

8. BOILER TECHNICAL SPECIFICATIONS

Boiler Serial No.

Parameter	Boiler rating (kW)					
	10	15	20	25	32	50
Required draught (mbar)	0,02	0,02	0,025	0,025	0,025	0,025
Water volume (l)	43	70	90	110	150	220
Combustion gases temp. (°C)						
• rated power						
- wood	165	165	165	165	165	190
- coal	175	175	175	175	175	178
• min rated power (Q _{min})						
- wood	165	165	165	165	165	170
- coal	150	150	150	150	150	150
Combustion gases stream						
• rated power Q (kg/s)						
- wood	-	0,023	0,030	0,040	0,049	0,062
- coal	-	0,021	0,026	0,034	0,043	0,058
• min rated power (Q _{min}) (kg/s)						
- wood	-	0,007	0,009	0,012	0,015	0,019
- coal	-	0,006	0,008	0,010	0,013	0,017
Water resistance (mbar)	0,45	0,55	1,0	1,3	1,8	5,5
Boiler class	3	3	3	3	3	3
Water pressure required for thermal protection (bar)	1,2	1,2	1,2	1,2	1,2	1,2
Recommended minimum volume of the accumulation reservoir (l)	-	-	350	450	560	1.000

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We would like to congratulate you and to thank you for purchasing our boiler. **Moderator Spółka z o.o.** has been manufacturing boilers utilizing proprietary technological solutions developed in late 70's in Hajnówka by engineer Kazimierz Kubacki. During last twenty years these boilers have undergone 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 designed for heating water up to max. 90°C in central heating (CH) and hot household water or technological installations (e.g. timber drying rooms, presses, etc.). This manual has been designed to assist users in boiler installation, maintenance and servicing. It shall be read and understood before commencing with these activities.

1. BASIC INFORMATION

1.1. Safety instructions

The main precondition of safe boiler operation is its correct connection to the CH installation. Boiler installation in open CH systems is presented on fig. 2 (section 2.6, page 9) and should be compliant with PN-91/B 02413.

Moderator boilers working in closed systems must be equipped with a temperature sensor (section 7, page 15) and a safety valve (for installation see - fig. 1, item 17). As an additional protection of the system, a device relieving excess thermal power shall be installed manufacturer recommends SYR 5067 thermal protection devices (section 2.6).

To ensure safety of the boiler operated in closed systems, a heat buffer (accumulation reservoir) may also be used. Its installation is beyond the scope of this manual and shall be performed according to its manufacturer's recommendations. The table on the last page of the manual specifies recommended volumes of such reservoirs.

Safety Signs and Labels



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



Note: The washout hole located under a masking cover can be hot. Pay special attention as other boiler elements and parts of its installation may also be hot.



This warning sign appearing on pages of this manual indicates possible hazards. Please read this section carefully to avoid potentially dangerous situations.



Remember that many parts and surfaces in a boiler room may have different temperatures. Pay special attention as the charging flap and doors may have higher temperatures than other parts of the boiler. This also applies to smoke conduit, chimney damper and supply and return lines. When staying in the boiler room, always pay special attention.



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

7. AIR SUPPLY SYSTEM

The air supply system is delivered in fully assembled condition. It consists of the following four elements:

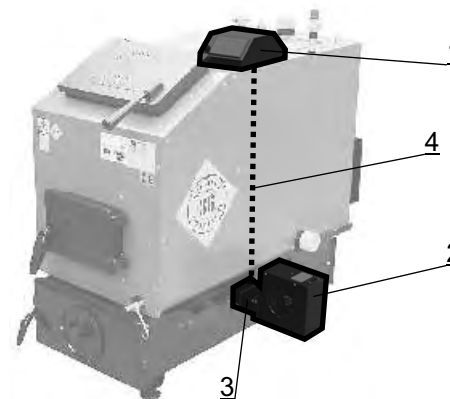


Fig. 5 Air supply system - main components

1. Electronic controller
2. Air-supply fan
3. Fan connector (not used if the draught lock is built-in the fan)
4. Connecting cable (may be inside a casing or hidden under the insulation)

The boiler is factory prepared for installation of the air supply system, which can be installed at any time. Elements used for this purpose: 15 and 6 (see fig. no. 1) are protected with caps. If you have not chosen this system installation at the time of the boiler purchase, the upgrade may still be performed at a later time. Please contact the sales department.

