EG-PELLET MINI BOILER

16-45 kW

Technical and Operation

Documentation

December 2014

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1. General information:

1.1 Introduction:

Recently, there have been numerous discussions at an international level about the danger to the ecosystem due to the increasing greenhouse effect. This effect is the result of vast amounts of greenhouse gases being released into the atmosphere, which are the product of burning various kinds of fuels, mainly fossil fuels. To prevent the degradation of the environment caused by the greenhouse effect, we began limiting the greenhouse gases emission by utilising special design boilers, which, however, does not solve the greenhouse effect problem (it only slows it down). Furthermore, cost of such boilers is relatively high and increasing fuel prices make operation costs higher every year.

Aiming to tackle the problem of global warming and increasing costs of modern solid fuel boilers (coal, pulverised coal), Zakład Ślusarski GREŃ introduced to the market a solution which is an almost perfect middle ground between greenhouse effect prevention and limiting costs of heating necessary for maintaining a certain level of comfort.

These problems are solved by the EG-Pellet Mini boiler which is designed for wood granules (pellet) combustion and, alternatively, wood in pieces, fed manually.

Pellets listed above are among the wide range of biofuels which have a lot of advantages, like:

- Renewable source fuels; their proper exploitation prevents deposit exhaustion.
- Biofuel only emits the amount of CO_2 absorbed by the fuel's material in its growing phase (wood, straw, miscanthus):
- Low ash content 0,3 - 0,5%;
- Ash can be used as a fertiliser.
- Low operational costs.
- Pellet price independence from coal price.

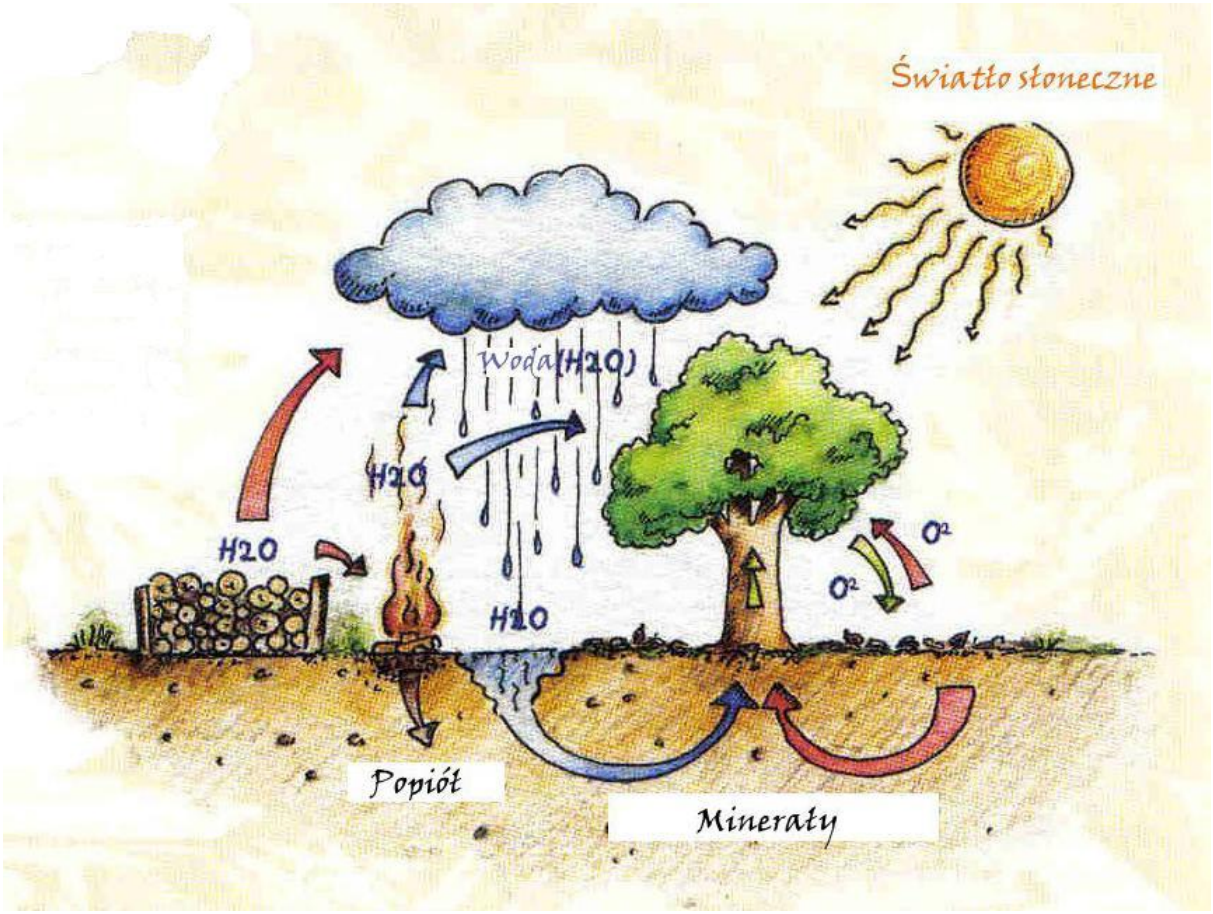


Fig 1: Water circulation in biomass production

1.2 Application and benefits of the boiler:

The EG-Pellet Mini is designed for pellet combustion. It is intended for heating multi- or single-family homes, offices, workshops, etc. Its benefits include, but not limit to:

