Temperature regulation range	60 - 80 °C
Electrical protection (fuse)	1A/220V



Front panel of the RK 2001 controller

1. Power ON/OFF
2. Boiler water temperature
3. Gasification status
4. Overheat indicator
5. Room thermostat indicator
6. Boiler thermostat knob
7. Pump status indicator
8. Fuel level indicator
9. Room thermostat knob
10. Boiler temperature setting test

4.2. How the controller works

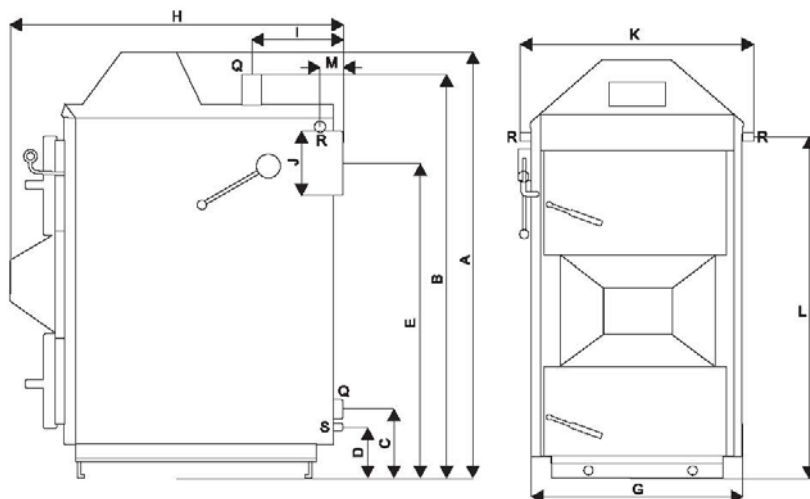
Boiler's temperature setting from 60 up to 80°C	The desired boiler temperature is set with a knob (6). Current temperature is displayed on the screen (2).
Boiler overheat indicator	The LED (4) indicates when the boiler temperature exceeds 90°C. This causes the fan to switch off
Low fuel indicator	If the boiler temperature doesn't reach 60°C after 30 minutes, the indicator (8) and the fan will turn on.
Fuel shortage indicator	If the boiler doesn't reach 60°C during burning (up to 2 hours), the indicator (8) will light up and the fan will turn off.
Fan status	A regulator modulates the fan speed, slowing the fan as the boiler approaches the target temperature.
Pump status	If a pump is connected to the regulator, the pump will remain off until the boiler temperature reaches 65°C. It will then run until the temperature declines to 60 degrees.
Room temperature control	The controller can work together with a room thermostat so that the boiler maintains the temperature desired in the room. If there is a room sensor or thermostat connected to the controller, then the boiler will remain in surveillance stage (maintaining a boiler temperature between 60 and 65°C).
"Flushing" during idle	The controller can be set to blow purge air into the upper burning chamber to get rid of accumulated wood gas when the boiler has reached its set temperature and is in idle mode. This keeps the fire from going out. The purging time is five seconds. The timing interval between "flushes" can be set between 1 and 9 minutes. Note: Flushing settings should be made by a qualified technician.

4.3. Connecting a pump and room thermostat to the controller

There are several electrical terminals on the back side of the RK 2001 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 various electrical connections, switches and dials on the bottom of the controller. It is always a good idea to check with your EKO dealer or distributor to determine the proper connections for your system.



5. Technical Specifications for the Orlan EKO Line



Boiler type	j.m.	ORLAN 18	ORLAN 25	ORLAN 40	ORLAN 60	ORLAN 80	
Power	kW	4÷18	5÷31	8÷40	15÷60	25÷80	
Efficiency	%	85	91	91	91	91	
Weight - STANDARD *	kg	395	510	580	910	1115	
Weight - SUPER *	kg	425	525	595	975	1165	
Casing height	A - mm	1220	1325	1570	1535	1575	
Heating water outlet height	B - mm	1210	1305	1560	1575	1625	
Heating water inlet height	C - mm	215	235	220	210	245	
Waste outlet height	D - mm	145	145	130	145	175	
Chimney conduit height	E - mm	870	960	1220	1170	1210	
Casing width	G - mm	545	600	600	740	740	
Depth	H - mm	960	1040	1020	1340	1700	
Heating water outlet	I - mm	340	320	330	575	600	
Chimney conduit diameter	J - mm	180	200	200	210	210	
Width with a coil	K - mm	660	720	720	860	860	
Height of coil connection	L - mm	990	1100	1330	1310	1300	
Coil outlet	M - mm	260	150	260	365	315	
Diameter of feeding and return ferrule	Q - inch	2"	2"	2"	2 1/2"	2 1/2"	
Diameter of the coil's ferrule	R - inch	3/4"	3/4"	3/4"	3/4"	3/4"	
Diameter of a drain valve	S - inch	1/2"	1/2"	1/2"	1/2"	1/2"	
Water capacity	dm ³	55	75	93	180	205	
Loading chamber capacity (gasification)	dm ³	85	120	185	310	465	
Power consumption	W	50	50	50	100	100	
Billet's length	cm	50	50	50	75	100	
Wood humidity:	- recommended					15÷25	
	- admissible					15÷35	
Voltage / frequency	V/Hz					230/50	
Chimney flue needed	Pa					15 - 20	
Electric protection range						IP 40	
Max pressure	bar					1,8	
Average fumes' temperature	°C	240					160