Installation of the air supply system

Installation of the electric part shall be performed by an authorized electric engineer, according to instructions attached with the delivery.

1. Attach the electronic controller by bolting it to the upper boiler surface in such a way, so that the sensor tip is located as close as possible to the pipe no. 15 on fig. 1.
2. Install the controller's sensor in the pipe
3. Screw on the fan connector to the ash pit side wall
4. Screw on the fan to the connector
5. Install the fan connecting cable. Connect the cable to the controller according to the air supply system instructions.



Note: Fan air intake must not be obscured, otherwise the fan may be permanently damaged.

4.1. Maintenance and Servicing

Boiler maintenance during the heating season involves its periodical cleaning. After the cleaning season, the boiler shall be thoroughly cleaned and internal surfaces protected with oil.

5. SAFETY REQUIREMENTS

The key requirement that has to be met in order to ensure secure boiler operation, is to deliver installations and protections according to Polish standards.

In order to maintain safe boiler operating conditions, the following guidelines shall be followed:

- wear protective gloves and goggles
- do not block charging flaps or ash pit doors
- adjust grates using the ash pit lever only
- use portable 24 V lamps
- always keep the boiler room in order
- ensure good technical condition of the boiler and its related installation
- in winter season, avoid heating pauses



If you suspect that water might have frozen in the installation, check whether safety pipes are not blocked. Water supplied to the system shall return through the overflow pipe in the expansion vessel. If pipes are blocked the boiler must not be lit. If pipes become blocked during boiler operation, proceed according to the emergency shutdown procedure (see par. 3.5.)



Do not:

- pour water into the combustion chamber
- light the boiler using flammable liquids

6. DISPOSAL

If maintained and operated correctly, the boiler should ensure failure-free operation for ca. 15 years. After this period, further boiler operation may become financially unjustified. The boiler is made of fully recyclable materials. It is recommended to commission a company specializing in machinery dismantling and disposal.



Pamiętaj o tym by pomieszczenie kotłowni utrzymywać w czystości. Pozostawione na podłodze lub rozsypane paliwo może być przyczyną pożaru.

1.2. Warranty

Manufacturer grants 3-year workmanship and material warranty for the boiler.

Manufacturer grants 1-year warranty for other equipment delivered with the boiler (if ordered), namely: controller and fan with cabling. The warranty shall not include elements specified on the list of equipment (section 1.5).

The warranty shall not include damages resulting from incorrect use or normal wear and tear, costs of installation and travel, damages resulting from unauthorized modifications or repairs, indirect damages, outage-related losses or any other financial losses resulting there from.

All warranty claims shall be directed to the boiler seller.

When filing a warranty claim, please include the following details:

- boiler rating
- serial number
- date of purchase

Declaration of Conformity

We

*Moderator Spółka z o. o.
11 Listopada 16a
17-200 Hajnówka
tel. +48 (085) 682 42 41*

we hereby declare, on 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, where applicable:

Directives
98/37/EC

Standards
EN-PN-303-5

Hajnówka 2004.02.01

Management Board Vice President

Mr. Mirosław Bartoszewicz, M.Sc.

1.3. Fuel

The Moderator boiler is designed to be fuelled by renewable fuels (timber and vegetable-based fuels) such as chipped wood, chips, sawdust or bark, with moisture content of up to 30%. Coal may be used as a substitute fuel. Specifications of boiler technical parameters are valid for fuels with humidity content of up to 30% and calorific values of $Q_i^a = 17.084$ kJ/kg and $Q_i^a = 29,924$ kJ/kg for wood and coal respectively.

