

Moderator Sp. z o.o.

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Instruction manual for 30-120 kW Smok Automatic Biomass Burning Set with cast iron heads and containers of up to 2m³

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NOTE TO USER

Thank you for purchasing our device and congratulations on a good decision.

Moderator Spółka z o.o. has been manufacturing boilers using proprietary technological solutions developed in late 1970s in Hajnówka by engineer Kazimierz Kubacki. During the last twenty years these boilers have undergone multiple technological changes and upgrades. We have also started production of automatic feeders intended for burning crumbled solid fuels, which combined with a boiler constitute complete Automatic Biomass Burning Sets (AZSB). This instruction manual is based on the latest information of the manufacturer. Due to ongoing development works on the boiler the manual is only applicable for the boiler it is delivered with.

AZSB is intended for heating water up to maximum 80 degrees Celsius in central-heating and hot household water installations as well as in process installations (wood dryers, presses, etc.).

This manual has been designed to assist users in boiler installation, operation, maintenance and servicing. Read the manual carefully before attempting any of the said actions.

1. INTRODUCTION

1.1. SAFETY INSTRUCTIONS

The main condition of safe boiler operation is its correct connection to the central heating installation. The manufacturer has put great effort to make the device as safe as possible. This will only be possible after all connection and operation requirements outlined in this manual are met and complied with. Failure to perform any action, due to involved costs of additional equipment installation will certainly affect the safety or cause the equipment operating costs to rise in the future.

The equipment has been subjected to performance checks and tests, which all have been performed using carefully selected accessories (safety valves, thermal protections) and equipment. In order to guarantee the declared high performance of the equipment, you should only use equipment recommended by the manufacturer.



We would like to hereby advise against using substitute solutions, which have not been checked with that boiler and which do not have required approvals (Technical Supervision Office - UDT) and certificates (declaration of conformity, CE sign). We also advise against any unauthorized changes in the equipment structure and against failing to follow safety instruction described in these instructions.

Failure to follow these recommendations may lead to serious danger and expose the operating personnel to health or life hazard.

In case of doubt, please contact our sales department or an authorized servicing agent.

Safety instructions for basic activities

Maintenance – during maintenance, the device must remain disconnected from the power supply. The power switch (9, fig. 2.3) must be in **0 (zero)** position. During maintenance always check the tightness of connections and condition of cover seals.

Leaks – when filling the tank check if there are any foreign bodies under the cover which could prevent it from being properly closed.

Head – keep in mind that the burner head stays hot long after the device has been switched off. All works on the burner head may only be performed after the temperature drops. The burner head must not be covered and must be kept clean.

Fire safety – leaving open covers or inspection holes or overfilling the container during burner operation may constitute an imminent fire threat. Too much fuel in the container will prevent tight closing of the cover:

- On each visit to the boiler room (at last once per 12 ÷ 24 hours), it is necessary to check whether the fire water tank contains sufficient volume of water,
- Appropriate fire prevention equipment shall be available in the boiler room (acc. to fire brigade recommendations, appropriately sized fire extinguisher, etc.),

- do not store ashes in plastic or cardboard containers. Do not leave ashes in premises unsupervised (even if in non-combustible containers),

Protective equipment – chips, sawdust and ashes may contain carbon monoxide, dusts and allergens. When working with this material, use appropriate means of personal protection. Note that ashes may contain concealed glowing coal particles. When working with ashes, use suitable gloves.

Clothing – When working in the boiler room, due to personal safety considerations, use infusible and non-combustible clothing.

Safety and Warning Signs

Please pay attention to the warning and safety signs, minding their meaning and placement on the equipment. They are designed to avoid accidents.



Pay special attention in the boiler room keeping in mind that various parts of the boiler and systems may be hot. Keep a safe distance.



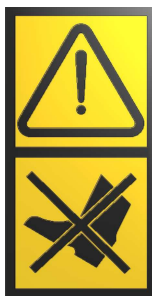
The device may periodically switch on without warning. Do not perform any works on a connected and switched on device.



This boiler may only be operated by people familiar with the content of this instruction manual.



The transport worm may start operating without warning. Switch off power supply before lifting the cover.



Do not stand on the housing.



The container may contain carbon oxygen and dust. Vent the container before commencing with loading or prior to its opening.

1.2. WARRANTY

The manufacturer grants 24-month warranty for the device, which includes workmanship and material faults.

The warranty does not cover damage resulting incorrect use or normal wear and tear. The warranty does not include refund of installation costs, refund of travel costs, damages in transport, damages caused by changes or repairs performed without manufacturer's authorization.

All complaints shall be always filed to the boiler vendor When filing a complaint, please provide the following:

- fault description
- proof of device purchase
- boiler output, head rated power
- boiler and Smok device serial numbers

Declaration of Conformity

We,
Moderator Spółka z o.o.
11 Listopada 16a
17-200 Hajnówka
tel. (085) 682-75-20

hereby declare, on our own and sole responsibility that the product: Smok Automatic Biomass Burning Set, with serial number starting from 250, to which this declaration applies, meets the following requirements and standards, where applicable:

Directives
EMC 204/108/WE
PED 97/23/WE
LVD 2006/95/WE
MAD 2006/42/WE

Norms
EN-PN ISO 12100
EN-PN 303-5

PREZES ZARZADU
mgr Mariusz Kubacki

Hajnówka 2012.11.15

1.3. FUEL

Use only recommended fuels.



AZSB is designed to burn crumbled fuels from renewable sources and wood and vegetable products, such as (chips, sawdust, bark, bricks, pellet with a bulk density of 450kg/m³) with humidity content of up to 25%. Technical parameters of the device are specified for fuels with humidity content of up to 12.39% and calorific value of Q = 15779 kJ/kg.



Avoid burning too fine fuels (such as saw dust), in which dust content exceeds 5%, as it may lead to an explosive combustion of dust. You should not compact the fuel as it may lead to its suspension.



In case of fuels with a bulk density below 100 kg/cubic meter the device may not reach its nominal power. Such fuels include chips from a panel planer.

Table 1.1. Approximate data of various fuels (for 30 kW units).

Fuel type	burning time of 1 cm*	weight of 1 cm	humidity
	(h)	(kg)	(%)
Briquette	51	400	10
Chips	28	250	25
Sawdust	16	145	25
Pellets	100	700	6

*cm - cubic meter

1.4. TECHNICAL DESCRIPTION

The AZSB set is composed of a Moderator exchanger and an Automatic Biomass Burning Feeder (APSB) manufactured by Moderator Sp. z o.o in Hajnówka. This instruction manual refers to the following units:

- exchangers - 30, 60, and 120 kW
- cast iron heads - 30, 40, 60, and 120 kW
- containers - 0.6, 1, 2 and other, made to individual order

Exchanger (boiler)

The Exchanger (Fig. 1.1, 1.2, 1.3) is made of high quality boiler steel plates (P265GH). The interior walls of the combustion chamber are cooled down with water. The 60 kW exchanger has an additional ceramic baffle in the combustion chamber, allowing better after-burning of exhaust gasses. The automatic ash removal system is part of the standard equipment of the 120 kW exchanger, but it can be installed in 20 and 60 kW exchangers for additional payment. The standard versions of these exchangers allow the system to be installed even when the device is already in use.

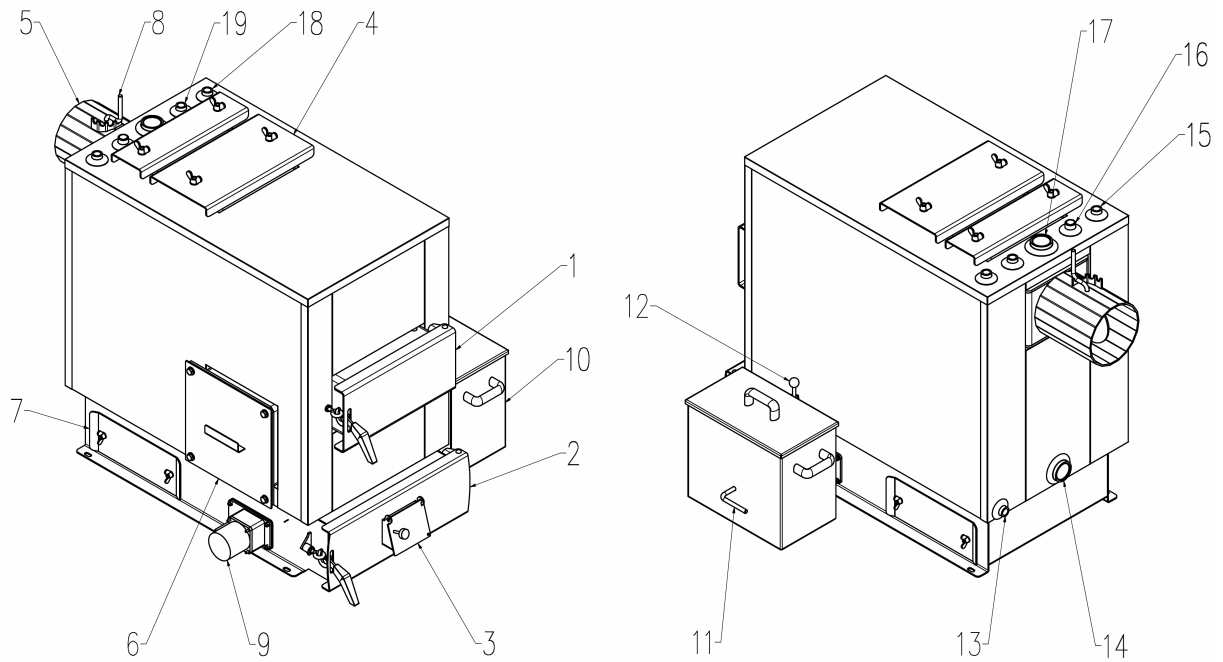


Fig. 1.1. 30 kW Moderator exchanger - main elements

1 - ignition door, 2 - ash tray door, 3 - air flap, 4 - top clean-out hatches, 5 - flue, 6 - head connection frame with cap, 7 - bottom clean-out hatch, 8 - exhaust gas damper, 9 - ash removal motor reducer, 10 - ash container, 11 - ash container inlet cover, 12 - ash container lock, 13 - drain valve connection, G1/2 male, 14 - return connection, G1½ male, 15 - thermal protection connection, G1/2 male, 16 - safety valve connection G3/4 female, 17 - supply connection, G1½ male, 18 - thermometer connection, G1/2 male, 19 - measurement well connection, G1/2 male

