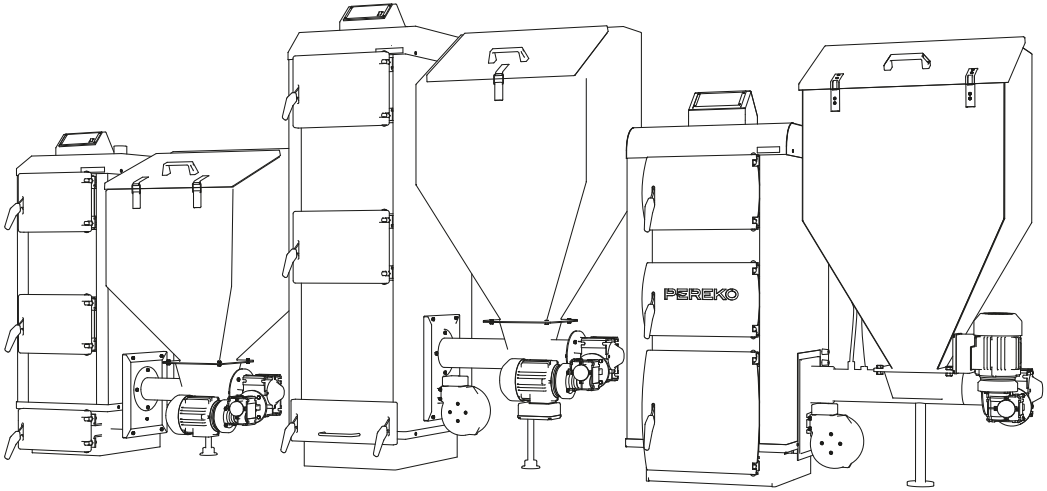
PEREKO®

Operation and Maintenance Manual

For feeder boilers of the **KSP Duo, KSR and KSRM** series



Thank you for purchasing a PEREKO boiler. This Operation and Maintenance Manual is concerned with the feeder boilers of the KSP Duo, KSR and KSRM series and contains all vital information and recommendations for their use.

Before starting your boiler up please read the contents of the Manual presented below carefully. Compliance with the recommendations specified in this Manual will ensure your safety and will protect you against improper use of the boiler and its malfunction.

The complete set of user documents comprises also a manual regarding the microprocessor temperature controller, a manual for the feeder and a manual for the fan that the user is also advised to read. The Manuals should be retained and stored in such a manner as will allow them to be used during boiler operation.

SPIS TREŚCI

1. INTRODUCTION

1.1. User responsibilities and safety instructions

To ensure user safety and to maintain optimum boiler operation the user must:

- read the Boiler Manual, the Controller Manual and the Feeder Manual and to follow the instructions specified therein,
- this Manual must be retained and kept in a safe place in the boiler housing so that it is available at anytime during boiler operation,
- it is forbidden to allow children access to the boiler operation and people who have not read the Manuals as well as disabled adults whose disability prevents them from safe operation,
- installation must be performed in adherence to current applicable legislation and to the rules and instructions set out in the Manual,
- prior to positioning the boiler and connecting it, please check that all subassemblies are in good working order and whether the boiler has a complete set of operational and cleaning equipment,
- clean the boiler regularly, Moreover, at least once per week, the soot and ash that hamper boiler efficiency, must be completely removed,
- ensure continuous access to the boiler,
- not allow water in the boiler exceed the temperature of 95°C,
- Maintain operating pressure not higher than 1.5 bar.

ATTENTION! The boiler must be installed in adherence to the effective standards and its first start-up must be performed by a qualified installer.

1.2. Selection of the correct boiler power

The rated power of the purchased boiler (i.e. the maximum calorific effect achievable during continuous operation with the manufacturer's declared efficiency maintained) should be selected in such manner so as to correspond to the actual demand for heat energy even if very low temperatures occur.

The user should not purchase a boiler with a higher heating power than planned in the project. The selection of a boiler with excessive heating power will lead to higher fuel consumption and a lack of complete control over the combustion process, and subsequently higher operational costs, whereas, if the boiler is too small it will not provide the appropriate heating power necessary to heat the building.

An approximate estimate of the boiler's heating power may be calculated using the boiler's heating power calculator, which is available on our Website at the address: www.pereko.pl. Additionally the following factors have to be also taken into consideration: the wall thickness and insulation, U value of window and door frames (including but not limited to air permeability of doors and windows, type of window panes used) and climatic zone in which the heated building is located.

2. TECHNICAL DESCRIPTION OF KSP DUO, KSR AND KSRM BOILERS

2.1. Application

The feeder boilers of the KSP Duo, KSR and KSRM series belong to the category of low-temperature, water boilers and do not have to be registered in the district Office of Technical Supervision. They have been designed for operation in water central heating gravitational systems or open-vented, forced circulation hot water central heating systems in single family houses, garages, commercial facilities, utility rooms etc., fitted with safety systems compliant with the requirements set forth in the Polish standard PN-91/B-02413, applicable to open-vented hot water heating systems including the Ordinance of the Minister of Infrastructure (Journal of Laws 2009. No. 56, item 461). These boilers have been approved for operation in systems where working pressure does not exceed 1.5 bar, and the highest water temperature in the boiler does not exceed 95°C.

2.2. Description of the boiler design

2.2.1. Door

The boilers in the KSP Duo, KSRM and KSR series with heating power 14, 100, 150, 200 and 300 kW respectively are equipped with an upper cleaning door, boiler furnace door and ash pan door. All doors are equipped with high temperature resistant tungsten plates protecting them against excessive heating. Additionally boilers in the KSRM and KSR series, with a heating power of 17-75 kW, are equipped with an ash drawer.

Cleaning door

The cleaning door is used for the cleaning of the convection ducts.

Ash pan door

The ash pan door enables the removal of ash produced during the combustion process.

Boiler furnace door

The boiler furnace door is used for firing up and control of the combustion process and for the cleaning of the heating surfaces. The boiler furnace door is also used to perform firing in the boiler using the "conventional method" on a water-cooled grate (KSP Duo) or cast-iron grid (KSR, KSRM) should a power outage occur.

Ash pan tray

The ash pan tray (applies to KSRM and KSR models, with heating power 17-75 kW) is used to remove ash produced during the combustion process.

Cleaning opening

The cleaning opening is used for the cleaning of convection ducts.

2.2.2. Water jacket

The water jacket is a space where the heating medium i.e. water is stored. It is made of P265GH grade steel sheet used for pressure vessels for operation at higher temperatures. In the combustion chamber the thickness of the body sheets is between 5 and 6 mm, whereas on the external side the steel sheets are 4 mm thick. It is designed to collect heat effectively during flue gas recirculation. The convection ducts are positioned in such a manner that they can be cleaned using the upper cleaning opening.