The higher the moisture content the lower the calorific value (note: moisture content of 60 % causes twofold reduction of calorific value, which means that as much as double the fuel volume is needed to achieve the same heating effect). Significant part of the heating energy during such combustion process will be wasted for fuel heating up and for water evaporation (note: moist fuels will also directly affect boiler lifetime and may cause its premature wear). Moisture content is measured using hygrometers (of different types for sawdust and wood) and they are necessary at the time of fuel purchase (to check fuel's actual moisture content) as well as during standard boiler operation.

1.3.1. Other fuels

Clear cardboard and paperboard may only be used for boiler lighting. Mixtures of various clear papers and cardboard may only be burned when mixed with wood. Newspapers and magazines must not be burned and have to be recycled. Keep in mind that impregnates and paints used for their printing, may significantly pollute the environment when burned.

We are also warning against burning plastics in all forms. Keep in mind that the smoke generated when plastics burns contains poisonous substances, which are harmful to human health and which will fall of in direct vicinity of the chimney. Never burn:

- PVC products:
- butter/bread spread boxes,
 - transparent plastic boxes,
 - cassette boxes, toys,
 - plastic construction materials;
- PApolyamide products:
 - e.g. textiles;

Some types of plastics identified as: PE, PP, PET may be burned, provided that their content is less than 5% of the whole fuel (e.g. wood) volume and the combustion temperature is higher than 850°C.

Approximate parameters of various fuels

Fuel Type	Burning time (hours)	1 mp weight (kg)	Moisture content (%)
chipped wood	4-6	300	30
chips	3-5	155	30
sawdust	2-4	145	30
bark	2-5	200	30
coal	6-8	-	-

4. TROUBLESHOOTING GUIDE

Problem	Cause	Remedy
The boiler generates smoke, the vacuum chamber contains a black liquid	No draught	Seal tightly the smoke conduit point of entry to the chimney stack
	Too low chimney stack cross-section	Increase the chimney stack opening e.g.: demolish a partitioning wall with neighbouring ventilation channel (at least 2m away from the "Moderator base")
	Another boiler/stove (e.g.: kitchen stove) uses the same chimney canal	Seal the outlet from the boiler to the smoke canal to prevent cold air sucking in
	Blocked chimney canal	Clean the chimney stack, burn out the chimney stack by burning dry wood
	Too frequent use of moist fuel	Burn out the chimney stack by burning dry wood
The fuel burns too fast even if doors are closed	Ash pit chamber not sealed	Seal the ash pit according to installation instructions
	Too large chimney cross-section	Reduce the chimney cross-section, install a chimney damper



Damp fire before commencing with cleaning works.

If the boiler is highly contaminated, it is permitted to use chemical agents to remove boiler deposit whereas such agents must be marked-accepted (identified with appropriate safety sign).

3.4. Programmed Shutdown

When the fuel finishes burning, open all doors and maximally open the chimney damper in the smoke conduit. Remove ashes and clean the boiler. Do not drain the circulating water. The cool-down time must be equal to the lighting time.

3.5. Emergency Shutdown

In case of emergency, such as: temperature of 100 degrees exceeded, insulation elements cracking or installation water leaking, failure of control or safety equipment or sudden pressure rise, it is necessary to:

- remove the burning fuel from the grate and remove it outside the boiler room
- reduce the circulating water temperature by adding cold water to the installation as during filling
- maximally open the smoke conduit throttle (if installed)

In case of boilers operated in closed systems, an emergency may be any power supply outage (pumps stopped) or boiler doors open. The central heating installation shall be protected with a safety valve set to 2.0 bar, additionally the boiler is factory-fitted with a safety valve set to 2.5 bar. However in emergency situations, such protections may render ineffective. Boiler must be additionally protected with a thermal protection valve, which in case of an emergency will remove hot water from the boiler while at the same time refilling it with cold water from the water pipe to cool down the boiler and to reduce its pressure (section 2.6).

Please keep in mind that such emergency conditions are likely to occur in summer season, when only hot household water is prepared in the boiler. In order to ensure protection for such anticipated emergencies, it is necessary to install a heat accumulation reservoir that will be capable of taking over the excess thermal power that is generated in such conditions inadvertently.



