BOILER OPERATING AND INSTALLATION MANUAL

BLAZE NATURAL PLUS 25

BLAZE NATURAL PLUS 35

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Dear customer,

Congratulations on choosing and purchasing a BLAZE NATURAL PLUS 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.

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

ORIGINAL USER MANUAL.

1 Use and advantages of the boiler

Boiler use:

BLAZE NATURAL PLUS hot water gasifying boilers are designed for efficient, ecological and comfortable heating of family houses, apartment units, cottages, office buildings, small establishments and other buildings. The BLAZE NATURAL PLUS boilers are officially approved (certified) for installation and operation without a storage tank (they meet the requirement of EN 303-.5 standard for 30-100% output controllability). However, we do not recommend connection without a storage tank for heating buildings whose heat loss is significantly less than the rated output of the boiler (even when operating at the minimum output of the boiler, overheating would occur). Operation with a storage tank is always more comfortable.

The equipment has been manufactured and tested according to the valid documentation and complies with the valid EN303-5 Boilers for central heating.

Conditions for connecting a boiler without a storage tank

We recommend connecting the BN PLUS boiler without a storage tank only in installations where at least one of the following conditions is met:

1. A building with a large natural accumulation (buildings with thick walls). The capacity of the building compensates for the accumulation tank.
2. A building with a heat loss equivalent to the rated output of the boiler:
- The BN PLUS 25 boiler is designed for a normal building with a heat loss of at least 20kW*.
- The BN PLUS 3540 boiler is designed for normal construction with a heat loss of at least 30kW*
* Normal building means a medium-heavy building made of blocks or clay bricks (including hollow bricks). For heavy buildings it is possible for the heat loss to be slightly lower (e.g. if the external walls are solid masonry with a minimum thickness of 50cm, the heat loss can be 20% lower). For lightweight buildings (e.g. made of Ytong, etc.) a storage tank is necessary.
3. A building with less demands on thermal comfort (tolerance of larger temperature fluctuations).
4. More professional operation of the boiler - timing of feed-in, batch size, power control must be appropriately matched to the heat demand requirements (outdoor temperature).
...Conditions 3 and 4 are to some extent proxy for each other and to some extent proxy with conditions 1 and 2.
5. In conjunction with another heat source - where the BN PLUS boiler is used only in winter where the heat demand is higher than the minimum boiler output and in the rest of the heating season is heated e.g. by a pellet burner or gas boiler.
6. Where the BN PLUS boiler is connected in a "cascade" - in larger buildings (one system) it is possible to install 2 BN PLUS boilers in parallel, so that one boiler is in operation in the transitional period and both in the winter period.
7. With special heating mode with shock heating (workshops with shift operation, etc.).
8. Where, in addition to heating, there is a supplementary heat demand of adequate capacity. E.g. process water heating, pool heating, greenhouse heating, etc.)

Advantages of the boiler:

- **Low investment costs**
  - 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).
- Thanks to the exceptional controllability of 30-100% of nominal output, BLAZE NATURAL PLUS boilers meet the legal requirement for installation without a storage tank.

- **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.) ensure low costs for parts subject to wear.
  - The boiler operates with unprecedentedly low power consumption, thanks to the patented beam nozzle it is even able to operate on chimney draft only (while operational safety and stoker functions are fully maintained even when operating without electricity).

- **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. 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
  - **The patented jet nozzle is characterized by excellent combustion, great controllability, excellent ash removal.**

- **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 (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.
- Odtahový ventilátor omezuje na minimum prašnost při odstraňování popela a čištění kotle.
- The hot combustion chamber ensures higher wall temperature, and there is no unpleasant tar deposition in the stoking chamber.
- A ceramic glass sight glass allows the operator to easily check the combustion and improve combustion by using simple secondary air control.
- The boiler can be operated (to a limited extent) even in the event of a power failure (see Chapter 7.3).