- High efficiency (over 90%), thanks to modern, thoroughly tested design;
- Virtually fully automatic operation - the boiler needs to be fed with fuel once every few days, depending on local weather conditions. The ignition and combustion are automatic.
- An innovative manual cleaning system which eliminated the need of boiler dismantling - one general cleaning needed every few months (3-4 times a year)
- Low level of pollutants in the exhaust gases;

- Low ash level, which can be used as a fertiliser;
- Extra grate which allows combustion of wood in pieces without the need of dismantling the burner;
- Low operating costs;

1.3 Basic rules of operation:

In order to ensure the correct and long-term boiler service, please observe the following rules:

- Fuel used - pellet, must have an appropriate granularity and quality (in accordance with DIN 51731 and DIN EN 14961-2:2011 - 6 to 8mm).
- Granules may not include wood shavings or dust, may not crumble while loading;
- It is prohibited to make changes in the construction of the boiler.
- It is prohibited to manually interfere in the boiler's operation cycle - this may result in damage or destruction of the feeder screw;
- Calorific value for granular material must be in accordance with DIN 51731 and DIN EN 14961-2:2011;
- Boiler must always be supplied with water circulation. Failure to do so may result in overheating, which may result in property damage and personal injury.
- Before the boiler start-up, it must be ensured that boiler room is properly ventilated, and that the flues and airways are always clean;
- The user must rigorously observe rules and instructions related to the network (central heating as well as power network) and the boiler's operation.

1.4 User Responsibility:

- Operation and proper maintenance of the boiler are the customer's obligation and he is fully responsible for it;

- Failure to conform to the attached boiler operation instructions may result in irregularities in the boiler's operation, poor performance and short service time;
- The boiler can be operated only by personnel who is in good physical and mental condition;

2. Technical data:

2.1 Fuel parameters:

To ensure optimal performance, fuel with proper characteristics must be used. In accordance with DIN 51731 and DIN EN 14961-2:2011 the pellet fuel should have the following properties:

- **Granulation 6-8mm;**
- Net calorific value 17500 - 19000 kJ/kg.
- Ash content max. 1.5 %.
- Moisture content: pellet - as regulated by norms, wood - 30%;
- Density 1 - 1.4 kg/dm ^{3};

Compliance with the specifications above ensures proper and long-term operation.

Using fuel of different granulation and parameters listed above may result in boiler damage which will not be covered by the warranty.

2.2. Basic boiler parameters:

Table 1: Basic parameters of 16-45 kW EG-Pellet Mini boilers

Boiler model	EG-Pellet Mini 16 kW	EG-Pellet Mini 24 kW	EG-Pellet Mini 35 kW	EG-Pellet Mini 45 kW
Boiler power [kW]	16	24	30	40
Efficiency [%]	>90	>90	>90	>90
Approx. Heating surface [m^2]	up to 200	Up to 300	Up to 400	Up to 600
Unit combustion[kg/h]	3,2	4,3	5,6	8,8
Exhaust gas temperature for rated/minimal power [°C]	160/100	160/100	160/100	200/120
Minimal chimney draught [mbar]	0,2	0,2	0,2	0,2-0,3
Minimal chimney height required [m]	8	8	8	9
Chimney cross-section required[cm^2]	200	200	250	250
Acceptable working temperature [°C]	90	90	90	90
Minimal return temperature [°C]	46	46	46	46
Burning time [h]				
Maximum working pressure [MPa]	0,35	0,35	0,35	0,35
Test pressure [MPa]	0,5	0,5	0,5	0,5
Boiler class	5	5	4	4
Weight [kg]	270	320	385	450
Fuel box capacity - standard [l]	300	300	600	600
Minimal input power [W]	105	115	115	115
Nominal input power [W]	136	166	166	166
Stand-by power [W]	4	4	4	4
Power [V]	230	230	230	230

* - fuel consumption and fuel efficiency are dependent on moisture content.

Parameters listed for EG-Pellet Mini boilers are for information purposes. Manufacturer reserves the right for deviation of particular values.