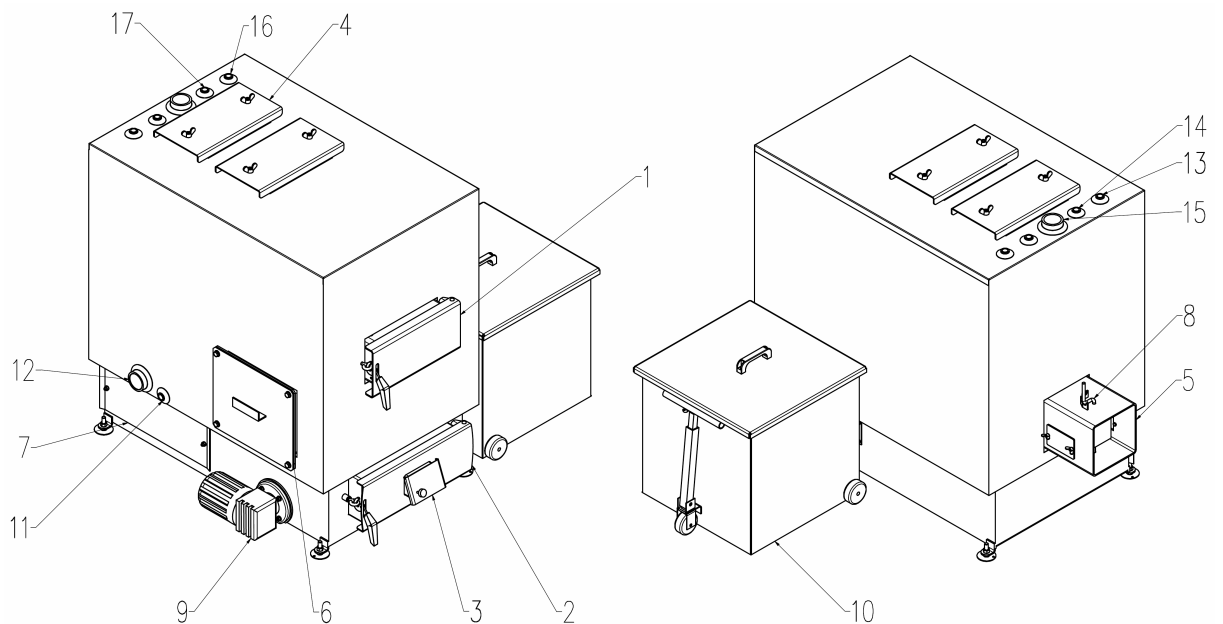


Fig. 1.2. 60 kW Moderator exchanger - main elements

1 - ignition door, 2 - ash tray door, 3 - air flap, 4 - top clean-out hatches, 5 - flue, 6 - head connection frame with cap, 7 - bottom clean-out hatch, 8 - exhaust gas damper, 9 - ash removal motor reducer, 10 - ash container, 11 - drain valve connection, G1/2 male, 12 - return connection, G1½ male, 13 - thermal protection connection, G1/2 male, 14 - safety valve connection G3/4 female, 15 - supply connection, G2 male, 18 - thermometer connection, G1/2 male, 19 - measurement well connection, G1/2 male

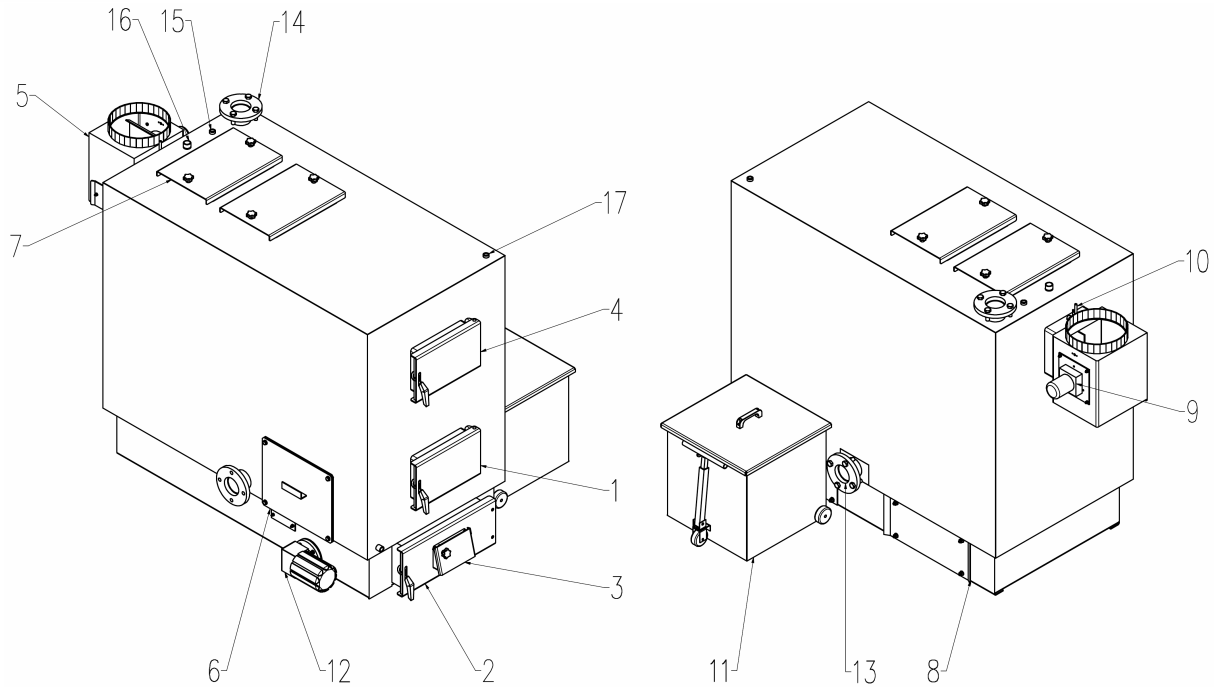


Fig. 1.3. 120 kW Moderator exchanger - main elements

1 - ignition door, 2 - ash tray door, 3 - air flap, 4 - front clean out (loading) door, 5 - flue, 6 - head connection frame with cap, 7 - top clean-out hatch, 8 - bottom clean-out hatch, 9 - draught regulator, 10 - exhaust gas damper, 11 - ash container, 12 - ash removal motor reducer, 13 - return connection, DN80, 14 - supply connection DN80, 15 - measurement well connection, G1/2 male, 16 - safety valve connection G1 female, 17 - thermometer connection, G1/2 male

On special occasions, after disconnecting the burner, the exchanger can be used to burn solid fuels in a traditional fashion by loading the combustion chamber manually. Such combustion should only be treated as an alternative for emergency situations (such as power outages, feeder malfunctions) and normal, automatic operation should be reinstated as quickly as possible. In emergency mode, fuel is loaded manually via the loading door or through the front clean out door. The bottom door (ash tray) are equipped with a manual air damper which allows air supply during power outages.

Before igniting the boiler with a manual load, you must install the cast iron grate, which is not part of the exchanger's standard equipment.

Head

The cast iron head (6, Fig. 1.4) is located inside the combustion chamber of the boiler. The cast iron grate works on the following principles: the fuel from the container (1, Fig. 1.4) is transported to the furnace of the head via the screw shaft, where it is burned at high temperatures thanks to the air supplied by the fan. The furnace of the head is equipped with a segmented grate whose elements are in a reciprocating motion towards each other. The movable grate is designed to remove debris from the grate. The movements of the grate are powered by an electrical actuator (14, Fig. 1.5).

Containers

The AZSB sets can come with a 0.6m³, 1m³, or 2m³ containers.

The containers are made from steel sheets and have, depending on its volume, one or two agitating disks for loosening the fuel with stiff or spring reels. The screw shaft rotates the agitator.

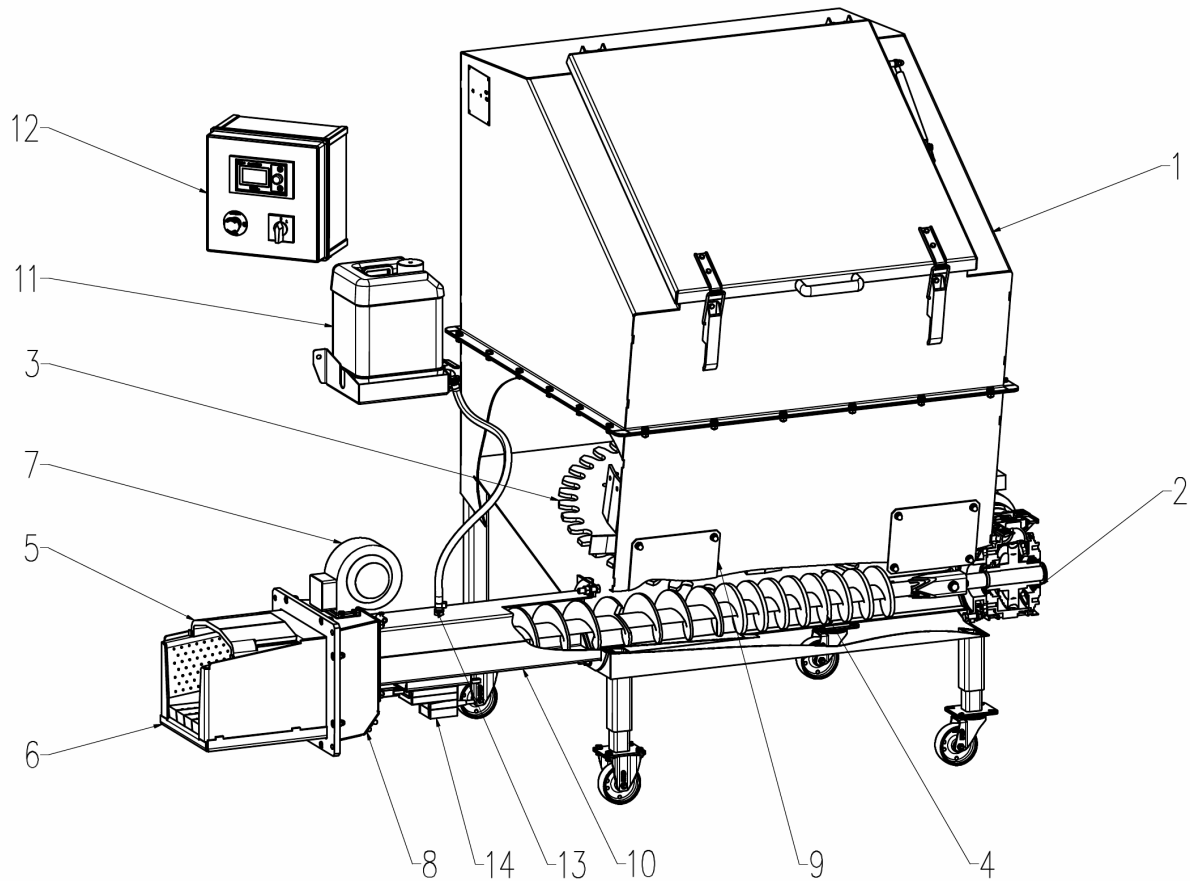


Fig. 1.4. Set with a 1m³ container and 40 kW cast iron head.