2.2.3. Thermal insulation panels

The thermal insulation panels fixed to the surface of the water frame reduce boiler heat loss into the surrounding environment. They are made of aesthetic zinc coated steel units, painted with powder paint known for its high resistance to corrosion. On the inside the units are lined with mineral wool that fulfills the function of insulation material.

2.2.4. Electronic controller

The Microprocessor controller, mounted on the upper front part of the boiler, enables not only the setting of the boiler temperature, but also the programming of boiler operation at any time. The controller is also responsible for combustion chamber blowdown. Additionally the controller is equipped with an operation control sensor and an emergency boiler switch once water temperature has exceeded 95°C. Details can be found in the Microprocessor Temperature Controller Manual attached to the boiler's documentation.

2.2.5. Forced draught (FD) fan

The FD fan has been designed to supply the appropriate amount of air into the boiler furnace. The amount of supplied air varies; it is automatically adjusted by the controller. Details can be found in the Forced Draught (FD) Fan Manual attached to the boiler's documentation.

2.2.6. The assembly of the feeder with the burner

The assembly of the feeder with the burner is powered by a geared motor and mounted on the right or left hand side of the boiler. Its objective is to take fuel from the hopper and to feed it automatically to the burner. The feeder boilers are equipped with three types of burners:

1. PSQ chute installed in KSP Duo model,
2. fixed retort installed in the KSR series,
3. Rotary retort in the KSRM series.

The assembly design allows for its rapid assembly and disassembly. The fuel container with a tightly sealed cover is mounted on the feeder assembly. Details can be found in the Feeder Operation Manual attached to the boiler's documentation.

2.2.7. Outlet water stub pipe

The Outlet water stub pipe is designed to connect the boiler to the central heating system on the hot water side.

2.2.8. Inlet water stub pipe

The inlet water stub pipe is designed to connect the boiler to the central heating system on the side of the cold water returning from the system.

2.2.9. Smoke conduit with damper

The smoke conduit with rotary flue gas damper is an integral part of the boiler, which directs flue gases towards the flue.

2.2.10. Flue gas revolving vanes

The flue gas revolving vanes are located in the convection ducts in order to swirl flue gas stream, which enhances boiler efficiency and power. In case of poor chimney draught they must be removed.

2.2.11. Water tubes

Water tubes are made of steel and are filled with water and are fixed permanently in the convection ducts. Their function is to expand the heating surface of the boiler i.e. to enhance boiler heating power and efficiency by more effective transfer of heat from the flue gases.

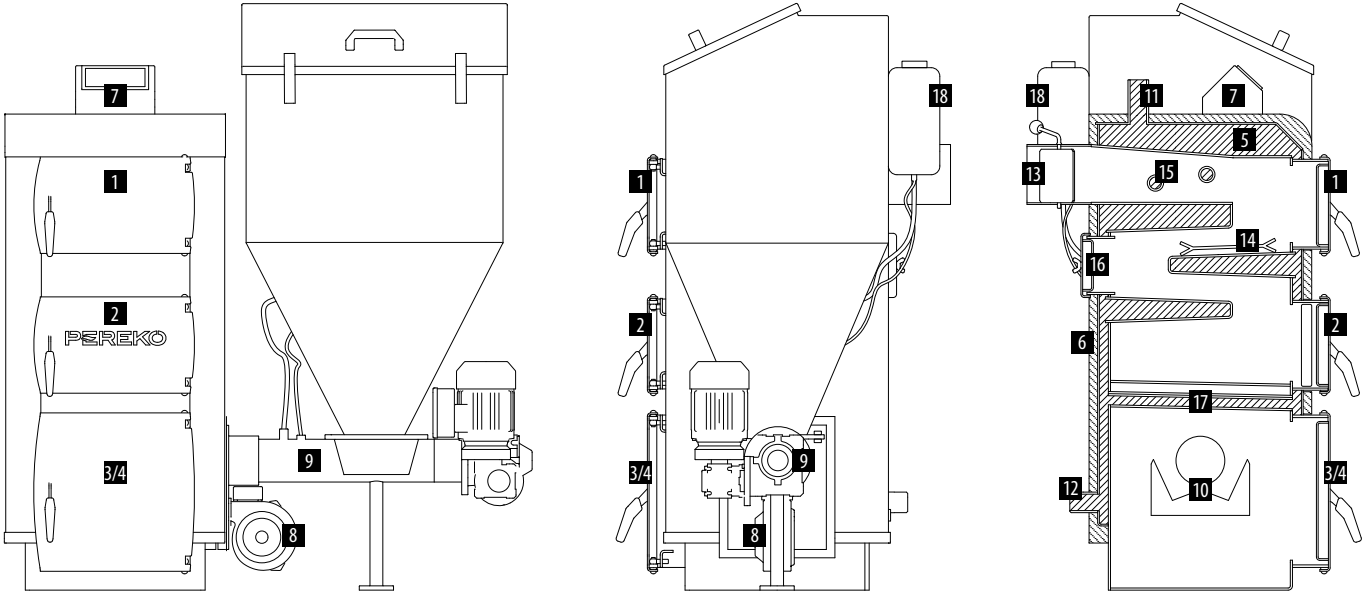
2.2.12. Water-cooled grate

The water-cooled grate is filled with water and performs the function of an emergency grate during a boiler breakdown or power outage.

2.2.13. Fire safety valve

The thermal fire safety valve protecting the fuel in the hopper against igniting. If the flame has withdrawn or got through into the feeding pipe the valve temperature sensor will make the valve open and will flood it with water from a 5 litre container connected with a hose.

2.3. Feeder boiler design diagram



1. Cleaning door
2. Boiler furnace door
3. Ash pan door
4. Ash pan tray
5. Water jacket
6. Thermal insulation panels
7. Electronic controller
8. Forced draught (FD) fan
9. Feeder
10. Burner
11. Outlet water stub pipe
12. Inlet water stub pipe
13. Smoke conduit with damper
14. Flue gas revolving vanes
15. Water tubes (KSP Duo, KSRM)
16. Cleaning opening
17. Water-cooled grate
18. Fire safety valve