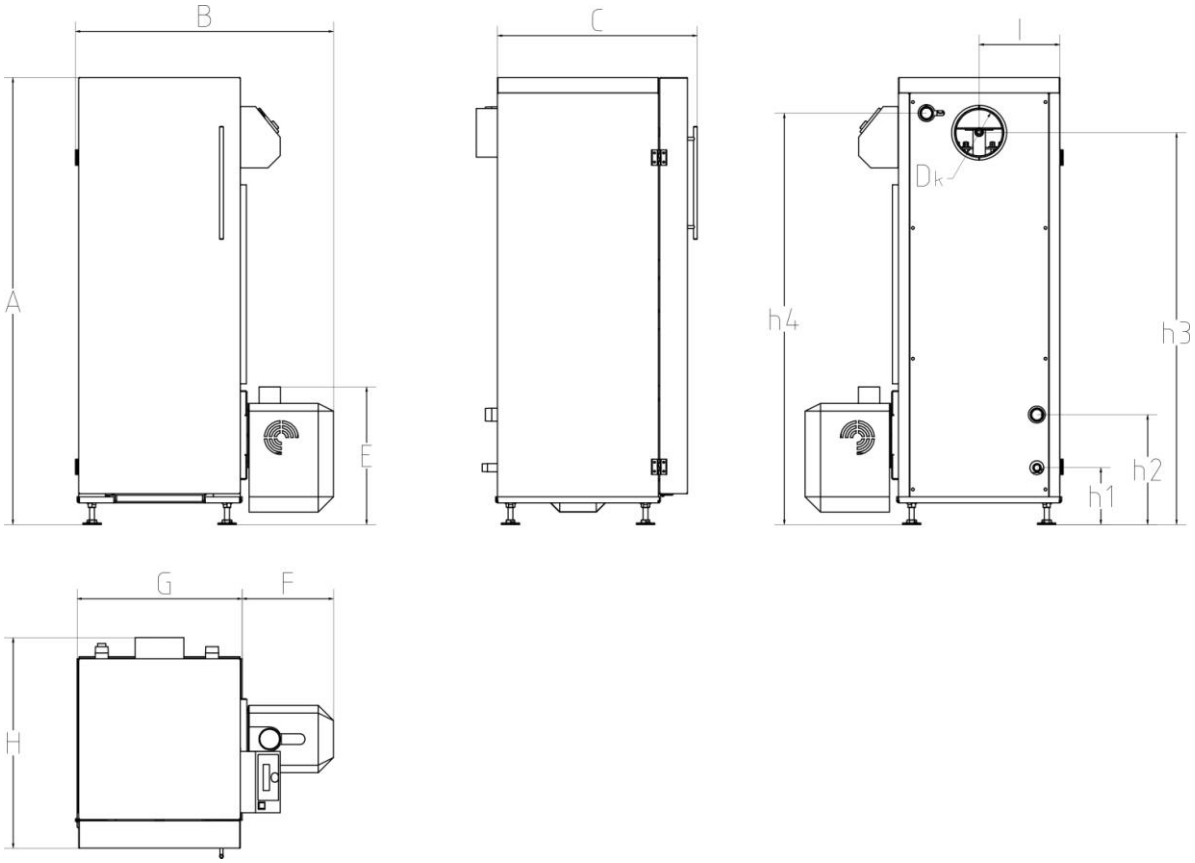
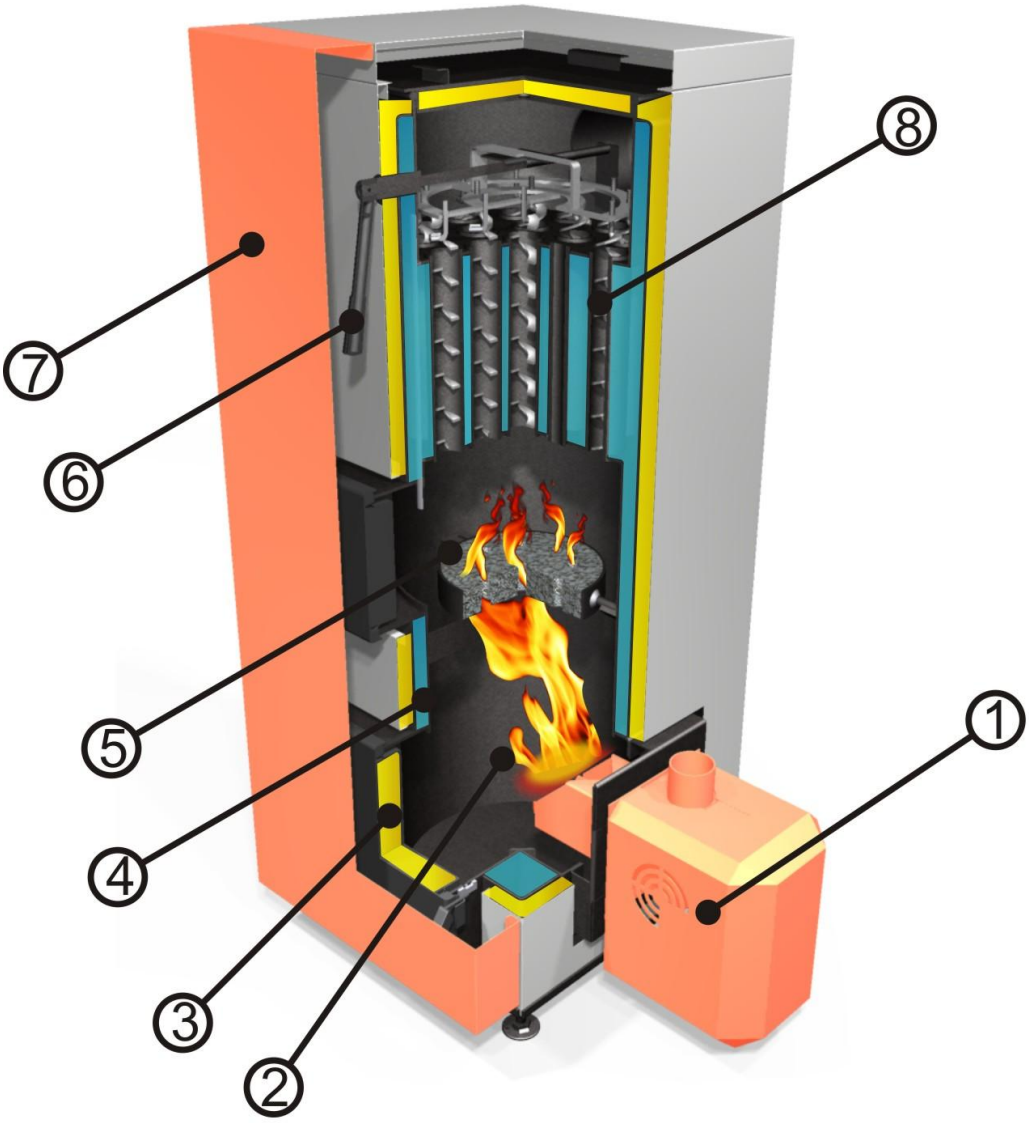