1 - fuel container, 2 - motor reducer, shaft, 3 - agitating wheel, 4 - screw shaft, 5 - head cover, 6 - cast iron head with moving grate, 7 - fan, 8 - head clean-out hatch, 9 - maintenance hatch, 10 - feeder pipe, 11 - extinguishing container, 12 - control cabinet, 13 - extinguishing connection with wax seal, 14 - grate motor.

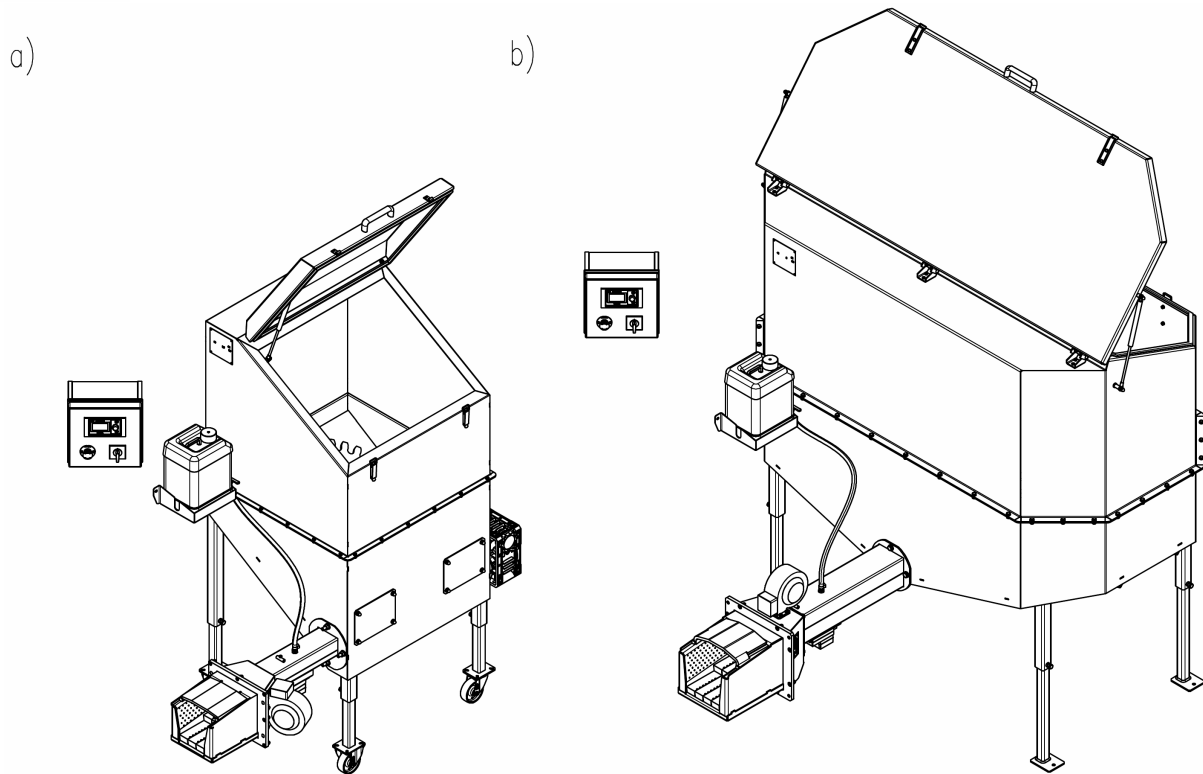


Fig. 1.5. Sets with 0.6m³ and 2m³ containers

a) APSB 30GZ 0.6m³, b) APSB 40GZ 2m³

1.5. EQUIPMENT

The boiler is supplied assembled. Its basic equipment includes:

- thermometer,
- cleaning kit,
- measurement well.

The feeder system is supplied partly assembled. Some of the feeder elements, after testing in the factory, are disassembled and packed inside the container or on a transportation palette in order to facilitate transport and bringing the device into the boiler room. The feeder is equipped with all the necessary elements for its assembly, apart from the electrical installation.

2. ASSEMBLY

2.1. GENERAL PARAMETERS

- Maximum supply temperature - 85°C,
- Recommended minimum return temperature - 55°C,
- Operating pressure - 1.5 bar,
- Thermal efficiency - 85.9%,
- Combustion gasses minimum temperature - 180°C,

2.2. BOILER ROOM

The boiler room should meet the requirements of the PN-87/B-02411 standard. Here are some of the most important of requirements:

- waterproof flooring,
- steel or wooden doors lined with sheet metal, opening outwards,
- 21x21 cm air supply hole in the bottom part of the boiler room,
- at least a 14x14 cm exhaust hole in the upper part of the boiler room,

Equipment:

- tap,
- sewage well,
- sink,



Do not use forced ventilation in the boiler room.

2.2.1. BOILER PLACEMENT

The installation of the heat exchanger (boiler) should be performed by a qualified and experienced installer (we recommend contacting one of our representatives whose installers have been trained by Moderator Sp. z o.o.). Faulty installation can cause premature war of the boiler, may result in fire or lead to an explosion.

When placing the boiler, consider such a position that does not prevent the walls from easy fuel load, sweeping, or access to cleaning holes.

2.2.2. FEEDER PLACEMENT

Preparation:

1. Remove all loose parts from the container, remove the grate from the boiler and tightly close all air inlets to the device.
2. Make sure to leave enough room in front of the burner head so that ashes can fall freely into the ash tray.
3. Find a suitable position for the extinguishing tank and prepare enough hose (the hose is provided with the device). To ensure safe operation, the water tank should be mounted to the wall of the boiler room, not the cover of the fuel container. The bottom of the container must be at least 50 cm above the top of the feeding canal. Ensure that the water hose is not bent or twisted.
4. Make sure that you have the appropriate tools to begin installation (set of wrenches).

Assembly (elements according to fig. 1.5):

1. Screw the wheels to the legs of the container (if part of the equipment).
2. Connect the screw feeder to the container (10).

3. Insert the screw shaft (4) into the container and feeding canal and fasten it to the shaft (2) of the motor reducer using an M12x70 screw fastened to the end of the screw shaft.
4. Screw the head (6) (notice the placement of the gasket).
5. Screw the fan (7) to the head.
6. Regulate the legs of the container to set the proper height of the head.
7. Remove the cover from the connection frame of the boiler.
8. Insert and screw the head to the connecting frame of the boiler; the container must be levelled
9. Position the head cover (5)
10. Install the extinguishing tank (11), place the hose on the connection and secure it with a hose clamp, open the valve and make sure that there is an air hole in the cap of the tank.
11. Connect the electrical installation and sensors (according to chapter 2.6. Control and Electrical Connection).

2.3. CONNECTION TO THE CHIMNEY

The flue is best connected directly into the chimney, and the connection should be sealed. The chimney should comply with standing norms.

Table 2.1. Chimney parameters, depending from device power.

Boiler power kW	Cross sectional area cm ²	Round chimney cm x cm	Min. chimney draught Pa
30	324	18	30
40	400	20	33
60	506	22,5	36
120	900	30	41

2.4. BOILER CONNECTION TO THE INSTALLATION

The Moderator exchangers are intended to work with an open system or a closed system for boilers of up to 100 kW.

The Boiler will operate correctly if the temperature inside the combustion chamber will be sufficiently high, which means that the supply water should have a temperature between 70-80oC, and that the returning water should not be less than 55oC. Such operating parameters will protect the boiler against low-temperature material corrosion. In order to ensure correct operation of the boiler, the manufacturer recommends installation of a mixing valve.

The exchangers have the following connections:

- 30 kW - G1½ male,
- 60 kW - G2 - male,
- 120 kW DN80 with a flange connection

The connection of the stubs with the installation should be performed using appropriate couplings. Stub descriptions as in fig. 1.1, 1.2, 1.3.

The boiler and the system should be filled with water by using the G $\frac{1}{2}$ drain valve. This should be performed slowly to ensure that all air is released from the installation. The water in the boilers should be free from grit and organic pollutants and meet the requirements of the PN-85/C-04601 norm. Loss-less installation can be filled with crude water, unless its hardness does not exceed 10%. If it does, the water should be treated.

2.5. SAFE INSTALLATION

2.5.1. OPEN SYSTEM

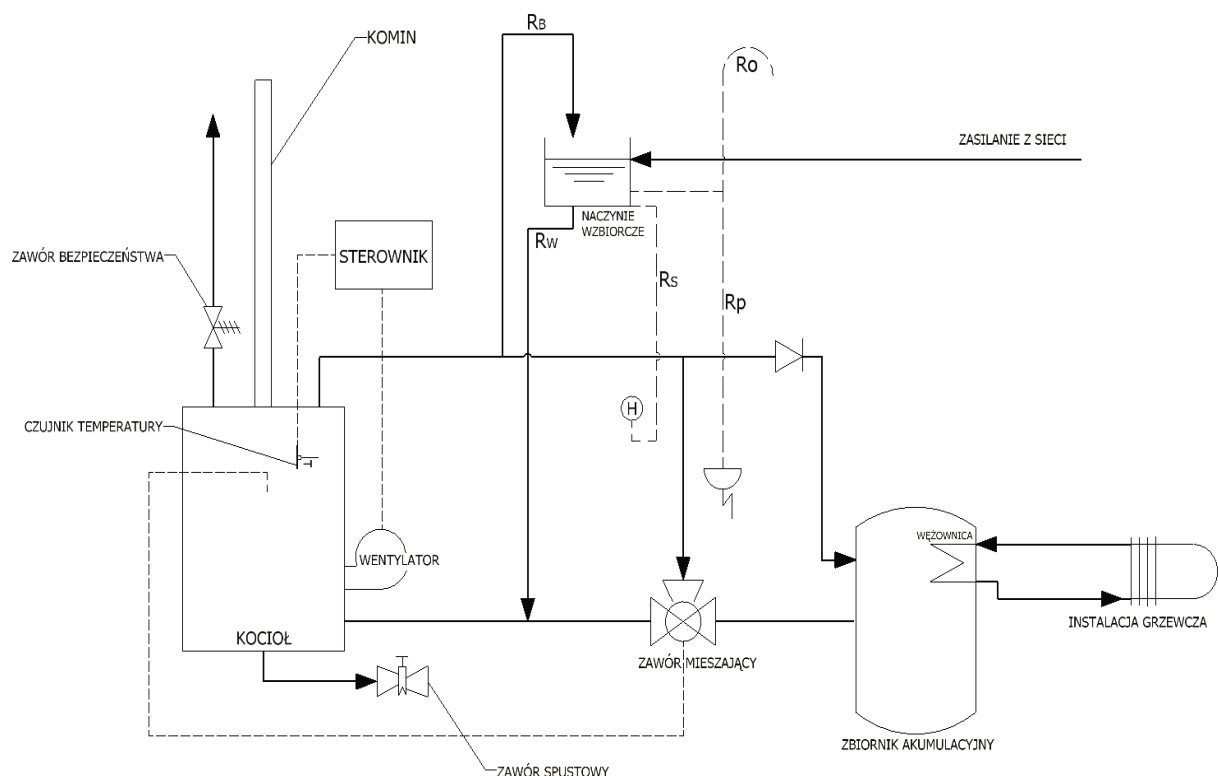


Fig. 2.1. Diagram of installation protection for boilers operated in open central-heating installations

KOMIN – CHIMNEY	ZAWÓR BEZPIECZEŃSTWA - SAFETY VALVE
CZUJNIK TEMPERATURY – TEMPERATURE SENSOR	KOCIOŁ – BOILER
STEROWNIK – CONTROLLER	WENTYLATOR – FAN
ZAWÓR SPUSTOWY – DRAINAGE VALVE	NACZYNIĘ WZBIORCZE – PRESSURE VESSEL
ZAWÓR MIESZAJĄCY – MIXING VALVE	ZBIORNIK AKUMULACYJNY – HEAT ACCUMULATION TANK
WĘŻOWNICA - COIL	INSTALACJA GRZEWCZA – HEATING INSTALLATION
ZASILANIE Z SIECI - WATER PIPE SUPPLY	

Moderator boilers operating in open central heating systems must be connected according to requirements of the PN-91/B-02413 standard, so that excess heat in the form of steam shall be removed through an open connection (Rb overflow pipe) to the atmosphere.