2.4. Technical and operational characteristics

Parameter	Jedn.	KSP Duo				KSR	KSR/KSRM					KSR		
		15	19	27	38	14	17	25	37	50	75	100	150	200
Height	[mm]	1460	1460	1500	1550	1220	1460	1550				2100		
Width	[mm]	1215	1215	1290	1350	980	1150	1150	1215	1215	1365	2000		
Depth	[mm]	730	730	730	850	630	670	670	780	1020	1020	1700	2100	2400
Height up to the smoke conduit axis	[mm]	1020	1200	1220	1350	1000	1100	1350	1350	1350	1350	1750		
Smoke conduit cross section	[mm]	140×140	140×140	160×200	160×200	120×120	140×140	140×140	140×140	160×200	160×200	300×300		
Floor area of heated premises[1]	[m^2]	150	190	270	380	140	170	250	350	400	600	1000	1500	2000
Cubic capacity of heated premises[1]	[m^3]	375	450	675	925	325	400	550	750	1000	1500	2500	3750	5000
Heating power	[kW]	15	19	27	38	14	17	25	37	50	75	100	150	200
Thermal efficiency	[%]	~92				85						~90		
Power control range	[%]	-90												
Charging hopper capacity	[dm^3]	160			190	150	160		190			900		
Boiler furnace charging capacity	[dm^3]	~20	~30	~45	~65	15	20	30	50	60	85	220		
Boiler water capacity	[dm^3]	70	80	100	120	45	70	90	105	120	140	700	800	1000
Heat exchanger material	—	P265GH [PN-EN 10028] Steel; thickness 5 and 6 mm										P265GH [PN-EN 10028] Steel; 8 mm		
Maximum operating pressure	[bar]	1.5												
Required minimum chimney draught[2]	[Pa]	20	23	25	25-30	20		25	28	35	40	50		60
Min./Max. water temperature	[°C]	57/95												
Power supply / Power	[V/W]	230/175										230/500		
Boiler weight without water	[kg]	374	396	484	550	269	372	409	517	649	763	2090	2530	2750
Diameter of the water stub pipe	[cal]	G 1 ½										G 3		

[1] When heat demand is equal to q–100 W/m^2 for the building insulated with polystyrene foam 5 cm thick; [2] in adherence to the standard PN-EN 12809, PN-EN 303-5:2002;

2.5. Fuel

Fuel used for burning in feeder boilers should have the appropriate calorific value, must be dried and have granulation recommended by the producer. The use of damp fuel or fuel with too high granulation may lead to blocking in the feeder and a major breakdown of the boiler. Moreover, a disadvantageous chemical composition of the fuel may lead to sintering and production of a large quantity of dust and soot and higher fuel consumption. Depending on the boiler firing method the time needed for fuel burning with a single charge is variable. The specified lengths of time apply exclusively to boiler operation when the appropriate fuel is used.

The length of time of fuel burning with a single charge depends on many factors: fuel calorific value, building thermal insulation, heat receiving devices (radiators, boiler, floor heating).When the boiler is operated at a lower heating power the length of time of fuel burning with a single charge is extended by several hours.

PRIMARY FUEL its use secures the attainment by the boiler of the stated heating power and efficiency	
KSR	hard coal (pea coal for power generation purposes, 26/050/06 grade, grain size 5-30 mm)
KSRM	Hard coal, I/II/III fine coal grade, 31-2 type in adherence to the standard PN-82 G97001-3; min. calorific value 24 MJ/kg; grain size 0-30 mm; moisture content below 15%

PRIMARY FUEL its use secures the attainment by the boiler of the stated heating power and efficiency	
KSP Duo	pellets, pea coal, fine coal, oats, lignite

SUBSTITUTE FUEL when used as a substitute for primary fuel, may reduce boiler heating power and efficiency	
KSR	pellets (following the fitting of the BVTS valve by the producer's service engineers)
KSRM	hard coal, pea-coal grade of 31-2 type; calorific value 24 MJ/kg; moisture content below 15%
KSP Duo	pellets, pea coal, fine coal, oats, lignite

FUEL FOR EMERGENCY GRATE used for burning only periodically in emergencies	
KSR	hard coal, I/II walnut grade, seasoned wood, lignite grain size <30 mm, briquetted lignite, sawdust briquettes and other long-flame fuels
KSRM	

FUEL FOR WATER-COOLED GRATE used for firing only periodically in emergencies	
KSP Duo	hard coal, I/II walnut grade, seasoned wood, lignite, briquetted lignite, briquetted sawdust and other slow-burning fuels

2.6. Equipment

The boiler is supplied to the user in assembled state, ready for start-up. Before boiler setup, the user must check for the presence of additional tools and operational equipment. The complete kit must include: the feeder, charging hopper, controller, fan, brush, scraper (for KSR and KSRM series, with a heating power of 50 kW and above), hook, ash paddle, drain cock, flue gas swirl vanes (2 pcs.), emergency iron grid (for KSR and KSRM series) and manuals for: feeder, controller and fan.

3. BEFORE START-UP

3.1. Boiler setup

3.1.1. The boiler room

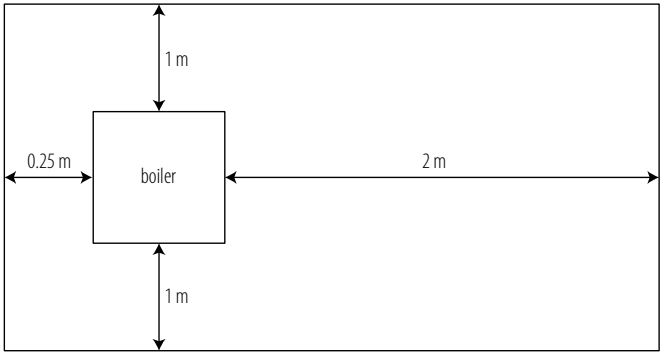
- The boiler room should be a separate room with a minimum height of 2.2 m in a building under construction (in an already existing building the permissible height is 1.9 m).
- The boiler room should have an artificial lighting system installed and, if possible, it should also have natural lighting.
- It should have efficient gravitational ventilation including:
  1. an intake ventilation duct in the external wall with a minimum diameter of 50% of the chimney cross section area at the maximum height of 1 m above the floor or a minimum of 200 cm^2 for boilers with a maximum heating power of 25 kW or 400 cm^2 for boilers with a heating power exceeding 25 kW,
  2. a separate intake ventilation duct on the internal wall with a minimum cross section 140×140 mm with the outlet underneath the boiler room ceiling next to the chimney.

ATTENTION! In a room where the boiler has been installed it is forbidden to install a mechanical exhaust ventilation system.

- In the central part of the room, space must be provided for a floor drain and the floor must have 1% inclination towards the drain.
- The floor and walls in the entire boiler room must be made of non-combustible materials.
- The boiler room door must open outwards.

3.1.2. Boiler setup

The boiler does not require a foundation, but is permissible to set up the boiler on a base course with a minimum height of 50 mm. The boiler setup must ensure free access to the boiler to allow for cleaning and maintenance. Therefore, during the boiler setup, it is advisable to keep a minimum space from individual walls: 1. The spacing between the front of the boiler and the boiler room wall it faces must be a minimum of 2 m; 2. The spacing between the boiler side and the boiler room wall must be a minimum of 1 m; 3. The spacing between the rear of the boiler and the boiler room wall must be equal at least the length of the terminal i.e. 0.25 m.