Fig 2: Basic dimensions of 16-45 kW EG-Pellet Mini boilers

Dimension	16 kW	24 kW	30 kW	40 kW
A	1419	1519	1719	1869
B	841	841	841	841
C	640	640	640	640
Dk	160	160	160	160
E	506	506	506	506
F	304	304	304	304
G	538	538	538	538
H	688	688	688	688
I	263	263	263	263
h1	242	242	242	242
h2	344	415	415	415
h3	1165	1336	1536	1686
h4	1300	1400	1600	1750
Water inlet	5/4”	5/4”	5/4”	5/4”
Water outlet	5/4”	5/4”	5/4”	5/4”
Water drain	3/4”	3/4”	3/4”	3/4”

Table 2: Selected dimensions of 16-45 kW EG-Pellet Mini boilers

2.3 Boiler construction:



1. Burner, 2. Combustion chamber, 3. Insulation, 4. Water jacket, 5. Grate,

6. Swirlers lever, 7. Body, 8. Firetubes with swirlers

Fig 3: Cross-section of 16-45 kW EG-Pellet Mini boiler

Care and proper maintenance of the boiler's components is key to its correct operation.

2.4 Boiler equipment:

Standard equipment for the EG-Pellet Mini boilers includes:

- Boiler body with masking doors
- ceramic or cast iron baffle grate
- Pellet burner (igniter, fan, fuel feeder)
- Control - TECH controller
- CO sensor,
- DHW sensor
- Exhaust gas temperature sensor,
- Top buffer loading sensor
- Bottom buffer loading sensor
- Blow fan power cord
- Igniter power cord
- Pellet tank (300 or 600l, depending on power)

Optional features:

- pneumatic pellet feeding.

2.5 Electrical system characteristics:

(a) Main power supply

Power supply must be equipped with a safety device to protect against power surges and lightning. The boiler must be fitted with a 30 mA differential switch, as well as a 2 or 4-pole switch, depending on extractor type. The boiler's power supply and electrical connections must conform to all regulations (EN 60335 - 1 norm) and must be installed by a specialist.

(b) Electrical connections:

According to the switchboard's instruction, the standard conditions for electrical connections are: 230 Volt (single phase) 50 Hz or 400 volt (three phase +N) 50 Hz. Please check the consistency between main electrical installation parameters and the boiler's electrical equipment parameters.

(c) Electrical cabinet:

Access to the electrical cabinet is secured with a keyed lock to prevent unauthorised access.

Electrical cabinet must always remain closed with a key, which must be kept out of the reach of children.

d) Boiler's controller:

The boiler is controlled by a ST-717 controller, whose detailed description can be found in the „EG-FIRE_manual_1.0_2013_EN.pdf" document attached to this manual.

Fig 4: ST-717 controller panel view

2.6 Load points:

Values listed below are for standard installation and may change according to circumstances. The table below lists the load points

No	Name	Producer	Model	Power supply	Power consumed [W]	CE certificate
1	Burner	Eko-Greń	EG-Fire	230 V, 50 Hz	280	YES
2	Boiler controller	Tech	ST-717	230 V, 50 Hz	11	YES

3. Boiler set-up and installation

3.1 Installer responsibility:

Boiler installation must be performed by a qualified boiler technician adhering to all applicable laws and regulations. The installer is to follow all instructions provided by the manufacturer. This applies mainly to the instructions for use and how to install the boiler and its parts, along with the schematics for hydraulic systems.

Any irregularity or damage caused by non-compliance with the manufacturer's recommendations listed in this instruction is the responsibility of the installing technician.

3.2 Boiler room:

The room where the boiler is to be installed (boiler room) must conform to proper norms and regulations. In Poland, the boiler room requirements are listed in the PN-87/B-02411 norm, as well as in the Ministerial Decree from 12 April 2002 regarding technical requirements of buildings and their placement. (Journal of Laws No. 75, item 690)

Solid fuel boilers need to be installed in dedicated rooms (boiler rooms). The fuel stockpile needs to be situated in a dedicated room, no closer than 400m from the boiler. To facilitate access to the boiler and its maintenance, a 400mm clearance around the boiler must be provided. The boiler must be situated on a non-flammable surface whose dimensions must exceed the boiler's base by at least 200mm on each side. If the boiler is to work in a basement, it is recommend to make a foundation of at least 50mm, on which the boiler is be placed.

It is essential to make sure the boiler is in an upright position to avoid becoming airlocked.

During the boiler's installation, the distance from combustible materials must be observed in accordance with their level of combustibility.

If the combustibility level of a material in the boiler's vicinity is unknown, double the recommended safe distance (safe distance is 200mm).

To ensure the boiler's proper operation, adequate boiler room ventilation needs to be provided. Forced ventilation should be performed via non-closing, 200cm^2 opening placed up to 1m above the floor level. Induced ventilation, installed in accordance with relevant regulations, is equally important and required.

Compliance with the instructions above regarding boiler room specifications protects the boiler from possible damage and ensures long-term operation.

It is essential to follow the boiler room instructions listed in this manual as well as regulations in force in the country, where the boiler is to operate (Poland).

In case where the boiler is installed in an open-air area, where the temperature is below 15ºC or in a room with conditions which may damage the boiler and its components (chlorine, acid, humidity etc.), the manufacturer is exempted from the obligation to provide warranty for the boiler and its parts. Any questions regarding boiler room should be directed to the boiler manufacturer.

3.3 Ventilation and exhaust installation - chimney:

In order to ensure proper combustion, there needs to be forced ventilation system (non-closing, 200cm2 opening placed up to 1m above the floor level).