No fittings permitting complete or partial closure of flow may be installed on Rb, Rw and Ro pipes. The protective equipment and pipes should be protected against freezing.

2.5.2. CLOSED SYSTEM

Moderator boilers working in closed systems should be connected to the installation according to the requirements of PN-B-02414:1999 and the provisions of the minister of infrastructure from 12.03.2009 on the technical conditions of buildings and their placement. Paragraph 133 of this provision reads: "It is forbidden to use a solid fuel boiler in closed water heating systems with an expansion vessel, except boilers with a nominal power under 300 kW equipped with a heat dissipating device."



The manufacturer's recommended SYR 5067 thermal protection is only and exclusively effective if the pressure in water pipe network can be guaranteed at the min. level of 2.3 bar and if safety valve is installed. The maximum power of devices supported by the SYR 5067 valve is 100kW, therefore more powerful devices should be installed in an open system.

Thermal protection should be connected only to a water source which will ensure water supply even during power outages (for example, water networks).

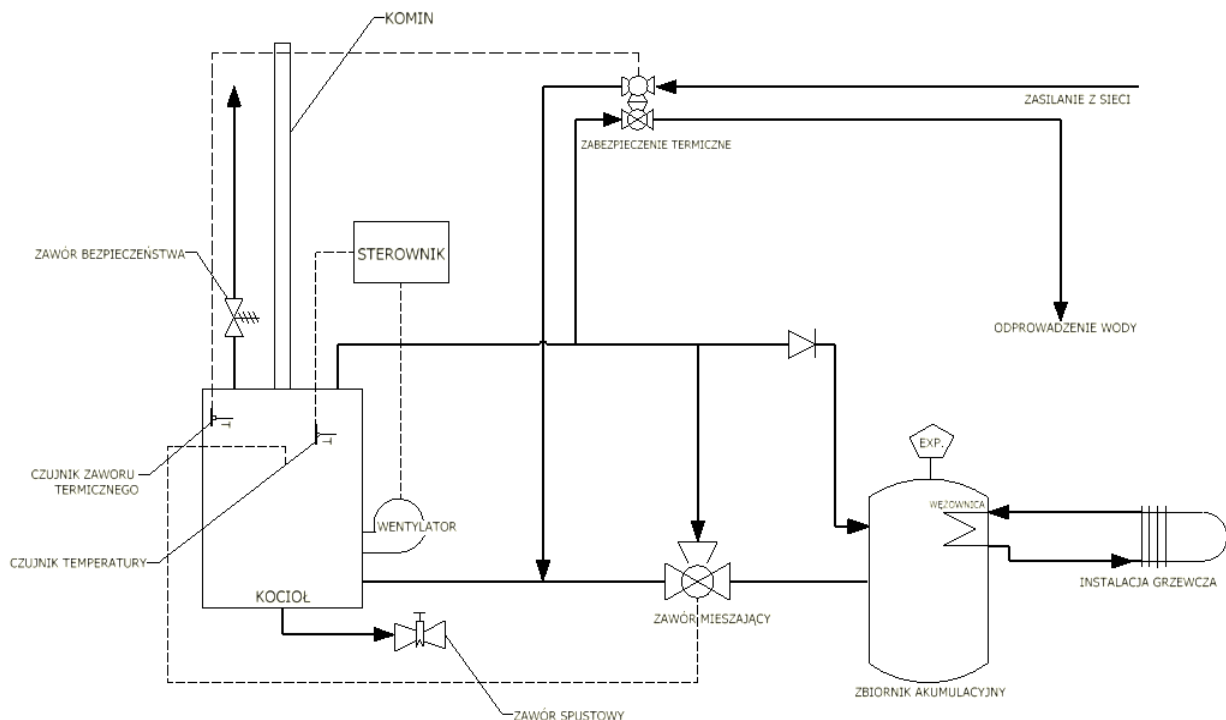


Fig. 2.2. Diagram of installation protection for boilers operated in closed central-heating installations

KOMIN – CHIMNEY	ZAWÓR BEZPIECZEŃSTWA - SAFETY VALVE
CZUJNIK ZAWORU TERMICZNEGO – THERMAL PROTECTION VALVE SENSOR	KOCIOŁ - BOILER
CZUJNIK TEMPERATURY - TEMPERATURE SENSOR	WENTYLATOR – FAN
STEROWNNIK – CONTROLLER	ZABEZPIECZENIE TERMICZNE – THERMAL PROTECTION
ZAWÓR SPUSTOWY – DRAINAGE VALVE	ZBIORNIK AKUMULACYJNY – HEAT ACCUMULATION TANK
ZAWÓR MIESZAJĄCY– MIXING VALVE	INSTALACJA GRZEWCZA – HEATING INSTALLATION
WEŻOWNICA - COIL	ODPROWADZENIE WODY – WATER DRAINAGE
ZASILANIE Z SIECI - WATER PIPE SUPPLY	

2.6. CONTROL ASSEMBLY AND ELECTRICAL CONNECTION.

2.6.1. SAFETY GUIDELINES

1. Before connecting the device, it is necessary to read boiler and control cabinet operating instructions.
2. After turning the control cabinet off with the button, dangerous voltage may occur on the regulator's terminals. Before commencing with installation, repairs or maintenance or when performing any connecting works, it is absolutely necessary to disconnect the power supply and to make sure that there is no live supply on any of terminals or cabling.
3. The boiler room should be equipped with an electric power system compliant with applicable regulations.
4. The electric system should be terminated with power supply receptacle with a protective terminal. **Use of power sockets without connected protective terminal may cause electric shock hazard!!!**
5. The boiler should be connected to a separate power line, protected with a single phase or a 3-phase C10A circuit breaker and a residual current circuit breaker (preventing electrocution).
6. The cabinet with the electrical accessories are installed may only be opened by a qualified electric engineer knowledgeable with the device operation.
7. The cabinet must be protected from access by unauthorised persons with, for example, a locket. The fitting on the cover allows locking it with a locket.
8. Location of the power socket used for the controller connection shall be chosen in such a way, so that the power plug is readily accessible for quick disconnection in case of an emergency.
9. Electric cables shall be well fixed on their whole length. Wires shall be guided away from heating parts of the boiler and in particular away from hot elements of the head, flue conduit and chimney,
10. The control cabinet must be installed and used in accordance with the principles of use of electrical devices.
11. The regulator must not be exposed to water and to conditions causing water condensation, e.g.: sudden changes of ambient temperature.
12. The controller must be placed in a location which prevents its heating above 50°C. It must not be installed on the wall of the fuel container.
13. The regulator must not be operated if its cover is broken or damaged.
14. The controller must be installed in a place inaccessible for children.
15. During thunderstorms, the controller should be plugged off from the power supply network

2.6.2. CONTROL CABINETS

The AZSB and APSB, depending on the customer's needs, may be equipped with one of two control cabinets - ZAB-07 REWERS RR and ZAB-12 RR. The two cabinets differ in voltage and the type of feeder motors connected to them. The said cabinets are by default equipped with additional outputs controlling the actuator of the moving grate.

Table 2.2. Differences between control cabinets: ZAB-07 REW RR and ZAB-12 RR.

CONTROL CABINET	ZAB-07 REWERS RR	ZAB-12 RR
Voltage	3~; 400V; 50/60 Hz	1~; 230V; 50/60 Hz
Phases	3	1
Containers	0.6–1–2 m ³	0.6–1m ³

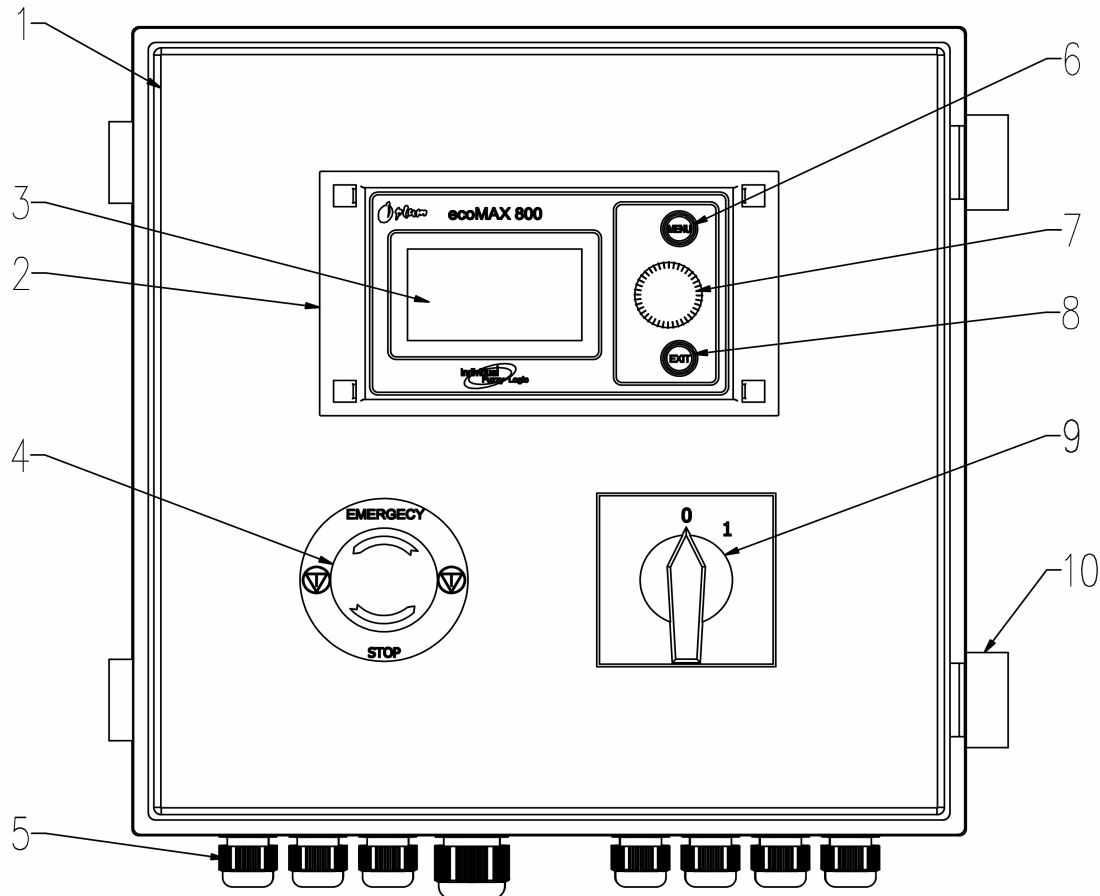


Fig.2.3. ZAB-07 REWERS RR and ZAB-12 RR control cabinets - front

1 - cover, 2 - operating panel, 3 - display, 4 - emergency stop button, 5- cable glands, 6 - menu button, 7 - select/change/accept wheel, 8 - EXIT button, 9 - main power-off button, 10 - cover lock clamp

The ZAB-07 REWERS RR control cabinet is connected to a three phase 400V power network. The feeder motor is also three phase. The ZAB-12 RR control cabinet is connected to a single phase 230V network. It works with a single phase feeder motor in sets with 0.6 and 1m³ containers.