3.2. Connection to the chimney

1. A stand-alone, sealed flue duct must be established for removing exhaust flue gases from the boiler.
2. The flue duct must be a minimum of 1.5 m above the roof ridge to avoid the occurrence of reverse chimney draught. The chimney stack diameter must match the boiler heating power and the chimney height respectively. The approximate estimates for the chimney stack height and diameter can be done using the calculator of chimney stack diameter, which is available on the Web site at the address www.pereko.pl. Regardless of thy results of the calculations the minimum diameter of the brick chimney stack must not be less than 14×14 cm! The diameter of a steel non-thermally insulated chimney must be increased by 20%, whereas chimney stacks made of steel pipes should be higher by 15-20% than a brick chimney stack.
3. Before connecting the boiler to the chimney stack, the technical condition of the chimney stack must be assessed (the most preferred option is that it should be done by a chimney sweep) and to check if the chimney stack is free from any other connections to heating systems.
4. The boiler must be connected with the chimney stack by means of a terminal. It is not advisable to apply the terminal at the right angle, because it will cause a loss in the chimney draught. Smoke conduit must be connected to the chimney stack by means of a 3 mm thick steel sheet connector (can be purchased from the boiler producer. This should be connected to the outlet of the smoke conduit, attached to the chimney stack and sealed with high temperature silicone. The service line should rise slightly upwards from 5° to 20°.If the smoke conduit is longer than 400 mm; it is advisable to isolate it with thermal insulation.

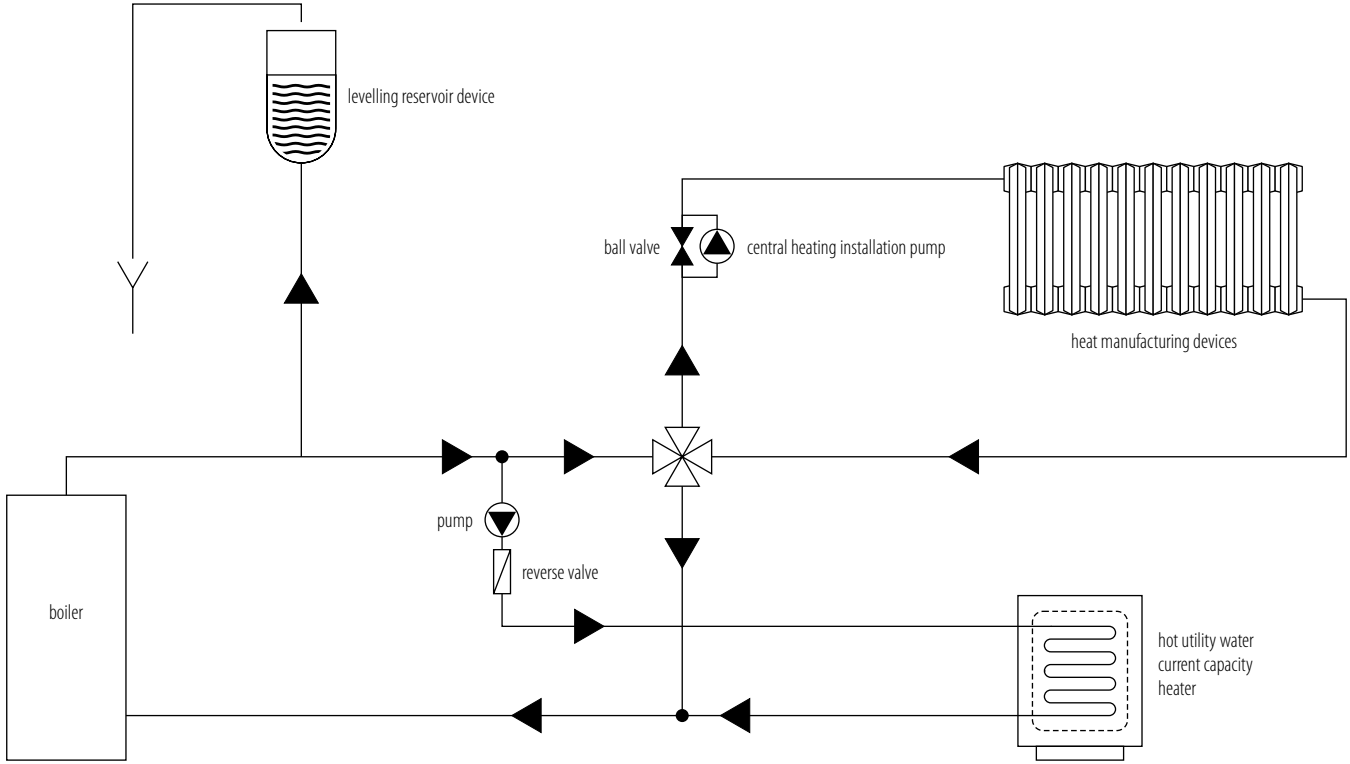
ATTENTION! The boilers in the KSR, KSRM and KSP Duo series have to be installed pursuant to the currently effective Ordinance of the Minister of the Infrastructure (Journal of Laws of 2002, No. 75, item 690 and Journal of Laws of 2009, No. 56, item 461.). Additionally it is advisable to use a chimney lining that is resistant to corrosion pitting, intergranular and surface.

3.3. Connection of the central heating and hot water systems.

3.3.1. Open-vented water systems

The boilers in the KSP Duo, KSR and KSRM series have been designed to supply open-vented central heating water systems with gravitational or forced circulation of water. The system with which the boiler will be operated must comply with the requirements set forth in the Polish standard PN-91/B-02413 Heating and District Heating – Open-Vented Water System Protection – Requirements.

Example diagram of the open-vented central heating system with a four-way valve and hot water heater.



3.3.2. Closed-vented water systems

Heating boilers bearing the PEREKO brand, which use solid fuels, with automatic fuel charging, with a max. Rated power of 300 kW can be used in the closed-vented water heating systems on condition that: 1. The system has been equipped with a diaphragm expansion vessel; 2. A device for the removal of excessive heat has been installed i.e. REGULUS DBV dual-purpose cooling valve – 1 and 3. 1.5 bar safety valve should also be installed.

ATTENTION! The correct selection of safety systems and appropriate membrane expansion vessel will have an impact on the safety level of the system including the boiler itself. The above device must be carefully inspected at least 2 times a year. The first inspection must be carried out during seasonal boiler start up along with the water system.

3.3.3. Four-way valve

The heating system design must include boiler protection against the return of too cold water from the system. It is advisable to apply a four–way mixing valve, which allows an increase in temperature of return water.