Proper combustion process also requires adequate exhaust installation - chimney. The chimney's purpose is to evacuate exhaust gases and feed air needed for the combustion process. Chimney draught necessary for this process depends on:

- temperature difference between the ambient air and exhaust gas;
- useful chimney height

- chimney cross-section (≥ 100 cm^2);

- chimney material - smooth surfaces preferable along with air-tight connections.

Effective chimney height is the difference in furnace's highest point and the chimney's exit. This value for individual chimneys should be at least 4m. In case of sloped roofs - within the ridge, inside the free air movement zone - to avoid draught disruption. The building's location in relation to other buildings should always be taken into consideration.

In most cases the approximation method is sufficient to determine chimney parameters, or following the manufacturer's diagrams. In case where basic method or diagrams are insufficient to design a chimney installation, the chimney should be designed using DIN EN 13384-1 (PN-EN 13384-1) norm.

The cross section of such a chimney should be 16x16cm (14x14cm in Poland). Incorrect cross-section values may result in slow exhaust gas evacuation and, in effect, accumulation of soot inside it. If the exhaust gas temperature drops below the dew point, water and sulphuric acid may damage the wall.

The boiler's connection to the chimney is via a DIN 18160 flue. They can be constructed as exhaust pipes or exhaust canals. Exhaust pipes are pipes or pipe fittings installed in rooms. Exhaust canals usually conform to the same fire safety regulations as chimneys and are made of the same material as the main chimney. The flue connection to the chimney should be short and directed upwards to avoid heat loss and additional resistance. It cannot lead to other floors. Exhaust pipes should not be placed in rooms unsuitable for furnace installation. Exhaust pipes should not be installed in walls or ceilings.

3.4 Boiler burner:

16-45kW EG-Pellet Mini boilers are equipped with EG-Fire burner, whose detailed specification is in the attached „EG-FIRE_manual_1.0_2013_EN.pdf" document. The burner consists of the following components:

- EG-Fire burner
- heat-resistant grate inserted in the burner's body
- ST-717 controller with a set of sensors

- flexible feeder tube
- 2x cable tie
- rigid feeder tube

Basic technical specifications:

Burner Model	**15**	**25**	**35**	**45**
Rated Power	16 kW	28 kW	41 kW	45 kW
Efficiency	88,50%	90,00%	92,80%	88,20%
Device class (EN-303-5:2012)	5	5	5	5
Weight	15 kg	16 kg	20 kg	20 kg
Fuel	C1 - 6 mm, DINplus wood pellet			
Noise level	52.8 ± 3.2 dB			
Electrical connection	230 V 50 Hz			
Energy consumption during ignition	280 W			
Energy consumption at max. power	110 W			

Table 3: Basic specifications of EG-Fire burners

Fig 5: General view of a EG-Fire burner

4. Boiler installation and start-up:

Solid fuel boilers must be installed in accordance with all applicable regulations and by a qualified technician. The responsibility for proper boiler installation rests on the installing company, properly trained in operating biomass boilers. Any tampering with the boiler's electrical installation could void the warranty.

The completion of installation and test start-up must be noted in the warranty card. No information on the boiler's start-up may cause loss of warranty.

The hydraulic installation must conform to all regulations and be done in accordance with construction principles.