The control cabinets are equipped in an automated reverse screw function after the fuel feeding cycle. This prevents the blockage of the screw during the set's operation.

Turning this function on or off depends on the type of fuel used. It should be turned off for rough fuels with large grains, such as chips of briquette. Screw reverse function is not required with easily transported fuels, such as sawdust or pellets. This function is accessible in the service menu of the controller - BOILER SERVICE SETTINGS. The parameters of this function are: REVERSE TIME and REVERSE MULTIPLICITY. Recommended reverse time is 1 second, multiplicity: 1.



Specific information on the basic parameters, button functions, parameters settings, terminal loads, etc., are available in the control cabinet manual.

2.6.3. CONTROL CABINET INSTALLATION

The control cabinet should be installed on one of the walls of the boiler room, in a location which is easily accessible.



It is prohibited to install the control cabinet on the boiler, screw pipe, chimney or fuel container, and on surfaces whose temperature exceeds 50°C.

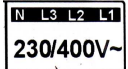







2.6.4. ELECTRICAL CONNECTIONS

Before making the electrical connections, ensure that the cables (not included) are placed in the boiler room in accordance with applicable rules. The cables should be placed in appropriate pipes or cable trenches by an authorized electrician. Cables with diameters not lower than the ones in Table 2.3 should be used to connect particular circuits.



Circuits not described in the Control Cabinet Instruction Manual are listed below.

Table 2.3. Minimal required cable cross sections

Circuit		Symbol	Type of cable	Cross section
Supply	ZAB-07 REW. RR		H05VV-F 300/500V	5x1.5 mm ²
	ZAB-12 RR		H03VV-F 300/300 V	3x2.5 mm ²
FEEDER (FEEDER MOTOR)	ZAB-07 REW. RR		H05VV-F 300/500V	4x1.5 mm ²
	ZAB-12 RR		H05VV-F 300/500V	6x1.5 mm ²
STB			H03VV-F 300/300 V	3x0.75 mm ²
AIR FAN			H03VV-F 300/300 V	3x0.75 mm ²
CENTRAL HEATING PUMP			H03VV-F 300/300 V	3x0.75 mm ²
DOMESTIC WATER PUMP			H03VV-F 300/300 V	3x0.75 mm ²
ASH REMOVAL (optional)			H03VV-F 300/300 V	3x0.75 mm ²
MIXING VALVE ACTUATOR			H03VV-F 300/300 V	3x0.75 mm ²
MOVING GRATE ACTUATOR			H03VV-F 300/300 V	3x0.75 mm ²
TO CONNECT OUTLETS 16-31 IT IS RECOMMENDED TO USE AN H03VV-F 300/300V 2X0.75MM ² CABLE.				



When connecting the controller's cables, remember to use sleeve ends to prevent fraying. On isolated ends of the feeder motor's cable use closed-loop endings.



It is prohibited to tin the endings of the cables connected to screw terminals in terminal blocks. After prolonged use, tinning causes the connections to loosen.

THREE PHASE FEEDER MOTOR - ZAB-07 REWERS RR

The winding of the feeder motor should be connected in a star (Fig. 2.4.a).

After connecting the motor, check the direction of the screw's movement. Do this by entering MANUAL CONTROL and turning on the feeder. The screw's movement should push the fuel towards the head. If it does not, change the order of L1 and L2 phases on the motor's terminals.

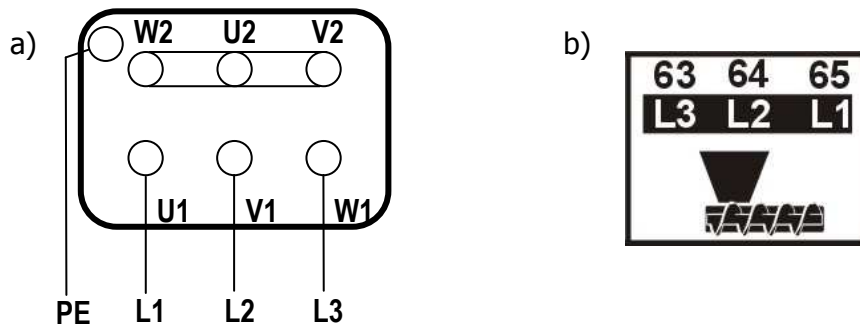


Fig. 2.4. Connecting the ZAB-07 REWERS RR feeder motor to the control cabinet.

a) view of the connection terminals on the engine after removing the cover, b) labelling of the terminals of the control cabinet to connect the feeder motor.

SINGLE-PHASE FEEDER MOTOR - BESEL – ZAB-12 RR

The motor is powered from the terminals on the bar of the control cabinet marked with the proper symbols (5, Fig. 2.5.).



Before connecting the cables, remove the connecting plate from the terminals

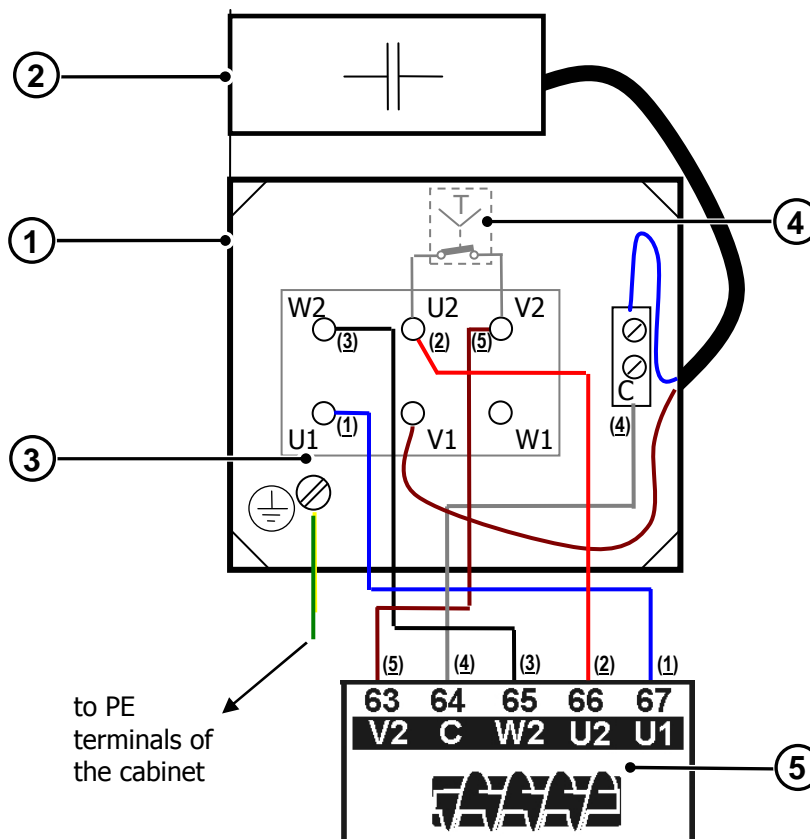


Fig. 2.5. Connection of a BESEL – ZAB-12 RR motor.

1 - motor connection box, 2 - capacitor, 3 - connection plate with terminals, 4 - in-built thermal switch, 5 - cabinet clamps.

After connecting the motor, check the direction of the screw's movement. Do this by entering MANUAL CONTROL and turning on the feeder. The screw's movement should push

the fuel towards the head. If it does not, change the order of the wires connected to W2 and C terminals.

SINGLE-PHASE FEEDER MOTOR - PRZYMIERZE– ZAB-12 RR

The motor is powered from the terminals on the bar of the control cabinet marked with the proper symbols (5, Fig. 2.5.).



Before connecting, leave one plate (BL, Fig. 2.6.).

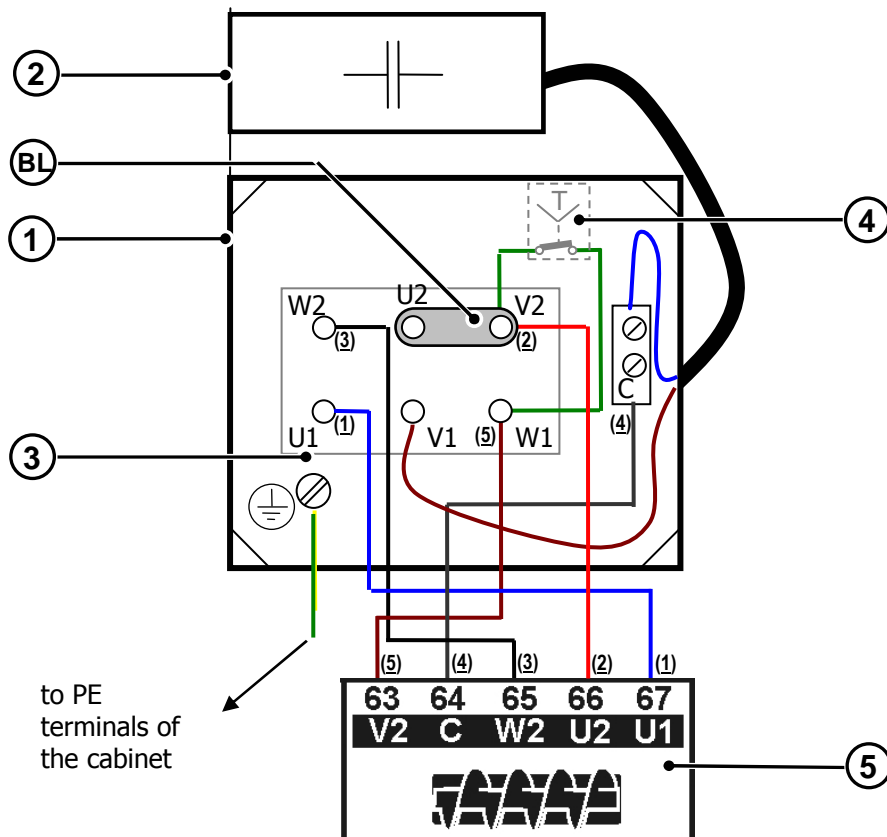


Fig. 2.6. Connection of a PRZYMIERZE – ZAB-12 RR motor.