The four-way valve mixes hot feed water with colder return water from the heating cycle and thus it:

- protects the boiler against low temperature corrosion and premature wear and tear,
- increases the heating efficiency of hot water in the hot water hopper,
- it supports continuous control of heating water temperature in compliance with the heating system requirements,
- increases the operational efficiency of the entire system.

Designing an appropriate system diagram for a particular house and its execution must be entrusted to a person possessing the appropriate set of qualifications. Central heating systems may differ from one another, therefore it is vital to adhere to the guidelines specified in the central heating system design. Below we present an example diagram of the boiler connection to the open-vented central heating and hot water systems with gravitational or forced water circulation.

3.4. Boiler connection to the wiring system

The boiler room must be equipped with a wiring system with a rated voltage of 230/50Hz in adherence to the regulations applying this area. The system must be finished with a plug-in socket equipped with a protective contact with an attached PE protective clamp to protect against electrocution.

3.5. Filling up the system with water

3.5.1. Filling up the boiler with water before the first start-up

1. Before filling up the boiler with water the heating system and boiler must be flushed out to remove impurities.
2. The water system must be filled up through the drain cock by means of a flexible hose. The water feeding the heating boiler must comply with the requirements set forth in the standard PN-93/C-04607. The quality of water in the central heating system has an impact on the length of its operational life. Therefore the feed water must be devoid of impurities, oil and aggressive chemical compounds. Water hardness must not exceed 2°tn (1°tn = 0.71 mval/l).If the water is too hard, then limescale will be deposited in the boiler and heating system, which will reduce boiler efficiency and might lead to its breakdown.
3. The water filling process must be stopped when the system has been filled i.e. water will start to pour out of the signaling pipe of the expansion vessel, located at the highest point of the system or when the pressure gauge shows pressure of approx. 0.8-1.2 bar. The filling up of the system must be performed for a couple of seconds to be sure that the water pours out of the vessel.
4. Once the system has been filled up the boiler drain cock must be closed and the hose must be disconnected from the boiler.

3.5.2. Adding water to the system

A heating system with an open hopper enables direct contact of the heating water with the air, which results in water evaporation and the necessity to refill it.

ATTENTION! It is forbidden to add cold water to a heated-up system. Adding water to heated up boiler elements carries the risk of causing damage and this is tantamount to the loss of warranty.

The replacement water may be added to the system only and exclusively when the boiler is cold. If it is necessary to add replacement water quickly to the system, then fuel must be removed from the boiler furnace, the boiler must be cooled down to a temperature of 30°C and only then can replacement water be added (see: Emergency shutdown of boiler operation).Once the system has been filled up, then firing up must be restarted.

3.5.3. Draining water from the system

It is not advisable to drain water from the system once the heating season is over, since it increases the risk of corrosion and limescale buildup. An exception to this rule is the time needed to carry out necessary repairs and a long boiler downtime during severe frosts. In the latter case it is advisable to drain off water from the system to keep it from freezing which will cause damage and then to refill the system once the frosty weather is over.

3.6. Feeder installation

A detailed description of the feeder installation is in the Feeder Manual attached to the boiler.

ATTENTION! With a KSR series boiler, it is necessary to seal off the connection of the boiler furnace plate with the air chamber by means of a refractory silicone sealant. The sealing of the boiler furnace plate and the air chamber and programming of the controller are the duties of the boiler installer. Failure to perform this duty will cause a number of problems related to the feeder operation, which are not covered by the scope of the warranty. In such cases, the visit of a service engineer to service a PEREKO boiler is considered to be groundless, and related costs have to be fully covered by the boiler user. The installation details are specified in the Feeder Manual.

4. OPERATION MANUAL

4.1. A safe operational environment

To maintain boiler safe operational environment one must primarily:

- Install the heating system correctly pursuant to the requirements set forth in the standard: PN 91/B-02413 on safety systems for open-vented water heating systems including the Ordinance of the Minister of Infrastructure (Journal of Laws2009. No. 56, item 461).
- Fill the system up correctly with water. During the operation of heating up the boiler, it is forbidden to add cold extra water to the system.
- Not let the boiler operate when the water level in the system has dropped below the level defined in the Central Heating Operation Manual.
- Never use flammable liquids i.e. gasoline for firing up the boiler.
- Never extinguish the fire in the combustion chamber by pouring water on it.
- For boiler operation use the appropriate equipment and protective clothing (gloves, safety goggles, headwear, footwear), and to handle with the utmost care any non-insulated elements (e.g. door) that may heat up to a high temperature causing the danger of scalds and burns.
- While opening the boiler door, stand at the side and watch out for flames shooting out.
- Take care of the cleanliness of the boiler room, ensure proper ventilation herein and remove from its vicinity any caustic and flammable materials.
- The boiler must be cleaned only during breaks in its operation.
- During boiler operation please use the portable lamps supplied with a maximum voltage of 24 V.
- Take care of the proper technical condition of the boiler and the hydraulic system.
- Maintain boiler cleanliness.

4.2. Before the first firing up of the boiler

Before the first boiler start-up the following checks must be performed:

1. The correctness of installation and connection to the wiring system should be checked: a) the actuator of the four-way valve (if any), b) the central heating pump, the hot water pump and the floor heating pump (if any), c) the boiler sensor, d) the fan , e) the feeder and fire extinguishing system (only for KSP Duo model).
2. The correctness of the sealing off of the boiler furnace plate (only in the case of KSR model – see item Installation of the feeder in the KSR series boilers).
3. Heating system: a) its water-tightness, whether there are any water leakages from the boiler or system, b) whether water has not frozen in the piping and in the expansion vessel, c) whether the water level and its pressure are correct and sufficient (the pressure gauge depending on the building height must show between 0.8 and 1.2 bar).If the pressure is too low, it is necessary to add water, but only to a cold boiler.
4. The cleaning opening that must be water-tight.
5. The correctness of the boiler connection to the chimney.
6. To measure the chimney draught.
7. To disassemble the emergency iron grid installed by the manufacturer (in the KSR and KSRM series).