4.1 Example installation schematics:

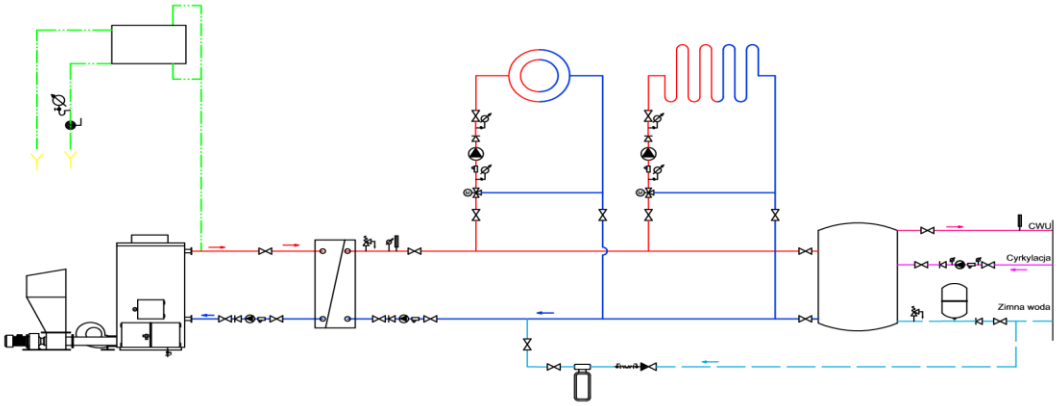


Fig 1: Option 1. OPEN SYSTEM

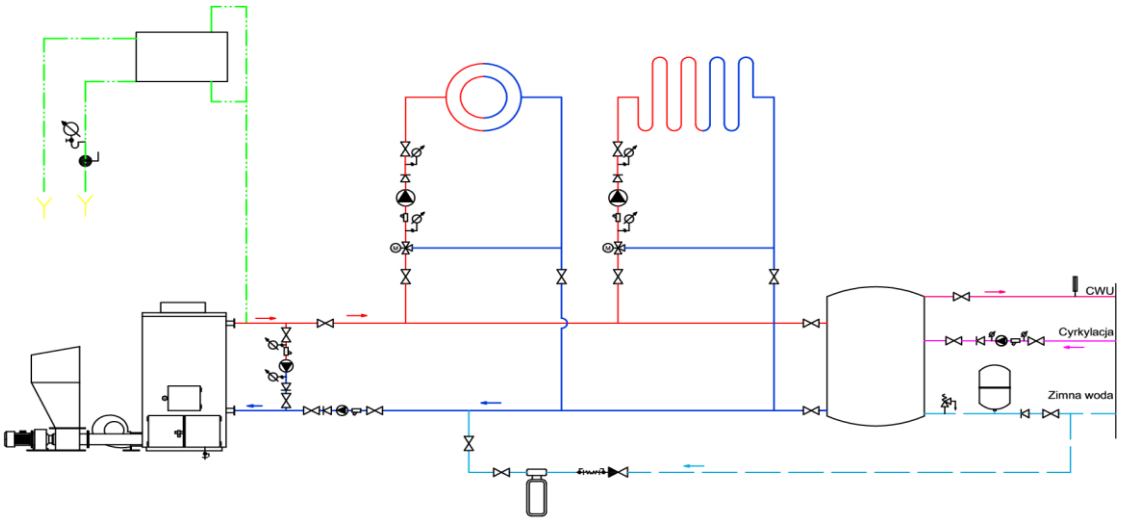


Fig 2: Option 2. OPEN SYSTEM

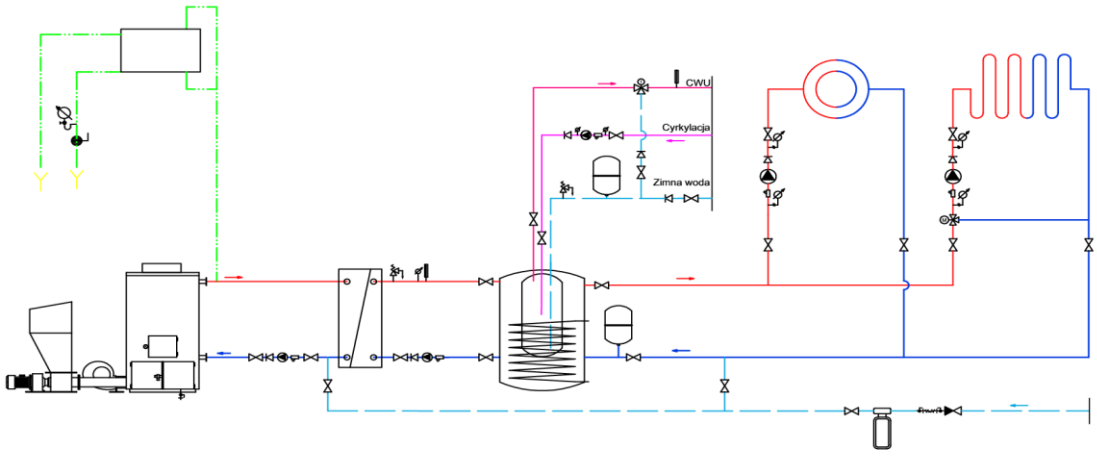


Fig 3: Option 3. OPEN SYSTEM

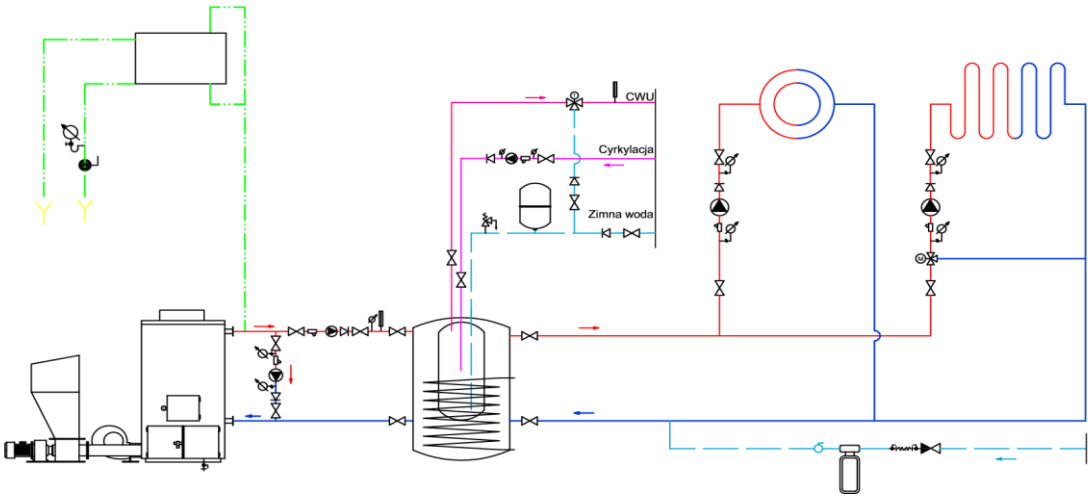


Fig 4: Option 4. OPEN SYSTEM

Heating network water requirements:

- water must be clean - no added active chemicals;
- water hardness lower than 20ºf;
- PH more than 8,5.

The boiler is designed for the 230V/50Hz power supply. Electrical installation should be performed by a qualified technician who, while installing power connection, should place the earthed 230V/10A socket in an easily accessible location. Boiler power and boiler room lighting should have a separate circuit.

4.2 Boiler start-up by the user:

In order to start the boiler you should:

- Load fuel into the tank.
- Load fuel into the manual feed burner;
- Keep feeding fuel until it starts falling through the flexible tube directly into the burner;

- Engage the boiler ignition function;
- if all steps have been properly performed, the boiler will start up automatically.
- from the moment of ignition the boiler will operate automatically - fuel feeding parameters will be chosen by the controller and adjusted for current conditions.