Do not pour water on glowing fuel.

1.4. Technical Description

This instruction manual is applicable for boilers with 10 to 50 kW rated power. Moderator boilers are designed with transverse circulation chambers and operate according to the upper combustion principle. Walls and grate are water cooled and made of 5-6 mm thick high grade sheet metal plates, with the internal coat made of 4 mm sheet metal plates. The boiler is charged with fuel manually from top. Grate ash removal is automatic, bottom doors (ash pit doors) are equipped with mechanical air supply system and throttle (used in case of power supply failure and in versions without the air supply fan). The smoke conduit is inclined at 15 degrees towards the chimney stack (this applies to boilers rated 15 kW or more).

1.5. Equipment

The boiler is delivered in an assembled state. Basic equipment includes a thermometer, with other elements depending on the purchased option not included in the boiler price.

Additional movable equipment:

- G1/2 draining valve
- G3/4 safety valve
- thermometer (0-120°C)
- counter flanges, seals and flange fixing bolts (they are delivered with 40 and 50 kW boilers as standard equipment; while with 32 kW boilers only G1/2 or G2 threaded connections are used)
- cleaning kit (outside the warranty scope)
- drawer

Additional movable equipment for boilers with air-supply system:

- controller
- fan with controller cable
- fan switch (only if the fan is not equipped with built-in with draught lock)

Air-supply unit is packed in environment-friendly cardboard boxes and placed for transport inside the boiler's combustion chamber (for installation instructions see section 7).

2. ASSEMBLY AND INSTALLATION

2.1. General Specifications

Maximum water supply temperature:	90 °C
Maximum water return temperature:	70 °C
Minimal water return temperature:	55 °C
Operating pressure:	1.5 bar
Thermal efficiency	
- wood	78.7 %
- coal	80.0 %
Minimum temperature of combustion gases	150 °C

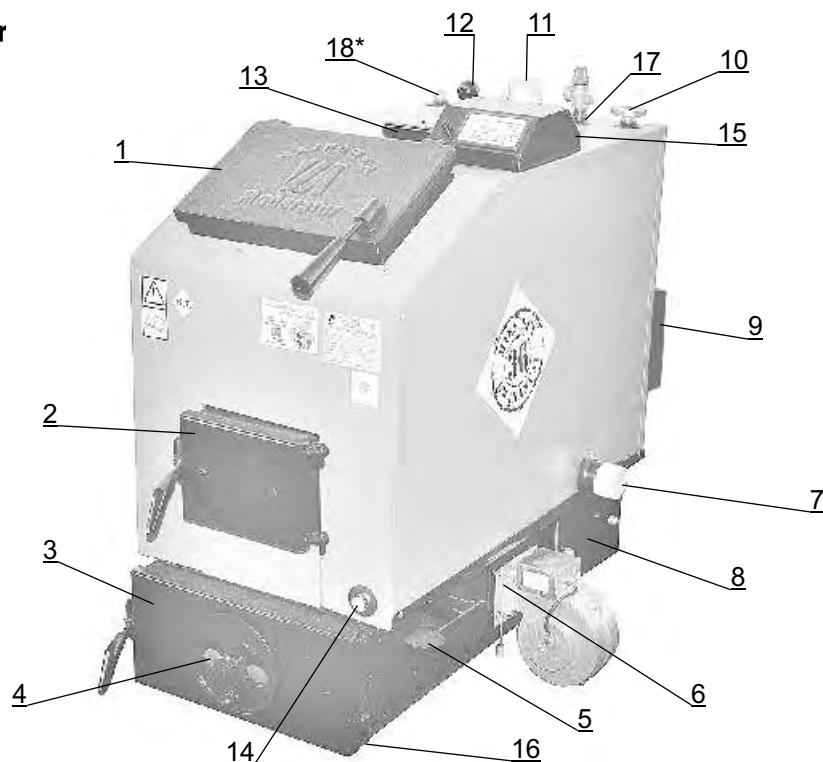


Fig. 1 Moderator boiler main parts
(the figure presents 20 kW version)