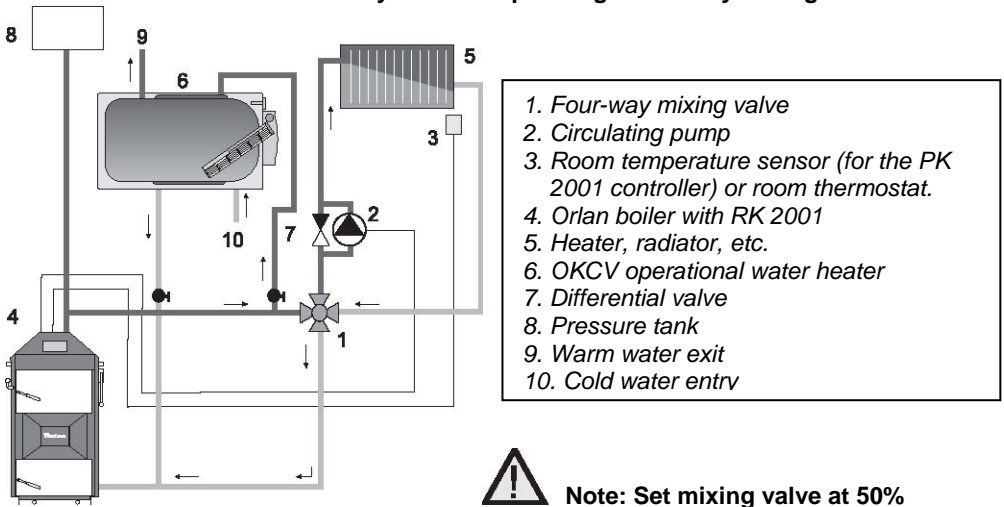
* The parameters above are net values, for transport pallet's sizes and packing should be added.

6. Connecting and Operating the EKO Boiler

6.1. Installation guidelines

A four-way mixing valve is an essential component of any EKO boiler installation. When properly installed, it allows hot supply water to be automatically mixed with cooler return water to avoid low return water corrosion at the boiler return water connection and maintain a relatively stable boiler water temperature. Four-way mixing valves also make it possible to maintain a steadier house temperature. Mixing valves can be used in either gravity or pumped hydronic systems.

Schematic of a system incorporating a four-way mixing valve



6.2. Conditions for successful wood gasification

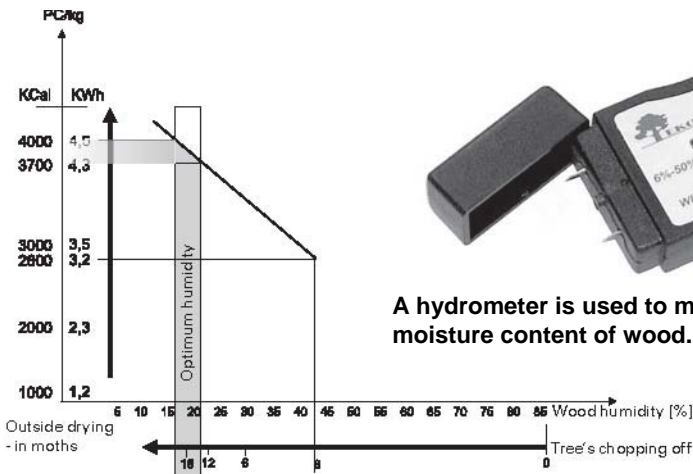
Wood gasification boilers require specific conditions for optimum performance and efficiency. For best results, the boiler water temperature should be in the 70-80°C range. Lower temperatures will result in incomplete gasification, resulting in poor efficiency and the accumulation of unburned residue. Because the wood is dried in the top chamber prior to gasification, incomplete gasification in the lower chamber will affect the fire's ability to sustain itself. The main cause of poor gasification, therefore, is the failure to use adequately dry wood.

