



# **BOILER OPERATING AND INSTALLATION MANUAL**

**BLAZE HARMONY 12**

**BLAZE HARMONY 18**

**BLAZE HARMONY 25**

**BLAZE HARMONY 33**

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**Dear customer,**

***Congratulations on choosing and purchasing a BLAZE HARMONY boiler. You have now become the user of a top-class boiler. To ensure that the boiler serves you well and reliably for a long time, use the boiler in accordance with the operating instructions; particularly pay attention to Chapters 6,7 and 8.***

***We greatly appreciate your trust, and we will be glad to hear feedback about the operation and service of the boiler.***

***This boiler has been approved for operation in EU countries by Strojírenský zkušební ústav, s.p., Notified Body EC 1015, Authorized Body 202, Brno, on the basis of certificate no. B-30-00939-18 of 31. 8. 2018.***

***In accordance with Government Order no. 176/2008 Coll., Annex 1, Article 1.7.4., this is the***

***ORIGINAL USER MANUAL.***

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# 1 Use and advantages of the boiler

## Boiler use:

BLAZE HARMONY hot water gasification boilers are designed for efficient, ecological and comfortable heating of houses, flats, cottages, office buildings, small shops and other buildings.

The BLAZE HARMONY 12 boiler is designed for heating buildings whose thermal loss does not exceed 15kW.

The BLAZE HARMONY 18 boiler is designed for heating buildings whose thermal loss does not exceed 20kW.

The BLAZE HARMONY 25 boiler is designed for heating buildings whose thermal loss does not exceed 28kW.

The BLAZE HARMONY 33 boiler is designed for heating buildings whose thermal loss does not exceed 35kW.

BLAZE HARMONY boilers are designed for the combustion of lumber.

## Advantages of the boiler:

- **Excellent price/performance ratio**
  - The boiler is equipped with a patented integrated mixing system that replaces standard return protection. It is therefore possible to implement a gravity connection to a buffer tank, and there is no need for an expensive mixing valve (e.g. Laddomat), pump or emergency cooling system. This type of connection enables the boiler to operate even in the case of a power failure.
  - The patented stable heat layer (embers) detection system, along with other progressive elements (such as multi-band primary air supply to the stoking chamber, warm stoking chamber, power control method, preheated secondary air, etc.) ensures uniform combustion, quality controllability and long-term maintenance of stable heat. This ensures the same operation comfort (number of fire-ups) with the buffer tank, with half the capacity of that required for regular boilers (without controllability).
  - The patented 3-band air inlet system allows combustion of fuels with various properties.
- **Low operating costs**
  - Fuel savings are also achieved by the special design of mechanical turbulators, which keep the heat exchanger clean and free of deposits. The unique boiler design ensures low flue gas temperature and high boiler efficiency. The use of insulation of the highest quality minimizes heat loss into the boiler room.
  - Electricity savings - the ability of a gravity connection (without a pump and mixing valves) saves electricity costs.
  - Service and maintenance savings - progressive conceptual features (e.g. split hot ceramic refractories, water-cooled ceiling of the combustion chamber, double sealing lines, etc.) ensure low costs for parts subject to wear.
- **High-quality combustion**
  - The original design of the combustion chamber and the patented 3-band combustion air supply system is unique, where the fuel burns out evenly with constant output (the fuel does not burn in the entire volume of the hopper, it only burns in the bottom layer).
  - The boiler allows high-quality combustion of fuels of different sizes - chips, sawdust, low-quality briquettes (small or minimally pressed). Regular gas boilers are very sensitive to the size and type of fuel.
  - The boiler has a unique "hot combustion chamber" design, where the walls of the stoking chamber are completely separated from the water and thermally insulated. The fuel is therefore not overcooled, and the combustion is good even at low power with fuels with higher moisture content.
  - The controller evaluates the immediate boiler output and makes sure that the boiler operates in a high-quality combustion range with high efficiency.
- **Long service life**
  - In the gasification of wood, organic acids are formed (acetic acid, etc.). In conventional boilers (from steel sheets or cast iron) these acids condense on the walls of the stoking chamber causing chemical corrosion, which greatly shortens the life of the boiler. The system of a compact hot stoking chamber completely eliminates this problem because the chambers are hotter, which prevents condensation. The durability of boilers designed this way is considerably longer than that of wood-fired boilers without similar protection.
  - The patented system of integrated water mixing ensures that the temperature of the other heat exchange surfaces that are in contact with the flue gas is higher during operation than the dew point of the flue gas (60°C). This is the perfect protection of the heat exchanger's heat exchanging surfaces against low-temperature corrosion.

- **Operating comfort**

- Unique controllability and a patented automated stable heat system makes the number of fire-ups in the boiler per season several times lower than in conventional boilers. The integrated weight detector detects the optimal layer for switching to stable heat shutdown, ensuring maximum time until the next stoking without the need for another fire-up. If it does burn out, an ideal hot layer of charcoal remains in the chamber; you only need to light it (e.g. with a piece of paper) and add wood. This eliminates the need for a regular fire-up (i.e. collecting ash with residual fuel from the stoking chamber and fire-up with wood chips) during operation.
- There is no need to remove the ash from the bottom of the refill chamber. The ash continuously slides along the sloping sides of the bottom into the combustion chamber.
- Long combustion time (up to 8 hrs at reduced power), you only need to stoke the chamber 2-3x a day.
- The inclined stoking door makes it easy for the operator to add loose fuel (chips, small briquettes, sawdust, etc.).
- Due to high-quality combustion, it is sufficient to remove the ash every 2 weeks of operation. The sophisticated boiler design allows easy and time-efficient ash removal and exchanger cleaning. Moving turbulators operated by a lever on the side of the boiler completely eliminate the need for manual cleaning of the main rear flue gas exchanger.
- The powerful exhaust fan and the suction slot in the refill hole ensure that smoke does not enter the boiler room during stoking and fire-up.
- The exhaust fan minimizes dust during ash removal and boiler cleaning.
- The hot combustion chamber ensures higher wall temperature, and there is no unpleasant tar deposition in the stoking chamber.
- The double-glazed ceramic peep hole allows the operator to easily check the fire and improve the combustion by simple secondary air control. Secondary air control takes place automatically with a lambda probe and control module (optional).
- The boiler can be operated (to a limited extent) even in the event of a power failure (see Chapter 7.3).

- **Operation with lambda sensor**

- The Lambda probe installed in the flue pipe checks the residual oxygen content in the flue gas.
- Based on information from the lambda sensor, the controller uses an actuator to move the combustion air control orifice plate and thus maintains the required value of residual oxygen in the flue gas. This ensures the best possible combustion and reduces fuel consumption.
- Operation with a lambda sensor enables even better combustion of various fuels such as wood chips, briquettes or sawdust. These fuels are very sensitive to the combustion air supply setting

## 2 Technical boiler data

Table 1. Boiler dimensions and technical parameters

Boiler type		BH12	BH18	BH25	BH33
Weight	kg	350	400	550	550
Water chamber volume	dm <sup>3</sup>	45	50	60	60
Flue gas duct diameter	mm	150			
Stoking chamber volume	dm <sup>3</sup>	70	100	150	150
Boiler dimensions: width x depth x height	mm	590 x 910 x 1190	590 x 910 x 1390	750 x 910 x 1390	750 x 910 x 1390
Size of stoking hole	mm	365 x 250		548 x 250	
Maximum allowable operating pressure	bar	3,0			
Test pressure for type test	bar	6,0			
Range of outlet water temperature control	°C	70 - 95			
Min. operating temperature of return water to the boiler	°C	20			
Maximum allowable operating temperature	°C	95			
Hydraulic boiler loss at $\Delta T = 20 K$	mbar	0,2	0,3	0,5	0,8
Maximum noise level	dB	55			
Minimum operating chimney draft	mbar	0,10			
Maximum operating chimney draft	mbar	0,40			
Boiler connections: - heating water	Js	G 6/4"			
- return water	Js	G 6/4"			
Connection voltage		1 PEN 230V / 0,5A / ~ 50 Hz			
Environment		basic AA5 / AB5			
Electric protection		IP 20			
Energy efficiency class		A+	A+	A+	A+

Table 2. Technical thermal boiler parameters

Boiler type		<b>BH12</b>	<b>BH18</b>	<b>BH25</b>	<b>BH33</b>
Nominal power	kW	12	18	25	33
Power controllability in continuous operation	kW	7 – 18	10 – 23	15 – 32	16 – 35
Fuel consumption at nominal power	kg . h <sup>-1</sup>	3,3	5	7	9,5
Burning time of full fuel batch at nominal power					
- softwood	h	4	4	4	3
- hardwood	h	5 - 6	5 – 6	5 – 6	4 - 5
Boiler class according to ČSN EN 303-5		5			
Ecodesign		yes			
Flue gas temperature					
at nominal power	°C	135*	135 *	135*	145*
at 7/10/15/16 kW	°C	105*	105 *	105*	115*
Efficiency	%	92	92	92	91
Flue gas flow rate at the outlet at nominal power	kg . s <sup>-1</sup>	0,008	0,012	0,017	0,012
Power input at nominal power	W	38	40	40	45
Power input in standby mode	W	2	2	2	2
Required buffer tank volume	dm <sup>3</sup>	700- 1500**	1000- 2000**	1500- 3000**	2000- 4000**
Maximum heat loss *** of a heated building where the boiler is the only heat source	kW	15	20	30	35

\* Applies to clean exchanger (during usual clogging the flue gas temperature is 10 – 20 °C higher)

\*\* The method for determining the storage tank volume is described in Chapter 5.4.

\*\*\* The method for determining the heat loss of a building is described in Chapter 8.3.

### 3 Prescribed fuel for the boiler

The warranty fuel for the BLAZE HARMONY boiler is the fuel listed in Table no. 3. This is the fuel used in the certification of the boiler.

Table 3. Warranty fuel

Type of fuel according to ČSN EN 303-5		A - Biomass logs
Diameter	[mm]	max. 150
Length	[mm]	330*/500**
Water content	[%]	max. 20
Ash content	[%]	max. 1.5
Calorific value	[MJ.kg <sup>-1</sup> ]	min. 14

\* Valid for BH12 and BH18 \*\* valid for BH25 and BH33



**ATTENTION! Poor fuel quality can significantly negatively affect the performance and emission parameters of the boiler.**



*The boiler is also designed for alternative fuels such as wood briquettes, dry wood chips or sawdust. They can be used in the absence of the warranty fuel.*

For more useful information on the fuel - see Chapter 8.

## 4 Boiler description

### 4.1 Boiler design

The boiler design meets the requirements of:

ČSN EN 303-5 : 2013 -Boilers for central heating - Part 5: Boilers for central heating for solid fuels, with manual or automatic supply, with a maximum nominal thermal output of 500 kW - Terminology, requirements, testing and marking.

\* Valid for BH12 and BH18

\*\* valid for BH25 and BH33

The BLAZE HARMONY boiler is based on the principle of two-stage combustion, which involves the gasification of fuel with subsequent burning of the generated gases.

The boiler body (5) is welded from 4 and 5 mm steel sheets. The walls of the refill chamber (1) are equipped with a protective steel sheath (6) consisting of several segments, mutually connected by screws. The side walls at the bottom of the stoking chamber are made of ceramic refractories (43). The bottom of the stoking chamber is shaped like a funnel and is lined with ceramic refractories (22, 51\*\*). The nozzle (21) opens through the connector (44) into the combustion chamber (2), which is also lined with ceramic refractories (28, 26). The nozzle contains a fire resistant grille (50). 25.33kW boilers have two nozzles.-The heat exchanging surfaces of the boiler are formed of side traverses (3) behind the combustion chamber refractories and the rear exchanger (4), consisting of 5\*,7\*\* separate channels.

The boiler is equipped with 30 mm thick mineral wool insulation. The outer surface consists of 1 mm thick steel sheet covers. The front wall of the boiler contains a sight glass (20) with ceramic glass. The control panel of the controller (18) is located on the top door. The control unit itself (7) is located on the rear wall of the boiler in an electric switchboard.

The front of the boiler under the front cover contains an air distribution panel (31). In its lower part there are 3 combustion air inlet openings (40, 41, 42) equipped with valves (19) connected to each other with a flat steel axle. The openings are equipped with a secondary air control curtain (9)

The stoking chamber (1) contains an arm for detecting (13) the stable heat layer with an axis of rotation in the front wall of the stoking chamber. The detecting arm (13) is firmly connected to a balancing arm (48) located in the air distribution panel (31). The stable heat detecting sensor (37) and a thrust mechanism consisting of a shaft with a thrust arm (46), which is connected to the stoking door (11) with a connecting rod (47), are located under the balancing arm (48).

The rear flue gas exchanger (4) contains turbulators (32) consisting of bars with cleaning segments suspended on an oscillating link. The oscillating link is connected by a pair of arms that are on one shaft with a control lever (33).

The water inlet (16) opens into a drainage duct equipped with a flow passage with a thermostat (34), which controls the amount of water flowing into the distributor (39), from which the water enters the boiler's water compartment through a number of small holes. The thermostat (34) is set to 60 °C, and it is located under the sealed lid on the front wall of the boiler.

The boiler is supplied with the bottom door mounted on the left side (hinges on the left). The door may be retrofitted to the right.

The exhaust fan (8) can be rotated so that the flue gas outlet (15) opens into any direction.

The top stoking door is equipped with a safety lock (27), and it is sealed with a double sealing cord when closed.

The control panel of the controller (18) is located on the top door. The control unit itself (7) is located on the rear wall of the boiler. To ensure better access, the control unit (7) can be attached to any side wall of the boiler, or the boiler room wall. The controller (7) and the control panel (18) are interconnected with a data conductor.