4.3 Resuming boiler operation after it has run out of fuel;

In case of boiler stopping due to lack of fuel you should:

- refill the tank with fuel;
- feed the fuel using manual function until it starts falling through the flexible tube directly into the burner;
- remove the ash accumulated as a result of fuel burn-out;
- start the boiler.

4.4 Final remarks regarding boiler installation and start-up:

In order to ensure long and safe boiler operation you should:

- Ensure proper chimney draught for optimal combustion process;
- protect the boiler from moisture and draught restriction by using acid-resistant or ceramic chimney liners with condensation elimination;
- place the boiler on a ceramic base to avoid dew accumulation;
- make sure that the central heating installation is equipped with a drain cock which needs to be placed at the lowest point and as close as possible to the boiler.
- remember that the boiler star-up should be performed by staff with Authorised Technician certificates, trained by the manufacturer.
- remember to note the installation completion and test start-up in the warranty card;
- remember that boiler can be operated only by adults who have read the instruction above.
- **Children are prohibited near the boiler without supervision;**

- turn of the boiler if there are any construction works in the boiler room using glue, paint etc., which may increase risk of fire or explosion;
- turn off the boiler for scheduled service and maintenance works.
- start up the boiler only using the auto ignition function. any flammable liquids or substances are prohibited to start up the boiler (petrol, kerosene, etc.);
- avoid boiler overheating;
- remember not to store flammable materials on or nearby the boiler;
- remember to keep the operating temperature at 60ºC and use a thermal protection of 45ºC on returning water;
- remember to clean the chimney thoroughly at the and of the heating season. the boiler room should be kept clean and dry;

- **remember that any tampering with the boiler's electric systems is prohibited and may cause warranty loss.**

5. Boiler cleaning and maintenance

In order to prolong the boiler's service time you need to remember about cleaning and maintenance. You need to:

- Regularly clean the exchanger using the cleaning mechanism lever located at the front of the boiler - move the lever both ways for around 30 seconds and clean the dust that will gather on the baffle grate and in the ash trap area of the boiler; (recommended - once a week)
- Systematically empty the ash from the ash trap area of the boiler - using a spatula or other tool direct the ash to the container and dispose of it into an appropriate waste container. The ash can be used as a natural fertiliser. (recommended - once a week)
- Regularly clean the boiler's exchanger tubes (firetubes) - it is done by removing the top cover and unscrewing the exchanger's cover. Next, you should remove the cleaning mechanism (turbulators) and clean each firetube separately wish a steel brush. (Recommended - 3-4 times a year).

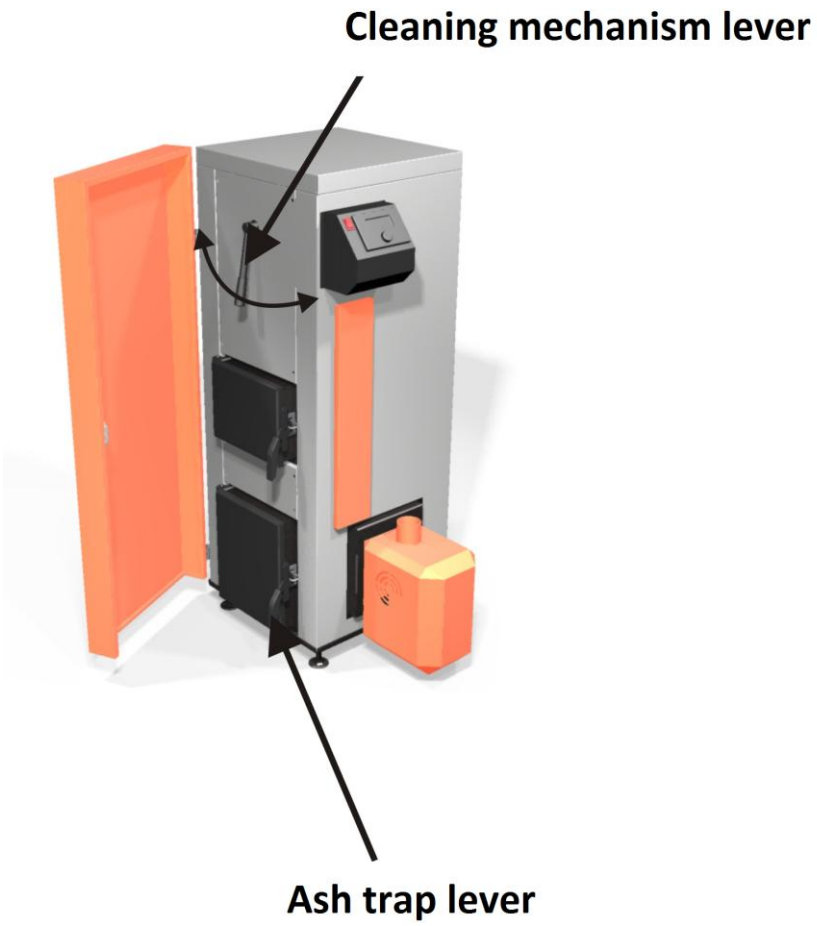


Fig 6: Boiler cleaning

If you notice any irregularities in the combustion process, please contact an authorised repairer, which will perform boiler diagnostic and maintenance.