* note: integrated water mixing thermostat and mechanical turbulators are optional accessories

2 Technical boiler data

Table 1. Boiler dimensions and technical parameters

Boiler type		**BN PLUS 25**	**BN PLUS 35**
Weight	kg	330	440
Water chamber volume	dm^3	40	
Flue gas duct diameter	mm	150	40
Stoking chamber volume	dm^3	80	80
Boiler dimensions: width x depth x height	mm	530x958x1200	714x958x1200
Size of stoking hole	mm	355 x 355	540 x 355
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 Δ T = 20 K	mbar	0,3	0,8
Maximum noise level	dB	55	
Minimum operating chimney draft	mbar	0,50	
Maximum operating chimney draft	mbar	0,20	
Boiler connections: - heating water	Js	G 6/4"	
- return water	Js	G 6/4"	
Connection voltage		1 PEN 230V / 0,5A / ~ 50 Hz	
Environment		základní AA5 / AB5	
Electric protection		IP 20	
Energy efficiency class		A+	A+

Table 2. Technical thermal boiler parameters

Boiler type		**BN PLUS 25**	**BN PLUS 35**
Nominal power	kW	26	40
Minimal power	kW	7,6	12
Power controllability in continuous operation	kW	7,6 – 25	12 – 40
Fuel consumption at nominal power	kg . h^{-1}	6,3	9,6
Burning time of full fuel batch at nominal power			
- softwood	h	3	2
- hardwood	h	4	3
Boiler class according to ČSN EN 303-5		5	
Ecodesign		yes	
Flue gas temperature			
at nominal power	°C	150*	160*
at 30% power	°C	110*	110*
Efficiency nominal power	%	89,5	92
Efficiency minimal power		90,5	91
Minimum return temperature <u>without</u> integrated thermostat	**°C**	**50**	**50**
Minimum return water temperature with integrated thermostat	**°C**	**20**	**20**
Flue gas flow rate at the outlet at nominal power	kg . s^{-1}	0,01691	0,02386
Flue gas flow rate at the outlet at minimum 50% power	kg . s^{-1}	0,00551	0,00763
Power input at nominal power	W	29	33
Power input in standby mode	W	1	1

* 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.

**** chimney requirements are described in chapter 5.2

3 Prescribed fuel for the boiler

The warranty fuel for the BLAZE NATURAL PLUS boiler is the fuel listed in Table no. 3. (Warranty fuel). 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	[$MJ.kg^{-1}$]	min. 14

* valid for BN PLUS 25 **valid for BN PLUS 35

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 boilers BN PLUS 25

** valid for boilers BN PLUS 35

The BLAZE NATURAL PLUS boiler is based on the principle of two-stage combustion, during which the fuel is gassed with the subsequent combustion of the resulting gases.

The main parts of the boiler are: the feeding (gasification) chamber (1), the combustion chamber (2), the flue gas exchanger (3,4). The feeding chamber and the combustion chamber are connected by a nozzle (20).

The body of the boiler is welded from steel plates of 3-8 mm thickness. The walls of the charging chamber (1) are provided with a steel protective jacket (5) made of several segments connected to each other by interlocking joints. The bottom of the feeding chamber is funnel-shaped and lined with ceramic fittings (21, 35, 44**). The nozzle (20) is formed by beam-like slots in the bottom of the gasification chamber, which continue through evacuated channels to a merger (40) which opens into the combustion chamber. The nozzle (20) is fed by secondary air inlets.

The combustion chamber (2) is also lined with ceramic fittings (27). The heat exchanger surfaces of the boiler are formed by the side walls of the combustion chamber (3) and the rear tubular heat exchanger (4).

The boiler is fitted with 30 mm thick mineral fibre insulation. The outer surface consists of steel sheet covers. The lower door of the boiler contains a ceramic glass screen (19).

An electro-analogue controller (processorless) (17) is located in the front wall of the boiler to control the fan output according to the flue gas temperature. The controller includes an expandable emergency thermostat (STB). An air distribution panel (30) is located at the front of the boiler under the front cover. There are 3 combustion air inlets at the bottom of the panel: Primary (50), secondary (512), pre-drying (521). Each of the openings is fitted with a damper on the inside. The flaps are fixed to a common shaft (46). The shaft is routed outside the panel, where a balancing arm is attached to it to keep the flaps in the open position (18). The openings (50,51,52) are fitted with a sliding screen on the outside for manual control of the secondary air ratio (8).