1 - motor connection box, 2 - capacitor, 3 - connection plate with terminals, 4 - in-built thermal switch, 5 - cabinet clamps, BL - plate connecting the terminals.

After connecting the motor, check the direction of the screw's movement. Do this by entering MANUAL CONTROL and turning on the feeder. The screw's movement should push the fuel towards the head. If it does not, change the order of the wires connected to W2 and C terminals.

SETTING THE MOTOR PROTECTIVE SWITCH (ONLY ZAB-07 REWERS RR)

The motor protective switch (Fig 2.7) is used to protect the feeder motor against the fuel feeding system's overload. The thermal switch should be set with the dial (1, Fig. 2.7) to the relevant reactive current, i.e. the motor's nominal current. The motor's nominal current is described on the feeder motor's identification plate or in the table below.

Table 2.4. Currents of the motor protective switch depending on motor power.

Motor power kW	Motor nominal current [A]	Current set on the protective switch [A]
0.55	1.8	1.9
0.75	2.2	2.3
1.1	2.6	2.7

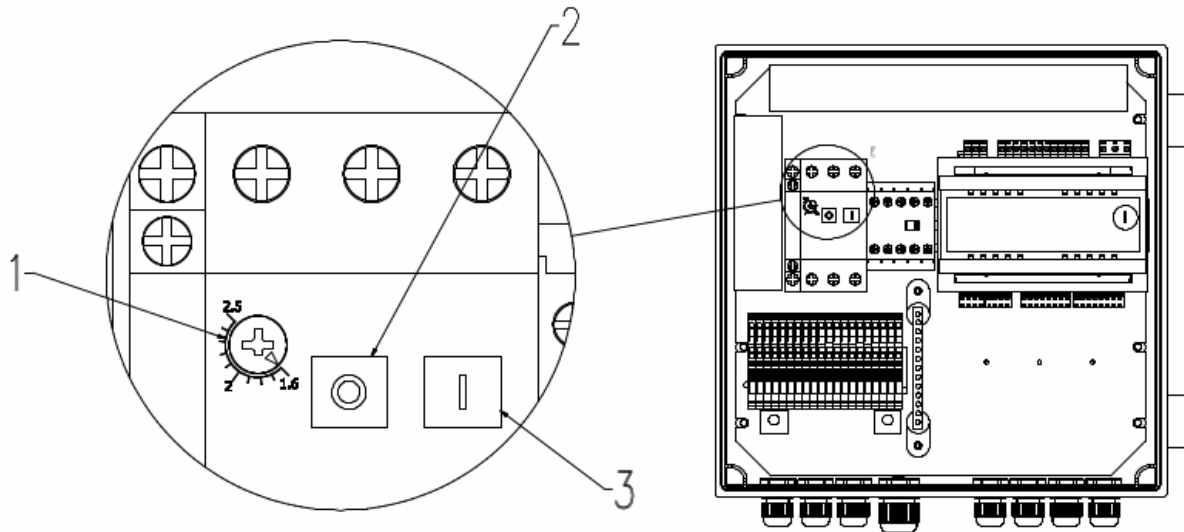


Fig. 2.7. Motor Protective switch.

1 - reactive current setting dial, 2 - off switch, 3 - on switch.



Improper setting of the protective switch (e.g. too high current) may burn the engine or rip the fitting of the motor reducer. Too low value may lead to the motor switching off often and unnecessarily.

THERMAL PROTECTIVE SWITCH (ONLY APSB AND AZSB WITH ZAB-12 RR)

Single-phase motors in APSB and AZSB sets have a built in thermal protection (4, Fig. 2.5-2.6) which protects the motor from the fuel feeding system's overload. When it is activated, the protective switch breaks the power circuit in the wires. The motor stops. After the motor cools down, it restarts automatically.

STB TEMPERATURE LIMITER

The function of the STB temperature limiter (Fig. 2.8) is to disconnect the power supply to the air fan and feeder after the temperature of the water supplied to the central heating installation exceeds 95°C. The limiter is installed directly on the boiler, on the couplings at the back. After removing 4 screws, remove the cover of the chassis.

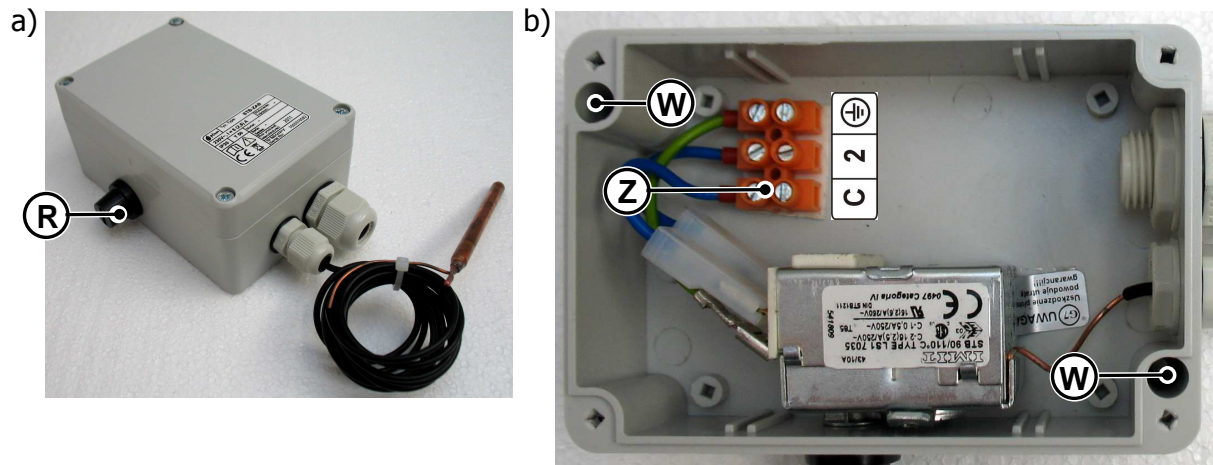


Fig. 2.8. STB temperature limiter

a – view of the limiter, b – limiter connection terminals

Next, using the two openings, mount the box on the boiler (W, Fig. 2.8.b). Connect the wires to the terminal (Z, Fig. 2.8.b.). The protective wire to the terminal marked PE. Two other wires to the C and 2 terminals. The change of wires connected to terminals C and 2 has no influence on the STB protection. In the control cabinet, connect the wire to the terminals marked STB. Place the STB capillary and the temperature sensor inside the measurement well (thermometer pipe) supplied with the AZSB set, which is then screwed into one of the connections.



Current regulations make it necessary to use a protective temperature limiter.



When the STB limiter is turned on, the air fan and feeder stop. To restart them, check why the boiler exceeded its allowed temperature. Next, after the temperature on the boiler falls down to 50-60°C, unscrew the black cap (R, Fig. 2.8.a) and using, for example, a match press the switch under the cap.

ASH REMOVAL

The ash removal motor is connected to the terminal bar in the control cabinet marked ODPOPIEL. After connecting the motor, check the direction of the screw's movement. The screw's movement should push ash towards the ash container. If it does not, change the order of the wires connected the motor.




The ash removal system is part of the AZSB 120 kW standard equipment.

MOVING GRATE ACTUATOR

The moving grate actuator can be connected according to the diagram in Fig. 2.9.

Table 2.5. Currents of the motor protective switch depending on motor power.

Terminals ZAB-07 REWERS RR, ZAB-12 RR	Wire colours of the Belimo actuator	Settings of the Belimo switch
70 L1 (OFF)	<u>3</u> (biały/white)	
71 N	<u>1</u> (niebieski/blue)	
72 L1 (ON)	<u>2</u> (brązowy/brown)	

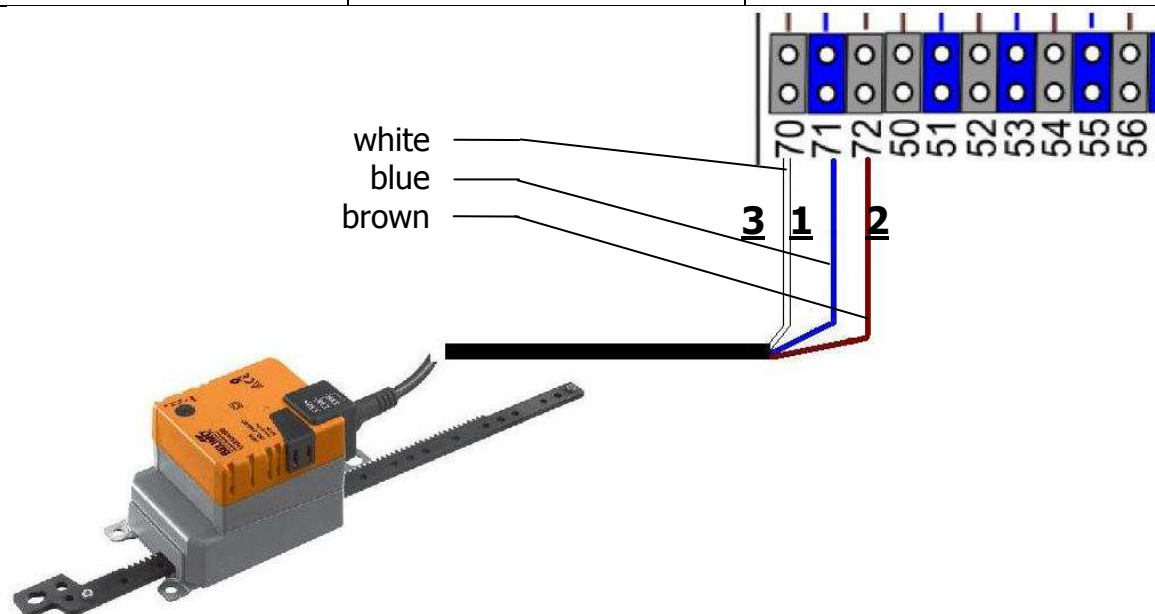


Fig. 2.9. Diagram for connecting the Belimo actuator to ZAB-07 REWERS RR and ZAB-12 RR control cabinets.

Settings of the moving grate are: Rake working time and rake opening time, can be found in: SERVICE MENU → BOILER SETTINGS

SENSORS

The temperature sensor should be connected according to the control cabinet's manual.



Avoid placing the sensor wires with power supply cables. Keep them at least 10 cm apart.



To lengthen the sensor wire use wire diameters from Table 3. Do not make them longer than 15 m, as this may influence the temperature measurement.



Install the sensor in dry conditions. Do not flood it with oil or any other liquid.