The controller allows equithermal control of heating circuits based on outdoor temperature, pump control, and the connection of the room thermostat and the outdoor temperature sensor (see first connection diagram). Additional functions (more mixing heating circuits, etc.) can be connected with an extension module. The standard delivery includes a flue gas sensor, boiler temperature sensor and buffer tank temperature sensor.

## 4.2 Function description

Opening the stoking door activates the sensor (14), and the fan (8) switches to full power. If there is a hot layer in the boiler, the operator adds fuel to the chamber. If the residual layer is no longer hot, it serves as ignition fuel, e.g. a lit piece of paper is thrown on it before adding fuel. When the door is closed, the boiler starts up. The flue gas fan creates a vacuum in the boiler, which opens the valves at the air inlets (40, 41, 42). The pre-drying air enters the distribution panel (31) through the opening to the right (42), rises through the channel in the distribution panel, passes through the opening in the top part of the body, and is led through a longitudinal opening (49) above the fuel layer. This air accelerates the drying and burning of the fuel layer. The secondary air enters the distribution panel (31) through an opening in the center (41); from here it flows through the circular channel into the cavity in the bottom of the stoking chamber, through which it is led into channels on the bottom of the refractories (36, 22) through a series of holes, where it is preheated and enters the nozzle (21). Primary air enters the distribution panel (31) through an opening to the left (40); from here it flows through an opening in the body under the bottom of the stoking chamber, and then rises through the rear channels in the refractories (43) beyond the protective sheath of the stoking chamber (6), where it exits through the front grooves in the refractories (43) into the bottom layer of the fuel. This air causes primary fuel burning (gasification). The resulting wood gas flows through the nozzle (21) into the connector (44), where it is mixed with secondary air - combustion of gaseous components (secondary combustion) occurs in the combustion chamber (2). Hot smoke gases gradually pass through the lateral (3) and rear (4) exchanger, where they transfer their heat to the heated water. The cooled flue gas is sucked by the exhaust fan (8), which pushes it through the outlet (15) into the chimney.

The ash slides into the combustion chamber (2), from where it is removed by occasional collection. The fan speed is controlled by the controller according to the water and flue gas temperature and the current power requirement.

When the fuel burns to the base layer, the fuel stops weighing down the fuel weight detection arm (37), which is detected by the sensor (37). The boiler then switches to stable heat shutdown. During shutdown, the fan turns on in the base layer at regular intervals to keep the layer hot for several hours.

When the stoking door is opened, the detection arm (13) is automatically lowered to prevent it from blocking the fuel. This lowering is performed by the thrust arm (46), which is connected by a connecting rod (47) to the stoking door.

The thermostat (34) limits the flow of water so that the temperature of the heat exchange surfaces is higher than 60°C.

### 4.3 Operation with lambda sensor

When operating the boiler with a lambda sensor, the supplied combustion air is controlled automatically. A lambda probe is installed in the flue pipe, which detects the amount of residual oxygen in the flue gas. Based on this value, the orifice plate (9) is automatically moved by the actuator, which maintains the optimal amount of residual oxygen in the flue gas, and this results in the most efficient combustion of logs, leading to significant fuel savings

### 4.4 Boiler diagram

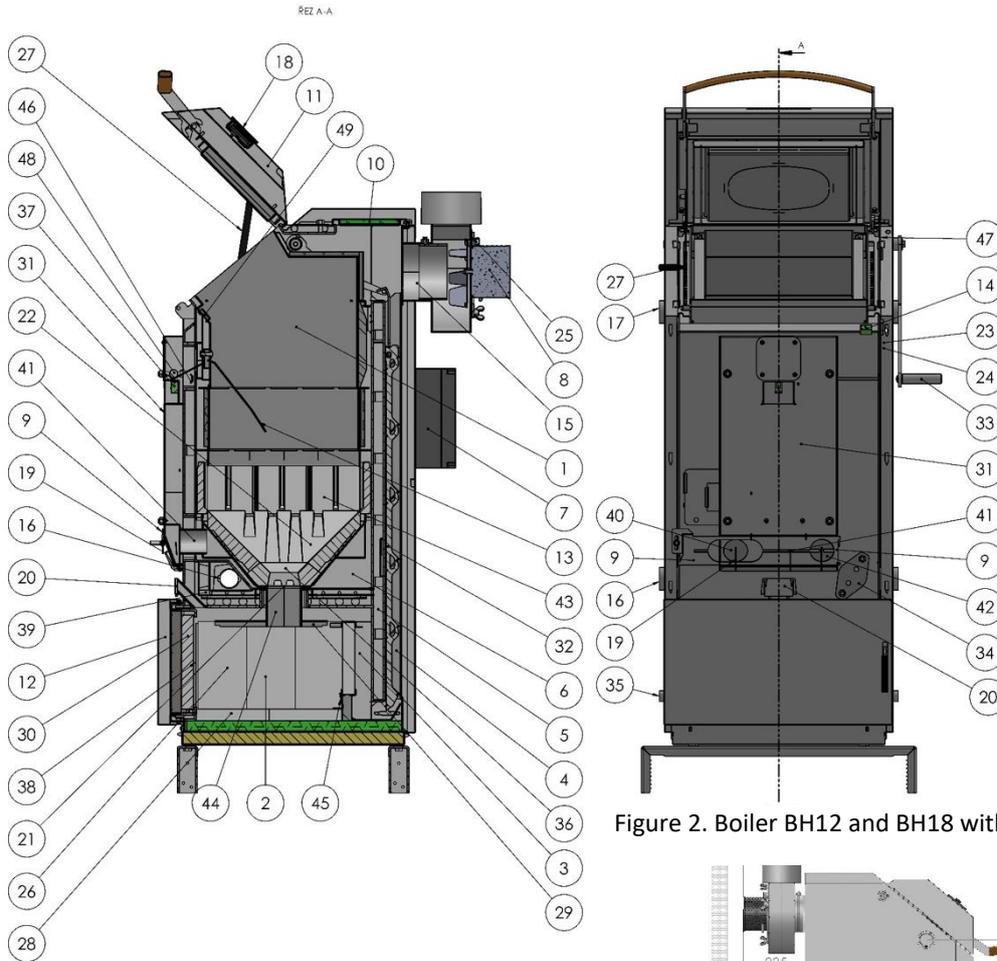


Figure 2. Boiler BH12 and BH18 without front cover

Figure 3. Cross section of the boiler BH12 and BH18

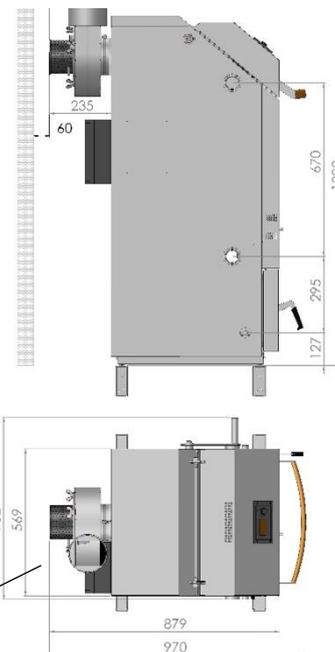


Figure 1. Dimensions of BH12 and BH18 and distance from walls

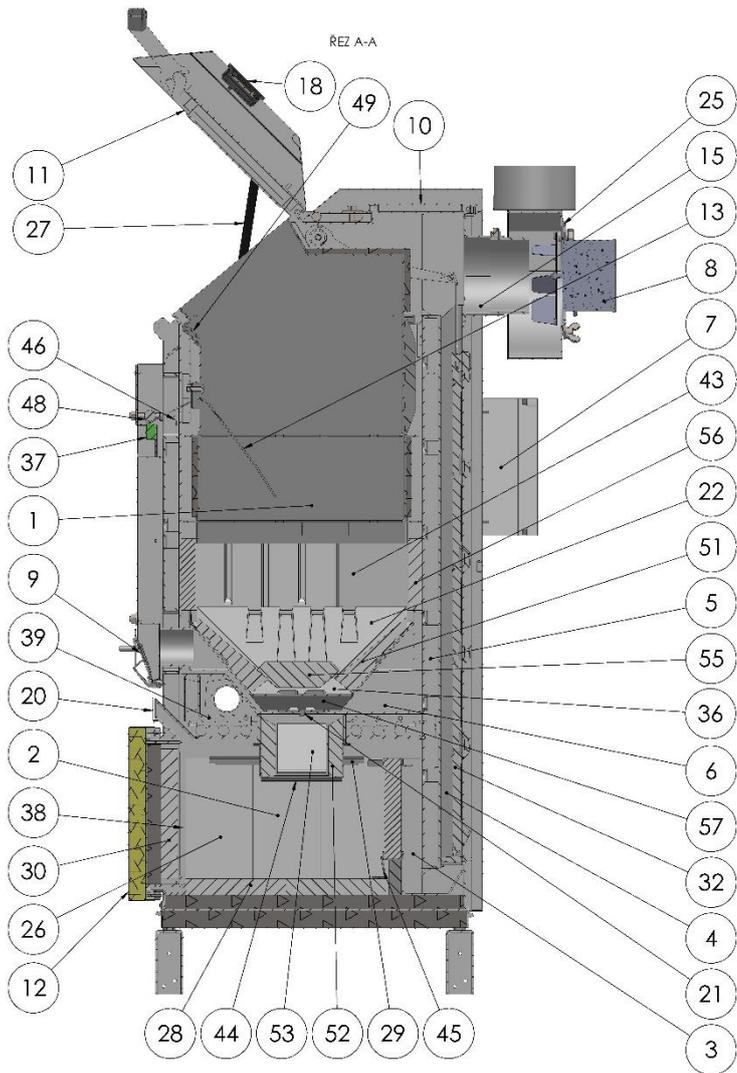


Figure 4. Cross section of the boiler BH25 and BH33

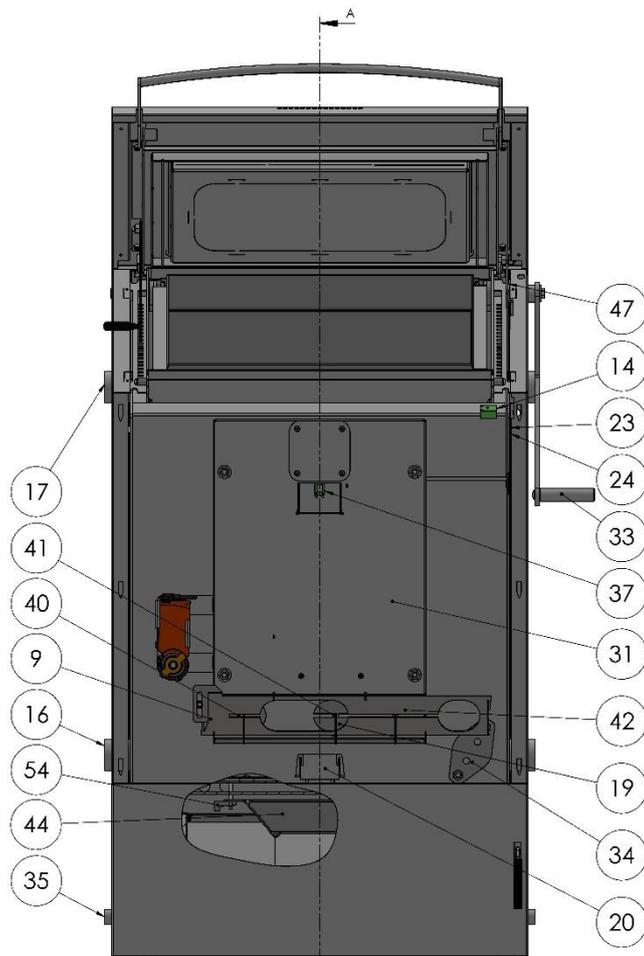


Figure 6. Boiler BH25 and BH33 without front cover

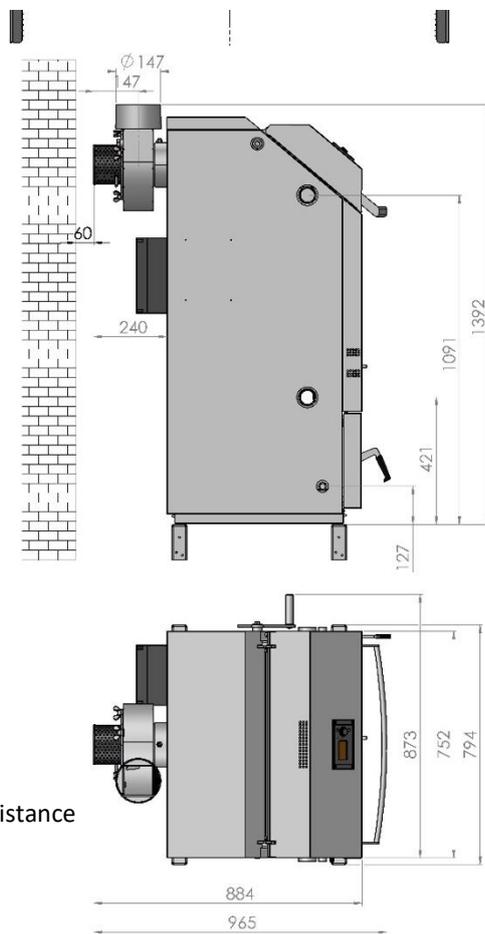


Figure 5. Dimensions of BH25 and BH33 and distance from walls

## Legend

1. Stoking chamber
2. Combustion chamber
3. Side flue gas exchanger
4. Rear flue gas exchanger
5. Boiler body
6. Protective sheath of refill chamber
7. Controller - module
8. Flue gas exhaust fan
9. Secondary air controller (sliding valve)
10. Rear exchanger lid
11. Stoking door
12. Bottom door
13. Stable heat detection arm
14. Stoking door sensor
15. Flue gas outlet
16. Inlet socket G 6/4" (inside)
17. Outlet socket G 6/4" (inside)
18. Controller control panel
19. Air valve (3x)
20. Sight glass with ceramic glass
21. Nozzle
22. Refractory on the bottom of the stoking chamber (4x\*,2x\*\*)
23. Emergency thermostat
24. Water temperature sensor
25. Flue gas temperature sensor
26. Side refractory in combustion chamber (6x)
27. Locking strut
28. Refractories on the bottom of the combustion chamber (6x\*,8x\*\*)
29. Support bar for combustion chamber refractories (3x side, 1x rear)
30. Bottom door refractory (3x\*,4x\*\*)
31. Air distribution panel
32. Turbulators (5x\*,7x\*\*)
33. Turbulator levers
34. Boiler water control thermostat
35. Drain and inlet socket 1/2"
36. Nozzle refractory (4x\*,8x\*\*)
37. Stable heat layer detection sensor
38. Side exchanger blind flange (2x)
39. Water distributor
40. Primary air inlet
41. Secondary air inlet
42. Pre-drying air inlet
43. Refractory lining (12x\*, 14x\*\*)
44. Connector
45. Rear exchanger collection hole blind flange
46. Thrust arm
47. Thrust mechanism connecting rod
48. Balancing arm
49. Pre-drying air outlet
50. Fire resistant grille
51. \*\*Long refractory on the bottom of the stoking chamber (2x)
52. \*\*Front connector refractory (2x)
53. \*\*Side connector refractory (2x)
54. \*\*Sprag (2x)
55. \*\*Center refractory (1x)
56. \*\*Additional refractory (2x)
57. \*\*Center of the nozzle