A stochastic layer detection arm (12) with a rotation axis in the front wall of the stochamber is located in the stacking chamber (1). A balancing arm located in the air distribution panel area (30) is rigidly connected to the detection arm (12). The detection arm lock (32) is a spring loaded compression strut mechanism (to force the detection arm when the door is opened so that it does not impede fuel loading).

The water inlet pipe (15) opens into the internal manifold (38), from which water enters the boiler water compartment through a number of small openings. The boiler water temperature control thermostat (33) is located in the inlet pipe (15).

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

The exhaust fan (7) can be rotated so that the flue gas outlet (14) is in any direction.

The boiler is equipped with a cooling loop for emergency aftercooling, with an inlet (39) and outlet (37) spigot (both 1/2" internal) and a sump (42) for the cooling relief valve sensor.

The overhead door shall be equipped with a safety lock (26) to secure any opening position.

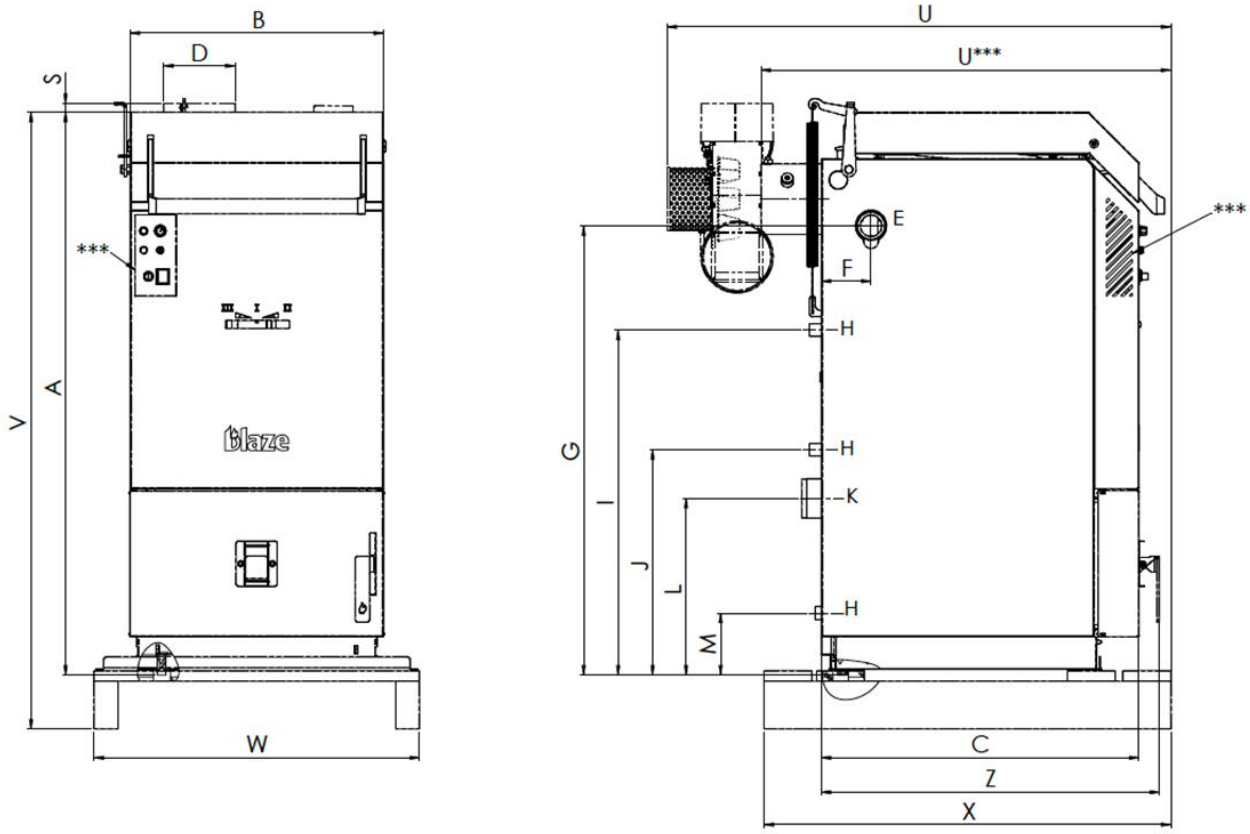
A mechanical water temperature controller (6) is located in the boiler face. The regulator is factory set at 90° and has a self-adhesive seal. It is forbidden to tamper with the temperature controller or to readjust it in any way.