4.3. Firing up in the KSP Duo model

1. Fill up the hopper with appropriate type of fuel.
2. Close the hatch of the hopper tightly.
3. Open the ash pan door.
4. Pressing the "Enter" button on the controller, enter into manual mode (the fan and feeder will be activated automatically) – see Controller Manual.
5. Check the operation of the following pieces of equipment: a) fan operation, b) the switching on of the central heating, hot water and floor pumps (on a motorized speed reducer rotation clockwise), c) feeder (the switch with rotation change in the box on the electric motor must rotate clockwise).
6. Switch off the fan. In manual mode, the feeder feeds fuel to the burner. Wait 2-3 minutes, until coal shows in the burner up to the level of blow-in holes.
7. Rake up the fuel. Put kindling and paper on top of the fuel, then add small pieces of wood and then ignite it. Once the boiler has been fired up the chimney draught should suck in the flue gases into the boiler convection ducts.
8. After firing up the wood and paper switch on the fan and adjust air blow so that the fuel burns evenly.
9. Once the flame has stabilized and the glow has been produced on the burner, close the door and switch the controller into automatic operation mode (fan, feeder and pump(s) will start operation automatically). Select the right fuel from the bank of fuels on the controller. The fire in the boiler furnace should burn with clear, intensive yellow flames. Red, smoky fire means that too little air is being supplied, whereas white flames mean that too much air is being supplied. If the operation of the boiler burner is correct , then the following settings have to be

performed: the temperature of the central heating system (usually it is from 60°C to 80°C), the temperature of hot water (45-55°C), the four-way valve temperature and floor pump temperature(in accordance with the Controller Manual).

ATTENTION! During controller automatic operation the charging door and cleaning door have to be closed tightly.

ATTENTION! The boiler temperature may not be set below 57°C! This increases the risk of "dew point" occurrence, which accelerates significantly low temperature corrosion of the exchanger. Maintaining the feed water temperature below 57°C accompanied by the use of incorrect solid fuels leads to accelerated wear and tear of the boiler and undermines boiler efficiency.

During boiler firing up, overall control over the combustion process will be taken over by the controller (see "Controller Operation Manual"), that maintains the set boiler water temperature taking into consideration the building's heat demand.

4.3.1. Approximate outlet parameters of the controller

The controller has been preconfigured, however, its outlet parameters are subject to change depending on the type of fuel used (eco-pea coal, fine coal, pellets, oats, and lignite) and may require individual adjustment. They may be adjusted depending on the heat demand, type and quality of fuel (calorific value) or depending on the configuration of the heating system. The selection of the right parameters ensures economic fuel combustion.

Fuel	KSP 15 Duo				KSP 19 Duo				KSP 27 Duo				KSP 38 Duo			
	min		max		min		max		min		max		min		max	
	a [s]	b [s]	a [s]	b [s]	a [s]	b [s]	a [s]	b [s]	a [s]	b [s]	a [s]	b [s]	a [s]	b [s]	a [s]	b [s]
Pea coal	4	116	24	96	4	116	36	84	4	116	42	78	4	116	48	72
Fine coal	3	117	20	100	3	117	30	90	3	117	36	84	4	116	42	78
Pellets	10	110	36	84	10	110	42	78	10	110	48	72	10	110	60	60
Oats	10	110	36	84	10	110	42	78	10	110	48	72	10	110	60	60

min – boiler operation at minimum heating power; max – boiler operation at maximum heating power; a – fuel feed time; b – a break in fuel feeding

Major controller parameters that control the KSP Duo boiler operation are feeding time and break in fuel feeding. The parameters are selected depending on the type of fuel by setting the appropriate operational parameters for boiler operation at maximum and minimum power. For this purpose, the minimum and maximum power test must be performed(more information in the Microprocessor Controller Manual), which will allow the determination as to whether the set values are appropriate or not – whether the flame burns in the middle part of the boiler furnace and whether the fuel manages to burn without leaving-unburnt residues.

The minimum power ("min") operational parameter is used to adjust boiler minimum heating power. If during operation at minimum power, fuel is close to the burner wall (at the perpetual screw) the min. operation time (feed time) must be extended by 1 second.

The second parameter – operation at maximum ("max.") power is used to adjust boiler maximum power. If the boiler fails to reach the set temperature then maximum operation time must be (feed time) must be extended by 1 second. The correct setting of parameters secures efficient and cost effective boiler operation. The modification of the"feeding time" parameter causes automatic modification of the "feeding pause" time.

4.4. Firing up in the KSR and KSRM series boilers

1. Fill up the hopper with the appropriate type of fuel.
2. Close the hatch of the hopper tightly.
3. Open the charging door.
4. Activate the controller (see Controller Operation Manual) and go into manual operation mode.
5. Check the operation of the following pieces of equipment: a) fan operation, b) switching on of the central heating, hot water and floor pumps c) feeder.
6. Switch off the fan. In manual mode the feeder starts feeding fuel to the burner for approx.2-3 min. Wait some time until eco-pea coal shows in the retort up to the level of the blow-in holes.
7. On top of the fuel fed by the feeder put kindling or paper and on top of them, add small pieces of wood and ignite them. Once the boiler has been fired up, the chimney draught should suck in the flue gases into the boiler convection ducts.
8. Once the flame has stabilized, switch the controller into automatic operation mode, which will initialize fuel feeder and fan operation. During boiler firing up, overall control of the combustion process will be taken over by the controller (see Controller Operation Manual) and from that moment onwards the boiler will operate automatically.
9. After 30 minutes set the required parameters on the controller: the boiler operating temperature (default setting is 57°C), the fuel feeding and pausing times and blow-in force in accordance with the specified values in adherence to the Controller and Feeder Manuals.

ATTENTION! The boiler temperature may not be set below 57°C! This increases the risk of "dew point" occurrence, which accelerates significantly low temperature corrosion of the exchanger. Maintaining the feed water temperature below 57°C in accompanied by the application of incorrect solid fuels leads to accelerated wear and tear of the boiler and undermines boiler efficiency. The required parameters have to be set on the controller in adherence to the Controller and Feeder Manuals.

Approximate outlet parameters of the controller

Parameter	KSR 14	KSR 17, 25	KSR 37, 50, 75	KSRM 17, 25		KSRM 37, 50, 75	
				Fine coal	Pea coal	Fine coal	Pea coal
Set temperature	min. 56°C	min. 56°C	min. 56°C	≥ 57°C	≥ 57°C	≥ 57°C	≥ 57°C
Coal feed time*	20 s	9 s	15-20 s	6 s	9 s	15 s	15-20 s
Coal feed pause**	15-20 s	18 s	15 s	25 s	18 s	20-30 s	15 s
Blow-in pause in fire feed	7-8 min	7-8 min	17-25 min	7-8 min	7-8 min	17-25 min	17-25 min
Time-lag in fan activation in fire feed	5 s	5 s	5 s	5 s	5 s	5 s	5 s
Fan power	2-3	2-3	5-6	5-8	2-3	5-8	2-3

* Constant parameter; ** When the retort moves non-burnt coal or when sintered coal occurs this parameter must be extended (every 2 seconds), observing the flame in the boiler furnace, which must be convex - 2-3 cm above the retort. Meanwhile if the flame is flat or concave this parameter must be reduced (every 2 seconds).

The above parameters will require customization depending on many factors such as coal quality. Detailed information on the controller parameter settings is provided in the Controller Operational Manual attached to the boiler.

