Moderator Sp. z o.o.
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17-200 Hajnówka
POLAND
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Instruction manual for 40-240 kW Smok Automatic Biomass Burning Set with cast iron heads, 4-27 m^3 containers, and spring sweepers

NOTE TO USER

Thank you for purchasing our device and congratulations on making 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.

The 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.

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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	Norms
EMC 204/108/WE	EN-PN ISO 12100
PED 97/23/WE	EN-PN 303-5
LVD 2006/95/WE	
MAD 2006/42/WE	

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/m^3) 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 60 kW units).

Fuel type	burning time of 1 cm*	weight of 1 cm	humidity
	(h)	*(kg)*	*(%)*
Briquette	**25**	**400**	**10**
Chips	**24**	**250**	**25**
Sawdust	**8**	**145**	**25**
Pellets	**50**	**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 - 60, 120, and 240 kW
- cast iron heads - 40, 60, 120, 180, and 240 kW
- Containers - 4, 6, 8, 10, 27 m3 and other, made to individual order
- spring sweepers

Exchanger (boiler)

The exchanger (*Fig. 1.1, 1.2, 1.3*) is made of high quality boiler steel plates (P265GH Steel). 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 120, 180, and 240 kW exchangers. In the 60 kW exchanger it can be installed for additional payment, and the standard versions is adaptable for installing the ash removal system also during use.

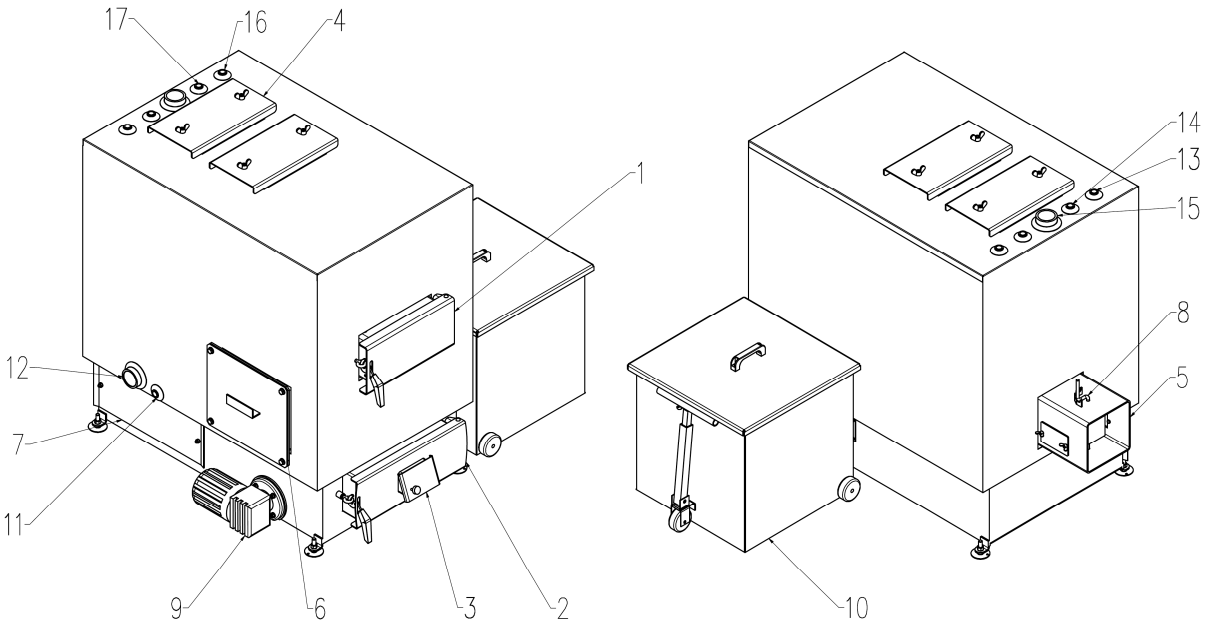


Fig. 1.1. 60 kW Moderator exchanger - main elements.

1 - inspection door, 2 - ash tray door, 3 - air flap, 5 - upper clean-out hatches, 5 - flue 6 - head connection frame with cover, 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, 16 - thermometer connection, G1/2 male, 17 - measurement well connection, G1/2 male

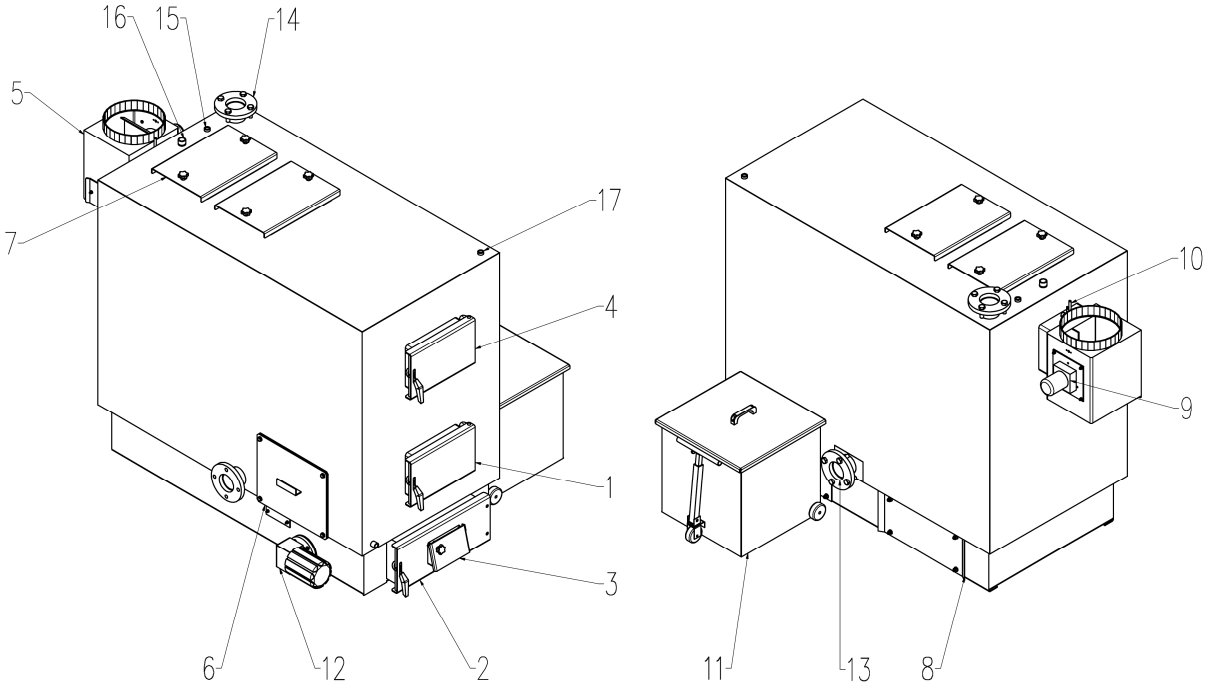


Fig. 1.2. 120 kW Moderator exchanger - main elements.

1 - bottom inspection door, 2 - ash tray door, 3 - air flap, 4- upper inspection door, 5 - flue, 6 - head connection frame with cover, 7 - top clean-out hatches, 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

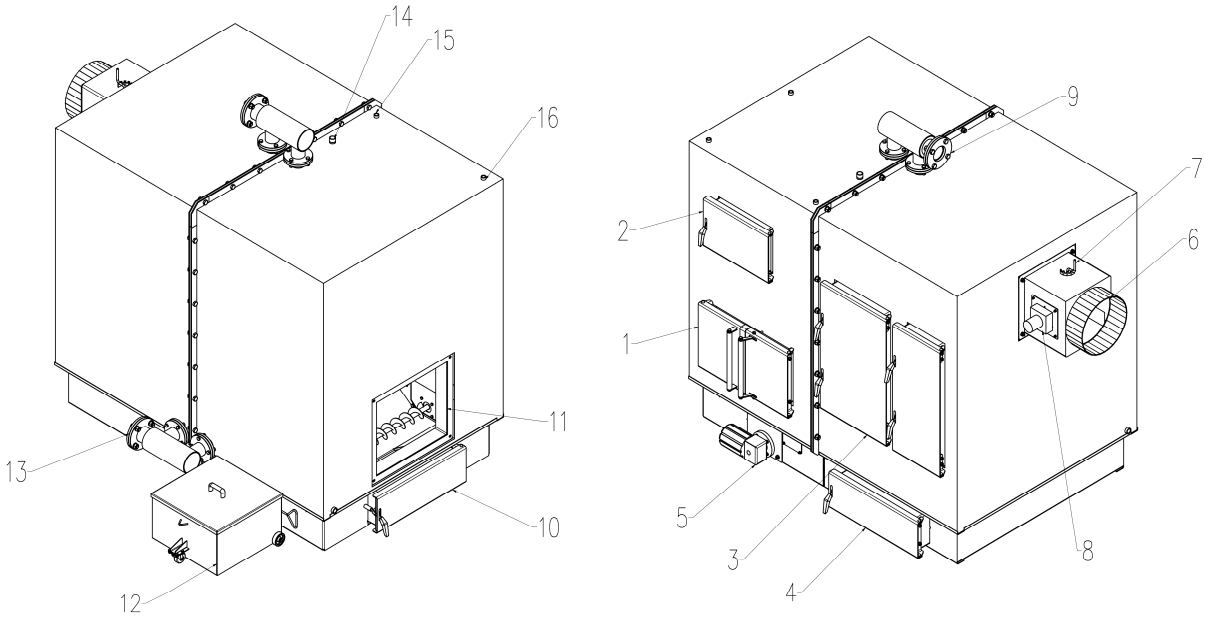


Fig. 1.3. 180, 240 kW Moderator exchanger - main elements.

1 - bottom inspection door, 2 - upper inspection door, 3 - side clean-out hatch, 4-eschanger part ash tray door, 5 - ash removal motor reducer, 6 - flue, 7 - exhaust gas damper, 8 - draught regulator, 9 - supply connection, DN80, 10 - combustion chamber ash door, 12 - ash container, 13 - return connection, DN80, 14 - safety valve connection, G1 female, 15 - measurement well connection, G1/2 male, 16 - 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, the fuel is loaded via the top inspection door. The air for combustion is supplied via the ash tray door or through the air flap.

Before igniting the boiler with a manual load, you must install the cast iron grate, which is part of the exchanger's standard equipment.

Automatic Biomass Burning Feeder (APSB)

The main elements of the APSB set are:

- cast iron grate
- fuel container or spring sweepers
- chamber dispenser
- extinguishing system
- container screw feeder

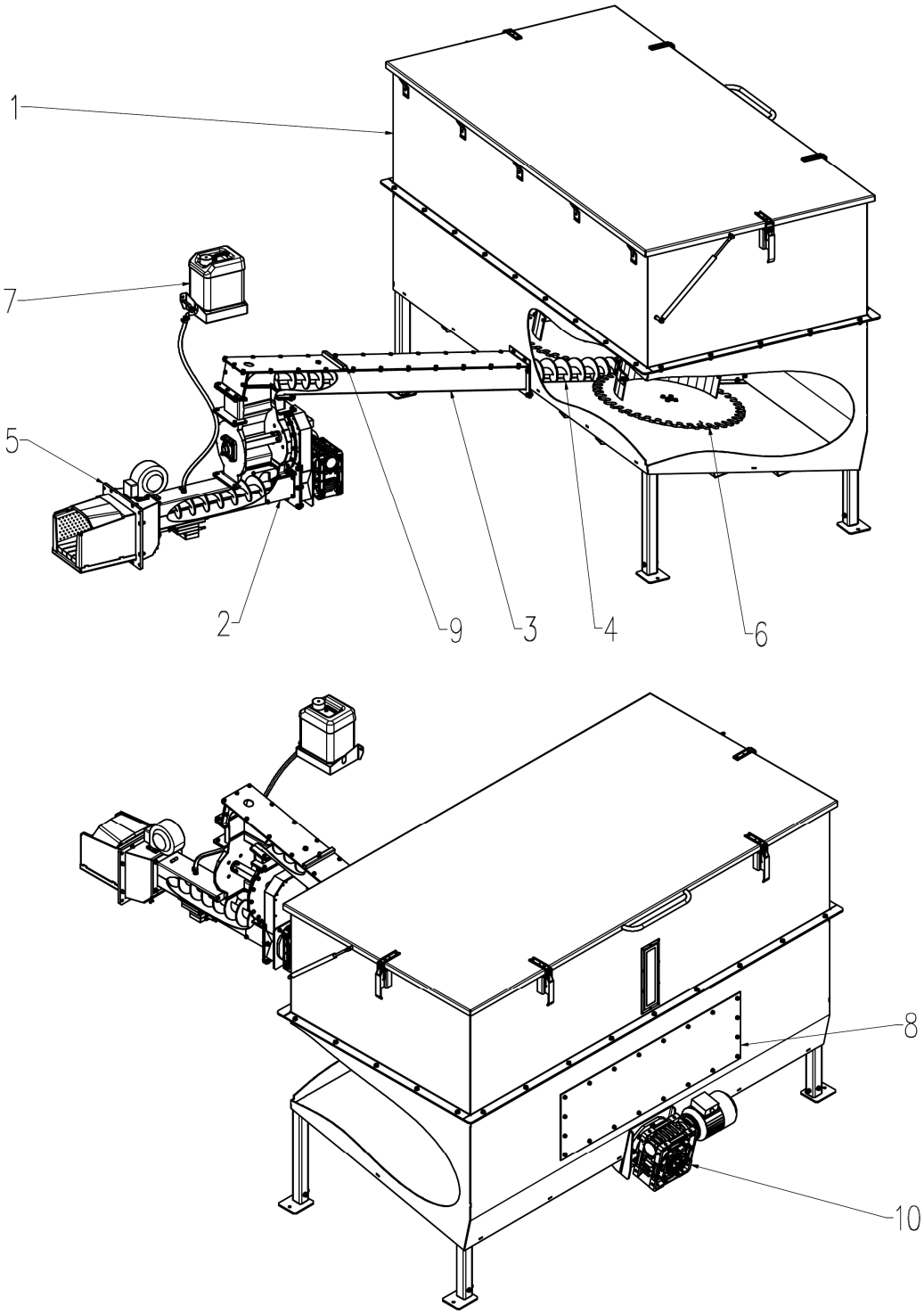


Fig. 1.4. APSB set with a 4 m³ container and a 40 kW cast iron head

1 – fuel container, 2 – chamber dispenser, 3 – container screw feeder, 4 – screw shaft, 5 - cast iron head, 6 - agitator wheel, 7 - extinguishing system, 8 - maintenance opening, 9 - additional fire protection connection (AVTA valve), 10 - feeder pipe, 11 - fire extinguishing tank, 12 - control cabinet, 13 - fire extinguishing connection with a wax seal, 14 - grate motor.

Cast iron head

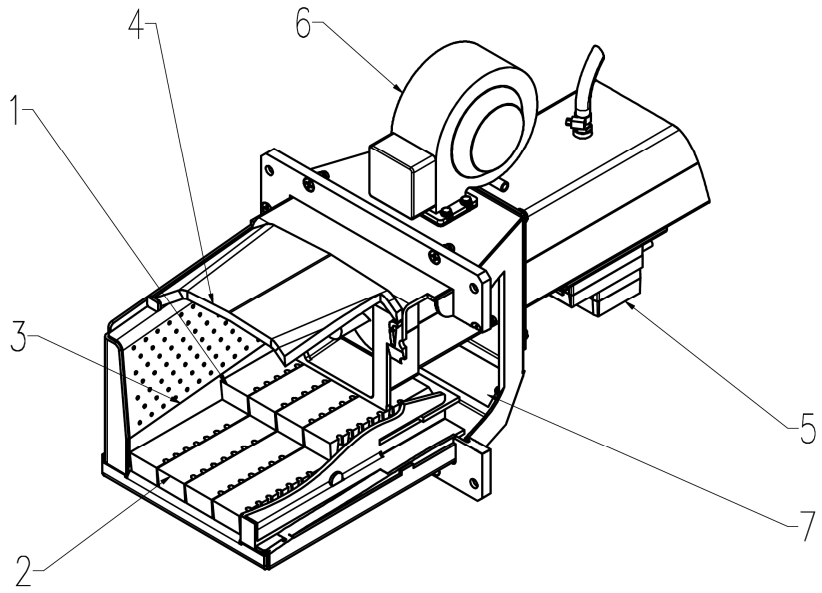


Fig. 1.5. 40 kW Cast iron head.

1 - moving grate, 2 - fixed grate, 3 - grate furnace, 4 - head cover, 5 - grate drive actuator, 6 - fan, 7 head clean-out hole

The cast iron head (*fig. 1.5*) 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 (5, Fig. 1.5).

Containers

The AZSB may be composed of the following containers: 4m^3, 6m^3, 8m^3, 10m^3, 27m^3.

The containers are made steel plates. The 4-10 m^3 containers have two toothed wheels on the bottom which agitate the fuel, and each of the wheels have spring arms which sweep the fuel. The agitating wheels are moved by locking with the feeder's screw shaft.

The 27 m^3 container is a chassis of the spring sweeper made of steel frames and panels.

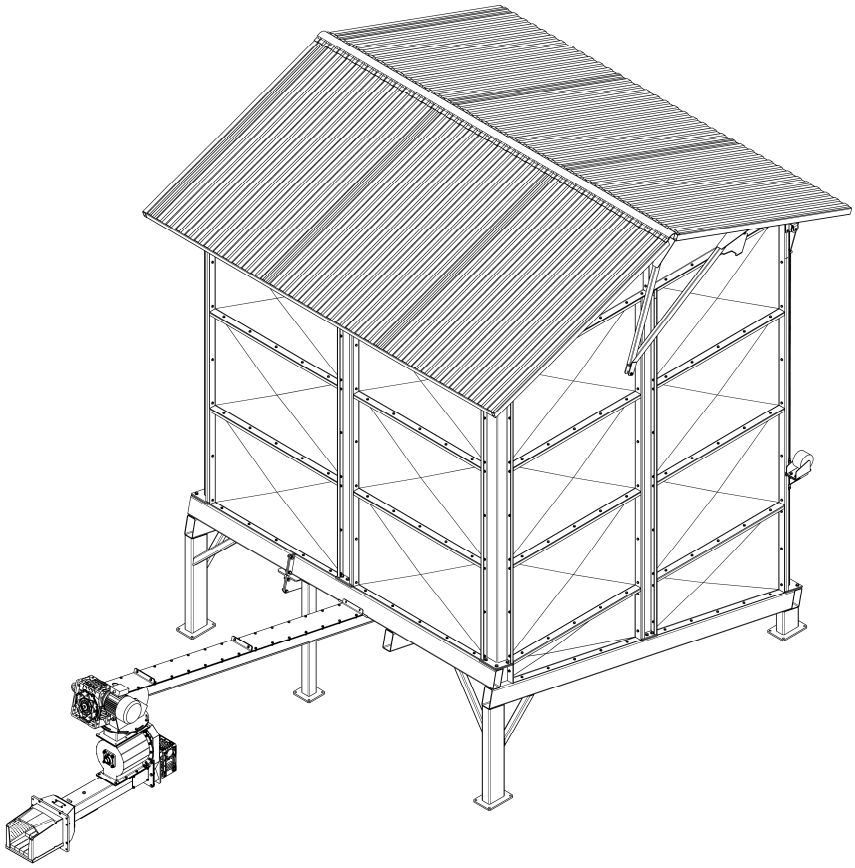


Fig. 1.6. APSB set with a 27 m^3 container and a 40 kW cast iron head.

Spring sweepers

The spring sweeper is a special device because it intended for installation in an existing room or one a room built especially for the sweeper, and this room is then used as the fuel container. This solution allows to use the space more efficiently than in the case of a standard container. The rooms for the sweeper may be of any shape, unless the distance from the spinning axis of the face and the wall of the room is between 0.75 m and 1.5 m. In the room where the sweeper will be installed, it is recommended to make the bottom in the surface of the sweeper's installation plate and build additional walls, if the room is too big. The design of the sweeper allows a large dose of flexibility in terms of installation thanks to the regulated elevation of the feeder and the possibility to rotate the head horizontally in relation to the feeder.

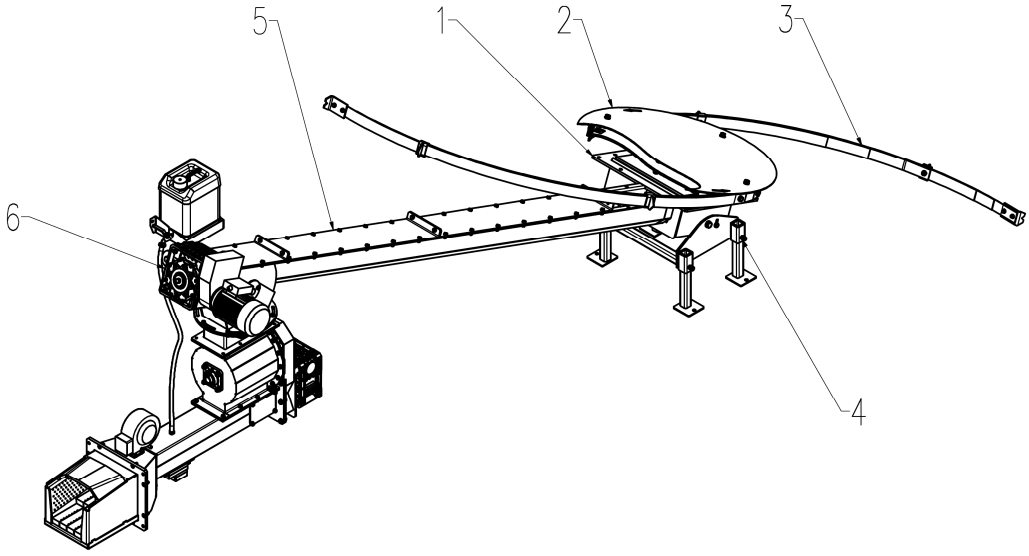


Fig. 1.7. APSB with a spring sweeper and a 40 kW cast iron head.

1 - installation panel, 2 - face, 3 - spring sweeper arms, 4 - base, 5 - feeder, 6 - motor reducer

Chamber dispenser

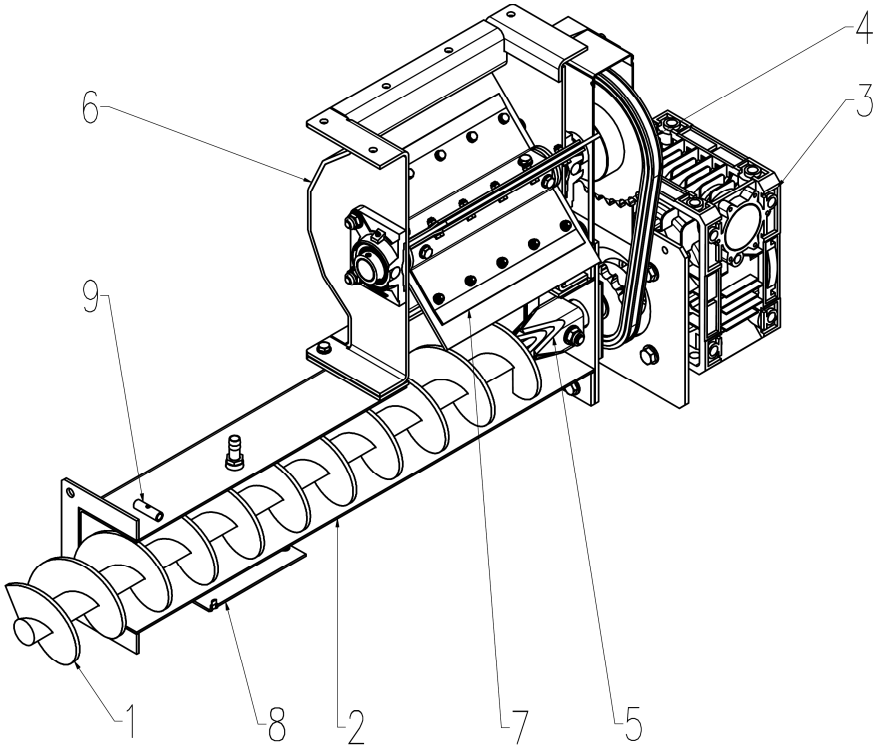


Fig. 1.8. APSB with a spring sweeper and a 40 kW cast iron head.

1 - bottom feeder screw shaft, 2 - bottom feeder chassis, 3 - drive motor reducer, 4 - chain transmission, 5 - clutch, 6 - dosage feeder chassis, 7 - dosage feeder rotor, 8 - linear actuator support, 9 - feeder temperature sensor connection.

The chamber dispenser is composed of two connected feeders: the bottom screw feeder and a rotating dosage feeder. During operation, the fuel is fed by the container's feeder via the top opening of the dosage feeder into the chambers between the blades of

the rotor, and after each 180o spin it is tipped through the chute to the bottom screw feeder, by which it is delivered to head's furnace. The rotor of the dosage feeder is equipped with metal-rubber blades, which fit tightly to the chassis during each phase of operation, and separate the container's feeder from the bottom feeder. The two feeders are separated in order to prevent fire in the container and to make extinguishing the device easier.

Extinguishing system

The extinguishing system prevents fire from moving from the furnace to the fuel container. Its elements include a water-filled tank, a valve, and a flexible hose ending with a wax sealed connection. The wax-filled connection is connected to the feeder canal at a specific position from the furnace. When the flame is moving along the feeding canal, it heats up its cover along with the wax sealed connection. When the connection reaches a temperature of approx. 50oC, the wax melts and the water from the tank floods the feeder and extinguishes the fire. After the extinguishing system works, you must:

- disconnect the connection from the feeder and elastic hose
- fill the connection with bee's wax (pour liquid wax into it)
- connect the connection with the feeder and elastic hose
- refill the water tank

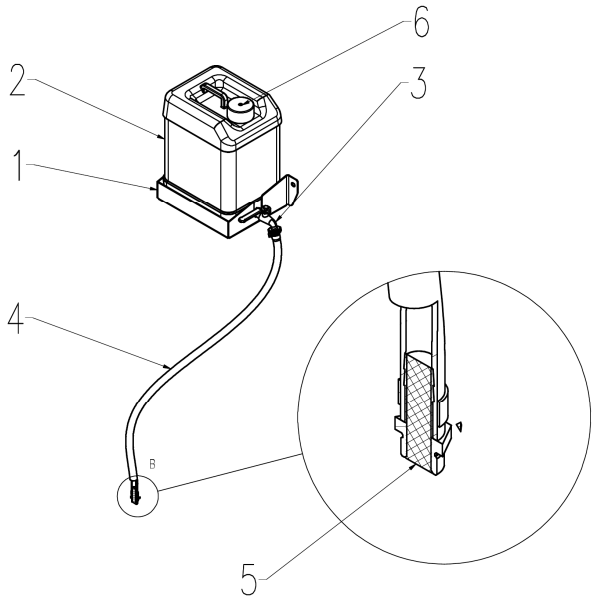


Fig. 1.8. Extinguishing system

1 - Water tank holder, 2 - water tank, 3 - valve, 4 - elastic hose, 5 - bee's wax, 6 - air vent

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. INSTALLATION

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:

- fireproof 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.
2. Make sure that you have the necessary tools for assembling the feeder (a set of wrenches).

Assembly of the APSB set with a 4-10 m^3 container:

3. Screw the head to the mounting opening on the boiler.
4. Mount the head cover.
5. Screw the chamber dispenser to the head.
6. Screw the hopper to the chamber dispenser.
7. Connect the grate pusher with a drive actuator placed on the bottom of the chamber dispenser. The connection screw is placed at the end of the pusher.
8. Connect the feeder tract to the container.
9. Place the screw shaft inside the container and feeder tract and fasten it to the shaft in the motor reducer using an M12x70 bolt, screwed to the end of the screw shaft.
10. Place the agitators:
    a. In sets up to 120 kW, the agitators should be placed so that the markers on the agitators form are lined and the spring arms are placed like in fig. 2.1.

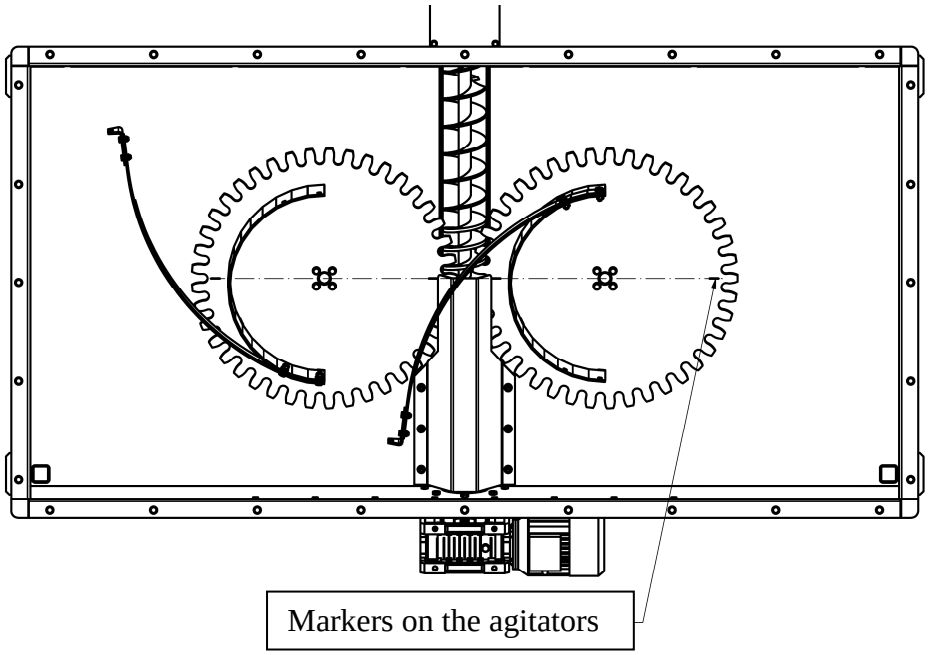


Fig. 2.1 Placement of agitators in the container, sets up to 120 kW.

    b. In sets larger than 120 kW, the agitators should be placed so that the lines made by the markers on the agitators meet perpendicularly the spring arms are placed like in fig. 2.2.

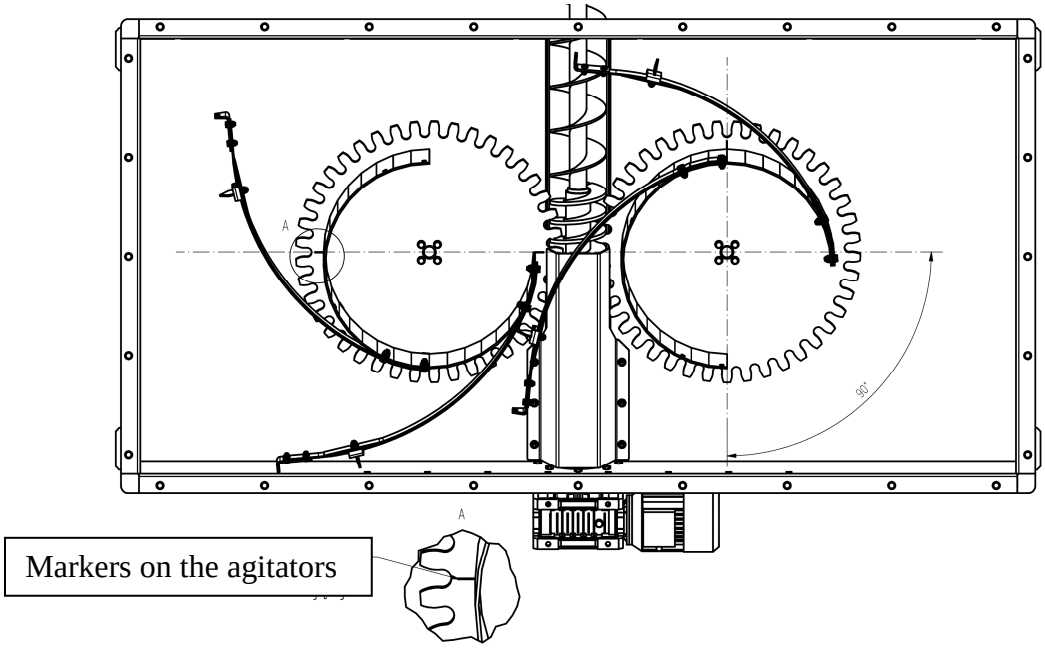


Fig. 2.2 Placement of agitators in the container, sets larger than 120 kW.

Improper placement of agitators will result in uneven feeding of.

11. Set the container co that the connection frame of the chute of the upper feeder fits tightly to the connection frame of the hopper. Connect the frames with the provided bolts. The container should be levelled and the connection frames should fit without pulling them together. The legs of the container are regulated, making it easy to adjust their height and levelling it. The inside part of the legs may, in some cases, be too long or too short. If necessary, shorten the legs or prepare a necessary base to place the container.
12. Find a location for the extinguishing water tank and prepare a necessary length of hose to connect it (the hose is provided with the set). For safety reasons, the water tank should be fastened to a wall of the room, and not to a side wall of the fuel container. The bottom of the water tank must be placed at least 50 cm above the upper surface of the feeder tract. Check if the water hose is not bent or twisted.
13. Install the extinguishing tank, connect the elastic hose to the connection and secure it with a zip tie, release the valve and make sure that the cap of the tank has an air vent.
14. Connect the electrical installation and sensors (see section 2.6. Installation of the control system and electrical connections).

Installation of the APSB sets with spring sweepers

The spring sweepers are supplied assembled. Only one spring arm is disassembled, in order to make transport easier.

1. Screw the head to the mounting opening on the boiler.
2. Mount the head cover.
3. Screw the chamber dispenser to the head.
4. Connect the grate pusher with a drive actuator placed on the bottom of the chamber dispenser. The connection screw is placed at the end of the pusher.
5. Place the spring sweeper in its intended location. Connect the chute of the sweeper with the hopper of the chamber dispenser.
6. Create a bottom in the surface of the sweeper's installation panel, and, if necessary, make additional walls. The bottom and walls can be made of steel sheets, construction panels, or boards. The structure of the walls and bottom must be strong enough to bear the weight of the fuel. The structure of the bottom should not transfer the load to the feeder and should not rest on the feeder. The base of the feeder is used to bear the load of the feeder face and to facilitate installation. If the spring arms touch the walls of the room, cover the walls with steel sheets at about ~40cm from the bottom. The cover of the feeder should be fitted to the room by shortening it or lengthening it, as necessary. If the bottom is not created, make a slide according to the following figure, which will prevent the arms from catching the chassis of the cover. Make the slide along the whole uncovered portion of the feeder.

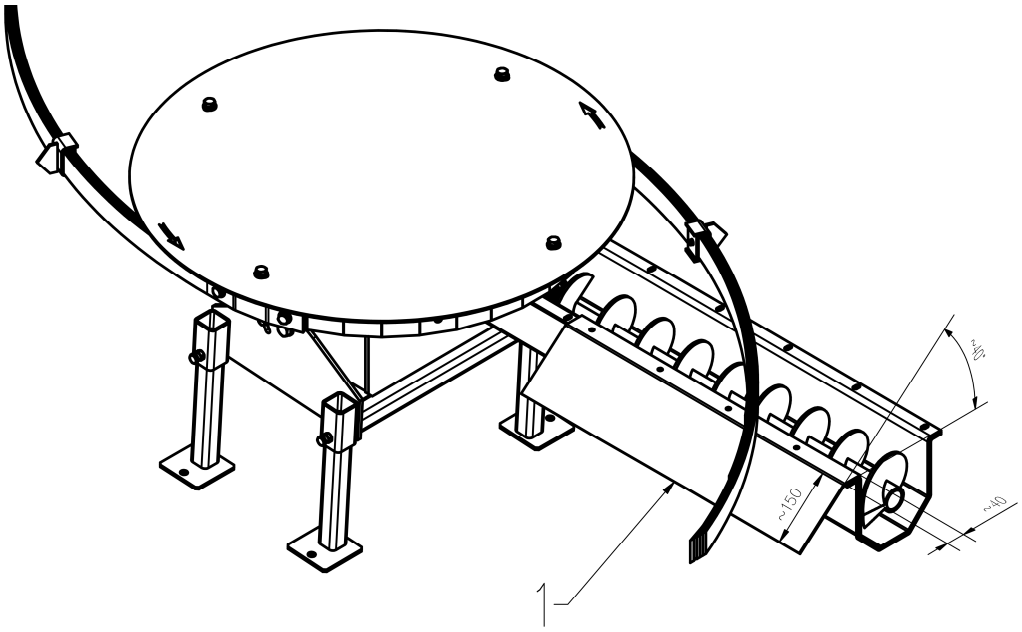


Fig. 2.2 Slide schematics.

1 - slide

7. Seal the chute of the feeder with silicone.
8. Find a location for the extinguishing water tank and prepare a necessary length of hose to connect it (the hose is provided with the set). For safety reasons, the water tank should be fastened to a wall of the room, and not to a side wall of the fuel container. The bottom of the water tank must be placed at least 50 cm above the upper surface of teh feeder tract. Check if the water hose is not bent or twisted.

9. Install the extinguishing tank, connect the elastic hose to the connection and secure it with a zip tie, release the valve and make sure that the cap of the tank has an air vent.
10. Connect the electrical installation and sensors (see section 2.6. Installation of the control system and electrical connections).

Assembly of APSB sets with a 27m^3 container:

1. Screw the head to the mounting opening on the boiler.
2. Mount the head cover.
3. Screw the chamber dispenser to the head.
4. Connect the grate pusher with a drive actuator placed on the bottom of the chamber dispenser. The connection screw is placed at the end of the pusher.
5. Mount the container in accordance with the manual provided with it.
6. Set the container so that the connection frame of the chute of the sweeper fits tightly to the connection frame of the chamber dispenser. Connect the frames with the provided bolts. The container should be levelled and the connection frames should fit without pulling them together.
7. Seal the chute of the feeder with silicone.
8. Find a location for the extinguishing water tank and prepare a necessary length of hose to connect it (the hose is provided with the set). For safety reasons, the water tank should be fastened to a wall of the room, and not to a side wall of the fuel container. The bottom of the water tank must be placed at least 50 cm above the upper surface of teh feeder tract. Check if the water hose is not bent or twisted.
9. Install the extinguishing tank, connect the elastic hose to the connection and secure it with a zip tie, release the valve and make sure that the cap of the tank has an air vent.
10. Connect the electrical installation and sensors (see section 2.6. Installation of the control system and electrical connections).

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 on device power.

Boiler power kW	cross section cm^2	Round chimney cm	Min. chimney draught Pa
40	**400**	**20**	**30**
60	**506**	**22.5**	**33**
120	**900**	**300**	**41**
180	**1225**	**350**	**45**
240	**1600**	**400**	**47**

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 exchanger (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 70-80°C, and that the returning water should not be less than 55°C. 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.

60 kW boilers have G2 male connections, while 120 kW, 180 kW, 240 kW boilers have DN80 flange connections. 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 G½ 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°n. If it does, the water should be treated.

2.5. SAFE INSTALLATION

2.5.1. OPEN SYSTEM

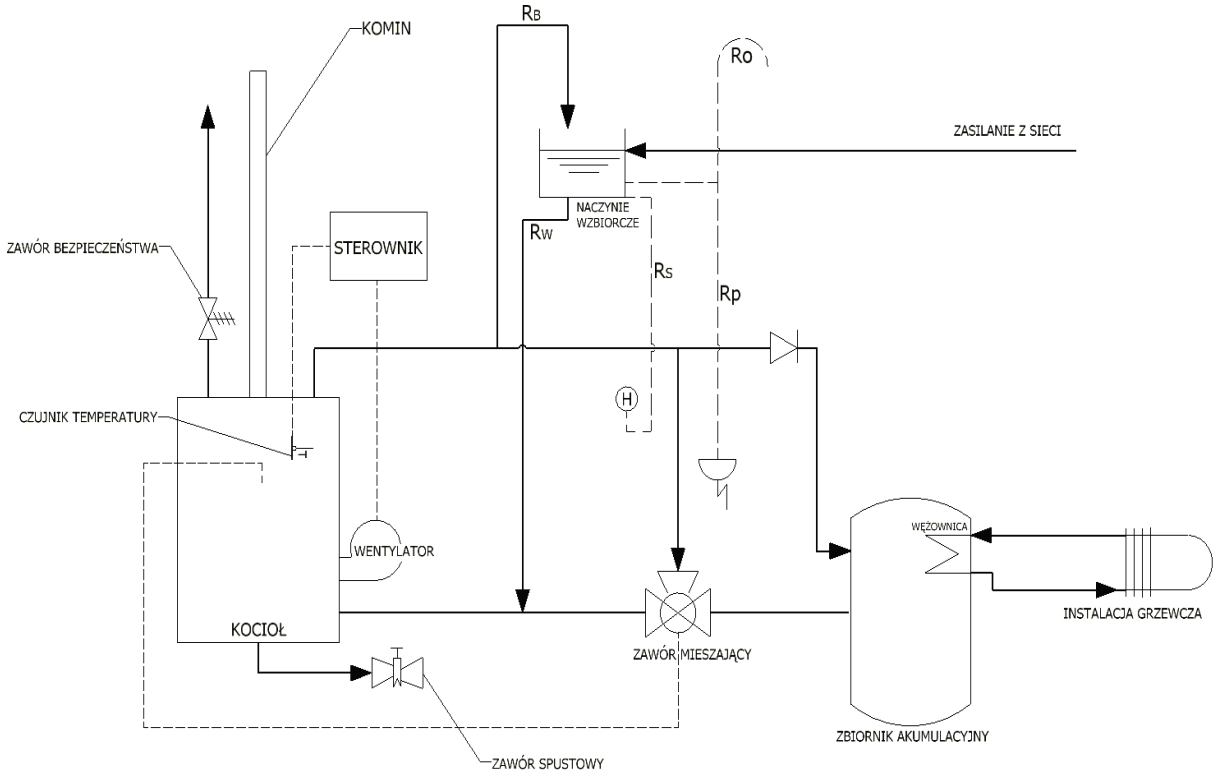


Fig. 2.1. Diagram of installation protection for boilers operated in open central-heating installations

KOMIN – CHIMNEY
ZAWÓR BEZPIECZEŃSTWA - SAFETY VALVE
CZUJNIK TEMPERATURY – TEMPERATURE SENSOR
KOCIOŁ – BOILER
STEROWNIK – CONTROLLER
WENTYLATOR – FAN

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).

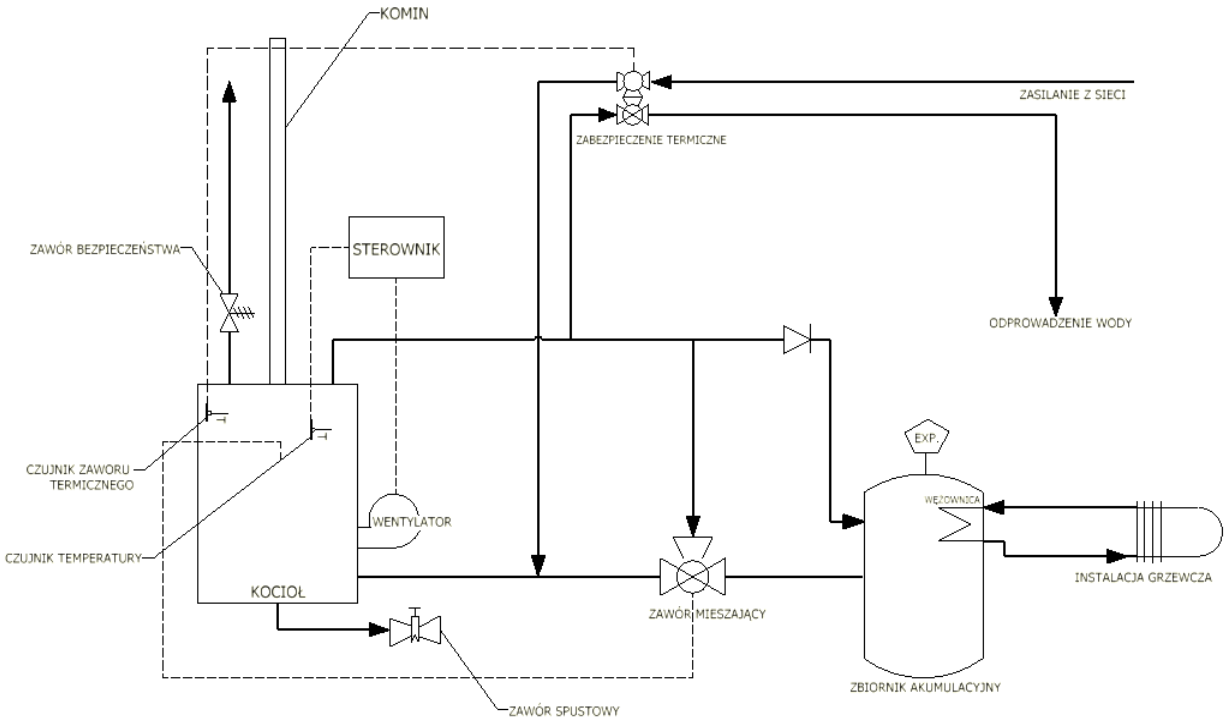


Fig. 2.2. Diagram of installation protection for boilers operated in closed central-heating installations

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

2.6. CONTROL ASSEMBLY AND ELECTRICAL CONNECTION.

2.6.1. SAFETY GUIDELINES

1. 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 3-phase C20A 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 sets with two feeders are equipped with a ZAB-14 control cabinet. Additionally, the control cabinet can be connected with an igniter or a movable grate drive, depending on the type of head. The control cabinet is connected with a 3-phase power supply, with a 400V phase-to-phase voltage, 50Hz.

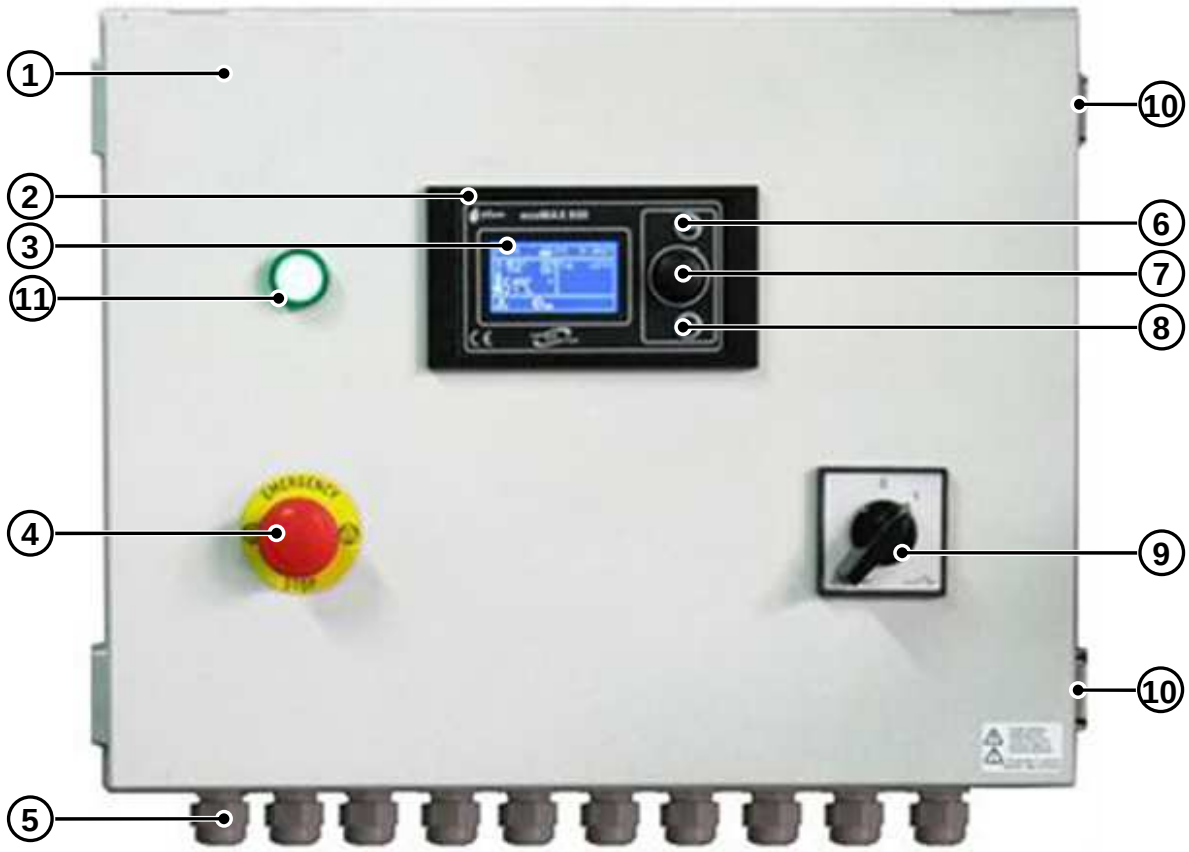


Fig.2.3. ZAB-14 control cabinet - front view

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, 11 - power-on lamp.

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 one of the walls of the boiler room, in a location which is easily accessible.

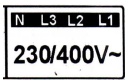
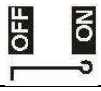
It is prohibited to install the control cabinet on the boiler, screw pipe, chimney or fuel container, and on surfaces whose temperature exceeds 50ºC.

2.6.4. ELECTRICAL CONNECTIONS AND CONNECTION OF MAIN ELECTRICAL COMPONENTS

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
POWER SUPPLY		H05VV-F 300/500 V	5x2.5 mm^2
FEEDER (UPPER FEEDER MOTOR)		H05VV-F 300/500 V	4x1.5 mm^2
FEEDER 2 (BOTTOM FEEDER MOTOR)		H05VV-F 300/500 V	4x1.5 mm^2
IGNITER		H03VV-F 300/300 V	3x2.5 mm^2
HOT WATER PUMP		H03VV-F 300/300 V	3x1 mm^2
CENTRAL HEATING PUMP		H03VV-F 300/300 V	3x1 mm^2
FAN		H03VV-F 300/300 V	3x1 mm^2
MOVABLE GRATE		H03VV-F 300/300 V	3x1 mm^2
CIRCULATION PUMP		H03VV-F 300/300 V	3x1 mm^2
MIXING VALVE ACTUATOR		H03VV-F 300/300 V	3x1 mm^2
MIXING CIRCUIT PUMP		H03VV-F 300/300 V	3x1 mm^2
ALARM		H03VV-F 300/300 V	3x1 mm^2
STB		H03VV-F 300/300 V	3x1 mm^2
ASH REMOVAL SYSTEM		H03VV-F 300/300 V	3x1 mm^2
FOR OUTLETS 96-122, IT IS RECOMMEBDE TO USE AN H03VV-F 300/300V 2x0.75MM^2 OR 3x0,75MM^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 MOTORS OF THE UPPER AND BOTTOM FEEDER

It is recommended to use cables in *Table 2.3* to connect the motor. The winding of the feeder motor should be connected in a star (Fig. 2.4).

Connect the motors in accordance with the control cabinet manual. 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 U1 and v terminals.

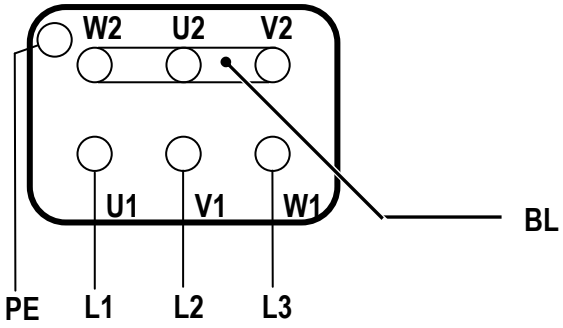


Fig.2.4. Connection terminals inside the feeder motor junction box.

BL - plate connecting the terminals.

SETING THE MOTOR PROTECTIVE SWITCHES

The motor protective switch (Fig 2.5) is used to protect the motors of the fuel feeders against the fuel feeding system's overload. The switch should be set with the dial (1, Fig. 2.5) 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

Set the current dial in both motors.

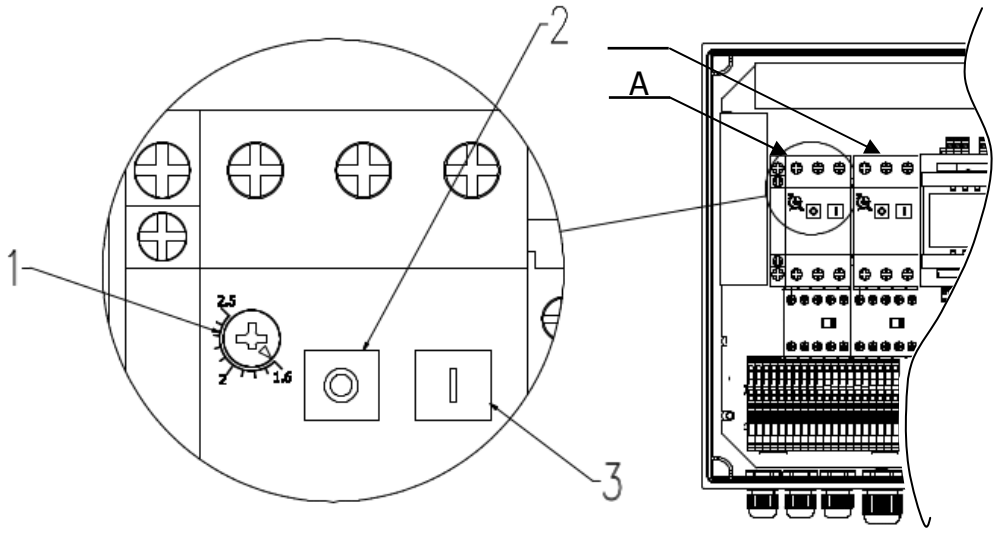


Fig.2.5. FEEDER MOTORS PROTECTIVE SWITCHES

A - UPPER feeder protective switch, B - BOTTOM feeder 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.

IGNITER

It is recommended to connect the igniter using the cables in *Table 2.3.* At the end of the cable, mount a socket for connecting the igniter (not included).

FANS

Connect the fan to the relevant terminals described in the control cabinet's manual. The 180 and 240 kW heads have two fans. One for primary air, the other one for secondary air. Both are connected to the same terminal in the cabinet. It is recommended to connect the fan using the cables in *Table 2.3.*

MOVING GRATE ACTUATOR

The moving grate actuator can be connected according to the diagram in Fig. 2.6. The diagram is intended for 180 and 240 kW heads with two actuators. For heads with one actuator, connect the actuator similarly, omitting one of the actuators. The recommended diameter of the cables is provided in table 2.3.

Table 2.5 Connection of Belimo actuators - terminals

Terminals: ZAB-14	Wire colours of the Belimo Actuators	Setting of the Belimo switch
75 L1 (OFF)	3 (biały/white)	
76 N	1 (niebieski/blue)	
77 L1 (ON)	2 (brązowy/brown)	

Fig.2.6. 180 and 240 kW - Belimo actuator connection diagram

The settings of the movable grate are: *Operation time* and *full opening time*, in: SERVICE SETTINGS→ MOVABLE GRATE.

STB TEMPERATURE LIMITER

The function of the STB temperature limiter (Fig. 2.7) 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.

a) b)

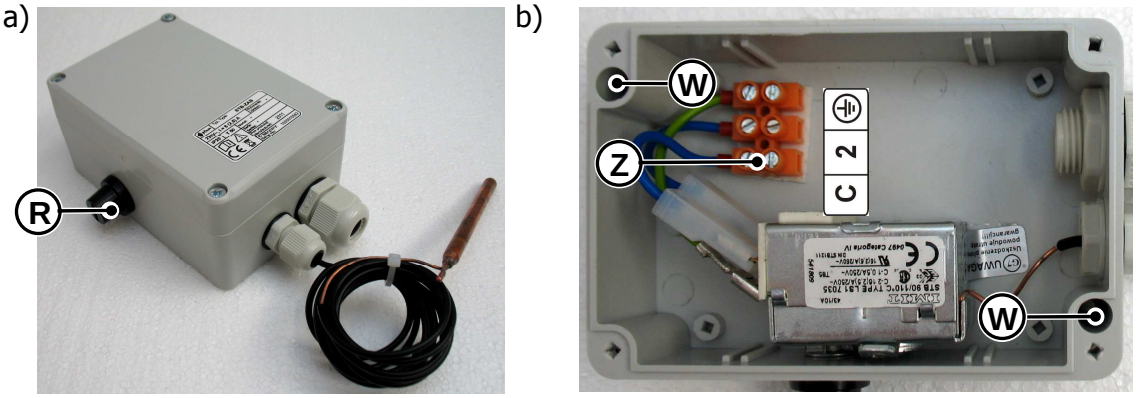


Fig.2.7. STB temperature limiter.

a) view of the limiter, b - connection terminals

Next, using the two openings, mount the box on the boiler (W, Fig. 2.7.b). Connect the wires to the terminal (Z, Fig. 2.7.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. The recommended diameter of the wires for the limiter is privided in Table 2.3. 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. 2.7.a) and using, for example, a match press the switch under the cap.

ASH REMOVAL SYSTEM

The ash removal motor is connected to the terminal bar in the control cabinet marked ODPOPIEL/ASH. 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 standard equipment for powers 120 kW and more.

SENSORS

Connect the sensors in accordance with the control cabinet 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.

BOILER TEMPERATURE SENSOR

Place the senor in sensor well screwed in the boiler (17, Fig. 1.1).

FUEL FEEDER TEMPERATURE SENSOR

The measuring sensor (C, Fig. 2.18) 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.

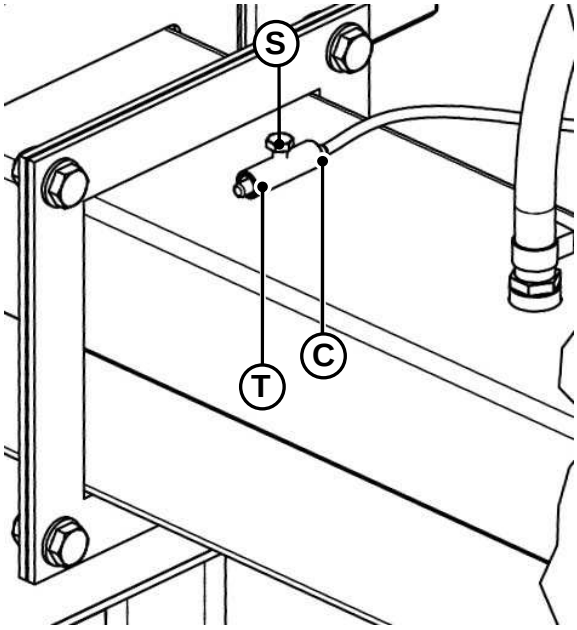


Fig.2.8. Fuel feeder temperature sensor installation

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

HOT WATER TEMPERATURE SENSOR

According to the cabinet's manual.

WEATHER SENSOR

According to the cabinet's manual.

EXHAUST GAS TEMPERATURE SENSOR

Install the sensor in the opening of the flue (Fig. 2.9).

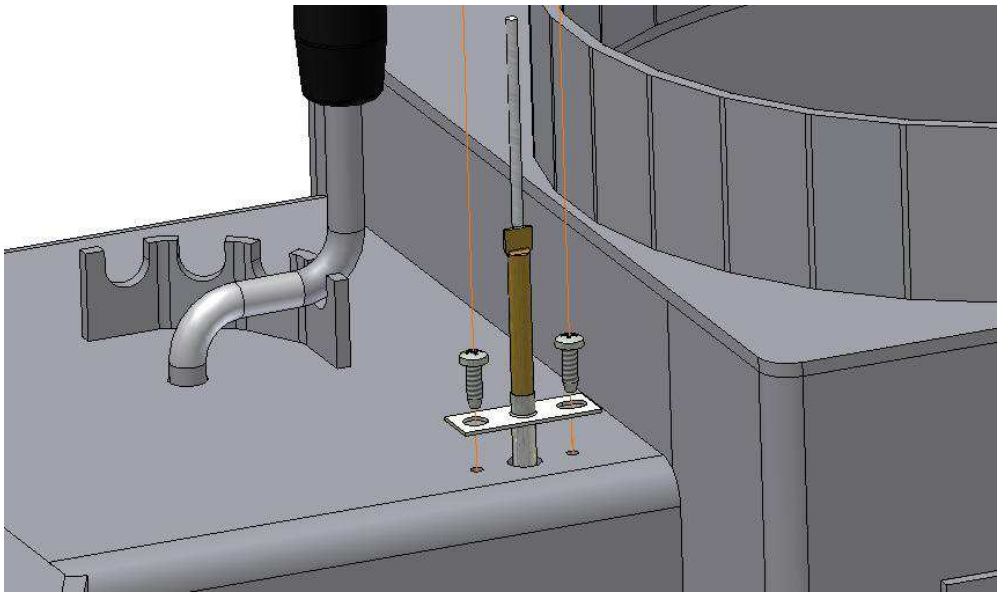


Fig.2.9. Exhaust gas temperature sensor installation.

MIXER 1 ROOM THERMOSTAT

According to the cabinet's manual.

MIXER 1 TEMPERATURE SENSOR

According to the cabinet's manual.

CAPACITIVE SENSOR

The operation of the capacitive sensor (chamber overfill) is described in the control cabinet's manual. Connect the sensor to the terminals in the cabinet in accordance with the following diagram (Fig. 2.10.).

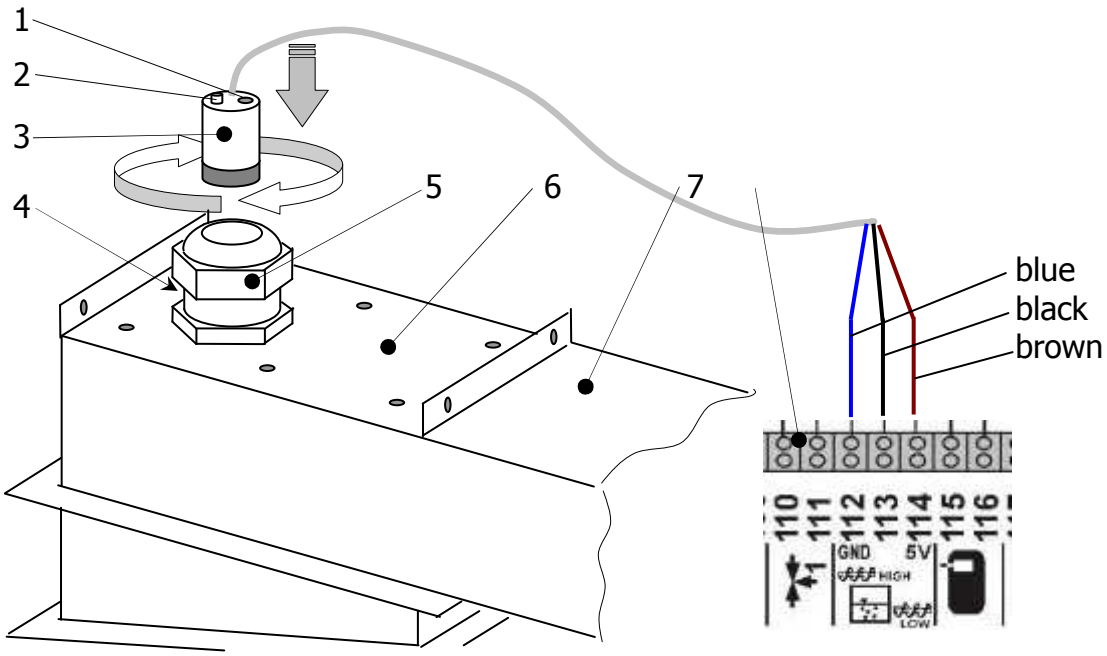


Fig.2.10. Capacitive sensor connection

1 - sensitivity adjustment screw, 2 - sensor activation indicator, 3 - capacitive sensor, 4 - installation socket, 5 - socket cap, 6 - clean-out cover, 7 - upper feeder, 8 - control cabinet terminal bar.

The capacitive sensor (*3, Fig. 2.10*) is to be mounted in the plastic socket (1), screwed into of the cover of the clean-out (6) of the upper feeder (7). To do this, loosen the cap (5). Insert the sensor through the cap's opening, in accordance with the picture, until the face of the sensor aligns with the end of the damper (Fig. 2.11.). To do this, it is best to unscrew the fastening bolts and, after lifting the cover of the clean-out, see when the face of the sensor aligns with the socket. Next, holding the capacitive sensor in place, tighten the socket's cap to prevent the sensor from accidental movement.

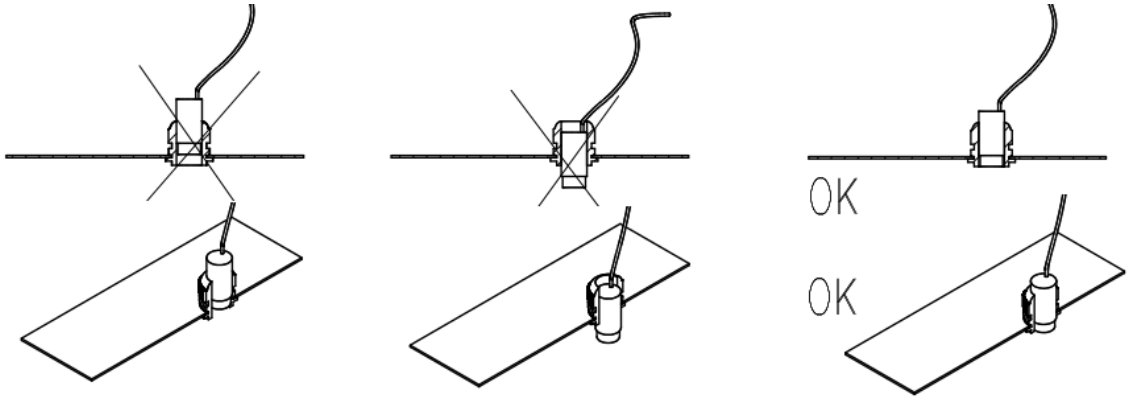


Fig.2.11. Proper setting of the capacitive sensor in the mounting socket.

The head of the sensor cannot stick out of the damper as it may get damaged.

After installing the sensor, adjust its sensitivity. To do this, with the control cabinet ON, screw in the adjustment screw (1, Fig. 2.10) until the indicator lights on (2, Fig. 2.10.). Then, turn the screw in the opposite direction until the indicator lamp switches off, and then make one more turn.

HEAD FUEL LEVEL SENSOR

Only for versions with ceramic heads.

MIXER 2 TEMPERATURE SENSOR

According to the cabinet's manual.

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 three power levels (100%, 50%, 30%) in OPERATION mode, if the temperature is below the set temperature. When the set temperature is reached, the unit switches into Control mode (version without an igniter) of burning off (versions with an igniter, since the device can start itself).

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 3.2 and set the temperature of the boiler. Depending on whether the set is equipped with an igniter or not, use different service parameters. See examples in table 3.1.

Table 3.1 Example service settings for a 120 kW unit with and without an igniter.

Firing-up	***ROZPALANIE***	***unit***	***w/o igniter***	***w/ igniter***
Ignition test time	czas testu zapłonu	sec.	0	90
Feeding time - firing-up	czas podawania rozpalanie	sec.	0	80
Firing-up airflow	nadmuch rozpalania	%	60	50
Firing-up time	czas rozpalania	min.	1	7
Ex.temp.delta	delta spalin	°C	1	6
EmissionT - firing up end	temp. spalin końca rozpalania	°C	1	100
Air flush period	moc przedmuchu	%	50	50
Air flush delay	opóźnienie przedmuchu	min.	3	3
Igniter pre-heating period	czas rozgrzewania zapalarki	sec.	1	25
Worktime with min.power	czas pracy z mocą minimalną	sec.	255	240

Burning off	***WYGASZANIE***			
Burning off time	czas wygaszania	min.	0	20
Burning off airflow	nadmuch wygaszania	%	60	67

Cleaning	***CZYSZCZENIE***			
Poker p.before inflame	czas czyszcz. rozpalanie	sec.	0	30
Poker period after bufning off	czas czyszcz. Wygaszanie	min.	0	1
Cleaning airflow	nadmuch czyszczenia	%	100	100
Ash removal working period	czas pracy odpopielania	sec.	10	10
Ash removal interval	czas przerwy odpopielania	min.	5	5

Supervision	***NADZÓR***			
Supervision time	czas nadzoru	min.	∞	60
Feed. time SUPERV	czas podawania nadzór	sec.	10	8
Feed interval SUPERV	przerwa podawania nadzór	min.	15	5
Blow-in SUPERV	moc nadmuchu NADZÓR	%	32	32

Minimum airflow output	Minimalna moc nadmuchu	%	22	22
No fuel detection time	Czas detekcji braku paliwa	min.	40	40

Emission temp. with no fuel	temperatura spalin braku opału	°C	60	60
Feeder 2-extended operation	wydłużenie pracy podajnika 2	sec.	2	2
Maximum burner temperature exceeded.	maxymalna temperatura podajnika	°C	65	75

Poker	***POGRZEBACZ / RR***	sec.	1	150

The client receives the control cabinet pre-set with the factory settings for the respective power and used fuel, if its type was indicated while placing the order. Due to the variety of fuel types, it may be necessary to adjust the service parameters for devices both with and without the igniter.

In the case of devices without the igniter, ignition should be conducted using manual operation (in the cabinet's menu). Turn on the feeder and supply fuel until it appears on the grate. Next, light the fuel on the grate using some kind of kindling (paper, cardboard, barbecue lighter) and turn on the fan. When the fire spreads on the whole furnace, press the TOUCH&PLAY button, turning on the device.

DO NOT use oil, gasoline, paint thinners or other flammable and explosive substances to ignite.

The time after which the devices is switched from manual mode to operation depends on the power of the head and the type of fuel used. It is longer, the larger the power of the head. This corresponds with the head reaching its minimal temperature, so that the set can start working in automatic mode. The time varies from 5 to 20 minutes for GZ40 and GZ240 respectively.

Turn on the sets with an igniter by pressing the TOUCH&PLAY button.

Before the first start-up of the device with an igniter, fill the upper feeder with fuel until it falls to the chamber dispenser.

When the exhaust gas sensor detects the flame, the controller switches to OPERATION mode and for a time specified in the menu, the head operates at minimum power, which gradually increases until it reaches maximum. This applies to set with and without an igniter.

The specificity of some fuel types does not allow for automated burning. For example, a mixture of wood dust and very fine sawdust.

During operation, the level of the fuel on the furnace of the head should look like in *Fig. 3.1.*

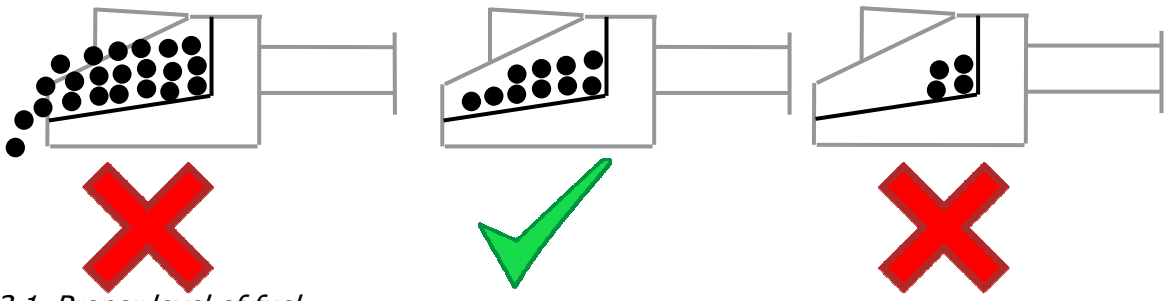


Fig.3.1. Proper level of fuel

Signs of well-adjusted combustion parameters:

- 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

SUPERVISION MODE

In SUPERVISION 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

A 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 display a feeder temperature alert and will start the bottom feeder in order to empty it.

Table 3.2 Head combustion parameters for APSB and AZSB sets

Typ i moc głowicy *Type and power of head* [kW]	Rodzaj paliwa (rodzaj paliwa używanego do spalania – nie mylić z rodzajem/typem paliwa ustawianym w szafie sterującej) *Type of fuel (type of fuel actually used - do not confuse with fuel type set in the control cabinet)*	TRYB / *MODE*											
		PRACA / *OPERATION*									PODTRZYMANIE / *SUPERVISION*		
		100%			50%			30%					
		100% Moc nadmuchu	100% Praca podajnika	100% Przerwa podajnika	50% Moc nadmuchu	50% Praca podajnika	50% Przerwa podajnika	30% Moc nadmuchu	30% Praca podajnika	30% Przerwa podajnika	Czas podawania NADZÓR	Przerwa podawania NADZÓR	Moc nadmuchu NADZÓR
		100% Blow-in output	100% Fedder operation	100% Fedder interval	50% Blow-in output	50% Fedder operation	50% Fedder interval	30% Blow-in output	30% Fedder operation	30% Fedder interval	Feed timie	Feed interval	Blow-in supervision mode
		[%]	**[sec.]**	**[sec.]**	**[%]**	**[sec.]**	**[sec.]**	**[%]**	**[sec.]**	**[sec.]**	**[sec.]**	**[min.]**	**[%]**
GZ 40	zrębka / chips	34	2	45	31	2	72	27	2	90	2	5	32
	brykiet / briquette	34	2	40	31	2	65	27	2	80	2	5	32
	trociny[1] / sawdust	31	3	25	28	3	42	25	3	50	2	3	32
	trociny[2] / sawdust	28	3	18	25	3	30	22	3	36	2	3	32
GZ 60	zrębka / chips	36	4	37	33	4	60	29	4	74	3	5	35
	brykiet / briquette	36	4	35	33	4	56	29	4	70	3	5	35

[1] trociny o rozdrobnieniu takim jak z pod pilarki o wilgotności względnej nie przekraczającej 25 % / sawdust from the saw blade having a relative humidity ≤ 25%
[2] trociny o rozdrobnieniu takim jak z pod strugarki, heblarki o wilgotności względnej nie przekraczającej 25 % / from a planer with a relative humidity ≤ 25%

	trociny [1] / sawdust	34	10	16	31	10	25	27	10	32	4	3	35
	trociny [2] / sawdust	32	10	12	29	10	19	26	10	24	4	3	35
GZ 120	zrębka / chips	44	6	30	40	6	48	35	6	60	6	5	35
	brykiet / briquette	44	6	25	40	6	40	35	6	50	6	5	35
	trociny [1] / sawdust	42	7	8	38	7	12	34	7	16	7	3	35
	trociny [2] / sawdust	40	9	5	36	9	8	32	9	10	7	3	35
GZ 180	zrębka / chips	48	8	30	40	7	48	35	6	60	6	5	35
	brykiet / briquette	48	8	25	40	7	40	35	6	50	6	5	35
	trociny [1] / sawdust	46	9	8	38	8	12	34	7	16	7	3	35
	trociny [2] / sawdust	44	11	5	36	10	8	32	9	10	7	3	35
GZ 240	zrębka / chips	60	5	45	54	5	72	48	5	100	10	5	35
	brykiet / briquette	60	5	40	54	5	64	48	5	110	10	5	35
	trociny [1] / sawdust	56	9	16	50	9	26	45	9	80	14	3	35
	trociny [2] / sawdust	54	11	16	48	11	26	43	11	80	14	3	35

The values in table 3.2 are only approximate. The target settings will differ from these depending on the combustion properties of the fuel, its humidity and particle size. Device startup should be done with the above settings. The values should be adjusted according to the amount of fuel in the head Do not allow not fully burned fuel particles to be moved to the ash tray (too much fuel and/or too little fuel). Do not allow too little fuel to be burned in the front part of the head fireplace (too little fuel and/or too much air).

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. 3.2*) and sweep out the sand and ash from the space under the grate (*2, Fig. 3.2*). 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.

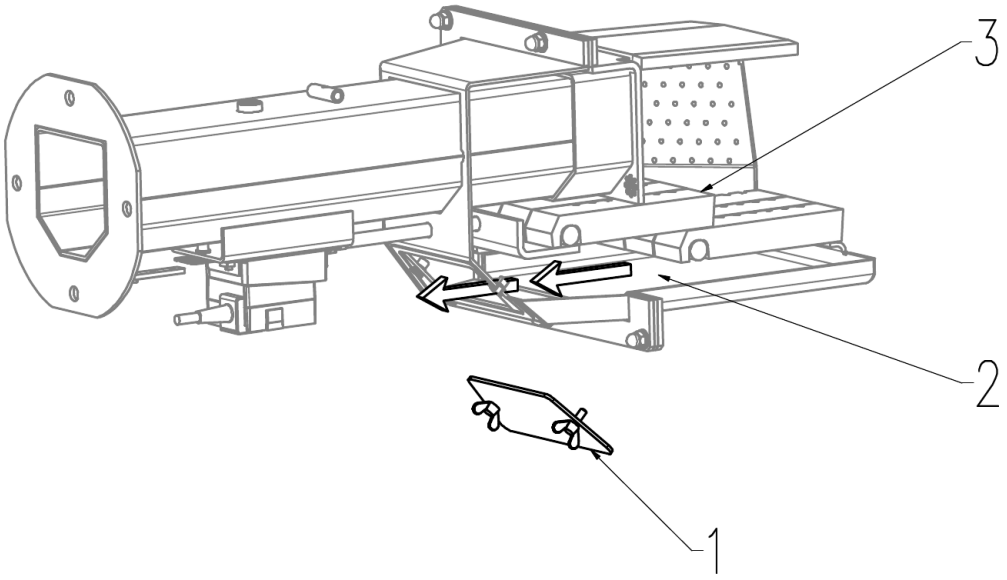


Fig. 3.2. Head cleaning schematic

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), 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, put the controller into **burning-off** mode.

3.4.2. EMERGENCY SHUTDOWN

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

In case of emergency situations, such as exceeding 100^0 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

Emergency shutdown of the unit starts when power switch is set to "0" (zero).

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 feeder	- no fuel in the container or fuel level too low, - fuel clogging, - container cover not fully closed	- refill the fuel container, - mix the fuel - check cover tightness
		- blocked screw shaft - no water in the container	- determine the cause and remove the failure - refill the water tank
		- insufficient chimney draught	- use an exhaust fan, improve the draught
2	Fuel clogging in the container	- 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	- change the fuel - add a portion of dry fuel and mix it thoroughly
3	Smoke in the feeder	- head contamination - blocked chimney - boiler cover and doors not fully closed	- clean ash in the head - clean the chimney - close covers and doors in the boiler
4	Screw shaft does not rotate	- power outage - blocked screw shaft - damaged screw shaft and agitator	- point 4.3.1 - replace the screw shaft, replace the agitator
5	Loud operation of the feeder unit	- damaged electric motor bearing, - gear-motor oil leak, - damaged agitator bearing, - foreign body (e.g. metal) in the feeder	- 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	- excessively contaminated fuel	- do not burn coal, coke, fine coal, plastics and rags, use fuels according to the instructions, - remove deposit
7	Boiler cannot reach the pre-set temperature	- contaminated fan - too much ash in the (cast-iron) head, blocked ventilation	- clean fan blades -remove ashes from the head

		openings in the head - too high moisture content of fuel, - incorrect controller settings	through the washout opening - charge correct fuel - set correct feed and pause times
8	Fire exhausting water tank emptying	- flame backdrafting to the feeder	- undo the connector, insert beeswax plug. If the container has been emptied when using sawdust, the fuel in the feeder 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:

- Change the direction of motor rotation of the blocked feeder. In manual mode turn on the blocked feeder for several seconds, then turn on normal direction of turns. 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.

Note: Electrical works can only be performed by certified professionals.

5. SPARE PARTS

5.1. MAIN SPARE PARTS LIST

No.	Part name	Part number
1.	Electrical motor with motor reducer	10
2.	Agitator	6
3.	Screw shaft	4
4.	Main electrical cabibnet	-
5.	Cast iron head (GZ40, GZ60, GZ120, GZ180, GZ240)	5
6	Movable grate segment	-

Part numbers as in fig. 1.4.

5.2. LIST OF WEARABLE PARTS*

No.	Part name
1.	Door seals
2.	Ash container
3.	Cast iron head cover
4.	"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.