\*only for 12 and 18kW boilers

\*\*only for 25.and 33kW boilers

## **5 Boiler assembly and installation**

### **5.1 Boiler placement**

The boiler must be installed in compliance with the requirements of ČSN 061008 - Fire Safety of Thermal Equipment.

The boiler is supplied with transport legs, which allow for pallet truck transport. The legs are fastened with 4 M10 bolts. After the boiler is placed in the boiler room, the legs are dismantled and the bolts are refastened (to set the boiler).

There must be enough free space (see boiler diagram) around the boiler for maintenance or service.

To facilitate access, the control module from the rear wall of the boiler can be mounted on the side wall of the boiler or on the boiler room wall.

The boiler must be placed on a non-flammable, heat-insulating material exceeding its bottom door ground plan (10, 11) by at least 300 mm, and by at least 100 mm on the other sides.

The smallest allowable distance between the external outlines of the boiler and flammable materials (see specifications in ČSN EN 13501-1) must be at least 400 mm.

Flammable materials must not be placed on the boiler or at a distance smaller than the safe distance from the boiler.

### **5.2 Connection to a chimney**

Because the boiler is equipped with an exhaust fan, the chimney draft requirements are minimal. The cross-section of the chimney must not be less than 200 mm<sup>2</sup>. The height of the chimney should not be less than 3 m.

The flue duct only attached to the flue socket and mounted on the boiler exhaust pipe must be firmly assembled so as to avoid accidental or spontaneous loosening of the connecting pipes. An exhaust pipe longer than 2 m must be firmly anchored. All components of the flue duct must be made of non-flammable materials.

We recommend sealing gaps in the flue duct (joints) with a sealant designed for these purposes, or with aluminum foil tape. Aluminum foil tape can also be used to seal chimney door joints (overpressure may occur in the chimney during fire-up).

We recommend that the chimney flue be sufficiently heat-insulated and protected from cooling with a suitable location in the building. A chimney that is overcooled must be lined so as to prevent the condensation of vapors in the cooled flue gas and the seeping of condensate into the chimney.

We recommend providing suitable insulation for a flue duct longer than 1 m (e.g. mineral wool with outer aluminum foil). In a non-insulated flue duct, the flue gas is cooled, and during low-power operation there is a risk of condensation and flue gas humidity.

The minimum allowable flue gas temperature 1 m below the chimney's upper edge (mouth) is 90 °C.

The boiler must be connected to the chimney in accordance with the requirements of ČSN 73 4201:2008 Chimneys and flues.

### **5.3 Ensuring air supply to the boiler**

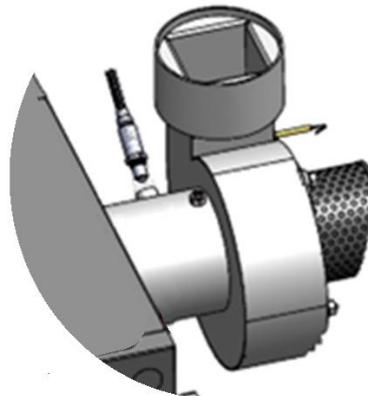
The air necessary for combustion can be supplied to the boiler directly from outside or from the living area. Air supply from the living area is in a sense more useful, because the air is ventilated and the air heat that would be lost during regular ventilation is used (approx. 2% of

heat is saved). At a nominated output, the air consumption is approximately 40 m<sup>3</sup>/hr. which corresponds with the hygienic minimum for air exchange in an apartment of usual size. If natural ventilation (micro ventilation of windows and doors) does not provide sufficient air, it is necessary to provide it through an outside opening of at least 50 cm<sup>2</sup>. The control grilles on the ventilation openings must be positioned so that they do not clog.

#### 5.4 Installation and operation of the lambda sensor

The boiler is supplied with a lambda sensor, which ensures continuous regulation of air supply for combustion. This results in more efficient combustion, saving fuel. Thanks to the lambda sensor, the controller knows the level of residual oxygen in the flue gas, and it determines the ratio of secondary and primary air for combustion by moving the air inlet orifice plate.

Lambda probe is supplied in the boiler together with other accessories and must be installed on the boiler after mounting on the flue pipe. Before installing the lambda sensor, make sure that the controller and the lambda sensor control module are disconnected from the mains! The fan has a threaded hole on which a lambda sensor can be installed, see picture no. 7. Then connect the lambda sensor to the control unit using a cable with a connector.



Installing the lambda sensor

#### 5.5 Heating system design, connection

**We recommend connecting the boiler to a buffer tank with a gravity circuit (Chapter 5.5.1).** If the installation does not allow this (the buffer tank is too distant or is below the boiler level), the connection is performed with a forced circuit (Chapter 5.5.2 and 5.5.3).

##### 5.5.1 Inlet and outlet connections:

The boiler inlet is placed into any of the 2 bottom G 6/4" sleeves. The boiler outlet is connected to any of the 2 top G 6/4" sleeves. The remaining sleeves are blinded or used for a parallel branch (see below). It is also possible to place a drain and inlet valve into an unused inlet sleeve.

##### 5.5.2 Buffer tank size:

The boiler must be connected to a buffer tank (or tanks) with a minimum volume according to the following table. If the boiler output significantly exceeds the heat loss of a building \* (e.g. 1.5 times), we recommend that the tank volume be proportionally bigger (i.e. at least 1.5 times). A greater volume is also selected when the boiler service intervals are greater than 12 hours. However, we do not recommend a larger tank volume than twice the minimum value (see table) due to disproportionate financial cost and high heat loss.

Table 4. Buffer tank volume

Boiler	12kW	18kW	25kW	33kW
--------	------	------	------	------

Minimum volume (l)	700	1000	1500	2000
Maximum volume (l)	1500	2000	3000	4000

\* The method of determining the heat loss of a building is described in Chapter 8.3.

### 5.5.3 Why is there no need for boiler-tank mixing in the circuit:

The boiler is equipped with integrated mixing (with a thermostat); it can therefore be connected to a buffer tank directly without a mixing branch and valve (Ladomat, etc.).

### 5.5.4 Why is a check valve installed in the boiler-tank circuit:

We recommend placing a suitable valve into the boiler-tank circuit, which will prevent tank-boiler re-circulation while the tank is hot and the boiler isn't working (The heat output that escapes into the boiler room is 100-300W depending on the temperature in the tank). For more information on the valve, see chapter 5.4.5e

**i** If the height of the buffer tank is significantly above the boiler, the check valve is not required.

### 5.5.5 Connecting the boiler - buffer tank with gravity circulation (without a pump):

When the storage tank is near the boiler, we recommend a gravity boiler-tank circuit (without a pump, with a larger pipe dimension) - see connecting diagrams (Chapter 5.5). Advantages of a gravity connection include reliability and operational savings (for electricity and pump maintenance), similar cost to forced connection (more expensive piping is compensated by savings for the pump and accessories).

\* The gravity "boiler - buffer tank" circuit must be designed to transfer the boiler's nominal power at a

temperature gradient of 90/60 °C. This is achieved if the following conditions are met:

- The total pipe length is up to 4 m.
- The copper pipeline has a diameter of 28mm in a 12kW boiler, 35mm in a 18kW boiler, and 42mm in a 26 and 33kW boiler. If steel pipes are used, they must have a diameter of 6/4" (for all boiler types).
- The number of elbows does not exceed 3 or the number of arches does not exceed 6.
- The boiler and tank are at least at 1 height level (floor). The inlet into the tank is at least 50 cm (80cm for a 33kW boiler) above the boiler outlet. If the height of the ceiling enables it, it is recommended to place the tank higher (10-50cm).
- If there is a check valve, its pressure loss must be less than 0.3 mbar (at nominal power and gradient of 60/90 °C) ( $K_v < 3 \text{ m}^3/\text{hr.}$ ). This is true for the gravity valve specially developed for this type of boiler supplied by BLAZE HARMONY s.r.o. A standard horizontal valve (floating) is inappropriate for high pressure loss.

### 5.5.6 Connecting boiler-buffer tank with forced circulation (with a pump)

For correct operation of integrated mixing, the pump in the boiler circuit must be located in a bypass branch with an ejector (see Chapter 5.5).

The advantage of this connection is the ability of gravity circulation (the pump with a filter does not limit flow). It is necessary to use Cu 28mm tubing. In this connection the circulation is mostly gravitational (the pump switches on only when the boiler temperature exceeds 85

°C, for example). The ejector part can be assembled from standard soldered Cu fittings, or supplied completely by BLAZE HARMONY s.r.o.. We recommend installing a pump with smaller power (approx. 25-40W).

The return check valve must enable a gravity circulation according to 5.4.5 e

Installations where the buffer tank location does not allow even partial gravity connection (buffer is below the level of boiler) the boiler pump is installed „directly“ at the return pipe from the buffer to the boiler (see Chapter 5.5). The return check valve does not need to enable a gravity circulation according to 5.4.5 e

### 5.5.7 Residual boiler power

The connection must be designed to ensure that the residual boiler power is drained, e.g. due to a power failure (In the event of a power failure, the air valve closes and the burning is stopped, but the hot fuel layer and the walls continue to release heat for about 1 hour. The amount of residual heat is 5-10MJ depending on the actual power and level of fuel burning.)

### 5.5.8 The best way to drain residual heat

The best way to ensure the draining of residual power is to connect the boiler to a **buffer tank** with a circuit that allows the residual power to be drained through gravity circulation (see recommended connections) (With a 1000 l tank, the residual power will cause an increase in temperature by 2-4 °C).

### 5.5.9 Other methods of draining residual heat

If a buffer tank cannot be used to drain residual heat (if the tank is too far from the boiler or is located below the boiler), another method must be chosen, e.g.:

1. Install a combined DHW tank in the gravity branch (it drains the extra heat if the pump fails). The DHW tank volume should be at least 120 l (the residual power will cause a temperature increase of 10-20 °C). The DHW outlet from the boiler can be fitted with a thermostatic mixing valve (to prevent scalding).
2. Use a backup power source on the circulation pump.
3. Use a suitably connected **open expansion vessel** (excess power is drained by boiling when the pump fails). For more information, see Chapter 5.4.11.
4. Connecting **an emergency cooling system** (see Chapter 5.6).

### 5.5.10 Water

We recommend using soft water without mechanical impurities that is chemically inactive to fill the boiler. The draftsman may also suggest appropriate additives for water in the heating system.

### 5.5.11 Open expansion vessel

If there is an open expansion vessel in the system, it must be placed so that it does not freeze; oxidation can be reduced by a thin layer of oil on the surface. The volume must be at least 5% of the total water volume in the system.