When water in the boiler has reached the temperature set on the controller, the boiler goes into fire feed mode – the fuel feeder and fan will be switched on cyclically (in accordance with the user settings). When the temperature in the boiler drops below the set value, the controller will activate the feeder and fan and will continue their operation until the set temperature has been achieved. The pauses between consecutive fuel charges and the fan operation time have to be adjusted in such a manner that the glow in the boiler furnace is maintained and it does not die. When the pauses have been set correctly, the fuel is burnt in the central part of the burner, the flame does not move towards the feeder, and unburnt coal does not fall into the ash pan.

Once the controller has been switched off, the device stores in its memory the parameters set last time.

After 8 hours, depending on the fuel quality, the parameters may be subject to change. Therefore the parameters have to be modified. However, the following rule of thumb that one parameter is changed at a time e.g. feed time remains constant, and only the fuel feed pause is modified. This must be assessed by looking into the boiler to find out whether the flame is level with the plate or whether a "molehill" has been formed. If the "molehill" is too large and moves, then the fuel feed pause must be extended.

The controller protects the boiler against overheating and switches off the overall system if the fuel has run out or the glow retreats into the hopper.

4.5. Fuel replenishment

To operate the boiler continuously it is necessary to replenish the hopper with fuel systematically. The fuel must be replenished at the latest when the thickness of the layer of coal in the hopper is min.30 cm from the hopper bottom. If the amount of coal is smaller than this then it may lead to dusting and smoking from the hopper. If the fuel is lacking the controller will switch off the entire system and it will be necessary to fire up the boiler again. To replenish fuel it is necessary to:

1. Switch off the fan.
2. Open the hatch of the fuel hopper.
3. Replenish the fuel in the hopper.
4. Make sure during adding fuel into the hopper, that there are no impurities in the fuel that could block the feeder operation (rubble, stones, and pieces of wood or metal).
5. Close the hopper hatch tightly.
6. Switch on the fan.

ATTENTION! During boiler operation the fuel hopper must be always closed tightly!

4.6. Shutdown of boiler operation

1. Switch into manual mode.
2. Switch off the fan and feeder.
3. Switch on the fuel feeder in manual mode for a couple of minutes to supply a significant portion of fuel so that the entire flame is extinguished in the combustion chamber.
4. Switch off the controller.
5. All doors, hatches and the damper in the smoke conduit must be closed tightly, so that the fire is put out.
6. After several minutes check if the fuel has not fired up again.
7. If the glow has been put out, then remove the coal residues and ash from the boiler.
8. Remove any remaining fuel from the feeder and hopper.

4.7. Fire damping at the end of the heating season

To dampen down a fire at the end of heating season, the actions from the Shutdown of Boiler Operation section must be repeated and then:

1. Remove fuel from the hopper and feeder.
2. Clean the whole boiler on the inside including flue gas piping and chimney.
3. During boiler downtime, leave the door open and fuel hopper hatch lifted to let the boiler inside dry and to secure a constant airflow.
4. To have the boiler technical overhaul performed.

ATTENTION! Do not drain the water from the boiler and heating system once the heating season is over or during a heating pause (except for the downtime needed for a possible repair). This protects the boiler against accelerated corrosion. However, you have to drain water from the system when frosts occur during boiler heating downtime. This will prevent water freezing and system damage.

4.8. Cleaning and maintenance

Boiler cleanliness is a prerequisite for boiler efficiency and, failure-free operation. Even the smallest layer of limescale will result in a reduction of heat transfer from the flue gases, and consequently a reduction of the boiler's efficiency. It may also cause damage to the boiler.

Therefore the boiler must be cleaned thoroughly at least once a week. After fire damping and the cooling down of the boiler the following tasks have to be performed: 1. Remove ash from the furnace and ash pan, 2. Remove soot from the combustion chamber using a wire brush, 3. After opening the top and bottom doors, use the wire brush to clean combustion tubes and flue piping, and then remove soot from the flue piping, 4. Clean the external boiler casing from the deposited wash, dust and fuel residues.

The boiler housing must be also kept clean and tidy. No objects other than those related to boiler operation can be kept in the boiler house.

Take care for the proper technical condition of the boiler and the hydraulic system:

- From time to time check and, if necessary, tighten up the screws fixing the motoreducer and fuel hopper.
- Check periodically the water-tightness of the water system and sealing of the boiler, smoke conduit and chimney stack. If necessary replace the hopper and door sealing.
- Periodic overhauls of the boiler have to be performed once a year in the boiler banking period.
- To carry out the boiler overhaul and to determine the scope of contingency repairs, the boiler must be cleaned thoroughly to remove any combustion residues from the firing side.
- Major boiler repairs caused by faulty operation, failures due to wear and tear or mechanical defects have to be carried out as soon as after they have been discovered by the manufacturer's service engineers.

4.9. Boiler operation in emergency mode

4.9.1. Emergency shutdown of boiler operation

The boiler operation must always be discontinued when: 1. there has been water leakage from the boiler, 2. temperature has risen above 90°C or 3. It is necessary to replace evaporated water in the system and in the radiators. To shutdown the boiler operation the actions referred to in the section "Shutdown of boiler operation" have to be performed. If it is necessary to shutdown the boiler as quickly as possible, then the embers and fuel from the boiler have to be removed using a metal spade into a metal container and carried away outdoors where it must be extinguished using water. ATTENTION! It is forbidden to extinguish glowing fuel with water in the boiler house premises!

4.9.2. Emergency firing up of KSR and KSRM boilers

In the case of a long—term power outage or failure of the control system, the boiler must be run in emergency mode. The emergency mode requires manual control, more frequent handling and installation of the iron grid. The use of the emergency grid is permissible only in emergencies.

The boiler operating in an emergency mode will not reach maximum power and requires manual control.

1. Dismount the deflector along with the fixing rod.
2. Put the iron grid on the angle sections, which are located below the bottom edge of the boiler furnace door frame.
3. Open the ash pan slightly to secure an inflow of air to the combustion chamber (the heating system is operated in gravitational mode).
4. Fire up the boiler using the iron grid (the boiler must be gradually fired up with wood and then using thicker and thicker layers of coal).
5. The smoke conduit must be opened to the maximum.
6. When basic firing has already been established then the iron grid must be disassembled, the deflector must be mounted and to start the boiler firing up process. (see item Section "Firing up the KSR and KSRM series boilers").

ATTENTION! In the case of a power outage and the application of the emergency grid, water circulation in the open-vented gravitational system must be secured (it is vital especially when a pump is used).

4.9.3. Emergency firing up of the KSP Duo series boiler

In the case of a long-term power outage or failure of the control system, the boiler is equipped with a permanent water-cooled grate. To fire up the boiler, the following actions have to be performed:

1. Open the middle and bottom door.
2. Put pieces of wood on a water-cooled grate, ignite them and then keep replenishing with fuel.
3. The smoke conduit must be opened to the maximum.