6.3. Wood fuel considerations

As noted earlier in this manual, the moisture content of the wood used to fuel the boiler should be between 20 and 25%. Hardwoods such as beech, oak, maple, hickory, etc. are best. While it is possible to burn dry softwood such as pine, spruce, fir, hemlock, etc., they will burn faster and require more frequent loading of the boiler than with hardwood. One way to determine wood moisture content is with a moisture meter (see next page). As a general rule, hardwood cut, split and stacked for one year under cover is usually ready for burning in an EKO boiler. Wood properly stored for two years is best. *The manufacturer and distributor are not responsible for problems related to using wood that is not adequately dry or dense.*

Wood density table

wood type	density of green wood [kg/m ³]	density of dry wood [kg/m ³]
pine	700	480
larch	760	600
spruce	740	430
fir	1000	450
elm	950	680
ash	920	750
beech	990	730
hornbeam	1080	830
alder	690	530
birch	650	650
maple	870	660

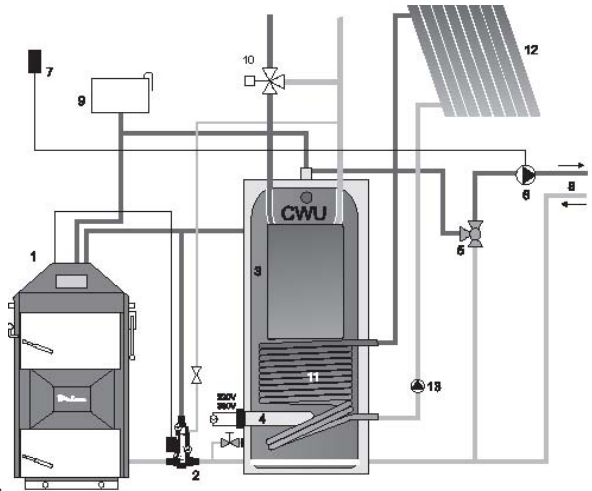


6.4. Hot water storage

For the best results, the use of a heat storage tank is recommended. A properly sized storage tank can cut wood consumption by as much as 40%. Hot water storage allows the boiler to run at optimum capacity regardless of the demand for heat from the building being heated. The stored heat can be recovered later, both stretching the time between boiler refuelings, and as an additional source of heat on very cold days. Generally speaking, the bigger the storage tank the better, as the boiler is most efficient when running at full capacity. The rule of thumb on tank sizing is that 50 litres of water can store about 1 KW of boiler heat. A hot water storage tank connected to an EKO boiler can also be used to store hot water from a solar hot water heater.

System set up with a heat storage tank and coil, domestic hot water heat option and solar panel.

1. EKO boiler with RK 2001 controller
2. Laddomat 21 thermoregulator
3. Hot water storage tank
4. Electric water heater
5. Three-way mixing valve
6. Circulating pump
7. Room temperature sensor or programmable room thermostat
8. Supply to heated space
9. Expansion tank
10. Domestic hot water mixing valve
11. Heat exchanger coil
12. Solar panel
13. Pump



6.5. 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 individual (plumbing & heating contractor, electrician, etc.) The system should be full of water and vented and all other settings checked and tested, especially the pressure relief valve.

When starting the boiler, the following steps should be followed in sequence:

- 1.) Switch off the power.
- 2.) Push the chimney damper lever in to open the burning chamber bypass.
- 3.) Put paper, kindling and a few larger pieces of dry wood in the burning chamber.
- 4.) Start the fire.
- 5.) Open the bottom combustion chamber door to provide natural draft.
- 6.) Let the fire burn for 15 to 20 minutes (**WARNING!! NEVER leave the boiler unattended at this stage.**)
- 7.) Add more wood
- 8.) Wait another 15 to 20 minutes for a charcoal layer to accumulate
- 9.) Fill up the entire upper combustion chamber with wood.
- 10.) Close both upper and lower doors.
- 11.) Pull the bypass damper closed and switch on the regulator.



WARNING!

Never switch on the regulator when the upper door is open.



CAUTION!

Never force the fuel loading door closed. Doing so may damage the door or other parts of the boiler. Use only properly sized wood.