6. POSSIBLE PROBLEMS AND THEIR SOLUTIONS:

Problem	Solution	How to fix
- Alert - fire went out	- No fuel - too low fuel dose - too high fuel dose - damaged/uncalibrated photosensor - internal feeder not functioning - Fan malfunction	- Restock fuel - calibrate the burner - check photosensor readings, check resistance, calibrate luminosity level, replace if damaged - check the motor's capacitor and output current in the manual mode. Replace in case of motor malfunction - Check the fan in the manual mode. Call electrician to check the connections and controller's cables if it does not work
- internal feeder temperature alert	- temperature sensor malfunction - internal feeder motor not functioning - exhaust gas canal blocked	- check and replace sensor if needed - check the motor's capacitor and output current in the manual mode. Replace in case of motor malfunction - Check and clean the boiler and chimney
- the burner overfeeds pellet	- too much fuel	- calibrate the burner
- the burner uses too much fuel	- too much fuel - no CO and DHW programs	- Calibrate the burner - Input CO and DHW programs

Table 4: Possible problems and their solutions

7. Warranty conditions and responsibility for product defects:

Greń Sp J provides a 60-month warranty for welded connections' tightness from the start-up, no longer than 62 months from the date of purchase The warranty applies only to the area of Poland. All other parts are under a 24-month warranty with exceptions (feeder screw, exhaust gas sensor, swirlers, deflector), which are under a 12-month guarantee.

Warranty conditions are as follows:

- First start-up performed by a technician and noted in the warranty card.
- Boiler connection to the heating system performed by a technician with proper certificates, noted in the warranty card. Any repairs and operations outside normal operation described in the Instruction can be performed only by authorised repair company.

Warranty is void when:

- **any rule listed in this instruction has been ignored;**
- confirmation of the instruction being read or boiler start-up card and has not been filled in;
- the warranty card lacks information on first start-up;
- warranty card lacks boiler number, date of purchase, seller's official stamp and signature, purchaser's information (name, address etc.) or purchase order number.

Closing remarks:

- Any information on malfunction must be forwarded immediately, always in writing - by filling in and submitting a complaint protocol to the place of purchase or servicing company.

- the manufacturer is not responsible for any damage caused by using a boiler of inadequate power;
- it is prohibited to check the air-tightness using compressed air;
- the user will be charged for calling in servicing company in case of damage caused by the user, caused by non-compliance with this instruction, caused by faults not connected with the boiler or in case of unwarranted calling of the servicing company.
- The manufacturer reserves the right make changes to the boiler or its control which are not covered in this instruction.

Every mechanical or electrical device needs to be serviced regularly to ensure proper operation.

8. Boiler maintenance

Do not change settings if the cause of a malfunction is unknown Please contact

- The boiler's installing technician

Company:.....

Address:.....

Last name:.....

First name:.....

Telephone:.....

- Zakład Ślusarski Greń company J.

Telephone (32) 326 34 70, (32) 210 16 26

8.1 Boiler operation card

Date	Boiler condition	Modifications

Table 5: Boiler operation card

EG Pellet-Mini boiler statutory plate specimen:

GREŃ ROK ZAŁOŻENIA 1990 43-200 Pszczyna ul. Karola Miarki 1b	Type EG-Pellet Mini Year of construction -
Rated heat output (kW)	
Boiler class	Class 5
Fuel grade	C1
Boiler efficiency (%)	>90
Working pressure (bar)	0,2-3,5
Test pressure (bar)	5,0
Test date	
Water holding capacity (litre)	
Operating Temperature [˚C)	60÷95
DGR 97/23/EG PN-EN 303-5 Norm CE 0036	
Boiler's number	
Max. power Consumption **0.28** kW, Frequency: 50 **Hz** Voltage: **230** V ~	

Zakład Ślusarski Greń Sp. J.

St. Karola Miarki 1b

43-200 Pszczyna

Warranty Card

Valid only if a copy is returned to the production plant (address below) within 10 days, counting from the day of delivery.
(See general conditions)

EG-Pellet Mini series

- steel boiler.....5 years
- concrete and fire-resistant elements.....2 years
- feeder's screw and silo's extractor.....2 years
- electrical and boiler regulation elements and.....1 years

Last name: .....
First Name: .....
Address: .....
Telephone: .....

Aware of guarantee conditions, i undertake to observe the manufacturer's instructions.

Warranty reservations:
.....
.....
.....
.....
.....
.....

Greń company is not responsible for above reservations. Any irregularities in boiler operation detected by a Greń company technician will cause the boiler to stop working. It is the responsibility of the customer to keep the boiler in operation. In case another boiler start by a technician is required, the customer will be billed.

Boiler specification:

Type: .....
Serial Number: .....
Date of delivery: .....
Date of start-up: .....

CUSTOMER'S SECTION
Zakład Ślusarski Greń Sp. J.
St. Karola Miarki 1b
43-200 Pszczyna

Warranty Card

Valid only if a copy is returned to the production plant (address below) within 10 days, counting from the day of delivery.
(See general conditions)

EG-PELLET MINI series

- steel boiler.....5 years
- concrete and fire-resistant elements.....2 years
- feeders screw and silo's extractor.....2 years
- electrical and boiler regulation elements and.....1 year

Last name: .....
First Name: .....
Address: .....
Telephone: .....

Aware of guarantee conditions, i undertake to observe the manufacturer's instructions.

Warranty Disclaimer:
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Greń company is not responsible for above reservations. Any irregularities in boiler operation detected by a Greń company technician will cause the boiler to stop working. It is the responsibility of the customer to keep the boiler in operation. In case another boiler start by a technician is required, the customer will be billed.

Boiler specification:

Type: AUTO .....
Serial Number: .....
Date of delivery: .....
Date of start-up: .....

Manufacturer signature (read) Installation technician's signature (read) Customer's signature: (read)

Notes: