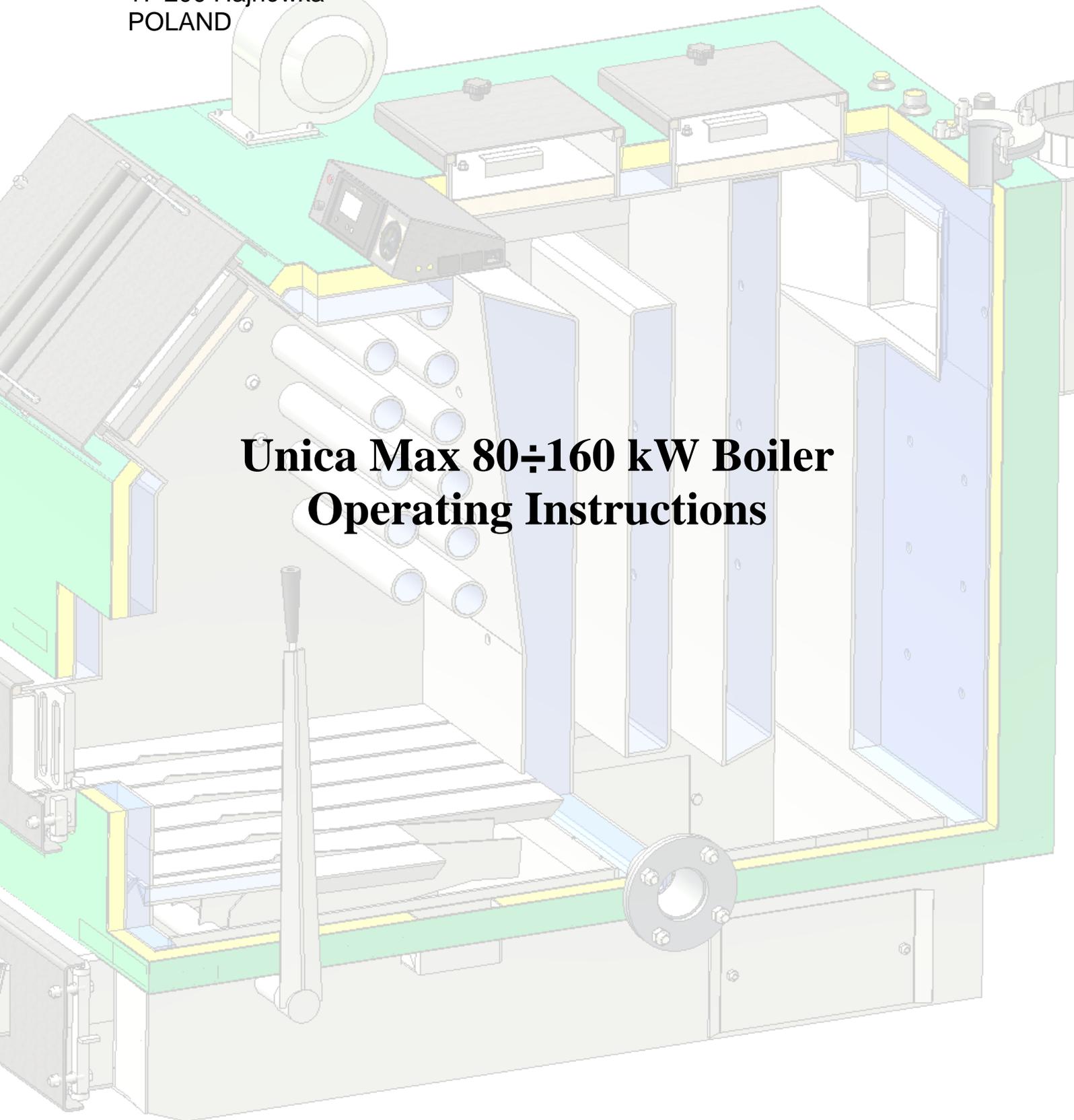


Moderator Spółka z o.o.

Ul. 11 Listopada 16a

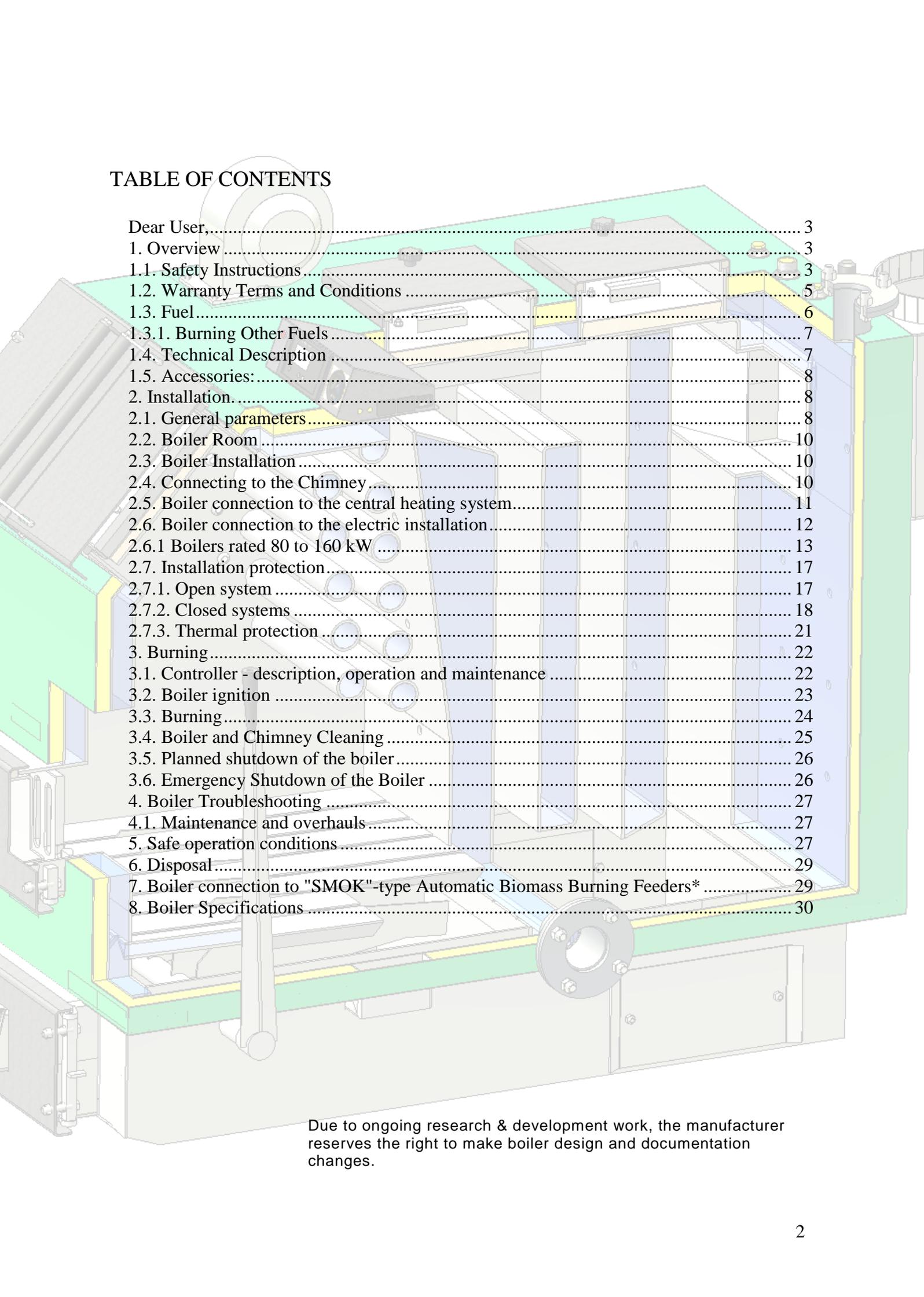
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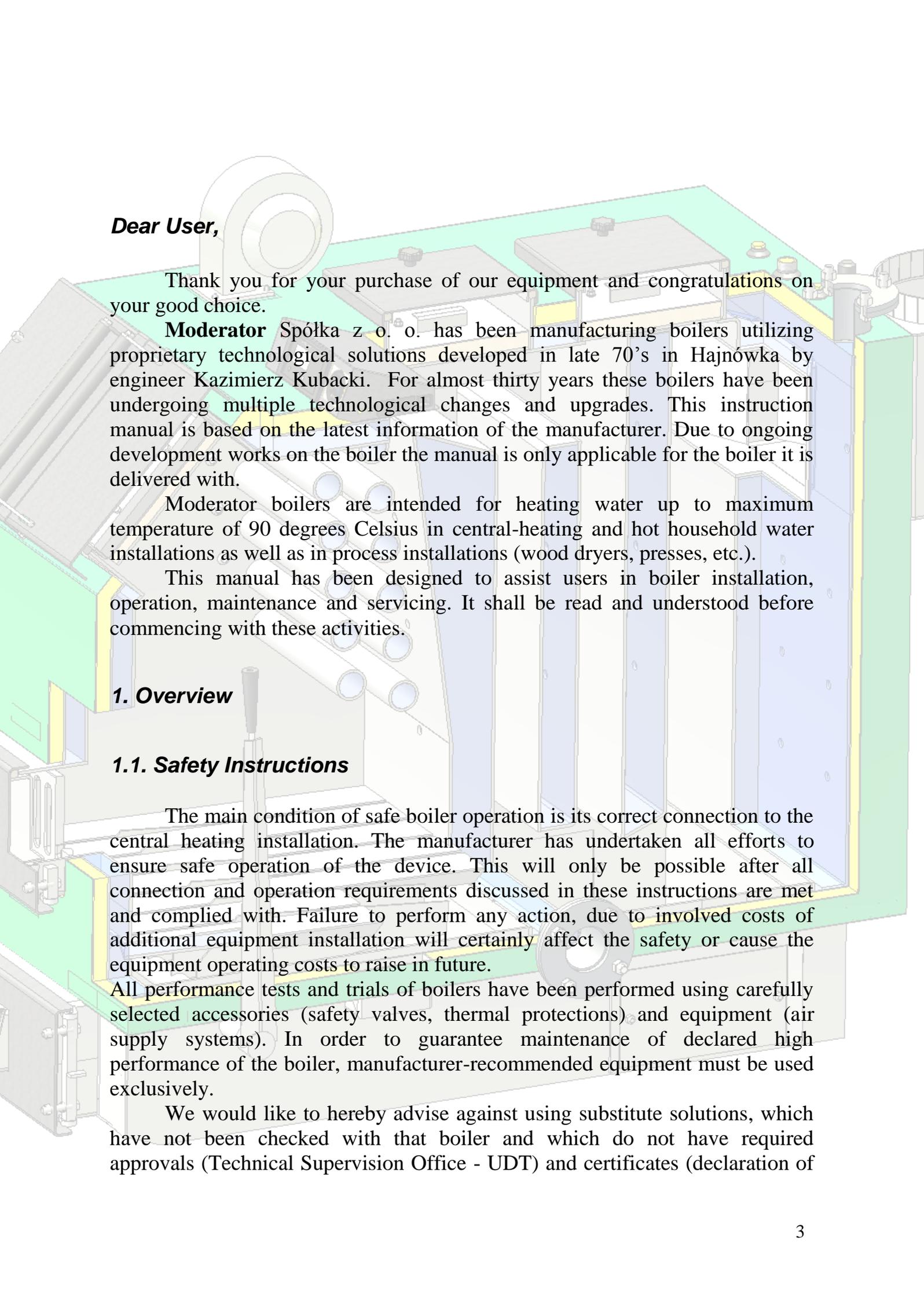
Unica Max 80÷160 kW Boiler Operating Instructions

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Due to ongoing research & development work, the manufacturer reserves the right to make boiler design and documentation changes.



Dear User,

Thank you for your purchase of our equipment and congratulations on your good choice.

Moderator Spółka z o. o. has been manufacturing boilers utilizing proprietary technological solutions developed in late 70's in Hajnówka by engineer Kazimierz Kubacki. For almost thirty years these boilers have been undergoing multiple technological changes and upgrades. 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.

Moderator boilers are intended for heating water up to maximum temperature of 90 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. It shall be read and understood before commencing with these activities.

1. Overview

1.1. Safety Instructions

The main condition of safe boiler operation is its correct connection to the central heating installation. The manufacturer has undertaken all efforts to ensure safe operation of the device. This will only be possible after all connection and operation requirements discussed in these instructions 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 raise in future.

All performance tests and trials of boilers have been performed using carefully selected accessories (safety valves, thermal protections) and equipment (air supply systems). In order to guarantee maintenance of declared high performance of the boiler, manufacturer-recommended equipment must be used exclusively.

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 boiler design.

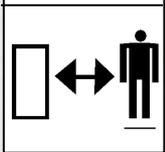
Failure to follow these recommendations may lead to serious threats and expose the operating personnel to health or life hazard.

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

Safety and Warning Signs



Note: The washout located under the masking cover may be hot. Pay special attention in the boiler room, as other parts of the boiler and the installation may also be hot.



This sign in this manual indicates a danger. Please carefully read the corresponding section so as to avoid dangerous situations in future.



Keep in mind that in the boiler room various surfaces may have different temperatures. You have to pay special attention to the fact, that temperature of doors may be significantly higher than the temperature of other boiler surfaces. This also applies to the smoke breaching and supply and return piping. When in boiler room, always pay special attention.



Keep in mind that ashes and fuel (in particular dry sawdust and chips) may cause allergic reactions. We recommend wearing protective gloves and dust masks.



Keep the boiler room clean. Fuel left or spilled on the floor may cause a fire.

1.2. Warranty Terms and Conditions

1. Manufacturer grants 36-month warranty for the unit, which covers all workmanship and material faults.
2. The manufacturer guarantees correct operation of the central heating boiler, which is confirmed by the declaration of conformity.
3. The manufacturer recommends the following guidelines to be adhered to:
4. the first start of the device shall be performed by the manufacturer's representative. The warranty shall not include damages resulting from misuse or normal wear and tear, refund of assembly costs, travel costs, damages resulting from modifications or repairs implemented or performed without manufacturer's consent, indirect and consequential damages, production outage related losses or any other economic losses caused.
5. The warranty shall not include faults resulting from:
 - failure to follow installation guidelines presented in these operating instructions or those resulting from laws currently in force
 - incorrect operation or maintenance or resulting from the boiler being used incompatibly with operating instructions (i.e. in result of using incorrect fuels, leaving ash after the heating season, faults resulting from central heating system freezing, incorrect or blocked exhaust gas extraction system, no water in the system)
 - boiler use for purposes different than its intended use specified in operating instructions
 - in case of incorrect matching of the boiler's output to the heat demand of the building.
6. All warranty complaints shall be directed to the boiler vendor. Before submitting a claim, please make ready the following information:
 - photocopy of page 5 of the operating instructions, item 1.2. (with date and legible signature of the user)
 - fault description
 - a document to prove boiler purchase
 - boiler rated power
 - serial number

7. User's statement:

I hereby declare to have acknowledged myself with the Moderator boiler operating instructions and that the unit has been delivered according to the order, new, complete and in good technical condition. Also the specialized installation company have acknowledged me with the unit operation and have provided me with the complete set of documentation.

Date and name
legible signature

Declaration of Conformity

We,
Moderator Spółka z o.o.
Ul. 11 Listopada 16a
17-200 Hajnówka
tel. +48 (0)85 682 75 20

hereby declare under our own and sole responsibility that the product: MODERATOR central-heating boiler, with serial numbers starting from 400, to which this declaration applies, meets the following requirements and standards, as applicable:

Directives
97/23/WE

Standards
EN-PN- 303-5

Hajnówka, 2004.02.01

PREZES Zarządu
mgr Mariusz Kubacki

1.3. Fuel



Use only fuels recommended by the manufacturer.

The Moderator boiler is designed to burn renewable fuels, wood-based and vegetable-based fuels (pieced wood, chips, sawdust, bark) with moisture content of up to 30%. Coal may be used as a substitute fuel.

Technical parameters of the boiler are specified for fuels with humidity content of up to 30% and with calorific value of $Q=17.084$ kJ/kg for wood and of $Q=29.924$ kJ/kg for coal.

The higher the moisture content, the lower the calorific value (note: an increase of moisture content causes calorific value to drop, which means that one will need twice as much fuel to achieve the same heating effect). A considerable part of thermal energy is wasted in the burning process for heating up the fuel and evaporating water (note: using wet fuel directly contributes to shortening of boiler's operational life and causes it to wear out prematurely). Hygrometers are used for moisture content measurements (different types are used for sawdust and different for wood). These are necessary equipment, which should be used when purchasing fuel (to check the actual moisture content) as well as during normal operation of the boiler.

1.3.1. Burning Other Fuels

Uncontaminated paper and cardboard may only be used for igniting fire in the boiler. Mixtures of various clean paper and cardboard may only be burned if mixed with wood. Papers and colour magazines must not be burned and should be recycled. One shall keep in mind that impregnates, inks and other components used for their production will significantly pollute the boiler's convection chambers and the natural environment.

We also advise against burning plastics in various forms. Keep in mind that smoke generated during combustion of plastics will contain substances, which are poisonous and harmful to human and that these substances will fall down in direct vicinity of the chimney. Do not burn PVC products under any circumstances, e.g.:

- butter or margarine boxes
- transparent plastic bottles
- jewel boxes (CD boxes) or toys
- plastic building materials
- polyamide (PA) products, such as textiles

Some plastics identified as PE, PP, PET may be burned, provided that their volume does not exceed 5% of the fuel volume (e.g. of wood) and the combustion temperature is not lower than 850o C.

Approximate data of different fuels

Fuel type	Burning time (h)	cubic meter weight (kg)	Moisture content (%)
wood pieces	4-6	300	30
chips	3-5	155	30
sawdust	2-4	145	30
bark	2-5	200	30
coal	6-8	-	-

1.4. Technical Description

This manual applies to boilers rated from 80 to 160 kW manufactured in the plate version.

Moderator boilers (Fig. 1) are boilers operating in the top-burning system. Walls and grate are water cooled and are made of boiler-grade sheet metal plates. Manual, top fuel charging, mechanical ash removal from the grate,

bottom doors (ash pan doors) equipped with mechanical air supply throttle (used in case of a power outage).

Boilers are equipped with directional air supply to the combustion chamber with automatic primary and secondary air distribution. On its way to the combustion chamber air is heated up. This has a significant impact on the combustion process. Boilers are equipped with exhaust fans, installed directly on the breeching. Breeching output (round cross-section—280) up, it allows the boiler to be connected to the chimney at an angle of 0 to 180°.

Boilers in the *Uni* version, i.e. with system connections can be connected on their left or right side, also a combined variant is possible, depending on the specific installation needs.

1.5. Accessories:

The boiler is delivered in assembled state. The standard equipment includes the complete cleaning set, connection flanges with installation bolts set, other elements depend on the purchased version and are not included in the base boiler price.

Additional non-fixed equipment:

- G ¾ drain valve
- G 1 safety valve
- SYR 5067 thermal protection (only in 80 & 100 kW models)

In Unica Max 80-160 kW boilers, the thermometer is installed inside the control panel. Therefore additional thermometer nor pressure gauge is not required.

The electric control system is installed on the boiler housing and is pre-wired. The blower installed on the upper boiler housing is connected with the primary and secondary air circuits and does not require the user to adjust blowing directions (for detailed information on the air-supply system see section 7 and operating instructions enclosed with the boiler).

2. Installation.

2.1. General parameters

Maximum supply temperature – 90°C

Maximum return temperature – 70°C

Minimum recommended return temperature – 55°C

Operating pressure - 1.5 bar

Thermal efficiency (in case of manual charging):

for wood – 78.7%

for coal - 80%

Minimum combustion gases temperature – 180° C

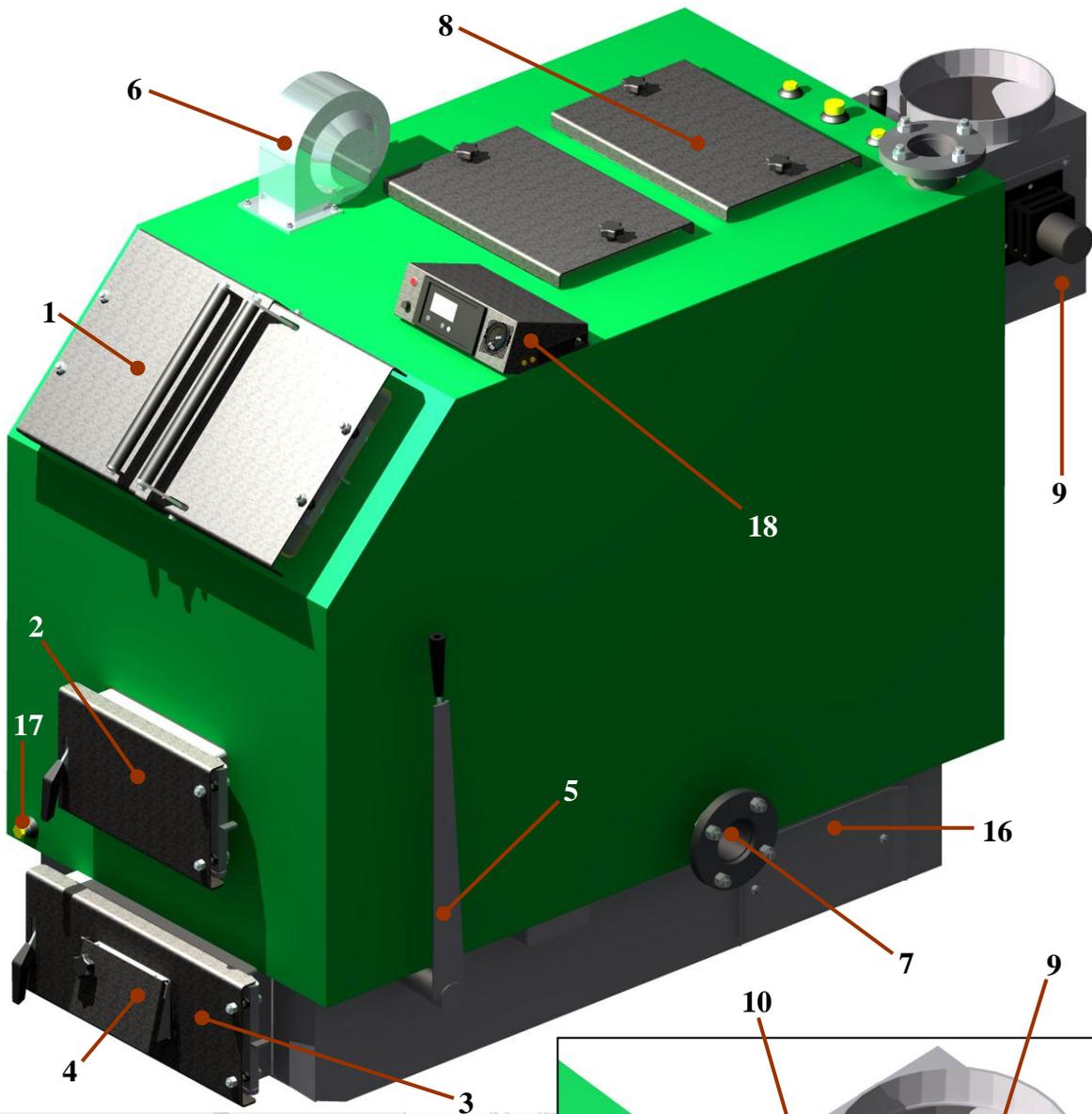
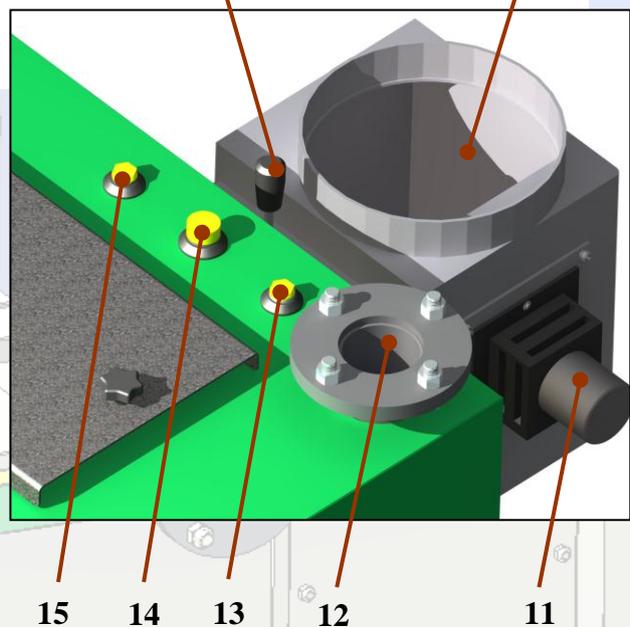


Fig. 1. MODERATOR UNICA MAX boiler description of main parts

1. Charging flap
2. Grate doors
3. Ash-pan doors
4. Air throttle
5. Mobile grate lever
6. Air supply fan
7. Return pipe
8. Washout cover
9. Smoke breaching –180mm
10. Chimney damper lever
11. Air exhaust fan
12. Supply pipe
13. Thermal protection sensor G½ muff (80, 100kW)
14. 1” stub pipe for safety valve connection
15. * Thermostat installation G½ muff
16. Ash pan cleanout cover
17. G¾ muff for drain valve installation
18. Controller



* in models prepared for installation of SMOK automatic biomass burning feeder

2.2. Boiler Room

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

- 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 14x14 cm exhaust hole in the upper part of the boiler room

Accessories:

- tap
- sewage well
- sink



Forced ventilation must not be used.

2.3. Boiler Installation

Boiler installation shall be performed by an engineer with appropriate qualifications and experience (we recommend to seek help in our representative centres, whose installers have been trained at Moderator Sp. z o.o.). A faulty installation may cause premature wear of the boiler and threatens fire or may cause an explosion.

The boiler is delivered in assembled state. Boiler may be positioned directly on the floor with 1 gradient towards the front wall (the top point of the boiler after the installation shall be the place close the supply pipe). During boiler installation, it is necessary to ensure its accessibility in such a way, so that boiler room walls do not make access to fuel charging, grate cleaning and the side cleanout of the boiler difficult.

2.4. Connecting to the Chimney

Boiler's smoke breeching shall be seated directly in the chimney, and after installation sealed along the contact line of: smoke breeching sheet metal – chimney brick. Chimney outlet shall be located 75cm above the roof ridge. Square or rectangular chimneys shall be made of burnt brick; round chimneys (usually steel ones) shall be insulated over the whole height with at least 5-cm mineral wool layer.

When installing the smoke breeching in the chimney, one shall pay attention to the chimney damper lever (it is necessary to provide a space needed for its easy opening and closing).



Remember that combustion gases entering the chimney are hot, therefore the chimney damper lever will heat up. To operate the chimney damper, always wear protective gloves.

Recommended chimney cross-sections		
Boiler power [kW]	Square (cm x cm)	Round - (diameter in cm)
80 160	30x30	35

2.5. Boiler connection to the central heating system

The Boiler will operate correctly if the temperature inside the combustion chamber will be sufficiently high, which means that the supply water (on the boiler output) shall have the temperature in the range of 70 to 80°C, and that the water on return, not 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, manufacturer recommends installation of a four-way mixing valve or a heat accumulation tank.

Boilers have G3 (ø80) flange connections. Weld counter flanges be to installation (supply and return) pipes then install seals and bolt the joint together using screws (enclosed with the boiler). In order to properly connect the boiler, it is necessary to install all accessories presented on Figure 1.



If the boiler is equipped with a thermal safety valve, install the valve sensor on the G½ muff (item 13 on fig. 1). Install the safety valve.

Connect water supply pipe through the valve installed in the G¾ muff (item 17, on fig. 1) using a flexible hose, which shall be disconnected after water change is filled. When filling open all venting valves in the installation and slowly close them until water overflows in the overflow pipe of the expansion vessel (in case of open systems). Lossless installations may be supplied with raw water, as long as its hardness is less than 10n. Otherwise the water shall be pre-treated.

Install boiler accessories (handles and bakelite knobs).

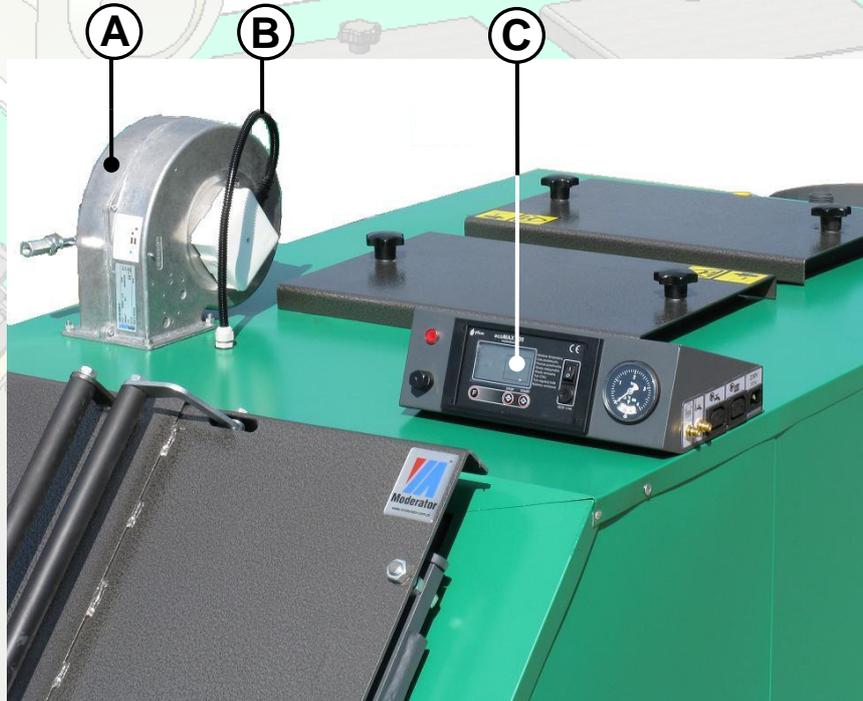
2.6. Boiler connection to the electric installation

Electric installation and connection principles

1. Before connecting the device, it is necessary to read operating instructions for the boiler and the regulator.
2. Before commencing with installation, repairs or maintenance and during all connection works, it is necessary to disconnect the power supply and make sure that terminals and electric cables are not live.
3. The boiler room shall be equipped with 230V/50Hz installation, according to applicable regulations.
4. The electric installation (regardless of its type) shall be terminated with a power receptacle with a protective terminal. **Using a receptacle without protected terminal may lead to electric shock!!!**
5. The boiler shall be connected to independently routed power supply line protected with an appropriately matched fast-blow fuse and differential current protector (shock protector). The value and the type of the fuse is specified in the controller's operating and maintenance documentation. **No other equipment must be connected** to that line.
6. The enclosure containing electric equipment may only be opened by competent electric engineers, knowledgeable with the device operation.
7. Location of power receptacle used for boiler connection shall be selected in such a way, so that the receptacle is easily accessible allowing quick boiler disconnection in case of an emergency.
8. Cables shall be routed away from heating parts of the boiler, and in particular away from hot smoke breeching parts.
9. The regulator may not be exposed to water splashes and to conditions causing steam condensation, e.g. in case of rapid ambient temperature changes.
10. The regulator may not be used if its enclosure is damaged.
11. Do not allow children to access the regulator.
12. During thunderstorms the controller shall be disconnected from the mains.

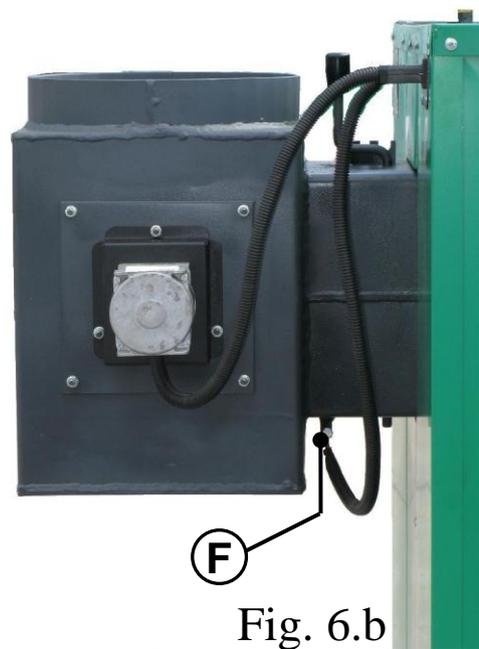
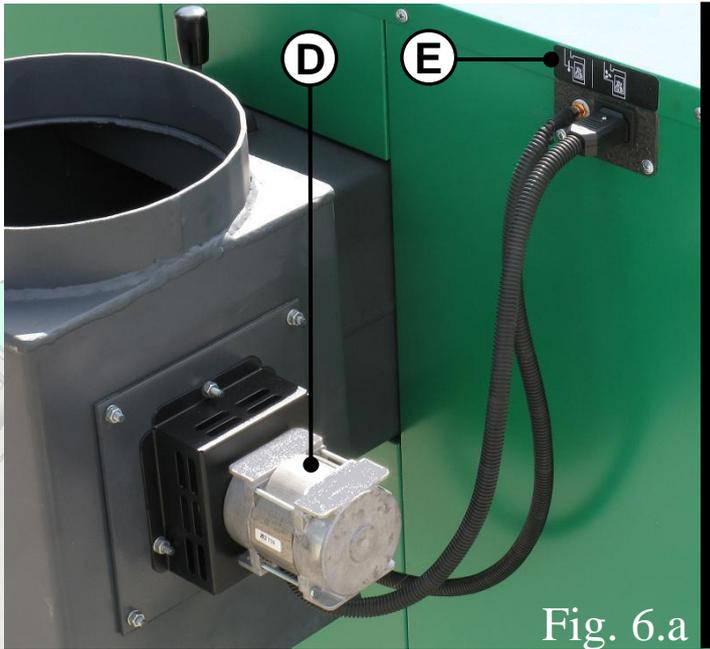
2.6.1 Boilers rated 80 to 160 kW

Unica MAX boilers rated 80 to 160 kW in their standard equipment include an automatic combustion process control system. The control system comprises of elements **A** **B** **C** shown on fig. 2 and **D** **F** on fig. 3.



- A. Blower
- B. Connecting line
- C. Controller with ecoMAX 200 regulator

Fig. 2. Unica MAX 100 automatic control equipment (front upper part).



- D. Combustion gases exhaust fan
- E. Connection sockets
- F. Combustion gases temperature sensor

Fig.3. Unica MAX 100 automatic control equipment (view of the boiler's rear part).

Other parts used for connecting power supply and controller's auxiliary equipment are shown on fig. 4.

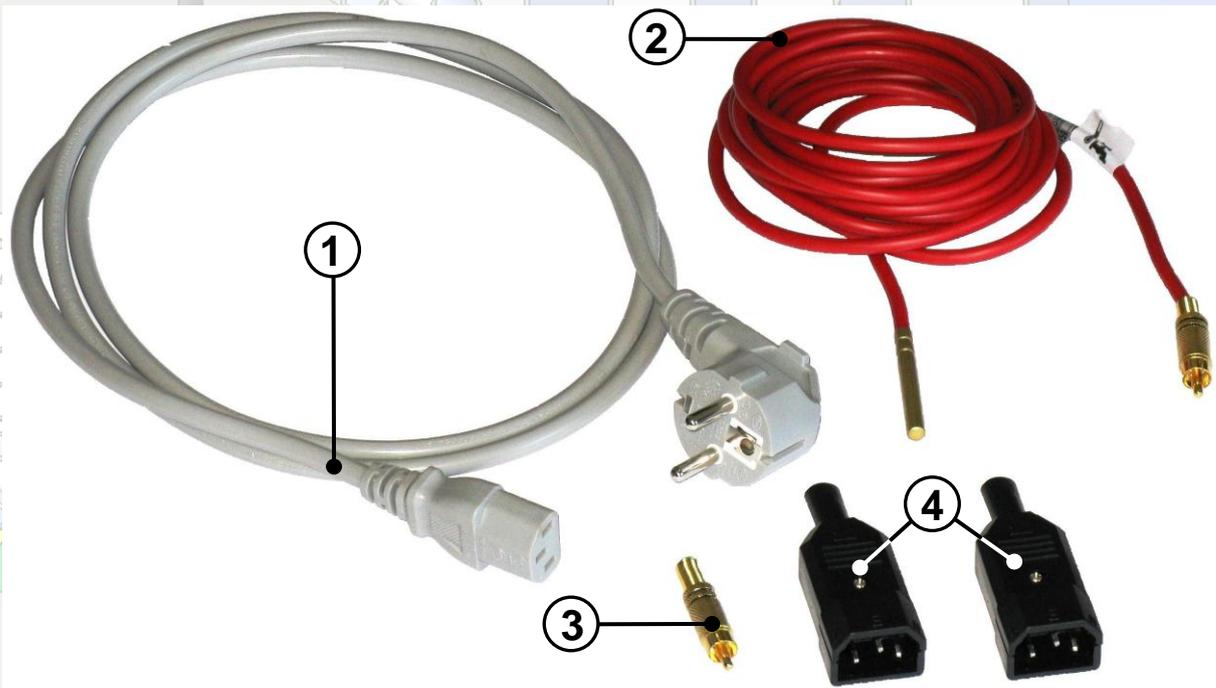


Fig.4. Additional accessories

- 1. Power supply cable.
- 2. Hot water reservoir temperature sensor.

3. RCA plug used to terminate the cable connecting the controller with the room thermostat.
4. Male computer-type power connectors used to terminate cables used to supply central heating and hot water pumps.

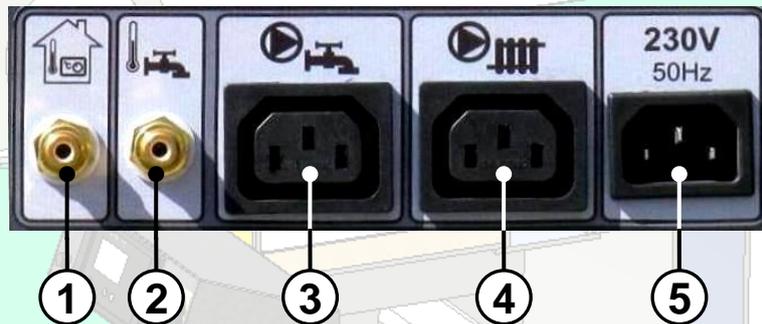


Fig. 5. Connection sockets - on the controller side

Fig. 5 shows the side wall of the controller containing sockets, which are used for connecting:

1. The room thermostat
2. Hot water temperature sensor
3. Hot water pump
4. Central heating pump
5. Power supply cable

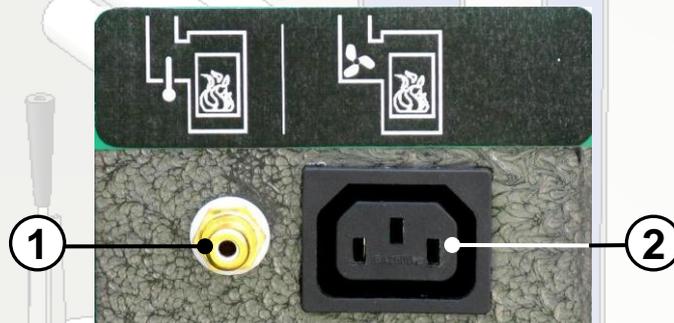


Fig. 6. Connectors – rear wall of the boiler (also shown on fig. 6.a, item (E)).

Fig. 6 shows sockets located on the rear wall of the boiler, which are used to connect:

1. Combustion gases temperature sensor
2. Combustion gases exhaust fan

Power supply connection

Boiler connection to the electric installation involves plugging one end of the power supply cable (item **(1)** fig. 4) into a socket marked as 230V~ 50Hz on the controller enclosure (item **(5)** fig. 5). The other end, terminated with a plug, shall be connected to the mains power receptacle.



If the power supply cable is damaged, it shall be replaced with a cable of the same type, with the cross-section of at least $3 \times 0.75 \text{mm}^2$.

Connecting central heating circulating pump



This operation shall be performed by a person with necessary qualifications to perform electric installation works.

The circulating pump of the central heating installation shall be connected to the socket (item (4) fig. 5) using a cable with cross-section of at least $3 \times 0.75 \text{mm}^2$. The pump cable shall be terminated with the computer-type power supply plug (item (4) fig. 4).

Connecting the hot water pump



This operation may be performed by a person with necessary qualifications to perform electric installation works.

The pump, which charges the hot water reservoir shall be connected to the socket (item (3) fig. 5), using a cable with cross-section of at least $3 \times 0.75 \text{mm}^2$. Having finished with connections, the pump cable shall be terminated with the computer-type power supply plug (item (4) fig. 4). The hot water reservoir temperature sensor shall be connected to its input (item (2) fig. 5).

Connecting the room thermostat



This operation may be performed by a person with necessary qualifications to perform electric installation works.

The room thermostat shall be connected to the socket (item (1) fig. 5) by terminating the cable with the RCA plug (item (3) fig. 4) included with the boiler. Operation of the controller when fitted with the local thermostat is described in the PLUM ecoMAX 200 regulator instructions.



Unused outputs may be left unconnected.

Permissible output loads

Output	Output symbol	Current [A]
Central heating pump		1
Hot water pump		1

Periodical maintenance notes

Maintenance activities involve periodic checking of electrical cabling, which is accessible outside the controller enclosure. In case of a mechanical or thermal damage (e.g. molten insulation of wires, broken wire, damaged controller enclosure), it is necessary to shut off the the device, disconnect it from the power and then proceed to repair the damage. If needed, you may contact the boiler manufacturer. Controller panel must be kept clean and protected against water.

2.7. Installation protection

2.7.1. Open system

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 (RP overflow pipe) to atmosphere.

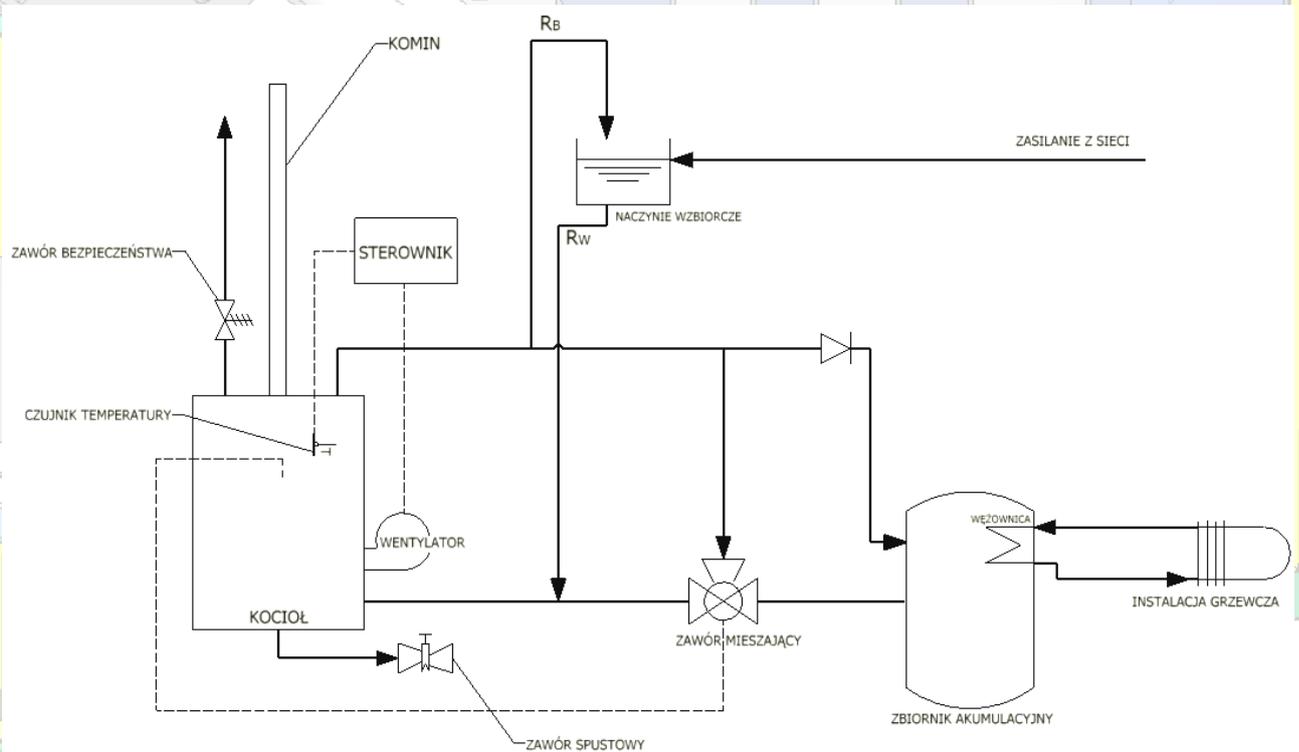


Fig. 7. Protection of the installation, for boilers in open central heating systems.

KOMIN – CHIMNEY
 CZUJNIK TEMPERATURY – TEMPERATURE SENSOR
 STEROWNIK – CONTROLLER
 ZAWÓR SPUSTOWY – DRAINAGE VALVE
 ZAWÓR MIESZAJĄCY – MIXING VALVE
 WEŻOWNICA – COIL
 ZASILANIE Z SIECI – WATER PIPE SUPPLY

ZAWÓR BEZPIECZEŃSTWA – SAFETY VALVE
 KOCIOŁ – BOILER
 WENTYLATOR – BLOWER
 NACZYNIĘ WZBIORCZE – PRESSURE VESSEL
 ZBIORNIK AKUMULACYJNY – HEAT ACCUMULATION TANK
 INSTALACJA GRZEWCZA – HEATING INSTALLATION

Installation requirements:

- pressure vessel with the volume of at least 4% of the total water charge

shape: cylindrical, type A, acc. to PN-91/B-02413-1-2

rectangular, type B, acc. to PN-91/B-02413-1-3

- safety riser tube (RB) with inner diameter of:
40 mm for boilers rated up to 100 kW, inclusively
50 mm for boilers rated 120 to 160 kW

- riser pipe (RW) with inner diameter of
25 mm for boilers rated up to 100 kW
32 mm for boilers rated 120 to 160 kW

- overflow pipe RP
inner diameters as in the case of RW and RB

- circulation pipe (RC) with inner diameter of 20 mm

- venting pipe (RO) and signalling pipe (RS) with inner diameters of 15 mm



No fittings permitting complete or partial closure of flow may be installed on RB, RW and RO pipes. The protective equipment and pipes shall be protected against freezing.

2.7.2. Closed systems

Only *Unica Max* boilers, which are rated 80 and 100 kW may be operated in closed systems. The thermal protection used by Moderator Sp. z o.o. protects boilers rated up to 100 kW only.

In case of higher power ratings, a heat exchanger or another device dissipating excess heat shall be used so that the maximum water temperature in the boiler does not exceed 110°C. The protection shall be installed by the user performing boiler connection works.



Installation of the boiler in a closed system without the equipment to dissipate the excess heat is unacceptable.

Moderator boilers operating in closed systems must be equipped with air supply system (designed by Moderator Sp. z o.o. for Moderator boilers - we advise against installation of other air supply systems) a safety valve and additional thermal protection permitting safe discharge of excessive thermal power. Muffs welded in the upper jacket of the boiler facilitate installation of this equipment (items 13 and 14 on fig. 1).

Moderator boilers are manufactured according to the PN 303-5 standard, which permits boiler operation in closed systems if specific requirements are complied with. In case of versions suitable for automated operation (only and exclusively versions with burners), protective systems are sufficient.

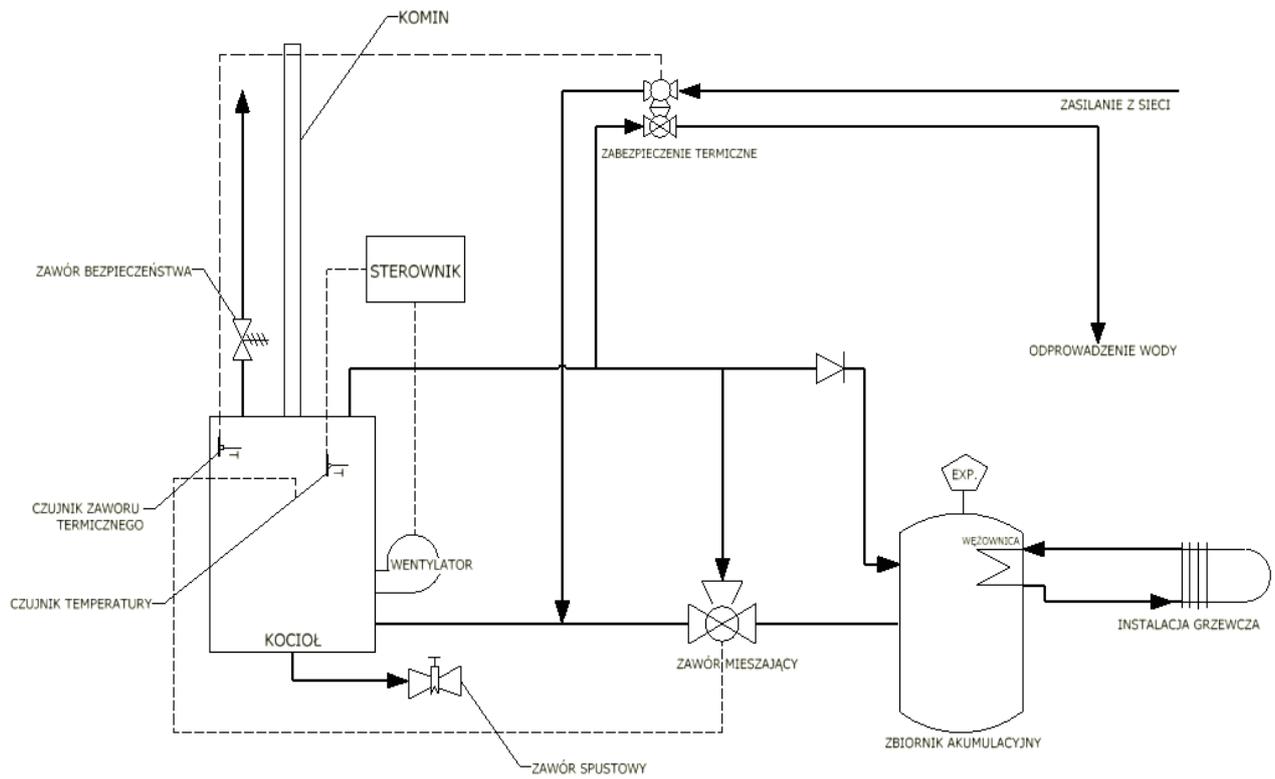


Fig. 8. Protection of the installation, for boilers operated in closed central heating systems.

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



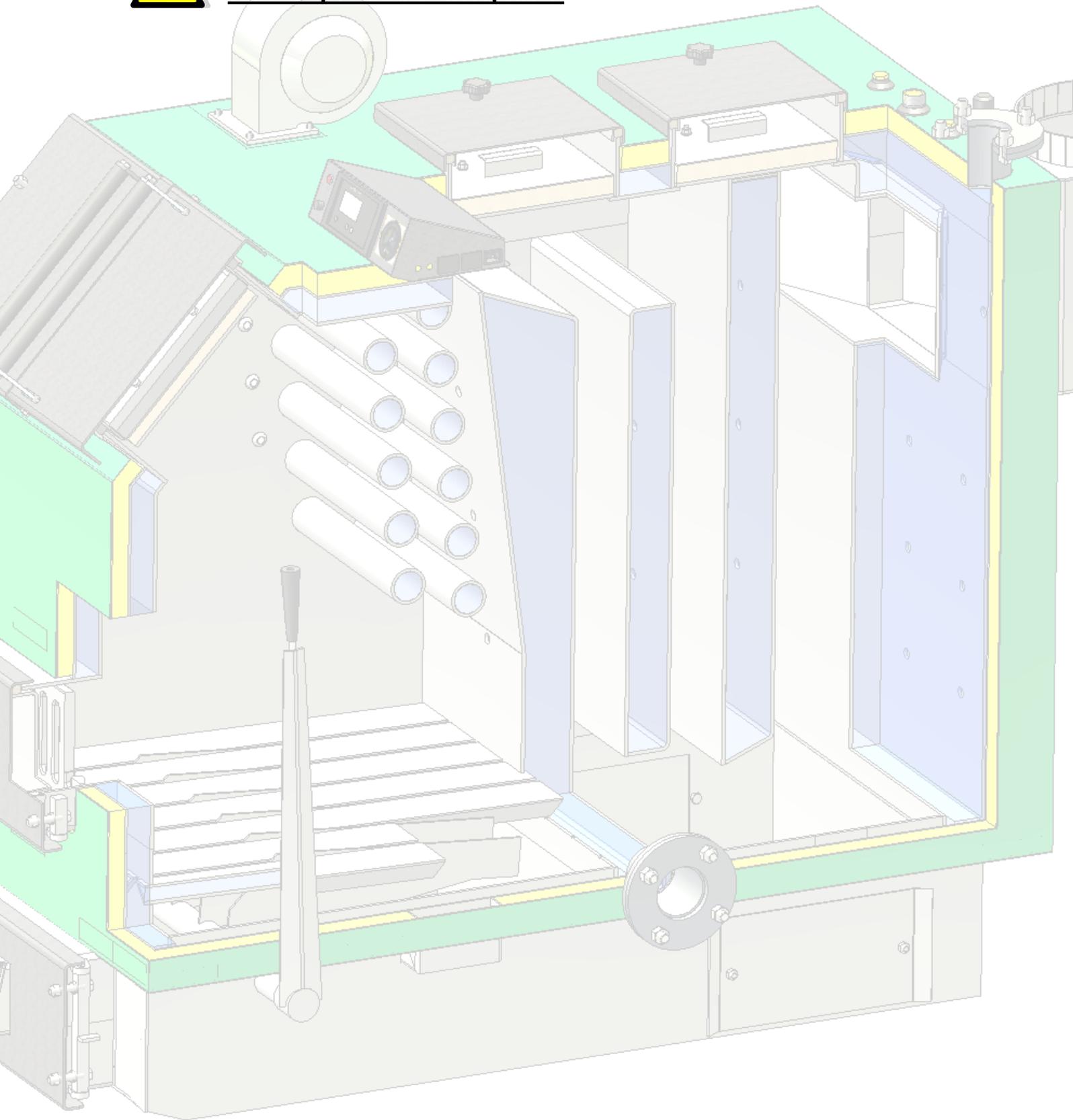
Special attention shall be paid in case of closed-system operation of boiler versions designed for manual charging.

The manufacturer-recommended SYR 5067 thermal protection device will only and exclusively be effective, if pressure in water pipe network can be guaranteed at the min. level of 2.3 bar and if safety valve is installed. This means that the system may not activate, if water from in-house water intake is used (e.g. if power supply outage prevents the pressure booster set to switch on), or wherever water supply outages frequently occur.

In such cases, the boiler shall not be installed in a closed system and its automatic version should be used instead (which can not burn solid fuels with manual charging).



Boiler installation without a reliable device to dissipate the excess thermal power is unacceptable.

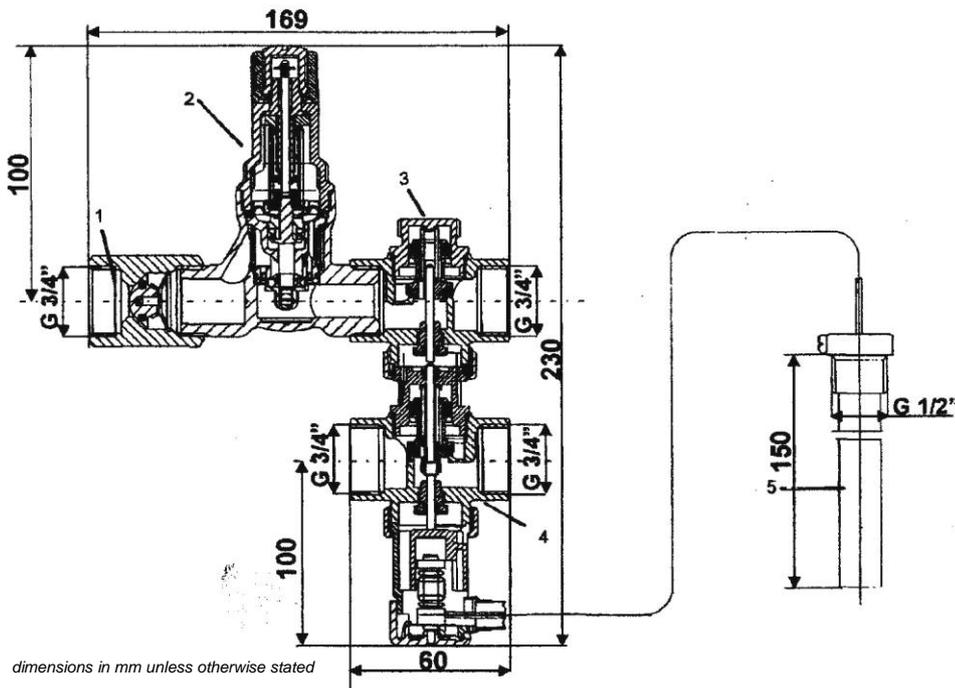


2.7.3. Thermal protection



ZABEZPIECZENIE TERMICZNE

5067



Applications:

5067 thermal protection is designed to protect solid fuel boilers in heating installations fitted with thermostatic valves conforming to the PN-EN303-5 Polish Standard. It is particularly recommended for boilers, which are not equipped with cooling exchanger. Figure 1 presents installation principle, at a close distance from the boiler, with special consideration for such guiding and sizing of pipes so that no pressure losses occur.

Installation and operating principle: The 5067 thermal protection valve consists of the following elements: non-return valve (1), pressure reducer (2), thermally-controlled filling valve (3) and ejection valve (4), pressure sensor with a capillary tube (5).

The pressure reduction valve (2) is connected to the water pipe network. The output of the thermally-controlled filling valve (3) is connected to boiler's return line. The supply line to the input of thermally controlled ejection valve (4), which output side leads to the outlet. The pressure sensor is installed in the warmest part, optimally in the upper part of the boiler. The pressure reduction valve is firmly set to 1.2 bar, thus the operating pressure in the heating device shall be by 0.2 to 0.3 bar higher. This prevents opening of the safety valve in the installation. It is recommended to use a safety valve with settings of at least 2 bars.

If the preset opening temperature of ca. 90°C is exceeded, the filling valve (3) starts to open. In order to maintain stable pressure in the heating installation, the ejection valve opens at 97°C. After the ejection valve opens, hot water flows out of the installation and cold water may flow in from the supply line, this cools down the boiler. When boiler temperature drops to 94°C, the ejection valve closes. Thermally controlled filling valve and temperature sensor help to restore the correct flow pressure in the heating installation.

When the temperature reaches 88°C, also the filling valve closes.

Build:

The thermal protecting device is controlled by two independent valves: the filling valve and the ejection valve. The body of the device is a die stamped brass element whilst other parts that contact water are made of stainless steel and temperature resistant plastic. All sealing elements are made of resilient and high-temperature resistant, heavy duty elastomeric rubber material. Springs are made of stainless spring steel. The sensor and capillary tube are made of copper, whereas the sleeve is additionally nickel-plated.

Valve opening is controlled by doubled temperature sensor. The fittings are self-venting. Elements of the valve, the valve seat and seal may be removed and cleaned without any change to pre-set opening temperature. Compact head of the temperature sensor may be conveniently disassembled during the valve body installation. The capillary tube from the sensor to actuator is protected by a special, metal flexible hose.

Pressure reducer operating pressure:	1.2 bar (factory-fixed)		
Maximum water inlet pressure:	16 bar		
Minimum required inlet water pressure :	2.3 bar		
Temperature		of opening::	of closing:
filling valve		90°C +0/-2°C	88°C +0/-2°C
ejection valve		97°C +0/-2°C	94°C +0/-2°C
Maximum operating temperature	135°C		
Capillary tube	1300 mm – standard length		
Weight	1.5kg		

3. Burning

3.1. Controller - description, operation and maintenance

Boiler automatic control unit utilizes a microprocessor-controlled PLUM ecoMAX 200 controller. Its task is to maintain the preset temperature in the heating circuit and temperature of hot water in hot household water reservoir. Regulation may be performed using any of the three available methods:

- employing linear reduction of air supply rate when the boiler is nearing its set temperature (CLASSIC regulation method)
- by continuous modulation of the air supply (PID control, without combustion gases sensor),
- by continuous modulation of the air supply (PID control, with combustion gases sensor, which is a part of the boiler's standard equipment)

Inclusion of the combustion gases sensor with the boiler has significantly contributed to reduction of chimney stack losses. It also allows to detect very fast nearing out-of-fuel condition. This reduces thermal losses related to the fuel-less fan operation and extends the boiler readiness for fuel refilling. The user does not have to hurry with fuel refilling, as fast detection of the out-of-fuel condition will maintain heat in the boiler for longer periods. The optimum temperature of combustion gases set in the regulator shall lie within the range of 200 to 230°C. A higher temperature would contribute to increased chimney losses - a lower temperature may lead to water condensation in rear chambers of the boiler, which would affect its durability.

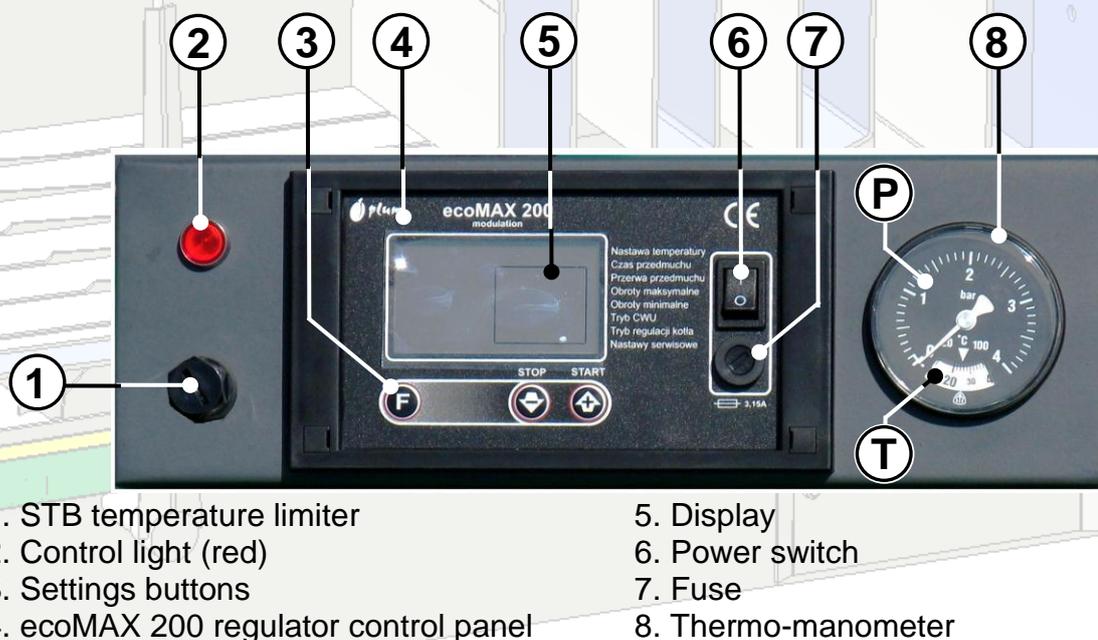


Fig. 9 Control system with ecoMAX 200 controller – front view



During "manual" brining (with the controller switched off and manual air supply control), under specific conditions the combustion gases temperature may reach levels, which are dangerous for combustion gases sensor, which could result in its damage. With the controller switched on, the air throttle 4 (see fig. 1) shall remain fully closed.

Figure 9 describes elements of the control system. Settings buttons **(3)** are used for specifying controller parameters and settings. The display **(5)** indicates the boiler's current operating status and temperatures. For detailed information on basic parameters, key functions, parameter setting methods, etc. see the *ecoMAX 200* controller operating instructions enclosed with the boiler. The STB Temperature Limiter **(1)** prevents against excessive temperature rise of water inside the boiler. When it activates (which happens when temperature exceeds 95°C) blower will be switched off. This condition is indicated by lighting of a control lamp (the red one) **(2)**. In order to restore the boiler to normal operation, it is necessary to undo the black nut of the STB temperature limiter and press the push button located underneath.



This activity may be performed having previously verified the cause of the boiler overheating.

Temperature is indicated on the thermo-manometer **(8)** dial **(T)**. The pressure in the central heating system is also shown on the thermo-manometer **(P)** dial. The thermo-manometer does not require electric power to operate and therefore its indications remain valid after power supply outage. Thermometer **(T)** indications may differ by several degrees from the indication of the regulator display **(5)**.

3.2. Boiler ignition

Ignition of a cold boiler may only be started after prior verification that the installation is tight and that it is correctly filled with water.

Open ash pan doors (or open the throttle on ash pan doors). Ignite using dry wood for about 1.5 hours, gradually reaching the temperature of 80°C. We recommend to perform first ignition without using the air supply system, adjusting the air supply by opening and closing ash pan doors (or the throttle), remembering to switch on the pump after the temperature exceeds 40°C (during further operation, when using the air supply system, the pump coupled with the controller will start automatically)..

NOTE! For 3 to 4 days, it is recommended to maintain continuous (NON-STOP) burning in the boiler with the supply water at the temperature of 70÷80°C. Further ignitions may be performed by programming boiler operation on the electronic controller, according to principles described in the controller

instructions. When igniting, do not fill the whole combustion chamber (ensure: 50% filling for wood, not more than 20% filling for coal).

3.3. Burning

During normal boiler operation monitor and periodically supplement the fuel. In order to maintain stable temperature of supply water, it is necessary to:

- use fuels with moisture contents of up to 30%
-

in case of higher moisture contents, dry the fuel beforehand or mix it with dry fuel, keeping in mind that the higher is the moisture content of the mixture, the lower is the dose and excess air

- when using fuels with varying granulation, charge it alternatively (fuel with large granule diameters or already glowing in the combustion chamber shall be supplemented with finer fuel, e.g. saw dust – as if the sequence is altered, the fine fuel would spill through the grate)
- if possible, avoid opening the charging flap during ignition and while the boiler temperature builds up

Note: avoid burning fine fuels, in which dusts concentration exceeds 5%.. Pay special attention when burning very dry sawdust (moisture content up to 10%), do not compact them tightly in the combustion chamber. Having charged sawdust, leave free space in the rear part of the chamber to ensure air access. Failure to meet these requirements may result with gases from combustion chamber backdrafting during sudden opening of the charging flap. (When the charging flap is opened, this 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 while the fan is operating. Before supplementing the fuel, switch off the controller.

- Adjustment of the boiler performance, and thus the supply water temperature shall be performed by modification of the throttle settings (or by modifying the adjustable slot in ash pan doors) and potentially by changing the cross-section of flue gas exhaust in the breeching. When operating a boiler with air supply system, the ash pan flap shall remain closed.



3.4. Boiler and Chimney Cleaning

Grate cleaning is performed when water temperature starts to drop and when the ash pan illumination reduces. Ash shall be removed while the flame is reduced.

In order to ensure fuel economy, keep internal chambers of the boiler and spaces between water tubes clean. An indication suggesting that cleaning is required is reduced chimney draught. Insufficient air will cause the boiler to smoke excessively.

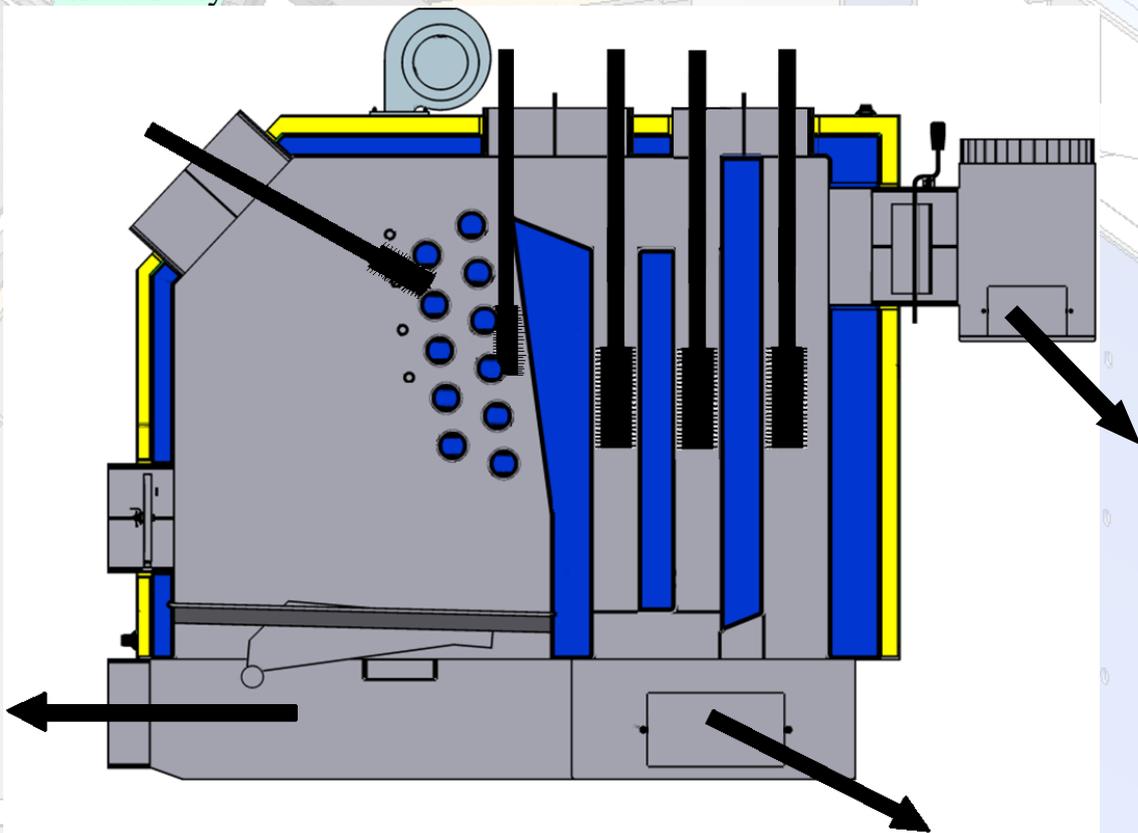


Fig. 10. Boiler cleaning diagram



Cleaning may only be performed on boilers that were shut down.

In case of heavy contamination of the boiler, chemical agents may be used to remove boiler deposits, but only such agents, which have been authorized for marketing (i.e. bearing the CE mark and instructions of use).



Combustion gases leaving blocked chimney are dangerous. The chimney and the conduit shall be kept clean; they shall be cleaned before each heating season.