1. Charging flap
2. Grate doors
3. Ash pit doors
4. Air throttle
5. Ash pit lever
6. Fan connector installation hole
7. Return pipe
8. Washout hole
9. Smoke conduit (in 10 kW versions in the upper part of the boiler)
10. Thermometer G1/2 muff
11. Supply pipe
12. Thermal protection sensor G1/2 muff
13. Vacuum chamber washout masking plate
14. G1/2 muff for straight-run valve installation
15. Electronic controller sensor's stub pipe
16. Boiler legs (in 15 - 25 kW versions, inclusive)
17. G3/4 muff for safety valve installation
18. * G1/2 muff for thermostat installation
*available only in models customized for SMOK biomass combustion unit installation



Note: avoid charging fine fuels with dusts content exceeding 5%. Exert extreme caution when burning very dry shavings (moisture content up to 10%), avoid compressing it too much in the combustion chamber. Having charged shavings, leave a free space in the rear part of the chamber ensuring free access of air. If these conditions are not met, combustion gases may move back from the combustion chamber when the charging flap is suddenly opened (flap opening may cause a sudden rise of air volume in the combustion chamber and cause explosive combustion of dusts).

When operating the boiler equipped with air supply system, the charging flap must not be opened at any time when the fan is on. Before refilling the fuel, switch off the controller.

- adjustment of the boiler output, and thus supply water temperature, may be performed by setting the throttle (or the slot in the washout hole doors) or possibly by changing the cross-section area of combustion gases outlet in the smoke conduit. When operating the boiler equipped with the air supply system, the ash pit flap shall remain closed.

3.3. Cleaning

Grate needs to be cleaned when water temperature and ash pit illumination start to drop. Ash shall be removed after flame is reduced.

In order to ensure economic fuel consumption, keep boiler's inside chambers and spaces between water tubes clean. A symptom indicating that cleaning is required is when chimney draught drops. Insufficient air supply causes the boiler to generate smoke.

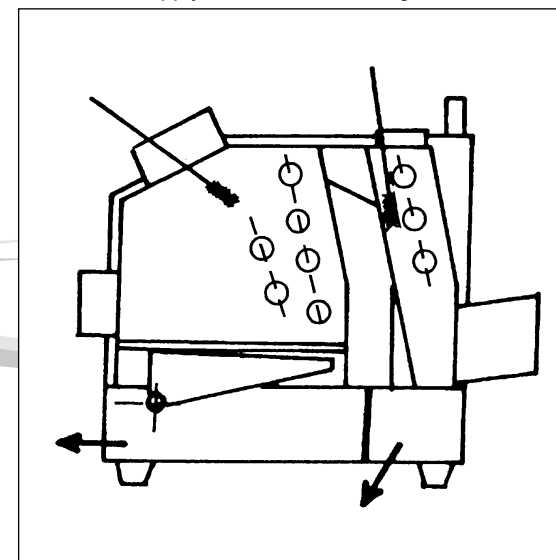
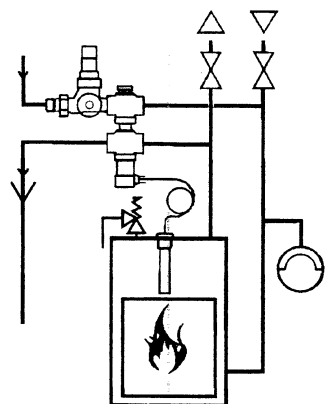


Fig. 4 Boiler cleaning diagram
(15-50 kW versions)



Rys. 3 Thermal valve installation



Valve view

3. BOILER OPERATION

3.1. Boiler Lighting

Before lighting cold boilers, it is necessary to ensure that the whole installation is tight and properly filled with water.

Open washout hole doors (or in case with round throttle, rotate it until holes fully open). Light the boiler using dry wood for at least 1.5 hours gradually reaching the water temperature of 80°C. It is recommended to perform the first lighting without utilizing the air supply system, by adjusting air supply by opening washout hole doors (or the throttle) while remembering to switch on the pump when the temperature exceeds 40°C (later, when the air supply system is used, the pump will be automatically switched on by the controller).