FUEL FEEDER TEMPERATURE SENSOR

The measuring sensor (C, Fig. 2.10) should be installed into the socket (T) and fastened with a screw (S). In order not to damage the metal casing of the sensor, tighten the screw with your hands or gently with a wrench. Connect the sensor to the relevant terminal in the cabinet.

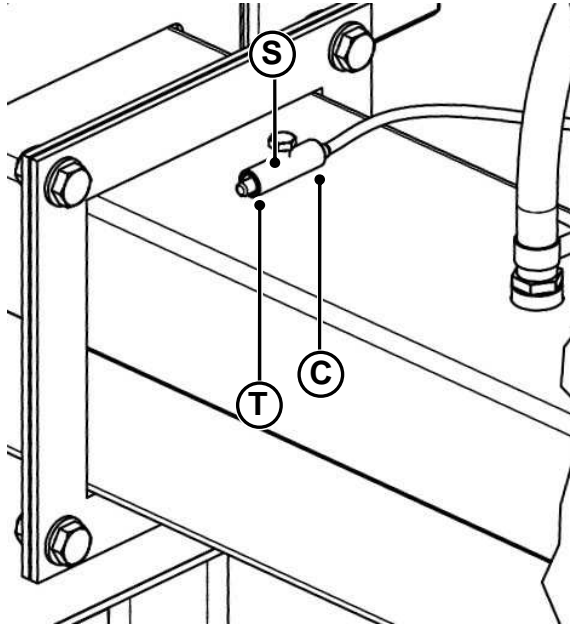


Fig. 2.10. FUEL FEEDER TEMPERATURE SENSOR INSTALLATION

S- Fastening screw, T - socket, C - Feeder temperature sensor.

3. DEVICE OPERATION

3.1. TECHNICAL DESCRIPTION

The operation of the AZSB set is based on creating exhaust gases by combusting fuel on the furnace of the head and exchanging heat between the gases and the heating medium. The fuel on the furnace of the head is fed by the screw shaft from the fuel container. The combustion process is controlled by the controller, whose main function is the maintenance of the set temperature of the heating medium. Depending on current temperature of the heating medium, the device selects one of two work modes: OPERATION if the temperature is below the set temperature, and CONTROL if the set temperature is reached.

3.2. BURNING



Do not load fuel directly to the furnace chamber of the boiler as this may damage the head. When burning fuels with a high dust content (mainly sawdust) under no circumstance open the boiler's doors during operation. Sudden access of air may cause an explosion. Do not allow the head to work while partially covered with ash. Poor cooling of the very quickly lead to the destruction of the steel cover or cracks in the plates of the furnace.

3.2.1. LOADING FUEL TO THE CONTAINER

Be careful when loading fuel to the container and avoid excessive dusting and compaction of fuel. Compacting fuel can lead it to suspend in the container.



DO NOT compress fuel in the container.

3.2.2. IGNITION AND SETUP OF BURNING PARAMETERS

Before igniting, set the parameters of the container and fan operation according to table 2.1 and set the temperature of the boiler.

After completing the above functions, set the controller into <IGNITION> mode. Turn on the feeder and supply fuel until it appears on the grate. Next, using some kindling fuel (paper, cardboard, grill lighting fluid) ignite the fuel on the grate and turn on the fan. As the fuel is burning, supply small amounts of fuel for approximately 10 minutes in order to heat the head. After heating the head, press the EXIT button so that the device enters <OPERATION> mode. Next, correct the feeding, pause, and fan power settings in <OPERATION> mode (if necessary). These parameters should be adjusted depending on the amount of fuel in the head. Do not allow partially burned fuel to be moved to the ash drawer (too much fuel and/or too little air). Do not allow too little fuel to be burned in the front part of the head's furnace (too little fuel and/or too much air).

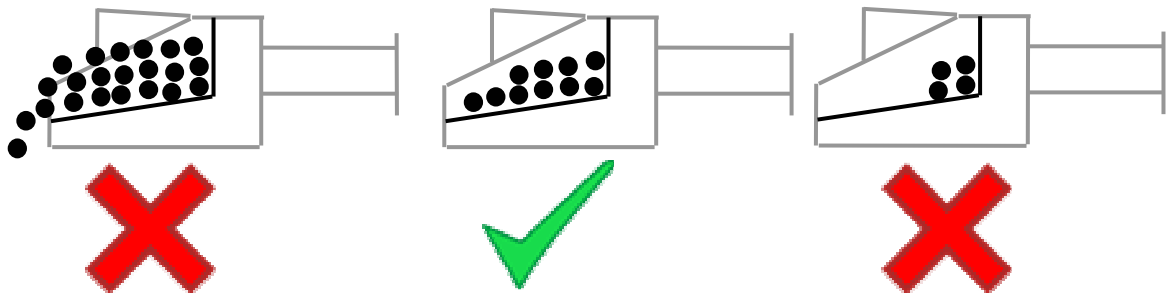


Fig. 3.1. Correct fuel amount

Figure 3.1 shows various amounts of fuel in the head's furnace. The middle illustration shows the optimal amount.

Signs of well-adjusted combustion parameters include:

- A bright yellow flame in and outside the fireplace, without smoke
- In the case of a cast iron grate, the sides of the fireplace and the cover are lined with a bright ashen deposit
- The walls of the first boiler chamber or exchanger (combustion chamber) are covered with a bright ashen deposit
- The flue gases leaving the chimney are not smoky (dark smoke), and should show rippling warm air

Table 3.1 Head combustion settings in APSB and AZSB

Type of power and head [kW]	Fuel type (type of actually used fuel, do not confuse with type of fuel set in control cabinet)	TRYB / MODE				
		PRACA OPERATION			NADZÓR CONTROL	
		Czas podawania PRACA	Czas przerwy PRACA	Moc nadmuchu	Czas podawania NADZÓR	Przer. podaw. NAZDÓR
		Feed time OPERAT	Feed interval OPERAT	Fan power	Feed time CONTR	Feed interval CONTR
		[sec.]	[sec.]	[%]	[sec.]	[min.]
GZ 30	chips	2	45	34	2	5
	wood briquette	2	40	34	2	5
	sawdust ¹	3	25	31	2	3
	sawdust ²	3	18	28	2	3
GZ 60	chips	4	37	36	3	5
	wood briquette	4	35	36	3	5
	sawdust ¹	10	16	34	4	3
	sawdust ²	10	12	32	4	3
GZ 120	chips	6	30	44	6	5
	wood briquette	6	25	44	6	5
	sawdust ¹	7	8	42	7	3
	sawdust ²	9	5	40	7	3

¹ sawdust fragmentation like from a circular saw with a relative humidity below 25%

² sawdust fragmentation like from a planer with a relative humidity below 25%

In CONTROL mode, the feed and interval time should be adjusted so that:

- The temperature of the boiler does not increase; rising temperature may lead to the activation of the overheating protection (STB) and automatic shutdown of the device.
- partially burned fuel does not fall into the ash tray
- the ambers from the fireplace do not ignite the fuel in the feeder canal and initiate the fire protection system

Adjusting the maximum feeder temperature

The sensor measures the temperature in the feeder. The threshold for the activation of the protection is set in the service menu of the controller. If the temperature of the feeder exceeds the set value, the regulator will start the feeder for a programmed fixed time of 3 minutes. At the same time, the fan is switched off and the pumps are turned on. After the fuel is "pushed out", the regulator turns of the feeder, and it will not turn it on even if the temperature is still high.



DO NOT use oil, gasoline, paint thinners, or any other flammable substances to ignite fuel, as this may cause explosions.

3.2.3. CONTINUOUS OPERATION

After approximately 1 hour after setting the operating parameters, the device can be left unsupervised for the time between fuel loads. Due to irregularities in fuel types, you must check the settings of the feed time, interval, and fan power after each load. Adjust them if needed.

3.2.4. EMERGENCY OPERATION

This function should be treated as emergency operation. The cast iron head and feeder must be disconnected and the head opening should be covered with a flap.

In closed systems, emergency burning mode cannot be used without the safety measures described by the manufacturer (see chapter 2.5.2).

When igniting, do not fill the combustion chamber completely (wood - 50% fill, coal no more than 20% fill). The humidity of the fuel should be below 30%. Do not use coal dust.

Under no circumstance burn any PVC products: butter or margarine containers, toys, plastic construction materials; polyamides, such as textiles.

During the boiler's operation you should periodically monitor and refill fuel. To maintain a possibly stable temperature of supply water:

- use fuels with humidity below 30%
- if your fuel is more humid, dry it first or mix it with dry fuel
- when using fuels of different fragmentation, load it in turns
- if possible, avoid opening the load hatch when igniting
- Adjust the boilers output, and therefore the supply water temperature, by changing the setting of the throttle (or the adjustable damper on the ash drawer door), or by changing the diameter of the exhaust outlet on the flue. When using the boiler with a fan system, the air damper on the ash drawer door should be closed.



Note: avoid burning fine fuels, in which dusts concentration exceeds 5%. Pay attention when burning very dry sawdust (moisture content up to 10%), do not compact them tightly in the combustion chamber. Having charged the sawdust, leave free space in the rear part of the chamber to ensure air access. Failure to meet these requirements may result in gases from combustion chamber backdrafting during sudden opening of the loading hatch. Opening the loading hatch may cause sudden growth of the air volume in the combustion chamber and explosive combustion of dusts

When operating a boiler with air supply system, do not open the charging flap during fan operation. Before supplementing the fuel, switch off the controller.

3.3 CLEANING AND MAINTENANCE

3.3.1. CLEANING THE EXCHANGER

Cleaning the exchanging surfaces should be done once a week and ash should be removed from the ash drawer and the back ash chamber when necessary. In the case of devices equipped in an ash removal system, removing ash consists only in emptying the ash

container when it is full. In emergency combustion mode, the grate should be cleaned before each load of fuel. Sweeping the exchanging surfaces of the boiler should be done only after the flame in the boiler has died out. Use the enclosed cleaning kit.

In case of heavy contamination of the boiler, chemical agents removing boiler deposits may be used, but only such, which are allowed on the marked (i.e. with CE mark and instructions of use).

3.3.2. CLEANING THE HEAD

The head is equipped with a movable, self-cleaning grate which greatly extends the time between cleanings. In the heating season, the cleaning of the head consists of removing the sand and ash which got through the grate to the inside of the head. To clean the inside of the head, remove the cover of the head's cleaning hole. (1, Fig. 3.1) and sweep out the sand and ash from the space under the grate (2, Fig. 3.1). This process is described on the picture below. Perform the action once a week or when necessary. Do not allow the accumulated ash to touch the grate from underneath. In the case of fuels which are excessively contaminated or have a low ash sintering temperature (such as straw, sunflower seed husks, oat grain) it may be necessary to remove the residue from the furnace (3, Fig. 3.1) using the cleaning kit.