3.5. Planned shutdown of the 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.

3.6. Emergency Shutdown of the Boiler

In emergencies, such as when the temperature of 100° C is exceeded, if component breaks down, if water charge is lost, if control & automatic equipment or protection equipment fails or if pressure increases suddenly, it is necessary to:

- remove the fuel from the grate and move it outside the boiler room,
- reduce the circulating water temperature by adding cold water to the water charge, like during filling
- maximally open the breeching throttle (if installed).

In case of boilers operating in closed systems, 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 by a safety valve set to 2 bars, additionally the manufacturer shall protect the boiler by a safety valve preset to 2.5 bar, however in case of an emergency condition, such protections are insufficient. The boiler must be additionally protected with a thermal protection valve, which will remove hot water from the boiler in case of an emergency condition, while at the same time supplementing caused water shortage with cold water from water pipe installation in order to cool down the boiler and to reduce the pressure (section 2.5).

Please keep in mind that emergency conditions are likely to occur during summer, when only household hot water is heated in the boiler. To prepare for such conditions, it is worth to consider installation of a heat accumulator capable of taking over the heating power surplus unavoidable in such circumstances.



Glowing fuel must not be extinguished or cooled down with water.

4. Boiler Troubleshooting

Fault type	Fault cause	Remedy
Boiler smokes, brownish liquid present in the negative pressure chamber	Insufficient draught	Seal the place where the smoke conduit enters the chimney
	Too low chimney cross-section Too low chimney height	Enlarge the chimney opening, e.g. demolish a wall splitting the chimney into two flue ducts, combining it with the adjacent ventilation channel (at least 2m above the base of the MODERATOR boiler, increase
	Another device (a boiler or a cooker/kitchen oven) is connected to the same chimney.	Seal the place where the outlet from the boiler enters the chimney so as to prevent cold air from being sucked in
	Blocked chimney	Clean the chimney by burning dry wood for 2 days in temp. at least 70°C
	Frequent use of wet fuel	Burn out with dry fuel
	Too low return temperature	Raise the return temperature to the recommended 55°C. Install a mixing valve.
Fuel burns too fast despite doors closed	Chimney cross-section too large	Use chimney damper

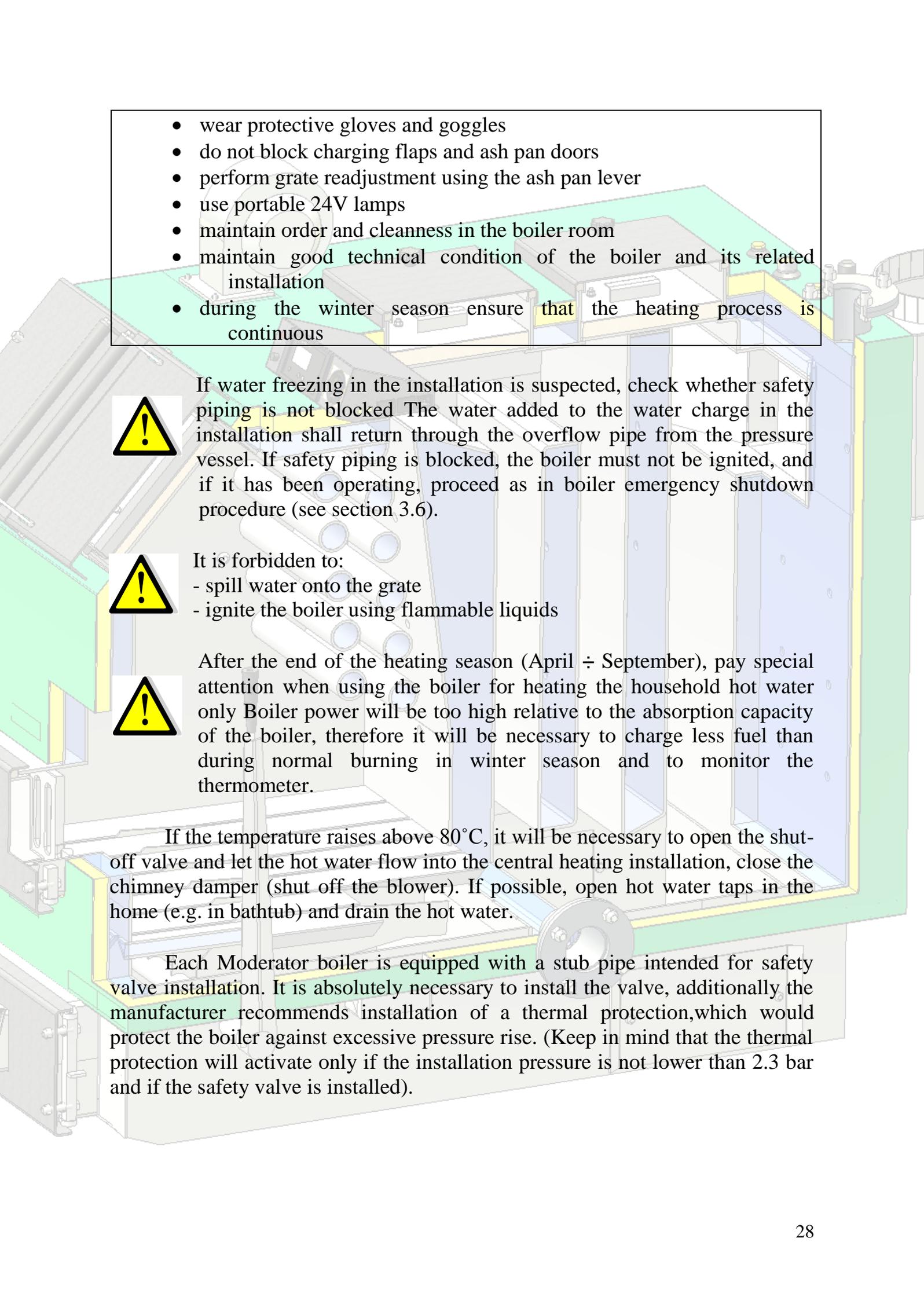
4.1. Maintenance and overhauls

Boiler maintenance during the heating season shall involve its periodical cleaning (Section 4.3). After the heating season ends, the boiler shall be thoroughly cleaned (Fig. 10), its inner surfaces shall be protected with oil and its secondary air nozzle openings shall be cleaned.

5. Safe operation conditions

The main precondition of boiler safe operation is construction 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 stated below:

- 
- wear protective gloves and goggles
 - do not block charging flaps and ash pan doors
 - perform grate readjustment using the ash pan lever
 - use portable 24V lamps
 - maintain order and cleanness 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 section 3.6).



It is forbidden to:

- spill water onto the grate
- ignite the boiler using flammable liquids



After the end of the heating season (April ÷ September), pay special attention when using the boiler for heating the household hot water only. Boiler power will be too high relative to the absorption capacity of the boiler, therefore it will be necessary to charge less fuel than during normal burning in winter season and to monitor the thermometer.

If the temperature raises above 80°C, it will be necessary to open the shut-off valve and let the hot water flow into the central heating installation, close the chimney damper (shut off the blower). If possible, open hot water taps in the home (e.g. in bathtub) and drain the hot water.

Each Moderator boiler is equipped with a stub pipe intended for safety valve installation. It is absolutely necessary to install the valve, additionally the manufacturer recommends installation of a thermal protection, which would protect the boiler against excessive pressure rise. (Keep in mind that the thermal protection will activate only if the installation pressure is not lower than 2.3 bar and if the safety valve is installed).

6. Disposal

Assuming correct operation, the boiler shall 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.

Steel parts shall be scrapped. Electrical parts shall be provided for safe disposal to a specialized contractor.

7. Connection of the boiler to "SMOK"-type Automatic Biomass Burning Feeders*

*** This section is only applicable for Unica boilers rated max. 80-160kW, which have been adapted for operation with Smok-type GŽ and GC Automatic Biomass Burning Feeders.**

A boiler prepared for installation of an automatic feeder, manufactured on custom order, has an assembly hole permitting connection of the feeder.

1. If the customer chooses to install the automatic feeder in future, the hole must be temporarily plugged. To plug the hole a plug must be used, which is mounted directly on the boiler. The plug is made of special fire-proof materials and is additionally protected by a steel screen. However keep in mind that the plug is a temporary solution, which shall only be used until the feeder is installed. This means that in result of intensive burning, the plug may deform.

If the automatic feeder is fitted, the hole needs not to be plugged.



Burning fuels without properly plugging the hole may cause a fire!

2. If a feeder with ceramic head is connected, it shall be slid in while fitting it to the frame in the boiler, then a seal shall be installed, and using feet of the head the head alignment shall be secured using screws and the frame shall be screwed together. Before seating, the inner gap between the breeching and the frame shall be sealed using a fire-resistant rope or a fire-resistant mortar (with fire resistance up to 1200 °C). Level out the fuel container.

3. If a feeder with cast iron head is connected, the head hearth must be slid into the hole in the boiler until resistance is felt, so that the hearth cover loosely slides onto positioning hooks (the cover is installed through the charging flap from top). The head shall be bolted to the frame from the outside using enclosed screws. The fuel container must be levelled.

8. Boiler Specifications

DESCRIPTION	BOILER POWER [kW]			
	80	100	120	160
Required draught (mbar)	0.38	0.40	0.41	0.44
Water volume (l)	365	410	455	500
Volume of the combustion chamber (l)	366	429	492	555
Combustion gases temp. (°C):				
Nominal power				
- wood	165	165	165	165
- coal	175	175	175	175
Minimum power (Q_{\min})				
- wood	129	129	129	160
- coal	125	125	125	150
Comb. gases mass flow				
Rated power (Q kg/s)				
- wood	0.072	0.090	0.108	0.138
- coal	0.067	0.086	0.105	0.136
Minimal power (Q_{\min} kg/s)				
- wood	0.026	0.029	0.033	0.040
- coal	0.024	0.026	0.030	0.038
Water resistance (mbar)	1.4	1.6	1.75	1.9
Boiler class	3	3	3	3
Breeching dimensions	-280	-280	-280	-280
Water pressure required for thermal protection (bar)	2.3	2.3	-	-
Boiler weight (kg)	985	1067	1149	1231
Boiler efficiency	83%	83%	83%	83%