It is recommended to burn-in the boiler for 3-4 days keeping the supply water temperature at 70-80°C. Further boiler lighting may be performed by programming the boiler operation on the electronic controller, according to instructions contained in the controller manual.

3.2. Boiler Operation

During standard boiler operation it is necessary to periodically check fuel level and refill it when necessary. In order to ensure the most stable water temperature possible it is necessary to:

- use fuel with moisture content of up to 30 %
- in case of higher moisture content, fuel shall be dried or mixed with dry one while keeping in mind that the more moist is the mixture the less of it should be fed to the boiler and the more air shall be supplied.
- try charging the boiler with fuel of different fractions alternatively (fuel with larger particle sizes shall be already glowing in the combustion chamber when finer fuel, e.g. dusts from saw mills is charged into the boiler, otherwise the fuel will spill through the grate)
- if possible avoid opening the charging flap when lighting the boiler and while the boiler temperature rises

2.2. Boiler Room

The boiler room shall meet the requirements of PN-59/B-02411 standard, which include:

- fireproof flooring
- steel doors or wooden doors covered with sheet metal, opened to the outside
- air supply hole 21x21 cm in the bottom part of the boiler room
- air exhaust hole at least 14x14 cm in the upper part of the boiler room

Required equipment:

- drawing cock
- sink basin
- sink



Mechanical ventilation must not be used.

2.3. Boiler Positioning

Boiler installation shall be performed by engineers with appropriate qualifications and certificates (we recommend to use service of distributors, whose installation engineers have undergone appropriate training at Moderator Sp. z o.o.). Faulty installation may lead to premature boiler wear, may cause a fire or an explosion.

Moderator boilers are delivered in the assembled state. Boilers can be installed directly on the floor with ca. 1 degree inclination towards the front wall (the highest point of the boiler after its installation shall be the place near the supply pipe) boilers rated 15 through 25 kW have factory preset angle. If necessary the boilers shall be levelled using nuts on its legs.

When positioning the boiler, remember to ensure good accessibility to it so that boiler room walls do not render fuel charging, combustion chamber cleaning or side washout or fan access difficult.

2.4. Chimney Stack Connection

Boiler's smoke conduit shall be fitted directly into the chimney an when properly aligned, sealed along the contact line between the smoke conduit sheet metal with chimney stack brickwork. Chimney stack outlet shall be located 75 cm above the roof ridge. Rectangular or square chimney stacks shall be made of burnt brick; round chimney stacks (usually steel ones) shall be insulated along the whole height with 5 centimetre thick mineral wool layer.

While installing the smoke conduit in the chimney stack, please pay attention to the chimney damper lever (it is necessary to provide sufficient space to allow for its closing and opening).



Keep in mind that combustion gases entering the chimney are hot and thus the chimney damper lever will also heat up. When operating the lever always wear protective gloves.

Recommended Chimney Stack Cross-Sections.

Boiler Rating kW	Square Chimney cm x cm	Rectangular Chimney cm x cm	Round Chimney cm
up to 15*	18 x 18	14 x 20	18
20 - 32	20 x 20	15 x 27	18
40 - 50	25 x 25	-	25

* for 10 kW boilers, 15 x 15 cm or Ø 15 cm chimney stacks may be used

2.5. Connecting Boiler to the Installation

The boiler will operate correctly as long as the temperature inside its combustion chamber is sufficiently high, which means that the water leaving the boiler shall have the temperature of 70-80°C and water returning to the boiler 55°C. Such operating parameters will protect the boiler against material corrosion at low-temperatures. In order to ensure correct boiler operation, manufacturer recommends to install a mixing valve and a heat reservoir.

Boilers with ratings through 32 kW are equipped with G1 1/2 or G2 threaded stub pipes. Stub pipes must be connected to the installation by means of appropriate connectors. Boilers with 40 and 50 kW rated power are equipped with flat flanges and counter flanges. Counter flanges shall be welded to the installation piping (supply and return), fitted with seals and then bolted using screws delivered with the boiler. The next step is to attach the thermometer.