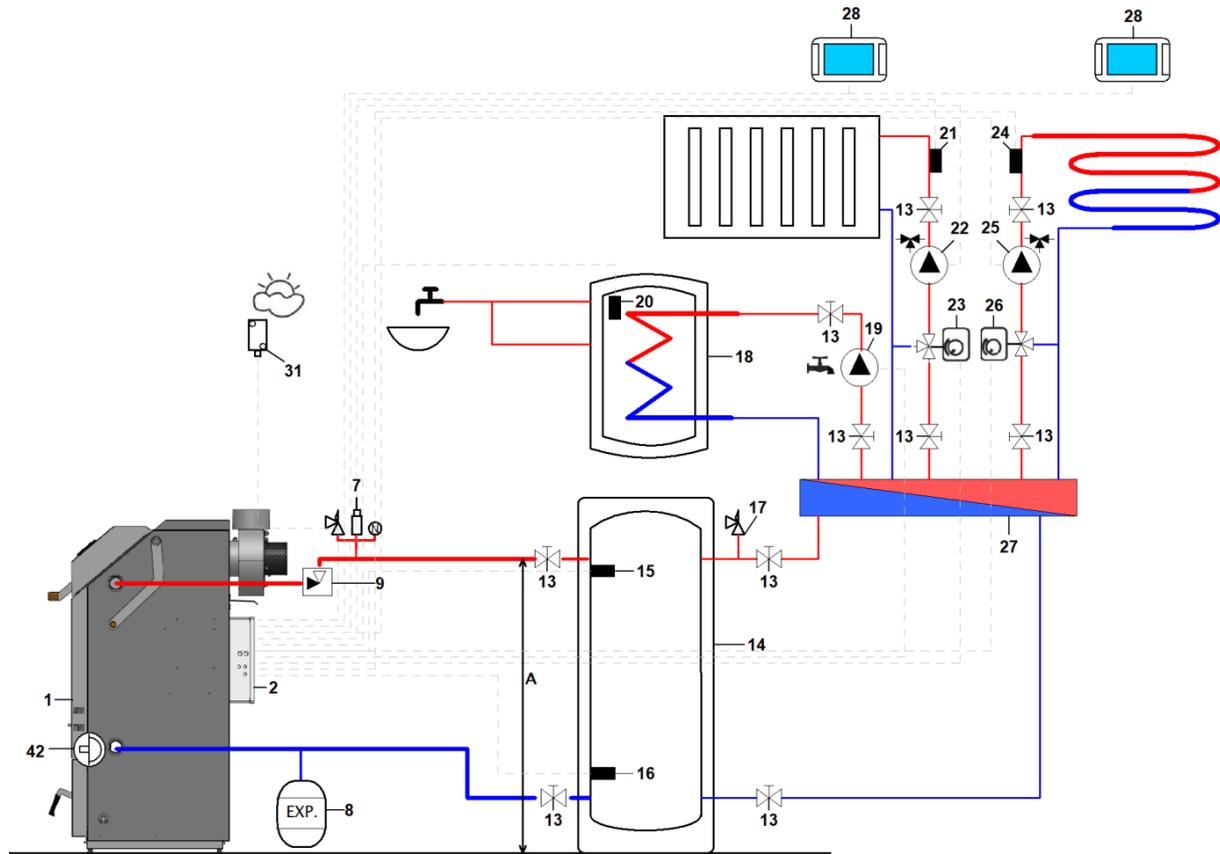
### **5.5.12 Connecting the boiler to an existing system**

If the boiler is installed instead of another type of boiler and the mixing valve with "return" protection or Ladomat remain in the circuit, the overall functionality of the connection must be assessed with regard to the draining of residual heat, and appropriate safety devices must be installed in accordance with Chapters 5.4.8 and 5.4.9, if necessary.

## 5.6 Diagrams of connections

### 5.6.1 Diagram 1 – Gravity connection boiler-buffer tank

Thermal relief valve for excess heat dissipation is not connected.



1 – boiler, 2 – controller, 7 – safety group (pressure valve, manometer, safety valve), 8 – expansion vessel, 9 – special gravity back-flow valve, 11 – filter, 13 – valve, 14 – buffer, 15 – upper buffer temp. sensor (CT4), 16 – lower buffer temp. sensor (CT4), 17 – air-vent valve, 18 – HDW tank, 19 – HDW pump, 20 – HDW temp. Sensor (CT4), 21 – mixer 1 temp. Sensor (CT4), 22 – mixer 1 pump, 23 – mixer 1 valve actuator, 24 – mixer 2 temp. Sensor (CT4), 25 – mixer 2 pump, 26 – mixer 2 valve actuator, 27 – manifold/collector, 28 – ecoSTER, 31 – outdoor temp. Sensor, 42 – integrated anti-condensation thermostat

Model	A – distance from floor of entry into buffer	Dimension of copper piping between boiler and buffer tank	Dimension of steel piping between boiler and buffer tank
BLAZE HARMONY 12	140 cm	28 mm	6/4"
BLAZE HARMONY 18	160 cm	35 mm	6/4"
BLAZE HARMONY 25	160 cm	42 mm	6/4"
BLAZE HARMONY 33	190 cm	42 mm	6/4"

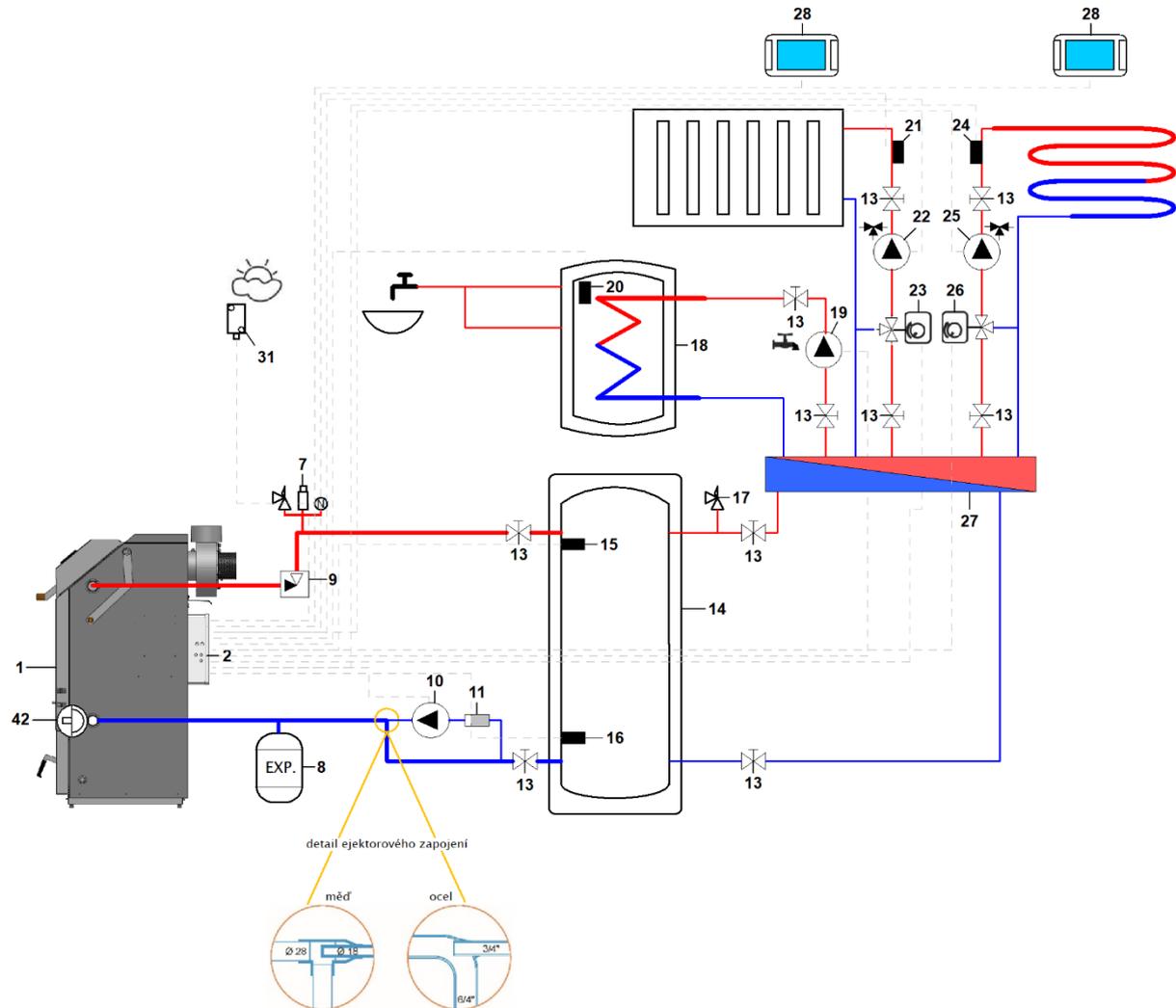
It is necessary to assure conditions for gravity connection, see Chapter 5.4.5

The hydraulic diagram shown does not replace the central heating project and only serves as an example!

## 5.6.2 Diagram 2 – combined connection boiler – buffer, with pump in ejector

Self-weight circulation works 70-80% of the time, the pump only switches on at the end of charging the buffer tank (at 80 ° C on the boiler).

**Thermal relief valve for excess heat dissipation is not connected.**



1 – boiler, 2 – controller, 7 – safety group (pressure valve, manometer, safety valve), 8 – expansion vessel, 9 – special gravity back-flow valve, 10 – boiler pump, 11 – filter, 13 – valve, 14 – buffer, 15 – upper buffer temp. sensor (CT4), 16 – lower buffer temp. sensor (CT4), 17 – air-vent valve, 18 – HDW tank, 19 – HDW pump, 20 – HDW temp. Sensor (CT4), 21 – mixer 1 temp. Sensor (CT4), 22 – mixer 1 pump, 23 – mixer 1 valve actuator, 24 – mixer 2 temp. Sensor (CT4), 25 – mixer 2 pump, 26 – mixer 2 valve actuator, 27 – manifold/collector, 28 – ecoSTER, 31 – outdoor temp. Sensor, 42 – integrated anti-condensation thermostat

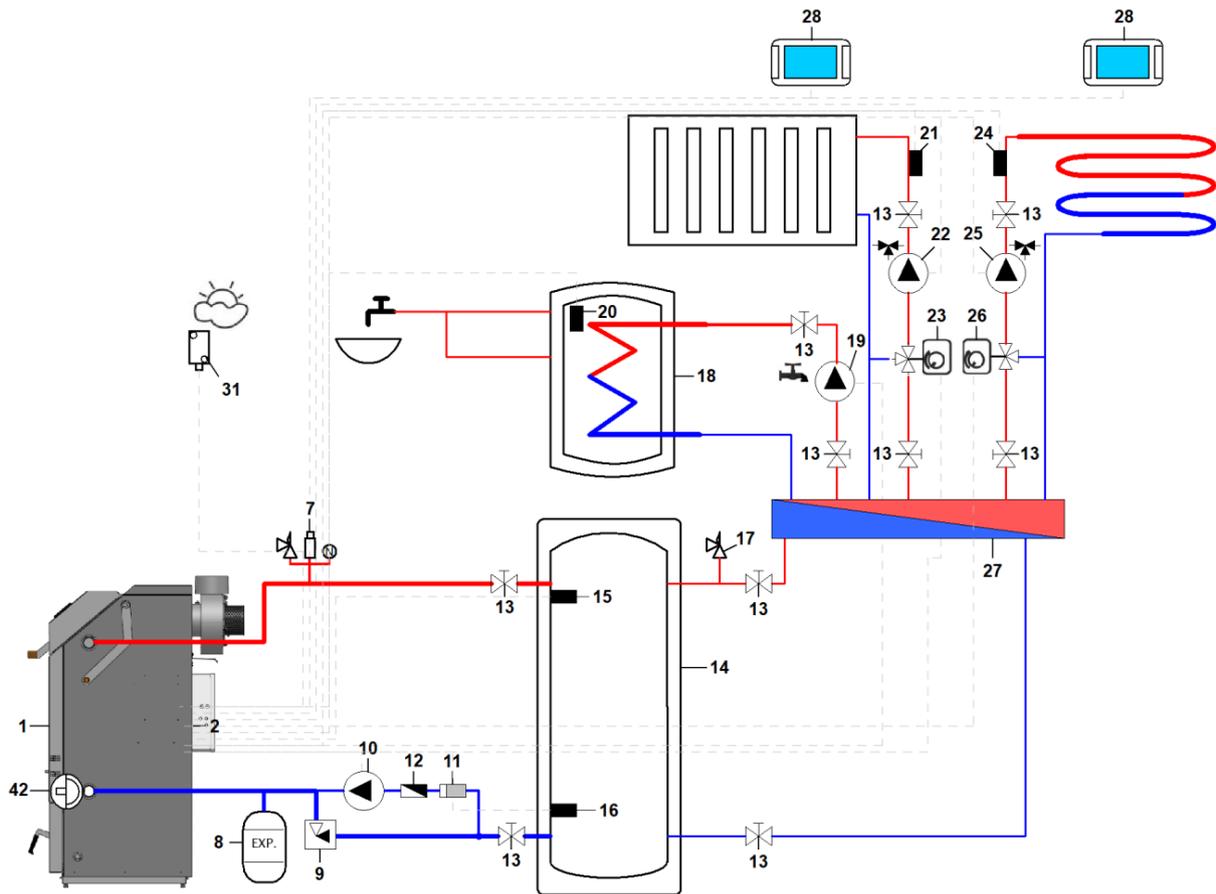
Pipe dimension between boiler and buffer tank is 28mm (Cu).

**The hydraulic diagram shown does not replace the central heating project and only serves as an example!**

### 5.6.3 Diagram 3 – combined boiler – tank connection, pump in bypass with non-return valve

Self-weight circulation works 70-80% of the time, the pump only switches on at the end of charging the buffer tank (at 80 ° C on the boiler).

**Thermal relief valve for excess heat dissipation is not connected.**



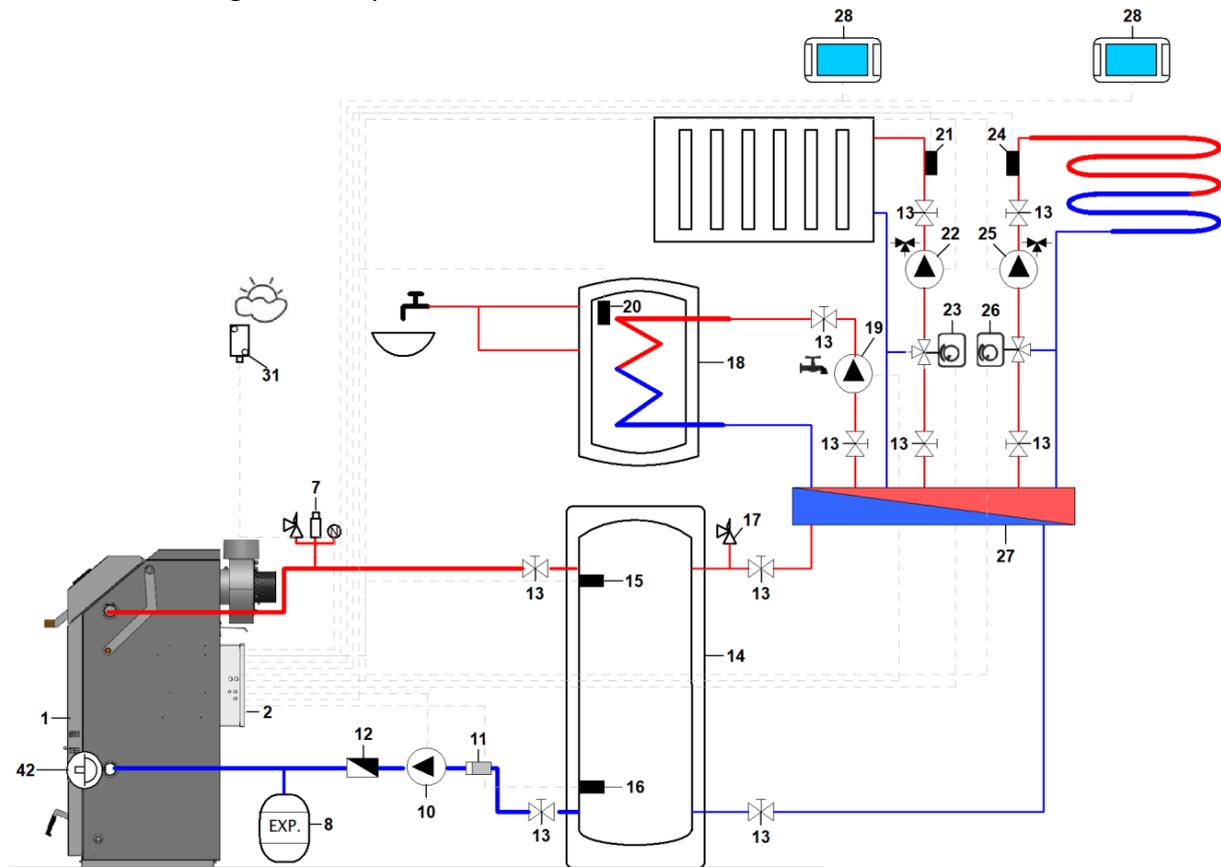
1 – boiler, 2 – controller, 7 – safety group (pressure valve, manometer, safety valve), 8 – expansion vessel, 9 – special gravity back-flow valve, 10 – boiler pump, 11 – filter, 12 – back-flow valve, 13 – valve, 14 – buffer, 15 – upper buffer temp. sensor (CT4), 16 – lower buffer temp. sensor (CT4), 17 – air-vent valve, 18 – HDW tank, 19 – HDW pump, 20 – HDW temp. Sensor (CT4), 21 – mixer 1 temp. Sensor (CT4), 22 – mixer 1 pump, 23 – mixer 1 valve actuator, 24 – mixer 2 temp. Sensor (CT4), 25 – mixer 2 pump, 26 – mixer 2 valve actuator, 27 – manifold/collector, 28 – ecoSTER, 31 – outdoor temp. Sensor, 42 – integrated anti-condensation thermostat

Pipe dimension between boiler and buffer tank is 28mm (Cu).

The hydraulic diagram shown does not replace the central heating project and only serves as an example!

#### 5.6.4 Diagram 4 – forced connection with gravity emergency cooling

Circulation is fully forced during operation; in the event of a power failure, limited gravity circulation manages to dissipate residual heat to the tank.



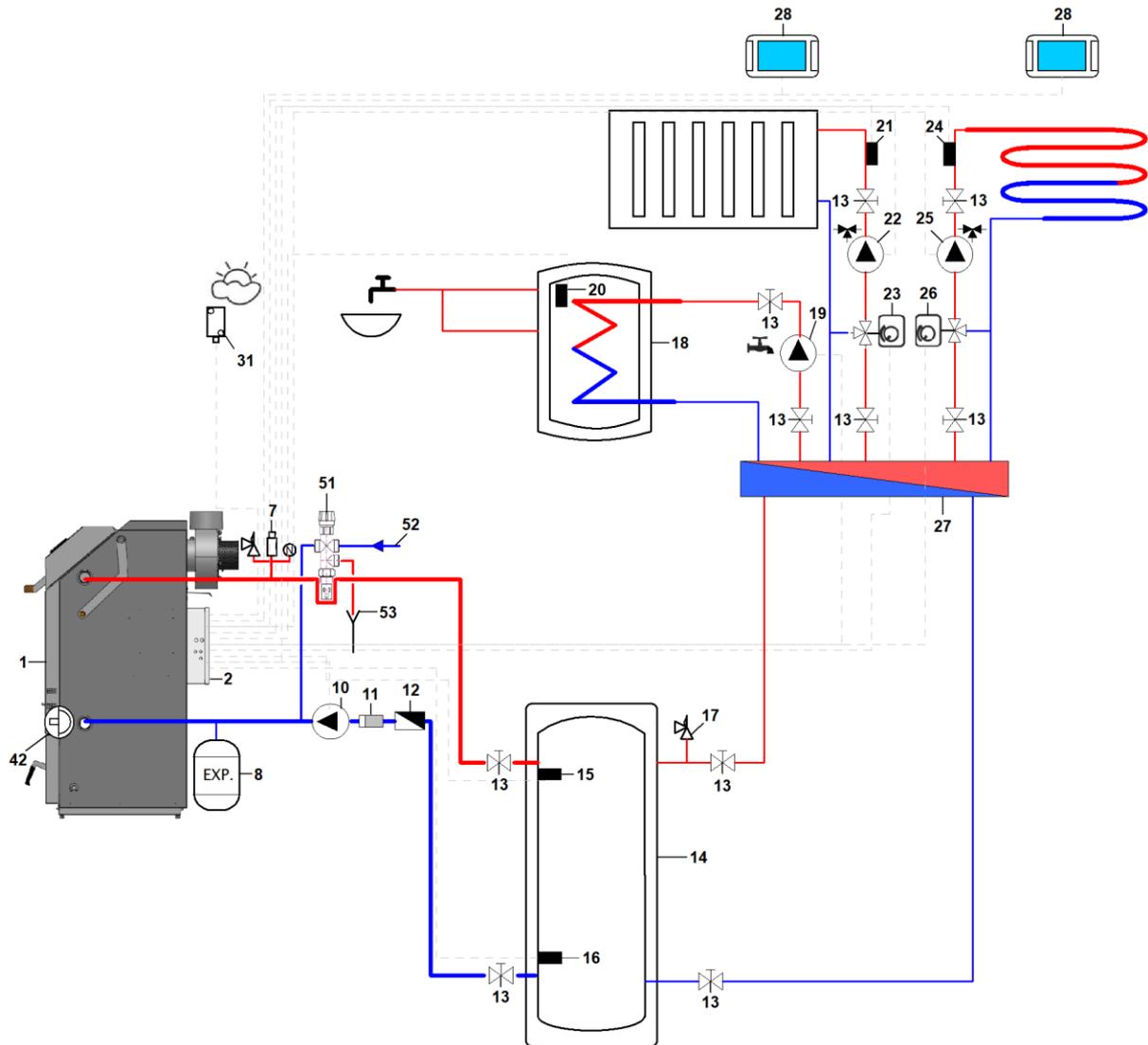
1 – boiler, 2 – controller, 7 – safety group (pressure valve, manometer, safety valve), 8 – expansion vessel, 10 – boiler pump, 11 – filter, 12 – back-flow valve, 13 – valve, 14 – buffer, 15 – upper buffer temp. sensor (CT4), 16 – lower buffer temp. sensor (CT4), 17 – air-vent valve, 18 – HDW tank, 19 – HDW pump, 20 – HDW temp. Sensor (CT4), 21 – mixer 1 temp. Sensor (CT4), 22 – mixer 1 pump, 23 – mixer 1 valve actuator, 24 – mixer 2 temp. Sensor (CT4), 25 – mixer 2 pump, 26 – mixer 2 valve actuator, 27 – manifold/collector, 28 – ecoSTER, 31 – outdoor temp. Sensor, 42 – integrated anti-condensation thermostat

Pipe dimension between boiler and buffer tank is 28mm (Cu).

The hydraulic diagram shown does not replace the central heating project and only serves as an example!

### 5.6.5 Diagram 5 – forced boiler-tank circuit

Only for installations when the accumulator tank is below the boiler level  
**Thermal relief valve (51) for excess heat dissipation is connected.**



1 – boiler, 2 – controller, 7 – safety group (pressure valve, manometer, safety valve), 8 – expansion vessel, 10 – boiler pump, 11 – filter, 12 – back-flow valve, 13 – valve, 14 – buffer, 15 – upper buffer temp. sensor (CT4), 16 – lower buffer temp. sensor (CT4), 17 – air-vent valve, 18 – HDW tank, 19 – HDW pump, 20 – HDW temp. Sensor (CT4), 21 – mixer 1 temp. Sensor (CT4), 22 – mixer 1 pump, 23 – mixer 1 valve actuator, 24 – mixer 2 temp. Sensor (CT4), 25 – mixer 2 pump, 26 – mixer 2 valve actuator, 27 – manifold/collector, 28 – ecoSTER, 31 – outdoor temp. Sensor, 33 – safety cooling coil, 42 – integrated anti-condensation thermostat, 51 – thermal relief valve, 52 – cold water inlet, 53 – waste disposal

**The hydraulic diagram shown does not replace the central heating project and only serves as an example!**

## 5.7 Connecting self-cooling

If the boiler connection does not enable other residual power drainage (see Chapters 5.4.7 - 5.4.9), it is necessary to connect a self-cooling system with water from the water supply system.

The boiler enables direct cooling with domestic water (no coolant loop). The cooling water is supplied to the boiler via an emergency thermostatic valve. The valve is usually mounted on unused sleeves on any side of the boiler - see Fig. 2. The valve and 3/4" connecting pipe can also be placed on the boiler outlet and inlet pipes (a T-piece is inserted instead of an elbow). The valve is not supplied with the boiler; it can be ordered from the accessories selection.

Domestic tap water is used for cooling with a max. inlet pressure of 4 bar (a pressure regulator can be connected at higher pressure). The water supply must not be dependent on the power supply (domestic waterworks cannot be used). The cooling water outlet is usually drawn into the drain by a hose. A filter must be installed on the cooling water inlet.

If the water temperature in the boiler exceeds 93°C, the thermostatic valve opens, and cold water from the water supply system flows into the boiler via the 3/4" connecting pipe. Hot water flows out of the valve outlet and into the drain.

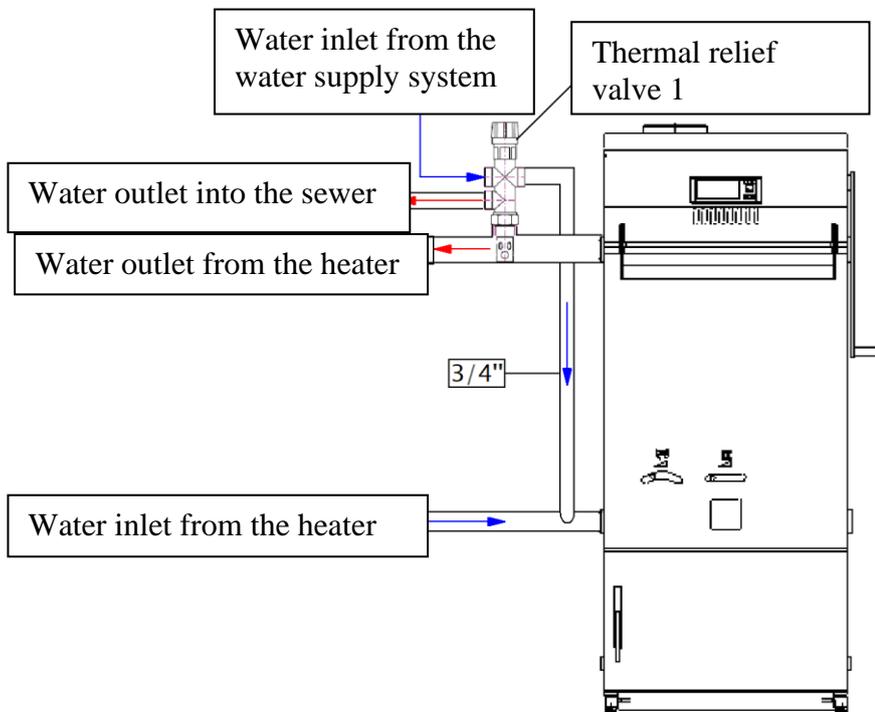


Figure 8 Connecting self-cooling

## 5.8 Electrical connection

Electrical connection information is in a separate document titled "Controller operation and installation manual", which is supplied with the boiler.

## 6 Boiler operation by the user

In order to achieve good and safe function, the boiler must be operated in accordance with the instructions given in the boiler operating manual and the controller operating manual (separate document).

### 6.1 Fire-up

Before fire-up, it is necessary to check and potentially ensure:

- Whether the buffer tank with the heated building are extracting the produced heat (see Chapter 6.3).
  - The functioning of the heating system (amount of water - pressure, whether it is frozen, ...)
  - The tightness of the top and bottom doors
  - The functioning of flue ducts (condition, tightness, ...)
  - The functioning of the stoking and combustion chambers (condition, proper assembly ...)
  - Whether the side and rear heat exchanger, or the combustion and stoking chamber, are overly fouled
- 1) Lift the door handle, wait for a few seconds until the fan is running on full power.
  - 2) If there is enough charcoal left at the bottom of the boiler (at least 20 cm), it is usually enough to light a piece of paper and throw it on the layer of charcoal, followed by a few pieces of fuel. By doing so, the flames will not rise upwards but flow through the layer of charcoal, igniting it.
  - 3) If there is not enough charcoal at the bottom of the boiler, stack small logs in the stoking chamber. Stack them with gaps between them (crossed). This layer should roughly fill the bottom tapered part of the refill chamber. Stack small wood chips or cuttings on this layer. Place lit crumpled paper on the wood chips. It is advisable that the paper covers a large portion of the bottom profile so that the flames do not burn upward but downward through the layer of wood. You can use paperboard or several logs.
  - 4) Close the door partially, leaving a 1 to 2 cm opening (do this by closing the door with the handle pressed down). Allow to burn as necessary (about 5 minutes).
  - 5) When you are sure that the fire is burning (by looking through the sight glass or the rising flue gas temperature), load the boiler with fuel (see Chapter 6.2). With a correct fire-up, the boiler reaches the nominal power within 30 minutes. If the flame is going down or dying, the top door can be opened to fire it up.



*After fire-up, the controller maintains the boiler's output at a higher value to allow the fuel to burn sufficiently and to heat the walls, then it automatically switches to the value set by the operator.*

**It is forbidden to use flammable liquids for fire-up. During operation, it is forbidden to increase the boiler's nominal output in any way.**



**No flammable objects should be placed near the boiler. The ash must be placed in non-flammable containers with a lid.**

## 6.2 Stoking

- 1) Lift the door handle, wait for a few seconds until the fan is running on full power. Slowly open the top door to about 5 cm, and wait for a few seconds until the fan exhausts any wood gas. When you are sure that sudden combustion of wood gas cannot occur (there is no dense smoke in the stoking chamber), open the door.
- 2) Fill the chamber with fuel. If the base layer is thin, add a few small pieces of fuel.
- 3) Close the door. After 2 minutes (default setting) the controller automatically switches to FIRE-UP or OPERATION mode, depending on the current flue gas temperature.
- 4) If a flame does not appear in the combustion chamber or it dies after a while, slightly open the upper door again and let the fuel fire up for a few minutes.



**Do not stir or press the hot base layer to prevent clogging of the nozzle.**

**If the base layer is small, the first few logs should also be small.**

**Place the logs parallel to the front wall of the boiler. Place them close together so that there is as little space between them as possible. The logs should not be longer than 33/50 cm. Longer logs may get stuck, which could prevent the fuel from sliding as well as proper combustion. The last logs should be smaller (they easily break down into the base layer).**

**Wood briquettes of regular quality increase their volume, lose their consistency and expand (swell) at a certain stage of burning. If they are stacked tightly in the boiler (without gaps), they are pushed up against the walls of the stoking chamber and do not slide down. When stoking, it is therefore necessary to leave space between the briquettes and the walls of the stoking chamber (poor them loosely). On the contrary, high-quality wood briquettes (their volume does not increase during combustion) can be placed close to each other.**

**Loose fuel (sawdust, chips) should be freely poured into the stoking chamber. Do not press it down, this would make it harder for it to slide down. Before inserting the fuel, it is advisable to place a few small logs, cuttings, etc. on the hot layer to prevent the fuel from falling through the nozzle.**

**You can prevent smoke during stoking by inserting new fuel when the previous fuel burns out so that only hot charcoal residues remain in the refill chamber - the base layer.**

You can insert the fuel by first opening the door partially and only inserting 3 to 4 logs; this will cover the hot layer, preventing the release of excessive smoke. Then, open the door fully and add more fuel.

If smoke enters the boiler room during stoking, check whether there is sufficient air supply into the boiler room, or open the window when inserting fuel into the boiler.

During stoking, it is advisable to clean the rear exchanger by turning the turbulator lever (the lever should be moved to both extreme positions). Leave the lever in the forward position. The recommended cleaning interval is once a day.



**Do not open the bottom door when the boiler is running; this will interrupt the combustion and there is a risk of smoke entering the boiler room.**

## 6.3 Amount of added fuel, stoking intervals

Usually, the stoking chamber filled up. **However, if the heat dissipation is small and the buffer tank is hot, it is necessary to extend the stoking intervals or add smaller amounts of fuel.**

We do not recommend adding less fuel than half of the volume of the stoking chamber; with a small amount of fuel, the burning time can be shortened so much that a good stable heat layer is not formed - the residual fuel is not completely carbonized and it smoulders. In the case of a smaller fuel batch, turn off the automatic stable heat function.

**Do not add fuel to the chamber if the buffer tank is hot - there is a risk of overheating and an emergency shutdown of the boiler.**

If the heating system and buffer tank are unable to absorb the heat from the fuel, this would result in overheating (temperature above 95°C) and an emergency shutdown of the boiler with the burned fuel. During a shutdown, the burned fuel creates smoke, and the flue and air paths in the boiler are fouled with moisture and tar. This endangers the proper functioning, reduces the life of the boiler and chimney and pollutes the air.



**Overheating creates the risk of blocking the turbulators with tar.**

**The time for which the boiler is overheated is calculated and stored in the controller's memory. If it exceeds 200 hours, the boiler warranty expires.**



*A stable heat shutdown is not detrimental to the life or ecology of operation, because it occurs with a primary hot layer of charcoal residues that do not contain volatile flammable substances and moisture.*

#### **6.4 Setting the required output**

The boiler output can be controlled by two parameters that are set on the controller (after pressing the top button):

- Required boiler output (50 – 150 %)
- Maximum boiler water temperature (60 – 95 °C)

We recommend setting the "Maximum water temperature" parameter to 95°C and adjusting the boiler output by setting the "Required boiler output" parameter.

*\* If automatic water cooling is connected to the water supply system, set the maximum water temperature to 90 °C.*

**Do not operate the boiler at a higher output than necessary! This unnecessarily reduces the running time and prolongs the downtime. We recommend setting the "Required boiler output" parameter to 50% to 70%, and if the output is insufficient during a greater heat demand (in winter), increase it as necessary.**

*\* When burning fuel of lower quality (large logs, fuel with higher moisture content), we recommend setting the max. boiler output to 60% or 70% to produce high-quality combustion.*



*Controller always primarily keeps boiler output. When the required boiler output is too high and water temperature rises up to value "Maximum water temperature" then the controller reduces boiler output automatically.*

## 6.5 Setting automatic stable heat

The boiler is equipped with an automatic stable heat function, which allows the controller to turn off the fan. The base layer remains hot in the boiler for another 6-10 hours, eliminating the need for another fire-up. The burnout of the base layer is detected by a moving detection arm, which is built into the front wall of the stoking chamber. When fuel is added, this arm is pushed on the wall by the fuel. During operation, the fuel level gradually decreases and the arm is gradually exposed. When the fuel level drops below the end of the detection arm, the arm is released and it tilts into the stoking chamber due to a counterweight. This activates the sensor (in the air panel), which informs the controller that a residual layer of the maximum set size (100%) is in the boiler. A red log appears on the display in the boiler power information section. If the stable heat layer size (user parameter on the controller) is set to 100%, the controller will shut down the boiler into stable heat shutdown immediately after the tilting of the detection arm. If the stable heat layer size is set (by the operator) to a lower value (90-10%), the boiler continues for some time in OPERATION mode so that part of the residual fuel still burns out and the stable heat layer reaches the desired size. During this burning, the symbol of the wooden log flashes.

After fuel is added, the detection arm is pushed back to the wall by the fuel, and the color of the wooden log changes on the display.



*When the stoking door is opened, the thrust mechanism coupled with the door presses the detection arm against the wall of the stoking chamber to prevent it from blocking the fuel. When the door is closed, the thrust mechanism releases the arm again.*

The transition into a stable heat shutdown (detected by the arm) is also dependent on the expiry of 30 minutes (service parameter) from the last stoking (opening of the door). During this time, the log on the display is yellow (see Figure ...). This function prevents an unwanted shutdown of the boiler when the boiler only has a small layer of fuel. When the door is open for less than 10s (service parameter), this function is not activated (the time in OPERATION mode is not reset.)

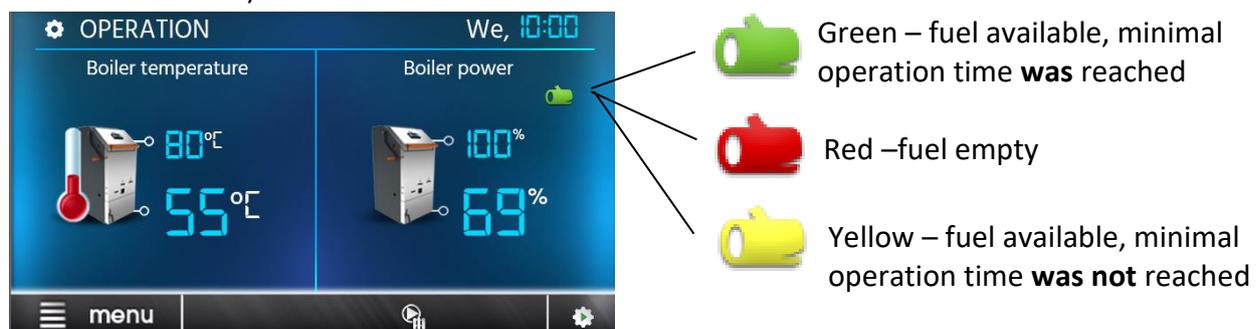


Figure 9. Visualisation of fuel signalization

An optimum base layer should roughly fill the bottom tapered part of the stoking chamber. The base layer must not contain smoldering fuel residues, because they foul the boiler with tar during a shutdown.

The size of the base layer can be set as a user parameter on the boiler's controller.

If the automatic stable heat function is switched off (there is no square on the display), the boiler switches off when the fuel burns out completely and the flue gas temperature drops below the set value (service parameter).

## 6.6 Inspection and adjustment of combustion

During operation, ensure that the combustion occurs as perfectly as possible. Imperfect combustion reduces efficiency and creates an excessive amount of harmful substances (hydrocarbons, especially tar) that pollute the atmosphere and foul the boiler and flue ducts. The quality of combustion is not only determined by the type and moisture content of the fuel, but it can also be significantly affected by the way we place the fuel in the boiler and how we control the output.

The quality of combustion can be assessed during operation according to the flames by looking into the sight glass (see next chapter). The smoke coming out of the chimney is not visible during high-quality combustion. Light white smoke that immediately clears away is not a defect, it is caused by the steam generated by combustion.



**A good amount of secondary air is a condition for good combustion.**

Excessive secondary air causes excess air to not engage in the combustion, cools the flame and drains heat into the chimney without any benefit. The flame is sharp, jagged or there is none at all - the charcoal residues in the combustion chamber that the flame is touching have a pale yellow color - **it is necessary to restrict the amount of secondary air (move the shutter to the left).**

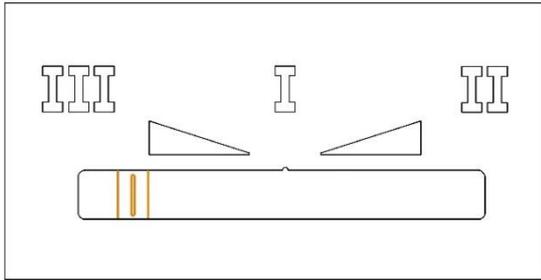
Insufficient secondary air causes part of the combustible substance to not burn, and it is drained into the chimney. The flame is long, sometimes there is smoke - the color of the charcoal residues in the combustion chamber that the flame is touching have the same color on the entire surface. Smoke that does not clear away even when the humidity is low is coming out of the chimney - **it is necessary to increase the amount of secondary air (move the shutter to the left).**



*Do not confuse smoke and steam. The flue gas contains water, which condenses above the chimney and produces a fog (similar to gas heaters). Usually (if humidity is low) the fog will dissolve (evaporate) within a few meters.*

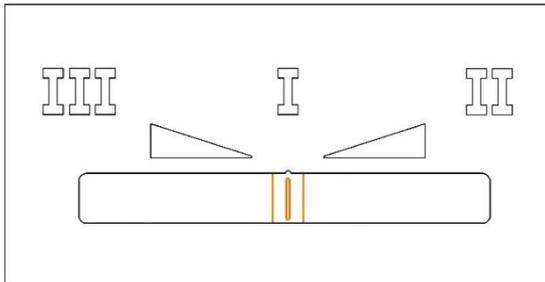
The amount of secondary air is adjusted with the sliding shutter (position 9).

## Oriental secondary air setting according to fuel type:



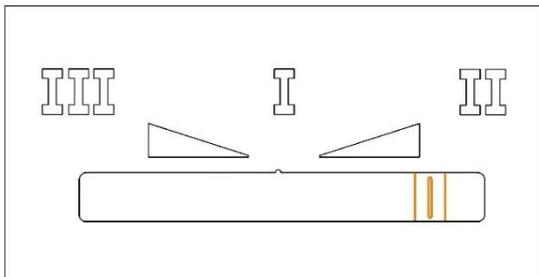
- Softwood, large uncut logs - small amount of secondary air (maximum primary and pre-drying air) - shutter on the left.

Figure 10. Shutter on the left



- Regular wood - shutter in the center.

Figure 11. Shutter in the center



- Hard wood (beech, oak), dry chips, wood briquettes - large amount of secondary air - shutter on the right.

Figure 12. Shutter on the right



*Secondary air control takes place automatically (optional) with the lambda probe and control module. The lambda probe can be additionally installed on the boiler.*

## 6.7 Ash removal, cleaning the exchanger

The ash from the combustion chamber (2) is collected when the central thickness of the layer is greater than 5 cm. Ash is either removed cold or before fuel is added, when there is minimum fuel in the boiler.

The ash from the bottom of the refill chamber usually doesn't need to be removed - it is pulled through the nozzle into the combustion chamber during operation.

Every time the bottom door is opened, it is necessary to remove the ash from the bottom horizontal rim. The ash would prevent the door from closing and it could be damaged.

With each ash removal, remove the side exchanger (3) front blinders (38) and remove the deposits from the side walls with a scraper.

**The rear flue gas exchanger is cleaned by moving the turbulator lever, preferably after each stoking. The lever must always be pushed to both extreme positions. Neglecting regular cleaning of the exchanger (by moving the turbulator lever) may result in the clogging and blocking of turbulators. Subsequent commissioning can be very difficult (requires opening the heat exchanger cover, pulling out individual turbulators, cleaning and subsequent assembly)**

Deposits on the ceiling of the combustion chamber and the rear wall behind the refractories are not removed.

The bottom door is opened and the ash is removed when the boiler is cold, or when there is a minimum amount of fuel in the stoking chamber (only the base hot layer).

Ash and debris underneath the exchanger do not need to be removed - only a small amount is generated during proper operation; they are pulled down by the flue gas and settle in the chimney catchment space. Nevertheless, we recommend removing the blind flange (45) once a month and checking for or removing any deposits in the area under the rear exchanger. We also recommend removing any deposits from the wall behind the rear refractories using a hook.

The ash must be placed in non-flammable containers with a lid.



*Wood ash is health and environment-friendly, and it can be used as fertilizer (it mostly contains calcium and potassium).*

## 6.8 Shutting down the boiler

When shutting down the boiler for a long period of time, we recommend cleaning its heat exchanging surfaces and collecting the ash from the boiler (see Chapter 6.7.).

Once a heating season we recommend removing the refractories from the bottom combustion chamber, cleaning the boiler walls and removing the ash. When reassembling, we recommend rotating all the refractories so that their opposite side is exposed to the heat. This will increase their durability.

## 6.9 Operating inspection and maintenance

### Boiler and heating system

The operator is obliged to continuously inspect the device and perform necessary maintenance according to the manufacturer's manual. No special qualification is required for this, training in commissioning the boiler is sufficient.

It is necessary that the boiler is occasionally checked by the operator. It is especially necessary to make sure that the temperature does not exceed 95 °C. It is also necessary to monitor the amount (pressure) of water in the system.

The state of the ceramic refractories and the tightness of both doors must be continuously inspected.

### Chimney and flue ducts

It is necessary to check the tightness and placement of the flue duct and the patency of the chimney flue. A layer of fly ash builds up in the chimney during operation and cleaning, which must be collected through the chimney door in order to prevent the clogging of the chimney (e.g. once per season).

Insufficiently tight flue ducts and chimney doors can be remedied with sealant or aluminum foil tape.

### Door tightness

It is necessary to check the tightness of the door - the edges of the stoking openings must be lightly pressed into the sealing cord. Re-sealing is performed by replacing the sealing cord.

### Lambda sensor

After the heating season, we recommend removing the lambda sensor from the flue pipe and removing any dirt with a dry soft cloth. Do not use any cleaning agents! We recommend subsequently calibrating the lambda sensor according to the instructions for the control unit of the boiler controller.



**Attention! When handling the lambda sensor, the mains supply to the controller and the lambda sensor module must be disconnected.**

## 7 Possible defects and their solutions

### 7.1 Overheated boiler

If the boiler water temperature exceeds 95°C, the controller shuts down the boiler (switches off the fan). If the temperature exceeds 97°C, an independent emergency thermostat switches off the power supply to the fan. The display and other devices remain in operation. To restart the boiler, it is necessary to unscrew the cover of the emergency thermostat switch STB (24) and press the thermostat switch STB with a suitable object (e.g. a pencil). The emergency thermostat cannot be switched on until the boiler temperature (thermostat sensor) drops below 80°C.

### 7.2 Power failure during operation

If the power to the boiler is disconnected (mains failure, shutdown by main switch), the valve on the combustion air inlet is closed - the boiler is immediately shut down. If the boiler is not connected to a backup power source, the connected pumps will also shut down. The heated walls and hot fuel layer continue to produce heat for several dozen minutes. The amount of residual heat is 5 - 10 MJ, depending on the output and level of fuel combustion before the shutdown.

### 7.3 Boiler operation without electricity

The boiler is capable of working only with the chimney draft. For this purpose, it is necessary to remove the front cover (loosen it by lifting it up), and the air valve (19) must be secured in fully open position with a suitable object (e.g. a piece of wood). Sufficient chimney draft is necessary: at a 10 Pa chimney draft the boiler is capable of operating at about 75%.

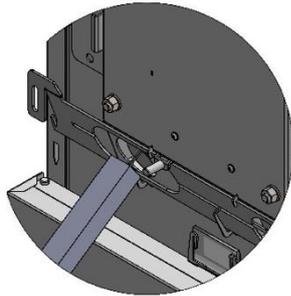


Figure 13. Securing the air valves

If the chimney is warm, switching to chimney draft operation is relatively easy.

If the chimney is cold, we recommend starting a fire in the bottom combustion chamber first, letting it burn for about 30 minutes with the bottom door slightly open and then starting a fire in the stoking chamber. If there is insufficient draft, the blind flange can be removed (45) from the cleaning hole. This will increase the flue gas temperature, resulting in increased chimney draft. The output can also be increased by removing the turbulators.

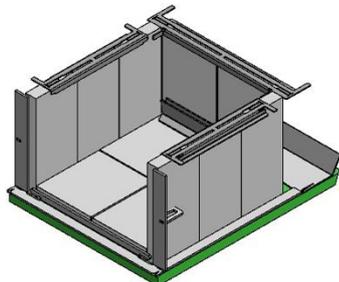


Figure 14. Bottom combustion chamber  
- installed blind flange (45)

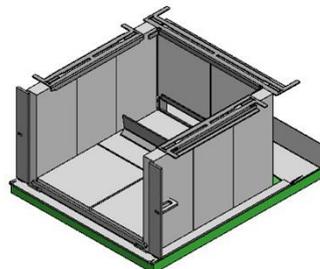


Figure 15. Bottom combustion chamber -  
removed blind flange (45)



**When the boiler is operated this way, it must be under constant supervision. It is necessary to make sure (by adding fuel, opening the combustion air hole) that the water temperature does not exceed 95°C.**

**In the event of a power failure, the boiler can be connected to a gravity circulating system.**

## 7.4 Other defects and their solutions

Defect	Cause	Removal
The controller display is not working.	<p>The internal fuse on the control module is burned.</p> <p>The display data cable connector on the controller panel or module is loose or disconnected, the cable is damaged.</p> <p>Damaged display.</p> <p>Damaged controller.</p>	<p>Replace the fuse (service technician, qualified electrician).</p> <p>Check the connector, replace the damaged part (service technician, qualified electrician).</p> <p>Replace the display (service technician, qualified electrician).</p> <p>Replace the controller (service technician, qualified electrician).</p>
The turbulator lever doesn't move.	<p>Poor combustion, inactive turbulators.</p> <p>Frequent boiler shutdowns with a large amount of fuel (overheating).</p>	<p>Remove the top cover, open the rear exchanger cover, gradually bend both arms, remove the oscillating link, individually set the turbulators in motion. Tar may be dissolved with an appropriate alcohol-based solution.</p>
The fan does not rotate in OPERATION mode.	<p>The water temperature is above the required value.</p> <p>The emergency thermostat is open.</p> <p>The fan impeller is blocked.</p> <p>Burned controller fuse.</p> <p>Engine malfunction.</p> <p>Damaged controller.</p>	<p>Change the set value.</p> <p>When the boiler water temperature drops below 80 °C, unscrew the emergency thermostat cover and press the switch with a suitable object (e.g. a pencil).</p> <p>Remove the cause (foreign object, clogging).</p> <p>Replace the fuse (service technician, qualified electrician).</p> <p>Replace the engine (service technician, qualified electrician).</p> <p>Replace the controller (service technician, qualified electrician).</p>

<p>The stable heat layer does not remain in the boiler.</p>	<p>Switched off in the controller settings.</p> <p>The air inlet valve is not tight (19). (under the front cover of the boiler)</p> <p>Damaged inductive sensor (the red LED diode does not switch on)</p> <p>The fuel weight detection mechanism is polluted by tar - Frequent boiler shutdowns with a large amount of fuel in the boiler (overheating)</p>	<p>Enable the „Automatic stable heat“ function in the controller menu</p> <p>Check the tightness of the valve when the fan is switched off, or adjust the valve if necessary (service technician)</p> <p>Replace the sensor (service technician)</p> <p>Remove the air distribution panel (31) and remove the tar along with other deposits</p>
<p>The exhaust fan is making excessive noise</p>	<p>The impeller is contaminated with tar - Frequent boiler shutdowns with a large amount of fuel (overheating). The inner cord of the stoking door is not tight.</p>	<p>Remove fan engine, clean. Remove cause of clogging</p>



**Always disconnect the boiler from the mains supply when removing defects! If the boiler unit also controls a backup heat source, it must also be disconnected from the mains supply.**

In order to maintain high-quality function and safe operation, boiler repairs must be performed exclusively by service center specialists.

Warranty and post-warranty boiler repairs are provided by BLAZE HARMONY s.r.o. through its specialist service centers and contractors.

## **8 Additional information**

### **8.1 Properties of different fuel types**

We do not recommend burning wood that is too damp. Burning damp wood reduces its effective calorific value, which results in increased fuel consumption. Burning damp wood also increases the water vapor content in the flue gas, increasing its dew point. This may result in moisture condensation and shorten the lifetime of the boiler or the chimney. Proper wood drying occurs naturally in split softwood logs after two years, and after three years for hardwood.

The calorific value of all types of wood is roughly the same, about 15 MJ/kg (at a moisture content of 15 %). Hardwood (with high density) is more suitable if we want to achieve a longer burning time.

The usual density of basic wood species in kg/m<sup>3</sup> (Festmeter) at 15 % moisture content:

Acacia	750	Hornbeam	680	Alder	520
Pine	500	Ash	670	Spruce	450
Birch	630	Maple	660	Poplar	450
Beech	670	Linden	490	Willow	440
Oak	690	Larch	590		

The density of wood with straightened edges (Raummeter) is 0.6 - 0.8 times smaller than the density of wood itself (Festmeter).

The calorific value of wood briquettes is about 17 MJ/kg. Larger briquettes pressed under great pressure are more suitable. Smaller briquettes or briquettes pressed with small pressure, which break down in the furnace after a short time, are less suitable. The density of wood briquettes is about 1000 kg/m<sup>3</sup>.

The calorific value of wood chips is the same as that of lumber, about 15 MJ/kg (at a moisture content of 15 %). The density of wood chips is 200 - 300 kg/m<sup>3</sup> (loose cubic meter).

## 8.2 Fuel consumption - stoking frequency

The fuel consumption per season depends on many factors:

- The heat loss of the building (the output required to heat the building at approx. -15°C)
- The efficiency of boiler operation (fuel quality, operation standard and output control)
- The location of the boiler room (whether the heat from the surface of the boiler and chimney contributes to heating the building)
- The temperature to which the building is heated (1 °C corresponds with 5 % of fuel consumption)
- Whether the boiler is used to heat domestic water, and what its consumption is
- The average outdoor temperature during the heating season (differences can be ±20 %)
- Whether the entire building is heated or only part of it, how great the heat loss through ventilation is, etc.

The usual consumption per season for a family house with a heat loss of 15 kW is about 10 000 kg of dry wood, which is about 30 m<sup>3</sup> (Raummeters) or 8 600 kg of wood briquettes.

The daily consumption is proportional to the outdoor temperature. An example of the usual daily consumption of a family house with a heat loss of 15 kW during the heating season:

Number of days	Outdoor temperature	Average boiler output	Daily fuel consumption	Stoking frequency per day*
5 days	-8°C	55%	75kg	3x
30 days	-5°C	45%	60kg	2-3x
30 days	-2°C	40%	50kg	2x
70 days	2°C	30%	45kg	2x
50 days	6°C	20%	40kg	1-2x
50 days	10°C	10%	20kg	1x

\*... with the assumption of usual wood fuel

## 8.3 Methods of determining the heat loss of buildings

- Heat loss is a parameter determined by a standard. It corresponds with the heat output required to heat the building to a specified temperature (21 °C for residential buildings) at a standard outdoor temperature calculation. In the Czech Republic this temperature

ranges from -17 °C to -12 °C, depending on the location of the building (lowlands, highlands).

- The heat loss can be roughly estimated from the size of the building (built-in volume). In a regular non-insulated family house, the heat loss is about 40W per 1m<sup>3</sup>, and about 20W per 1m<sup>3</sup> in an insulated house. (In the Czech climate zone)
- The exact heat loss is determined by a draftsman from the building's parameters (area, strength, wall material, window type, outdoor temperature, etc.). The calculation is usually done on a computer.
- There are programs available on the Internet where even a layman can perform the calculation (e.g. TZB-info).
- Heat loss can often be accurately determined from the consumption of the current fuel per season:

Consumption of different types of fuels per **1kW** of heat loss.

Fuel	Total efficiency considered	Consumption per season
Dry wood	70 %	650 kg (1.5 - 2 m <sup>3</sup> )
Wood briquettes	70 %	600 kg
Wood pellets (automatic boiler)	77 %	550 kg
Coal (boiler with manual stoking)	70 %	600 kg
Coal (automatic boiler)	77 %	550 kg
Gas	85%	260 m <sup>3</sup> (2 400 kWh)
Propane	85 %	185 kg
Electricity	100%	2 000 kWh
Remote heat	100%	2 000 kWh (7 200 MJ = 7,2 GJ)

## 9 Safety instructions



**Only equipment that has been installed and commissioned according to the documentation and is in proper technical condition can be operated**

When handling the product at the designated place, safety regulations must be observed. For transportation, we recommend using tools and transport equipment designed for this purpose with the corresponding weight of the transported product (the weight of the product is stated on the nameplate).

**Flue gas and chimney inspections must be carried out in accordance with applicable regulations.** The flue duct must be securely led into the chimney. The flue ducts must be mechanically rigid, leakproof to flue gases and cleanable, and they must rise from the boiler into the chimney. The condition of the chimney must be checked regularly. The cleaning opening in the chimney must be closed tightly so that the smoke driven by the fan does not escape into the surrounding area. **Only one boiler can be connected to one chimney flue.** The device must be connected to the chimney flue with the consent of the respective chimney guild. Flue ducts must not lead through the commercial or residential premises of third parties. The internal cross-section of the flue duct must not be larger than the inside diameter of the flue socket, and it must not taper in the direction of the socket. The methods for executing flue ducts are listed in ČSN.

With the exception of approved liquid fire-lighters, it is forbidden to use flammable liquids (petrol, oil, etc.).

Boiler defects can only be removed when the boiler is burnt out and disconnected from the mains.

Interference with the boiler and electrical connection of the boiler is prohibited!

The boiler can only be connected to a corresponding 230 V socket or switchboard. After installation, the socket or switchboard must be accessible without restrictions.

There must be adequate lighting in the boiler room.

Only a qualified worker can interfere with the electrical part of the boiler.

The installation and operation of the boiler (boiler room) must comply with the relevant design, safety and hygiene regulations.

The boiler operator must comply with the assembly, installation and operating manual.

The boiler operator must be over 18 years of age, and he must be familiar with the manual and operation of the appliance. Leaving children unattended around operating boilers is unacceptable. Boilers must be operated under occasional inspections by the operator.

Gloves and goggles must be used for all activities associated with the boiler operation.

Do not place flammable objects on the boiler and near the stoking and collection openings. The ash must be stored in non-flammable containers with a lid. Always keep in mind that the outer surface of the boiler may be hot to touch.

If there is a risk of the formation and entry of flammable vapors or gases into the boiler room, or when there is a temporary risk of fire or explosion (bonding floor coverings, coatings with flammable paint), the boiler must be shut down before the work begins.

The operator is required to inspect the boiler and safety equipment at least once a year and perform a functional test according to the local operating conditions. If the boiler is connected to an exclusive pressure device (e.g. an expansion vessel), the operator is obliged to carry out inspections according to the valid regulations.



**ATTENTION! The boiler may only be used for the purpose for which it is intended.**

## **10 Disposal of shipping package**

- Put the polyethylene film into a container for plastic.
- Take apart the wooden groundsheet and burn it.

## **11 Disposal of the boiler at the end of its useful life**

- Clean the boiler and disassemble it.
- Take the metal parts to a scrap metal yard.
- The ceramic parts can be disposed of as household waste, or they can be used as building material.
- Dispose of the insulation boards and sealing cords as household waste.

## 12 Optional accessories for BLAZE HARMONY boilers

### a) Control module with lambda probe and actuator for automatic control of air supply

This accessory controls the supply of primary, secondary and predrying air automatically which ensures the highest quality of combustion and saves fuel. The actuator moves the shutter to keep required value of oxygen in the flue gases. Boilers BLAZE HARMONY are ready for installation of lambda probe and actuator and there is no need for purchase of additional components.



Figure 16. Lambda probe and control module

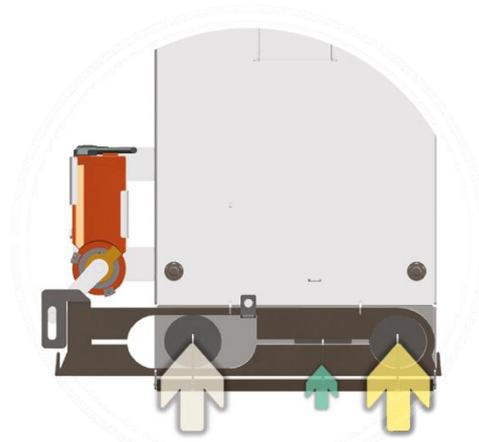


Figure 17. Shutter and actuator

### b) Set for conversion to combined boiler for wood and pellets

Gasification boilers BLAZE HARMONY are prepared for later conversion to automatic combined boiler, which allows pellet combustion. This solution means for user increasing of comfort after installation of the pellet burner, when after the wood burns off, the boiler operation continues automatically with pellet combustion. The conversion set includes rotary burner, lower doors with hole for the burner, pellet feeder, module P for controlling the operation of the burner.



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**Hybrid**  
BIOMASS



## 13 Related standards

### Heating system

ČSN 06 0310	Heating systems in buildings - Design and installation
ČSN 06 0830	Heating systems in buildings – Safety devices
ČSN EN303-5	Boilers for central heating
ČSN 07 7401	Water and steam for thermal energy equipment

### Chimneys

ČSN 73 4201	Chimneys and flues - Design, implementation and connection of fuel appliances
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### Fire regulations

ČSN EN 13501-1	Fire classification of construction products and building structures
ČSN 06 1008	Fire safety of thermal equipment

### Electro

ČSN EN 60445 ed. 2	Basic and safety principles for the man-machine interface, marking and identification - Labeling device terminals and terminals of certain selected wires, including the general rules of the letter-number system
ČSN 33 2000-3-701	Electrotechnical regulations - Electrical equipment part 3: Determining basic characteristics
ČSN 33 2000-4-41	Protection against electric shock
ČSN 33 2000-5-51	Electrotechnical regulations - Electrical equipment part 5: Construction of electrical devices
ČSN 33 2000-7-701	Electrotechnical regulations - Electrical equipment part 7: Single-purpose devices and devices in special premises
ČSN EN 60079-14-2	Electrical devices for an explosive gaseous atmosphere - part 14
ČSN 33 2030	Electrostatics - Guidelines for avoiding static electricity hazards
ČSN 33 2130	Electrotechnical regulations. Internal electrical wiring
ČSN 33 2180	Connecting electrical devices and appliances
ČSN EN 60 446	Basic and safety principles for operating machinery – Marking wires with colors or numbers
ČSN EN 50 165	Electrical devices of non-electrical household appliances. Safety requirements
ČSN EN 55 014-1	Electromagnetic compatibility – requirements for household appliances part 1
ČSN EN 60335-1 ed.22003,+1:2004+A11:2004+A1:2005+2:2006+A12:2006+a2:2007+3:2007+ Z1:2007	Household and similar electrical appliances - Safety – part 1: general requirements
ČSN EN 60335-2-102	Household and similar electrical appliances - Safety – part 2

## 14 Warranty conditions

The device has been manufactured and tested according to valid documentation and it complies with applicable standard ČSN EN303-5 Boilers for central heating.

The warranty period for the pressure part of the boiler is 7 years

The warranty period for consumable parts is 12 months.

The warranty period for other parts is 2 years.

The warranty period for the burner ignition coil is 12 months or reaching 3000 ignition cycles.

The warranty only applies to boilers that are operated in accordance with the instructions in the assembly, installation and operating manual issued by an authorized company.

Ceramic fittings, sealing cords and refractory steel parts in the lower combustion chamber are considered consumable parts.

The warranty applies to the free **replacement** of a defective spare part. A new spare part will be sent to you within 24 hours of filing a complaint at the sales department of BLAZE HARMONY s.r.o. If the defective spare part is not delivered to the sales department of BLAZE HARMONY s.r.o. within 14 days of the receipt of the new part, the warranty on the product (boiler) shall expire. The warranty does not apply to travel refunds associated with the replacement, which will be charged according to the current travel refunds.

The warranty does not apply to defects arising due to:

- Connecting the boiler to a water pressure higher than 300 kPa
- Using fuel other than the recommended fuel
- Improper operation (e.g. frequent shutdowns and overheating), connecting the boiler to a power supply other than 230V/50Hz or a defective power supply
- Untreated water (e.g. limescale in the boiler)
- Improper operation and mechanical damage to parts
- Incorrectly dimensioned and incorrectly executed heating system
- Forceful treatment, interference with the boiler structure, natural disaster, improper storage or other reasons not affected by the manufacturer
- Boiler overheating and resulting shutdowns. The warranty expires when 200 hours of overheating are exceeded.

*(MENU => Information => Operating counters)*

Failure to comply with the above will result in the loss of the warranty.

When filing a complaint in the warranty period, please contact the service and installation organization that commissioned your product.

If the first boiler commissioning is performed by an unauthorized person, the product warranty shall expire!

It is necessary to send the manufacturer a properly filled out and signed **Check sheet of boiler commissioning and Protocol of heating test** immediately after the boiler is commissioned. If the user fails to comply with this condition, the manufacturer cannot approve the repair as a warranty repair.

When reporting a fault, you must report:

- The boiler's serial number
- The date of installation
- The authorized company that commissioned the boiler
- Conditions of the failure (description of the failure)

The manufacturer reserves the right for changes implemented during R&D activities which may not be included in the manual.

## **15 ATTENTION!**

Return the properly filled out warranty card for the manufacturers of the BLAZE HARMONY boiler to the following address:

BLAZE HARMONY s.r.o.

Trnávka 37

751 31 Lipník nad Bečvou

Czech Republic



## 17 Declaration of Conformity of BLAZE HARMONY boilers

### ORIGINAL EC AND EU DECLARATION OF CONFORMITY

According to Directive 2006/42/EC of the European Parliament and Council (Government Decree no. 176/2008 Coll.)  
According to Directive 2014/35/EC of the European Parliament and Council (Government Decree no. 118/2016 Coll.)  
According to Directive 2014/30/EC of the European Parliament and Council (Government Decree no. 117/2016 Coll.)

**Manufacturer:** BLAZE HARMONY s.r.o.  
Trnávka 37, 751 31 Lipník nad Bečvou, Česká republika  
TIN: 27816273, VATIN: CZ27816273

**Device:** Hot water boilers for wood with manual fuel supply

**Type designation:** BLAZE HARMONY 12, BLAZE HARMONY 18, BLAZE HARMONY 25, BLAZE HARMONY 33

**Description of the device:** Hot water gasification boiler for wood, with manual fuel supply with a nominal output of 12 – 33kW, designed for heating family houses and other similar buildings whose thermal losses do not exceed the boiler's nominal output.

**The manufacturer declares that the product complies with all applicable provisions:**

Directive 2006/42/EC (Government Decree no. 176/2008 Coll.)  
Directive 2014/35/EU (Government Decree no. 118/2016 Coll.)  
Directive 2014/30/EU (Government Decree no. 117/2016 Coll.)

The manufacturer also declares that he has taken measures to ensure the conformity of all products placed on the market with the technical documentation, the basic requirements for the product and the approved type.

**List of harmonized standards used for the conformity assessment:**

ČSN EN 303-5:201, ČSN 06 1008:1997, ČSN EN 60335-1 ed. 3:2012, ČSN EN 60335-2-102:2007  
ČSN EN 55014-1:2007 ed.3 ČSN EN 61000-6-3 ed.2 :2007, ČSN EN 61000-3-2 ed.3 :2006, ČSN EN 61000-3- ed. 2 3:2009, ČSN EN 61000-6-2 ed 3:2006 ed 3, ČSN EN 62233:2008, ČSN EN ISO 12100:2011, ČSN EN ISO 14120:2017, ČSN EN ISO 11202:2010 ČSN EN ISO 3746:2011, ČSN EN 15036-1:2007 a ČSN EN ISO 13857:2008

**Conformity assessment:**

To assess the conformity, certificate no. B-30-00939-18 from 31.8.2018, valid until August 31, 2020, issued by the Engineering Test Institute in Brno - Strojírenský zkušební ústav Brno, Hudcova 56b, 621 00, ID no.: 00001490.

**Person authorized to draw up the original EC and EU Declaration of Conformity: Roman Tihelka Jr.**

This Declaration of Conformity is the original EC and EU Declaration of Conformity.

**The last two digits of the year in which the product received CE marking: 18**

In Lipník nad Bečvou, September 1st, 2019

Signature of Roman Tihelka Jr. and company stamp for BLAZE HARMONY s.r.o. The stamp includes the company name, address (Trnávka 37, 751 31 Lipník n.B., Czech Republic), and identification numbers (IČ: 278 16 273, DIČ: CZ27816273).

.....  
Roman Tihelka Jr.  
Person authorized to draw up  
the original EC Declaration of Conformity

Signature of Roman Tihelka and company stamp for BLAZE HARMONY s.r.o. The stamp includes the company name, address (Trnávka 37, 751 31 Lipník n.B., Czech Republic), and identification numbers (IČ: 278 16 273, DIČ: CZ27816273).

.....  
Roman Tihelka – CEO  
Identification of the person authorized  
to sign on behalf of the manufacturer







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