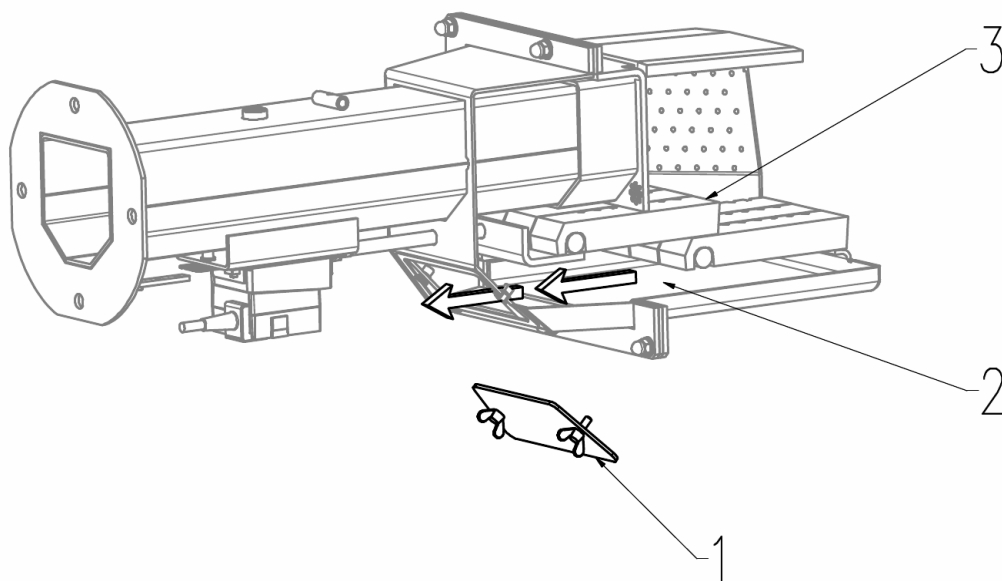


Fig. 3.1. Head cleaning schematic

1 - Cleaning hole cover, 2 - space under the grate, 3 - furnace

After the heating season's end, it is necessary to disconnect the head from the boiler and to inspect the grate. Remove deposit from cast-iron elements, check cast-iron surfaces (for cracks; small dents, which do not interfere with the head's operation, are normal signs of work), clean air inlet holes. After cleaning, reinstall the head. If seals are damaged during maintenance work, replace them with new ones.

3.4. TURNING OFF THE DEVICE

3.4.1. PROGRAMMED SHUTDOWN

Boiler

After the fuel burns out, open all doors and maximally open the damper in the smoke conduit. Remove ash, clean the boiler. Do not drain the circulating water. Cool down time is equal to the ignition time.

Feeder

If the fuel in the container is supplemented on ongoing basis, the feeder will work continuously. In order to stop the device, e.g. to prepare it for ash removal, place the power supply switch in „0“ (zero) position.

3.4.2. EMERGENCY SHUTDOWN

Boiler (applies to the emergency operation mode after feeder disconnection)

In case of emergency situations, such as exceeding 100⁰ C temperature, the installation's elements break, loss of water charge, control & automatic equipment or protection equipment failure or sudden pressure increase, it is necessary to:

- remove fuel from the grate and move it out of the boiler room
- decrease the circulating water temperature by adding cold water to the water charge, like during filling
- maximally open the smoke conduit throttle (if installed)

In the case of boilers operating in closed system, an emergency condition may be any condition resulting from power outage (pumps stop) or from leaving doors of the boiler open. The central-heating installation shall be protected with a safety valve set to 2 bars, additionally the manufacturer shall protect the boiler with a safety valve, factory pre-set to 2.5 bar, however, in case of an emergency condition, such protection is insufficient. The boiler must be additionally protected with a thermal protection valve, which will remove the hot water from the boiler in case of an emergency condition, while at the same time supplementing the resulting shortage of water in the boiler with cold water from the water network installation in order to cool down the boiler and to reduce the pressure (section 2.6).

Keep in mind that emergency conditions are likely to occur in summer, when only household hot water is heated in the boiler. Anticipating such conditions, it is worth to consider installing a heat accumulator capable of taking over the heating power surplus unavoidable in such circumstances.



DO NOT pour water over embers.

Feeder

Set the regulator to IGNITION Set feeding to OFF and the fan to ON. The fan will cause the fuel remaining on the grate to burn out and then it will start cooling down the head. Open the throttle in the boiler. After the fuel burned out, you can open the boiler's doors in order to cool it down. When the temperature begins to fall, turn off the device.

4. TROUBLESHOOTING, SAFE OPERATION CONDITIONS

The main condition of the boiler safe operation is the execution of its installation and protections according to Polish standards.

In order to maintain safe operating conditions of the boiler, it is necessary to follow the principles listed below:

- wear protective gloves and goggles
- do not block charging flaps and ash drawer doors
- move the grate using the ash tray lever.
- use portable 24V lamps
- maintain order and cleanliness in the boiler room
- maintain good technical condition of the boiler and its related installation
- during the winter season ensure that the heating process is continuous



If water freezing in the installation is suspected, check whether safety piping is not blocked. The water added to the water charge in the installation shall return through the overflow pipe from the pressure vessel. If safety piping is blocked, the boiler must not be ignited, and if it has been operating, proceed as in boiler emergency shutdown procedure (see p. 3.6.).

4.1. INSTALLATION OF THE FUEL CONTAINER IN A NON-HEATED ROOM

Installation of the fuel container in unheated rooms does not constitute a problem to the container operation as such. However, condensation resulting from changes of atmospheric conditions may cause the device to freeze and the fuel to freeze to the walls of the container when the outdoor temperature drops.

4.2. ANTI-FREEZE PROTECTION

To prevent damage caused by freezing, the feeder pipe and the bottom of the container may be thermally insulated and additional defrosting device may also be installed.



Note: Despite this effort, in particular if wood chips are used as fuel, the fuel may jam in the worm shaft. Any remains shall be removed before the start of the heating season and at least once during the season.

If a water container is located in the same room, it will be necessary to use anti-freeze agent.



Note: Gas pressure drops when temperatures drop. due to this gas cylinders of the container flap will behave differently under such conditions.

4.3. TROUBLESHOOTING

No.	Fault	Cause	Solution
1	Flame backdrafting to the fuel container	<ul style="list-style-type: none"> - no fuel in the container or fuel level too low, - fuel clogging, - container cover not fully closed 	<ul style="list-style-type: none"> - refill the fuel container, - mix the fuel - check cover tightness
		<ul style="list-style-type: none"> - blocked screw shaft - power outage for a longer period - no water in the container 	<ul style="list-style-type: none"> - determine the cause and remove the failure - empty the container of the fuel and flood the screw shaft line with water - refill the water tank
		<ul style="list-style-type: none"> - insufficient chimney draught 	<ul style="list-style-type: none"> - use an exhaust fan, improve the draught
2	Fuel clogging in the container	<ul style="list-style-type: none"> - using sawdust with dusts content of more than 5%, - too high moisture content in fuel (above 40%), the fuel freezes to container walls during the winter season 	<ul style="list-style-type: none"> - change the fuel - add a portion of dry fuel and mix it thoroughly
3	Smoke in the container	<ul style="list-style-type: none"> - head contamination - blocked chimney - boiler cover and doors not fully closed 	<ul style="list-style-type: none"> - clean ash in the head - clean the chimney - close covers and doors in the boiler
4	Screw shaft does not rotate	<ul style="list-style-type: none"> - power outage - blocked screw shaft - damaged screw shaft and agitator 	<ul style="list-style-type: none"> - start left rotation, then restart (see par. 4.3.1.) - replace the screw shaft, replace the agitator
5	Loud operation of the feeder unit	<ul style="list-style-type: none"> - damaged electric motor bearing, - gear-motor oil leak, - damaged agitator bearing, - foreign body (e.g. metal) in the screw shaft pipe 	<ul style="list-style-type: none"> - replace the bearing - seal any leaks, add more oil, - replace the bearing - remove the screw shaft, remove the foreign body
6	Quick deposit build-up	<ul style="list-style-type: none"> - excessively contaminated fuel 	<ul style="list-style-type: none"> - do not burn coal, coke, fine coal, plastics and rags, use fuels according to the instructions, - remove deposit
7	Boiler cannot reach	<ul style="list-style-type: none"> - contaminated fan 	<ul style="list-style-type: none"> - clean fan blades

	the pre-set temperature	<ul style="list-style-type: none"> - too much ash in the (cast-iron) head, blocked ventilation openings in the head - too high moisture content of fuel, - incorrect controller settings 	<ul style="list-style-type: none"> -remove ashes from the head through the washout opening - charge correct fuel - set correct feed and pause times
8	Fire exhausting water tank emptying	<ul style="list-style-type: none"> - flame backdrafting to the fuel container 	<ul style="list-style-type: none"> - undo the connector, insert beeswax plug. If the container has been emptied when using sawdust, the fuel in the pipe must be cleaned fuel as soon as possible, as sawdust expands and may permanently block the machine – immediately force feeding of the combustion chamber with fresh fuel.

4.3.1. PROCEDURE IN CASE OF SCREW SHAFT JAMMING

If the fuel feeding screw shaft does not turn, even though the controller is working properly, do the following:

- Using manual control, turn “reverse” mode of the feeder, then switch the feeder to turn in the proper direction. Check if the problem is solved. If so, return to normal operation. If not, see the following points.
- Open the inspection hole and examine the screw.
- Remove element causing the malfunction (stone, root, etc.)
- Make sure that the screw is working properly, tightly close the inspection hole.
- Return to normal operation.

5. SPARE PARTS

5.1. MAIN SPARE PARTS LIST

No.	Part name	Part number
1.	Electric motor with motor reducer	2
2.	Agitator	3
3.	Screw shaft	4
4.	Main electrical cabinet	12
5.	Cast iron head (GZ30, GZ40, GZ60, GZ120)	6

Part numbers refer to fig. 1.5.

5.2. LIST OF WEARABLE PARTS*

No. Part name

1. Door seals
2. Ash container
3. Spring reels of the agitator
4. Cast iron head grate
5. "Fireman" safety valve

***NOTE: The above parts are not subject to warranty replacement. If their replacement is needed, they are available for purchase from Moderator Sp. z o.o. service department.**

6. DISPOSAL

Assuming it is used correctly, the boiler should operate without problems for about 15 years. After that time, its further operation may be economically unjustified. The boiler is made of materials which are fully recyclable. It is recommended to provide it for disposal to a specialized machine disassembly and disposal company.

In case of the feeder, the fault-free operation time of the head (provided it is maintained, operated and serviced properly) shall reach several years (7 to 9). After that time, it may be necessary to replace cast-iron grate inserts. If the repair is no longer economically reasonable, the best way will be to dispose the head. In case of the head, the simplest way of disposing it is to send it to a metal specialized scrap metal collection plant.

7. SERVICE

The current list of authorized service representatives of Moderator is available on-line at www.moderator.com.pl in the SERVICE →SERVICE REPRESENTATIVES tab. Link below:

<http://www.moderator.com.pl/pl/serwis/serwis/przedstawiciele-serwisu.html>.