6.6. Fuel loading

A properly sized and installed EKO gasification boiler should require loading every 8-12 hours. To add wood, following the following procedure:

1. Switch off the boiler with the main switch on the controller.
2. Open the combustion chamber bypass chimney damper.
3. Open the upper door and load the chamber if necessary,
4. Close the door, pull the chimney flap closed and switch on the boiler

It is important to avoid obstructing the chimney bypass damper with wood in the combustion chamber when loading fuel.

Ideally, the wood in the upper combustion chamber should be burned down to embers before reloading the boiler.



NOTE:

The yellow “no fuel” light indicates when the boiler needs to be reloaded.

6.7. 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 when the boiler contains burning fuel, as doing so could cause it to overheat.

6.8. 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 70°C or greater.

At times, such as when there is a large call 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 return water temperature can also shorten the life of the boiler. The return water temperature should not be allowed to drop below 20°C below the supply water temperature.

A three-or four-way mixing valve should be installed at the boiler outlet in such a way that supply water can be mixed with return water before it enters the bottom of the boiler. Check with your dealer or installer for details.

6.9. Protecting the boiler during a pump or power failure

During the course of operating the boiler, there is always the possibility of a pump or power failure. NEVER refuel the boiler during a power failure or power outage. NEVER attempt to operate the boiler with natural draft by opening the chimney bypass damper or the bottom gasification chamber door during a power outage, as the boiler will likely overheat. It is advisable to install an auxiliary power supply to power the boiler fan and pump during a power failure. It is also a good idea to install a gravity feed storage tank directly above the boiler. Typically, this would be a 40- or 50-gallon electric water heater connected to a normally-closed zone valve (or at minimum, a manual valve) that will allow hot water from the boiler to circulate into the tank in the event of a power outage.

7. Boiler Maintenance

7.1. Offseason preparation

It is important that the boiler be properly prepared for the offseason (summer) idle period. The upper and lower combustion chambers, heat exchanger tubes and chimney bypass damper should all be thoroughly cleaned. After the boiler is cleaned, both doors should be left open to avoid condensation in the boiler.

7.2. Fan maintenance

The fan is an essential part of boiler operation, and it should be kept clean. It is advisable to monitor the fan's condition and clean it from time to time with a soft bristle brush.



WARNING!!: Operating the boiler with the bottom door open can cause the fan to overheat.

7.3. Routine cleaning

Ashes produced during boiler operation fall down through the nozzle into the lower gasification chamber. During fuel loading, any ash remaining in the upper combustion chamber can be pushed down through the nozzle with the tool provided, using care not to damage the nozzle. Accumulated ash should be cleaned out of the lower chamber as needed, typically every 3-5 days.

Once a month, the upper combustion chamber should be cleaned out as well. Creosote which has accumulated on the firebox walls should be scraped out. It can be allowed to fall through the nozzle and into the ash pit, where it can be easily removed.

The heat exchanger tubes at the back of the boiler are also susceptible to carbon and creosote buildup, which diminishes their ability to transfer heat. On the EKO Standard models, the heat exchanger pipes should be manually cleaned every two weeks using the following procedure. *(Note: The Super 1 models have a lever-activated heat exchanger cleaner which should be operated every time the boiler is loaded with fuel. The tubes should be inspected on a regular basis, but the bi-weekly cleaning routine described below is not necessary with the Super 1 models).*

- 1.) Remove the back panel and unscrew the heat exchanger cover plate with a metric wrench (from 13 to 17 mm, depending on the model). **IMPORTANT:** Use care when screwing and unscrewing the retaining nuts. Lubricate the threads before removing the nuts, and avoid excessive force when tightening them back down.
- 2.) Clean each heat exchanger tube for its entire length, using the tool provided. Be sure that soot and creosote do not accumulate at the bottom of the tubes. Clean any soot that has accumulated in the back of the boiler behind the tubes.
- 3.) To facilitate cleaning, it is a good idea to burn dry potato skins (about 10 litres) in the boiler a day or two prior to cleaning. The starch in the potato skins acts as a catalyst, allowing the boiler to burn off accumulated soot and creosote more easily. No kidding.