If the boiler is equipped with a thermal protection valve, then install the valve's sensor in the G 1/2 muff (12, fig. 1). Then install the safety valve.

Connect water supply pipe through the G1/2 valve (14, fig. 1.) using a flexible hose, which after filling is completed shall be disconnected. When filling open all venting valves in the installation and slowly close them until water overflows in the overflow pipe of the expansion vessel. Lossless installations may be supplied with raw water, as long as its hardness is less than 10 n. Otherwise the water shall be pre-treated. Install boiler accessories (handles and bakelite knobs).

2.6. System Protections

2.6.1. Open Systems

Moderator boilers operated in open CH systems should be connected according to requirements of the PN-91/B-02413 standard, which specifies that the excess heat in the form of steam should be discharged through an open line (RP overspill pipe) outside.

Installation requirements:

- expansion vessel with volume of at least 4% of the total installation water volume
shape: cylindrical A-type acc. to PN-91-02413-1-2
rectangular B-type acc. to PN-91-02413-1-3
- expansion RB safety pipe with internal diameter of:
25 mm for boilers up to 32 kW
32 mm for boilers 40 through 50 kW
- RW expansion pipe with internal diameter of 25 mm
- RP overspill pipe
internal diameters as RW and RB
- RC circulating pipe with internal diameter of 20 mm
- RO venting pipe and RS signalling pipe with internal diameters of 15 mm

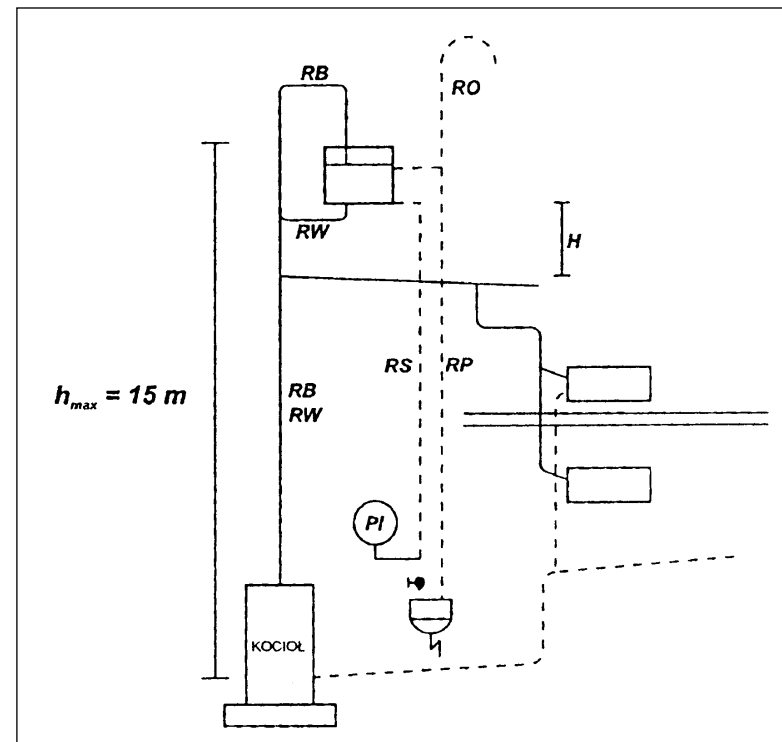


Fig. 2 Protection of boilers in open CH installations



No fittings capable of partial or complete flow limiting may be installed on RB, RW and RO pipes. Protective equipment and fittings should be protected against freezing.

2.6.2. Układ zamknięty

Moderator boilers operated in closed systems shall be equipped with air supply system (designed by Moderator Sp. z o.o. for Moderator boilers – third party ventilation solutions are not recommended), safety valve and additionally with a thermal protection that releases thermal power excess to the atmosphere. These protections are installed in muffs welded into the upper coat of the boiler (items 12 and 17 on fig. 1).