The water-cooled grate may be applied during day-to-day boiler operations, however, this requires frequent fuel replenishment and increased parameter control. Boiler operation using the water-cooled grate reduces boiler efficiency and heating power.

5. BOILER TROUBLESHOOTING GUIDE – BEFORE YOU CALL THE SERVICE ENGINEER

In the case of a needless request for a Service Engineer the travelling costs and Service Engineer's work will be covered by the Customer. Therefore before you call the manufacturer's service engineer, become acquainted with the most frequent boiler operational issues and how to address them.

Symptom	Cause	Repair
Smoke gets outside	insufficient chimney draught	Deal with the lack of sealing of the chimney stack, smoke conduit or boiler door
	Insufficient chimney stack height	Raise chimney stack a minimum of 1.5 m above the roof ridge
	Chimney stack diameter too small	Adjust smoke conduit damper by reducing the amount of blown-in air
	Very low atmospheric pressure	Use the fan to increase the chimney draught
	Flue pipes polluted	Clean the flue pipes
Low heating effect of the boiler	Combustion of fuel with low calorific value	Replace fuel with fuel with a high calorific value
	No air inflow into the boiler house	Allow proper air inflow through a window or air intake conduit
	Failure of forced draught fan or controller	Reset parameters as recommended in the Operation Manual or replace with a new one – in working order
	Pollution of flue piping in the combustion tube chamber	Clean the ducts, adjust the damper
The inside of the boiler got damp or tar accumulated (symptoms similar to leakage)	Application of wood as primary fuel in the heating process	Use fuel in adherence with the operation manual
	Low temperature maintained in the boiler	Operate boiler at min. temperature of 57°C
Leakage	Subject to manufacturer's evaluation	Repair by the PEREKO service engineer
Chimney draught too high	—	Adjust chimney draught using damper in the boiler smoke conduit

Symptom	Cause	Repair
Fuel stacks in the hopper	Fuel may have high moisture content	Fuel must be removed from the hopper and dried
Fuel does not leave the hopper	Protecting feeder cotter pin broken	Remove element blocking perpetual screw and put in a new cotter pin
Feeding screw does not switch on	No power supply	Check power supply
	Controller switched off	Check the main switch of the controller
	Motor switch	Check motor switch
Smoke coming out of hopper	Incorrect setting of fuel feed time	Set correct fuel feed time on the controller
	Fuel may have high moisture content	Check fuel moisture content and dry fuel
	Hopper hatch not tight enough	Replace sealing
Fuel consumption too high	Wrong parameter setting	Get help from Manufacturer's service unit
	Low fuel quality	Switch to another fuel
Fuel does not burn fully	Time interval between fuel feeds to short	Set the correct time interval between consecutive fuel feeds
	Low fuel quality	Switch to another fuel

6. WARRANTY TERMS AND CONDITIONS

1. The manufacturer of the boilers under the PEREKO brand is Envo sp. z o.o. with its registered office in Starachowice at ul. Radomska 76 POLAND.
2. The warranty certificate is not valid without the date, stamp and signatures of the manufacturer, selling outlet and salesman.
3. If the warranty certificate has been lost, no duplicates can be issued.
4. The warranty certificate or purchase invoice are the only documents giving the entitlement to the buyer to have a warranty repair done free of charge.
5. The producer extends the warranty for efficient operation of the exchanger for a period of 60 months for the KSP Duo series boilers and for a period of 72 months for the KSR and KSRM series boilers counting from the manufacturing date and for a period of 24 months for subassemblies.
6. The manufacturer extends the warranty for the integrity of welds for a period of 10 years from the manufacturing date.
7. The warranty for the integrity of welds is not tantamount to the warranty for water-tightness of the whole boiler and is applicable in the case of lack of integrity of welds.
8. The manufacturer reserves the right to introduce technical modifications without giving any prior notice.
9. The warranty shall be extended by the length of period from the date of notification concerning the required boiler repair until the execution date. The execution of the repair is confirmed in the warranty certificate as well as a report on the site visit and repair execution.
10. The manufacturer will process a compliant within 14 days of its receipt.
11. In the warranty period the boiler may be replaced with a brand new one if the Producer has discovered (based on the statement of an authorized expert) that the boiler is not repairable.
12. Quality complaints about the boiler have to be notified to the point of sale or directly to the manufacturer.
13. The warranty does not cover the boiler terminal, clamps, and high temperature creep resisting door, packing cord inside the external door and tools for operation and cleaning.
14. The warranty for the electronic temperature controller, fan and coal automatic feeding system is covered by their manufacturers' warranty and this is attached to the complete set of boiler documents.
15. In case of a groundless complaint and groundless summoning of a Service Engineer the travelling costs and the Service Engineer's work will be covered by the Customer.
16. The above Operation Manual for feeder boilers is the property of Envo sp. z o.o. It may not be copied and used by any other business entities or natural persons without the prior written consent of its owner. All rights reserved.

ATTENTION! The manufacturer bears no responsibility for the results of incorrect installation, incorrect boiler operation, failure to follow the recommendations specified in the operation manual and incorrect maintenance of the boiler.

The warranty is not valid when:

1. The safety systems used do not adhere to the Polish standard PN-91/B-02413.
2. Incompliant connection in a closed-vent system in accordance with the Journal of Laws 2009. No. 56, item 461.
3. Incorrect boiler transport and storage.
4. Start-up of boiler without a sufficient amount of water.
5. Defects caused by boiler overheating.
6. Repairs in the warranty period performed by persons and business entities not authorized by the producer.
7. Defects that occurred as a result of failure to following the recommendations specified in the Manual.
8. When the permissible operating pressure has been exceeded by 1.5 bar.
9. Mechanical damage or interference with the boiler design by unauthorized persons.
10. Corrosion of steel elements due to maintaining at too low return water temperature below 57°C with simultaneous use of incorrect, damp fuel.

SERVICE SUPPORT

Date	Comments	Signature

WARRANTY CERTIFICATE

for central heating water boiler

Manufacturer's number .....

Type .....

Date of Manufacture .....

Quality mark .....

The manufacturer extends the warranty for the integrity of welds for the body of water boiler for the period of 10 years from the manufacturing date, for the water-tightness of the exchanger for a period of 60 months for the KSP Duo series boilers and for a period of 72 months for the KSR and KSRM series boilers counting from the manufacturing date and for a period of 24 months for other subassemblies.

.....	.....	.....
Signature and stamp of the Producer	Date of retail sale	Signature of salesman and stamp of commercial outlet

Producer

Envo sp. z o.o., 27-200 Starachowice, ul. Radomska 76, POLAND

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