7.4. Maintaining tight seals

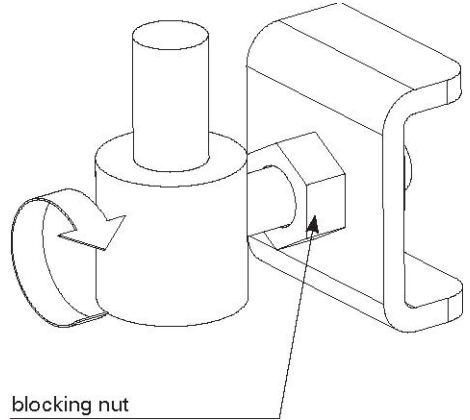
It is very important to maintain tight seals on the doors, heat exchanger cover plate and the firebox bypass chimney damper. Poor seals can result in smoke and gasses leaking out of the boiler, and lead to uncontrolled burning which may cause the boiler to overheat. The insulation rope used to seal both doors and the heat exchanger cover should be inspected regularly and treated with graphite or some other lubricant as needed, to keep them flexible.

Over time, (one heating season, for example), 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, as follows:

- 1.) Remove the door.
- 2.) Loosen the cap.
- 3.) Turn the hinge 360 degrees
- 4.) Tighten the blocking nut to block the hinge retaining screw.



Note: The upper and lower hinges should be adjusted at the same time



Note: Chimney inspection and maintenance is a critical part of any wood-burning maintenance schedule. Make sure that the chimney connection is secure and airtight. Inspect chimney regularly and clean as needed.

7.5. Standard Cleaning Tools



Heat exchanger cleaning tool not included with Super 1 model.

7.6 Cleaning the EKO Super 1 model

The EKO Super 1 model boilers are equipped with a lever-operated heat exchanger cleaning device consisting of spiral steel elements that clean the tubes as the elements are moved up and down. Vigorously moving the handle back and forth either before or after each fuel loading will help assure that the heat exchanger does not become clogged with creosote, carbon or ash. The lever should not be operated while the chimney bypass damper is open.

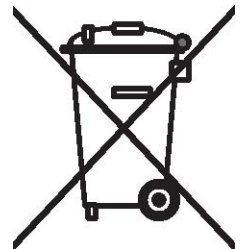
8. Troubleshooting Guide

Problem	Cause	Remedy suggested
boiler doesn't reach the temperature needed	problems starting fire	refer to Section 6.5
	wood too moist	use properly seasoned wood
	primary air conduit choked	call service – not covered by warranty
	secondary air conduit choked	call service – not covered by warranty
	smoke tube of heat exchanger choked	clean with supplied cleaning shield or call service – not covered by warranty
	wrong regulation of the air and wood gas	call service – not covered by warranty
	nozzle damaged	replacement – not covered by warranty
	fan's gasket damaged	replacement – not covered by warranty
	fan damaged	replacement – not covered by warranty
smoke out of the cleaning cover	leak on a seal rope	door regulation or call service – not covered by warranty
	seal rope worn	rope's replacement – not covered by warranty
	cover warped - overheating	cover's replacing or call service – not covered by warranty
smoke coming out while loading (little smoke is acceptable)	intensive -Heavy wind blows the fumes into the chimney	consider installing a special chimney cap – not covered by warranty
	Inadequate chimney	consult a chimney maintenance professional (chimney sweep).
smoke out of the boiler's door	leak on a seal rope	adjust door hinge per instructions.
	seal rope worn	replace rope or call service – not covered by warranty
	door damaged	replace door – not covered by warranty
regulator doesn't work	no power	check the wiring and circuit breakers
	fuse damaged	replace fuse – not covered by warranty
	live wire conduit damaged	Inspect and repair wire

	temperature sensor damaged	call service
	regulator damaged	call service
fan not working	thermal protection engages	investigate reasons for boiler overheating
	no power in regulator	check fuse and wiring
	fan damaged	call service - fan's replacement
	regulator damaged	call service
	fan blocked	inspect and clean the fan
fan making noise	bearings damaged	call service - fan's replacement
	condenser damaged	call service - condenser's replacement
	fan clips loosened	check, turn the clips tight
	fan's blades unclean	check and clean
	debris in fans cover	check and clean
fan working poorly	dirty fan blades	check and clean
	pitch on the fan cover	check and clean
Explosion or "puffing" in the firebox	problems with startup	refer to Section 6.5
	chimney draught to low (below 10 Pa)	rebuild chimney. Consider use of WKO exhaust fan
	chimney draught to intensive (over 20 Pa)	use exhaust regulator
	wood too small or too dry	mix with larger humidity fuel as to increase humidity level (in about 15-35%)
	clogged heat exchanger tubes	clean the exchanger or call service – not covered by warranty

9. Disposal and Recycling of Boiler Components

EKO 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 an EKO 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.



Distributed in North America by:

New Horizon Corporation, Inc.
151 McGregor Drive
Sutton, WV 26601
(304) 765-7171
newhorizon@gmail.com