4.2 Function description

After opening the door, the fan* starts, (10) the operator evaluates the layer of carbons left from the previous fuel load. If this residual layer is still hot, the operator simply refills the charging chamber with fuel. If the residual layer is already extinguished, it serves as ignition fuel and e.g. lit paper is thrown on top of it before adding fuel. After the door is added and closed, the fan creates a vacuum which causes air to flow into the boiler for combustion. The pre-combustion air enters the distribution panel (30) through the left-right opening (521), rises through a channel in the distribution panel, passes through an opening in the upper part of the boiler body and is fed through the longitudinal opening (43) above the fuel bed. Its effect is to accelerate the drying and burning of the fuel bed. Secondary air enters the distribution panel (30) through the right-hand opening (521), from where it flows through a circular opening in the boiler body under the bottom of the feed chamber, from which it is fed through a series of openings into the channels in the underside of the fittings (21), where it is preheated and exits into the gas stream in the nozzle (20) in the merging vent (40). The primary air enters the distribution panel (30) through the centre opening (50), from there it flows through the opening in the body behind the protective jacket of the feed chamber (5) and from there it exits into the lower fuel bed. Its effect is to cause primary combustion of the fuel (gasification). The resulting wood gas flows through the nozzle (20) into the combustion chamber (40), where it mixes with the secondary air - the gaseous components are burned (secondary combustion) in the combustion chamber (2). The hot flue gases flow behind the rear fittings (27) into the heat exchanger, where they transfer their heat to the heated water. The cooled flue gases are drawn in by the flue gas fan (7) and pushed out through the exhaust port (14) into the chimney.
The ash is deposited in the combustion chamber (2) where it is removed by occasional removal.
If the water temperature exceeds 95°C, a mechanical controller (Honeywell) turns the damper shaft and closes the air supply. At the same time, it activates the sensor (36), which switches off the fan via the controller.
If the water temperature exceeds 95°C , the fan will switch off the emergency thermostat (STB).
After the fuel has burnt out on the base layer, the fuel stops pressing the detection arm (12) and it tilts upwards towards the loading chamber, at the same time its inner balancing part tilts downwards and closes the air flap shaft (46). The closing of the flaps is simultaneously detected by the sensor (36) which switches off the fan via the controller. The boiler then switches to a permanent shutdown. The base layer keeps the heat for up to 8 hours (depending on the chimney draft, fuel type, etc.).
Thermostat (33) limits the flow of water to the internal distribution ducts so that the temperature of the heat transfer surfaces is above 60°C.

*In normal operation, it is applied when the boiler is in shutdown (fan is not running). By opening the door, the detection arm (12) is lowered via the locking mechanism (32) so that it does not restrict the refuelling. At the same time, the air dampers (46) are opened and the sensor (36) switches the fan on via the controller.

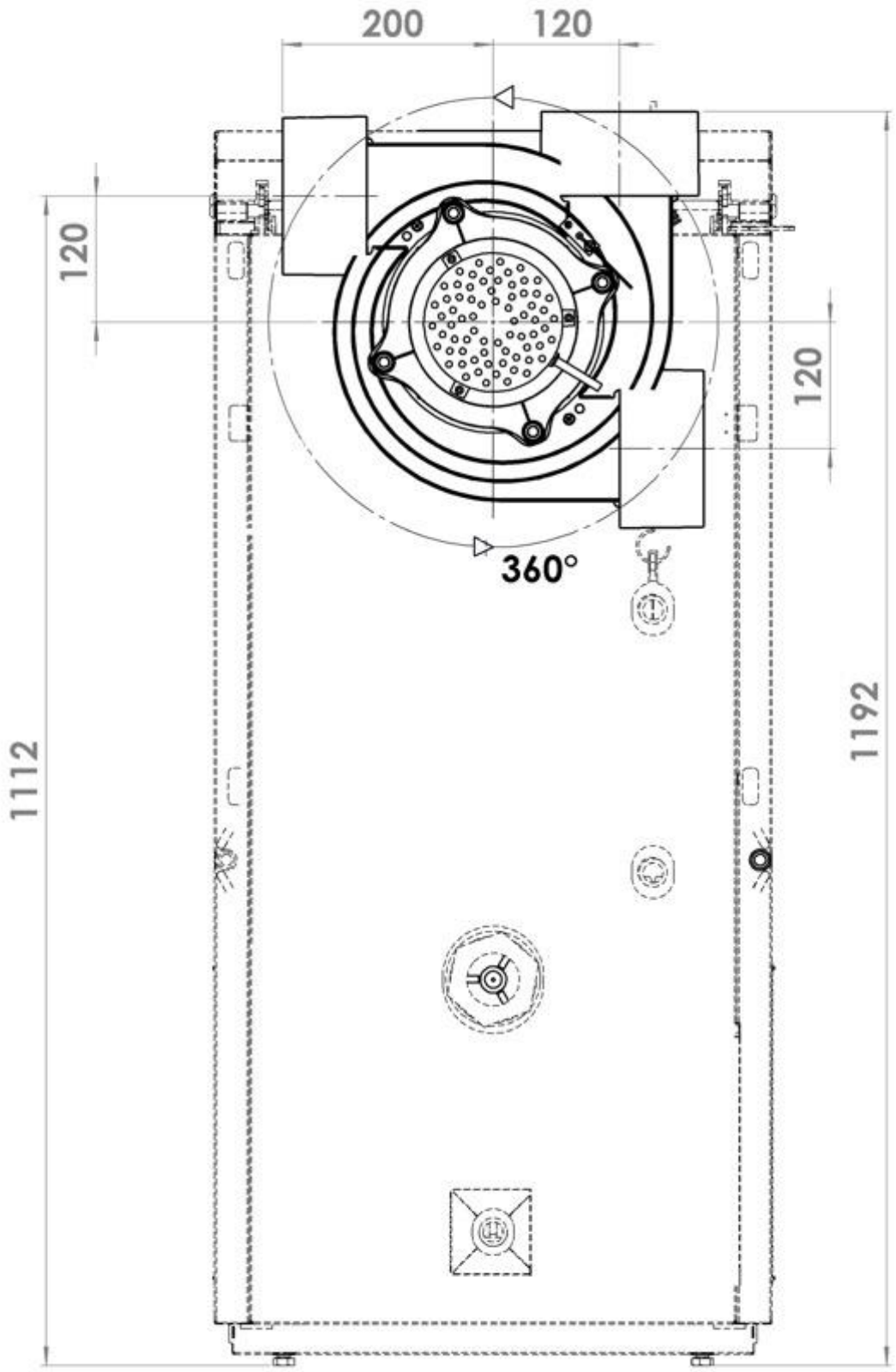
4.3 Boiler dimensions



Front and side view of the boiler with dimensions table

	BN 20; BN PLUS 25	BN 30; BN PLUS 35
A	1200	1200
B	530	714
C	664	664
D	⌀149	⌀149
E	G6/4'	G6/4"
F	104	104
G	939	939
H	G1/2'	G1/2"
I	721	721
J	471	471
K	G2 1/2' *	G2 1/2" *
L	370	370
M	130	130
N	113	113
O	995	995
P	200	200
Q	120	120
R	⌀141	⌀141
S	18	18
U	843*** / 1040	843*** / 1040
V	1176	1176
W	680	870
X	850**	850**
Y	265	324
Z	707	707

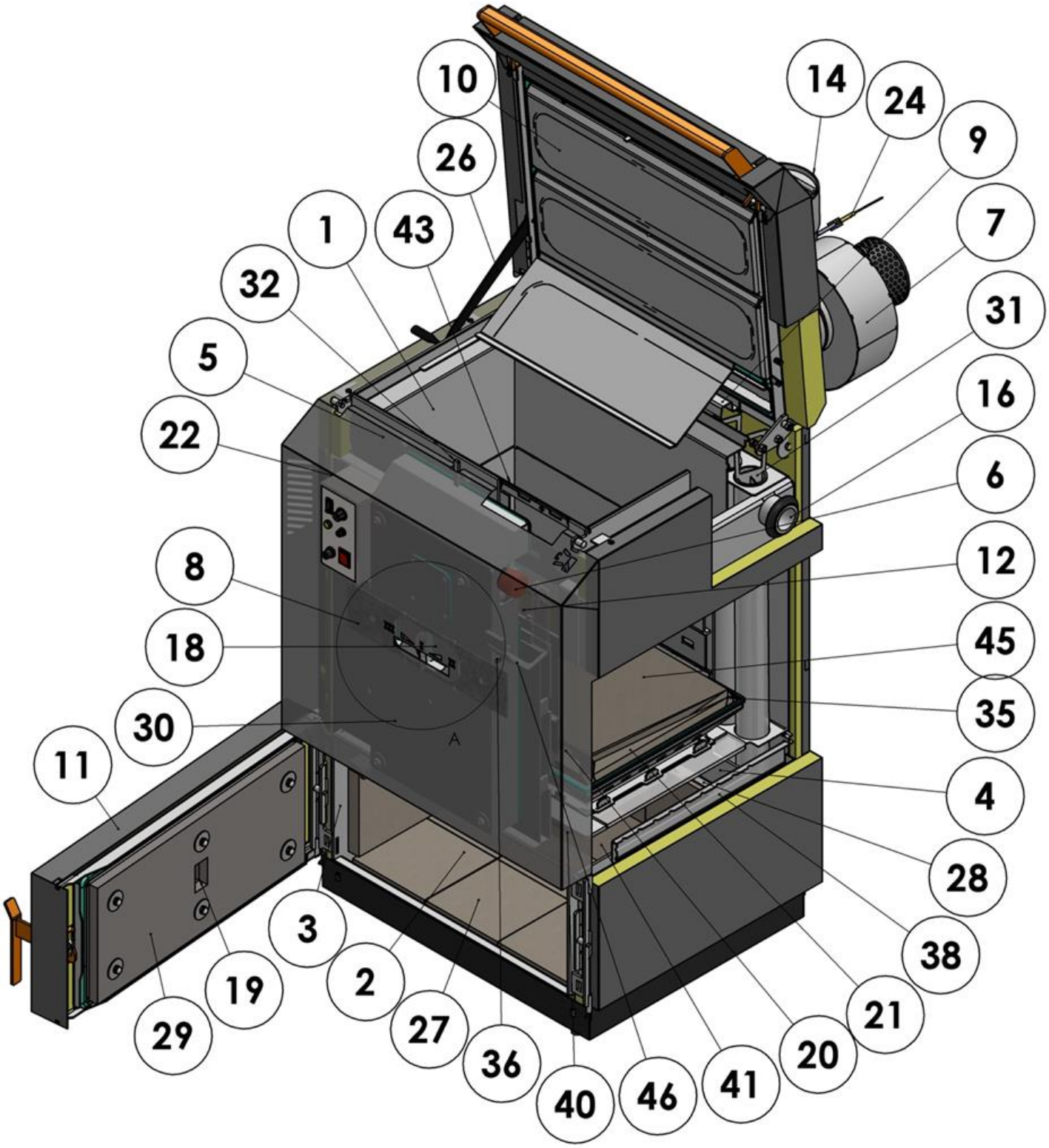
* cold water inlet to the boiler reduced by reduction to 6/4
** maximum transport dimension after removing the fan



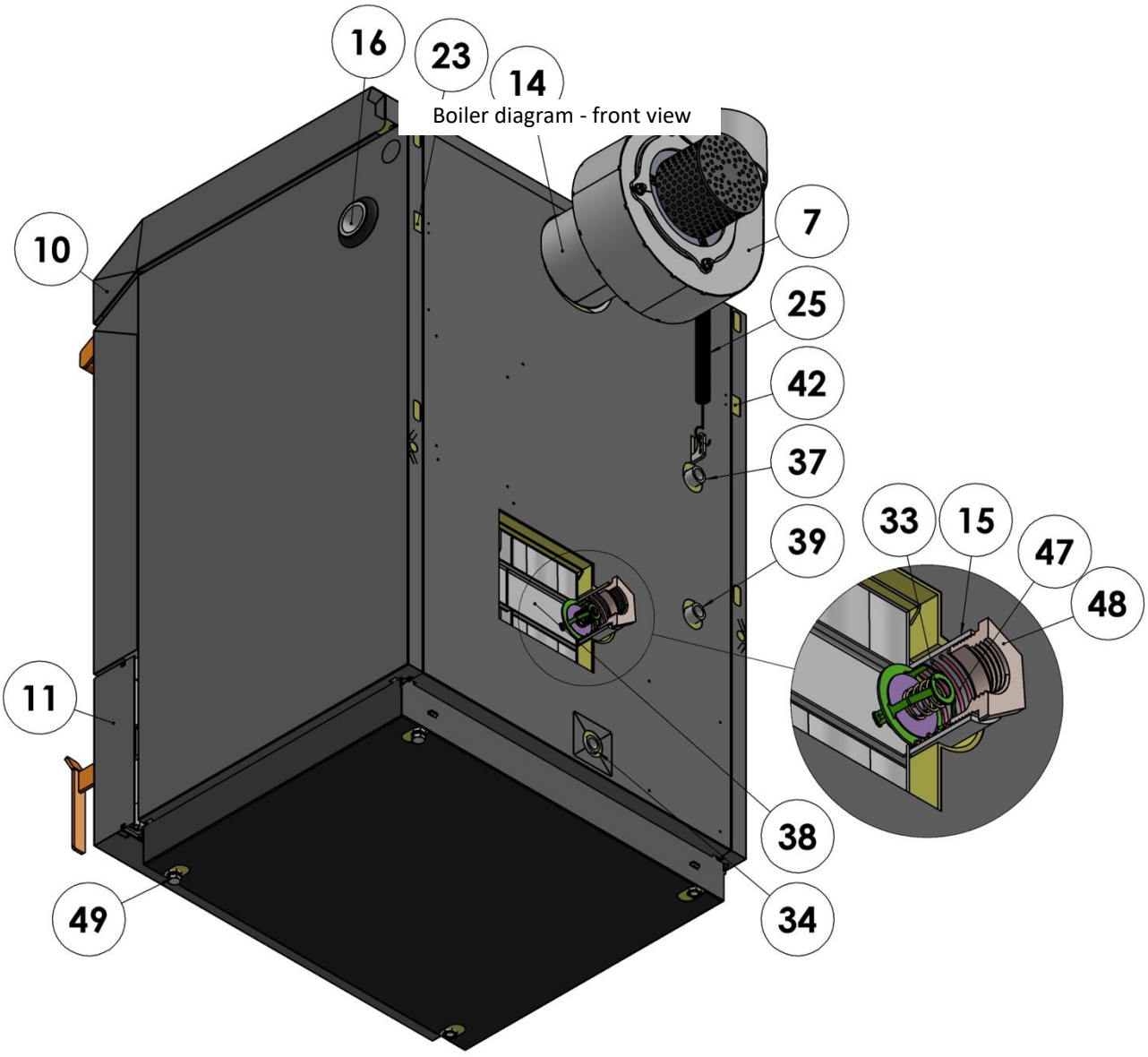
Back view of the boiler with dimensions

Rear diagram of the boiler with dimensions

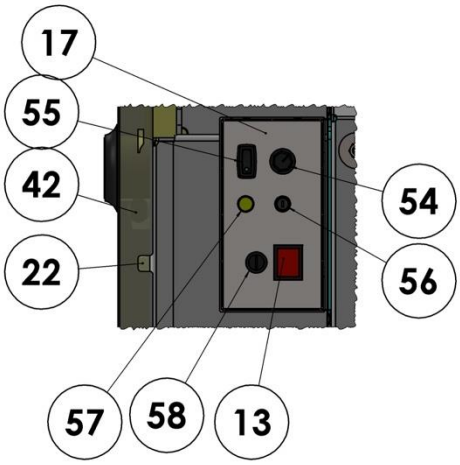
4.4 Boiler diagram



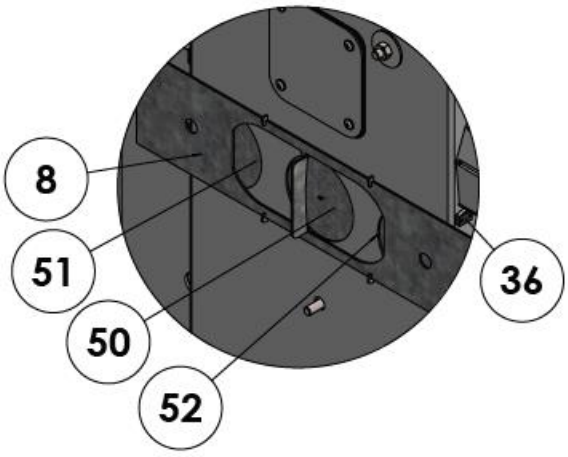
Boiler diagram - front view



Boiler diagram - back view



Boiler controller - controls



Boiler diagram - airing detail

Legend

1. stoking chamber
2. combustion chamber
3. side flue gas heat exchanger
4. rear flue gas heat exchanger
5. protective shell of stoking chamber
6. Mechanical water temperature controller
7. flue gas exhaust fan
8. secondary air regulator (sliding orifice plate)
9. rear heat exchanger orifice plate
10. stoking door
11. bottom door
12. stable heat detector
13. main switch
14. flue gas outlet
15. inlet sleeve G 2 1/2" (inner)
16. outlet sleeve G 6/4" (inner)
17. controller control panel
18. air flap (3x)
19. ceramic glass sight glass
20. nozzle (vent connecting the feeding and combustion chamber)
21. feed chamber bottom fitting (4x*,2x**)
22. emergency thermostat sensor
23. sump for pump thermostat
24. flue gas temperature sensor
25. top door reinforcement spring
26. locking strut
27. combustion chamber brick (10x*,13x**)
28. combustion chamber brick rail, (1x rear)
29. bottom door heat insulation
30. air distribution panel
31. economizers (6x*,9x**)
32. blocking of the detection arm
33. boiler water temperature control thermostat ***
34. outlet and inlet sleeve 1/2"
35. corner brick (4x)
36. air inlet closure sensor
37. aftercooling water outlet
38. internal water distributor
39. aftercooling water inlet
40. looper brick
41. brick - plug for the rear heat exchanger outlet
42. sump for the aftercooling sensor
43. pre-drying air outlet
44.
45. **stoking chamber bottom brick (2x)
46. **central brick
47. thermostat pressure spring
48. reduction 1 ½“ to 6/4“
49. boiler foot bolt
50. primary air inlet
51. pre-drying air inlet
52. secondary air inlet
53. .
54. power regulator wheel
55. feed switch (full fan power)
56. controller fuse
57. fan shutdown indicator light (fuel burnout, water temperature)
58. emergency thermostat switch

Note: The boiler diagrams shown are in the version with integrated thermostat for backflow protection. .

*only for BN PLUS 25
**only for BN PLUS 35

Any interference with the air inlet flaps by hand or tool may cause irreversible damage to the flap mechanism and the stator. Manual opening of the air inlet flaps is prohibited.

4.5 Detail and description of control and signalling elements of the boiler controller

FEEDING SWITCH
Press to activate the fan at maximum power for approx. 1 minute

BOILER POWER SETTING
Allows you to set the boiler output. Based on the power setting, the controller modulates the exhaust fan. It is recommended to set the output to 40 - 70%.

FAN SHUTDOWN SIGNALLING
1. Fuel burnout (stator)
2. Boiler overheating

CONNECTION 1A
If the connection to the power supply is OK and the controller cannot be switched on, check and replace the fuse if necessary

STB EMERGENCY THERMOSTAT RESET
When the boiler overheats, the power supply to the fan is disconnected. To restore the fan operation, it is necessary to lower the boiler temperature and press the emergency thermostat switch after unscrewing the cap.

MAIN EXCHANGER
Used to switch the controller on or off

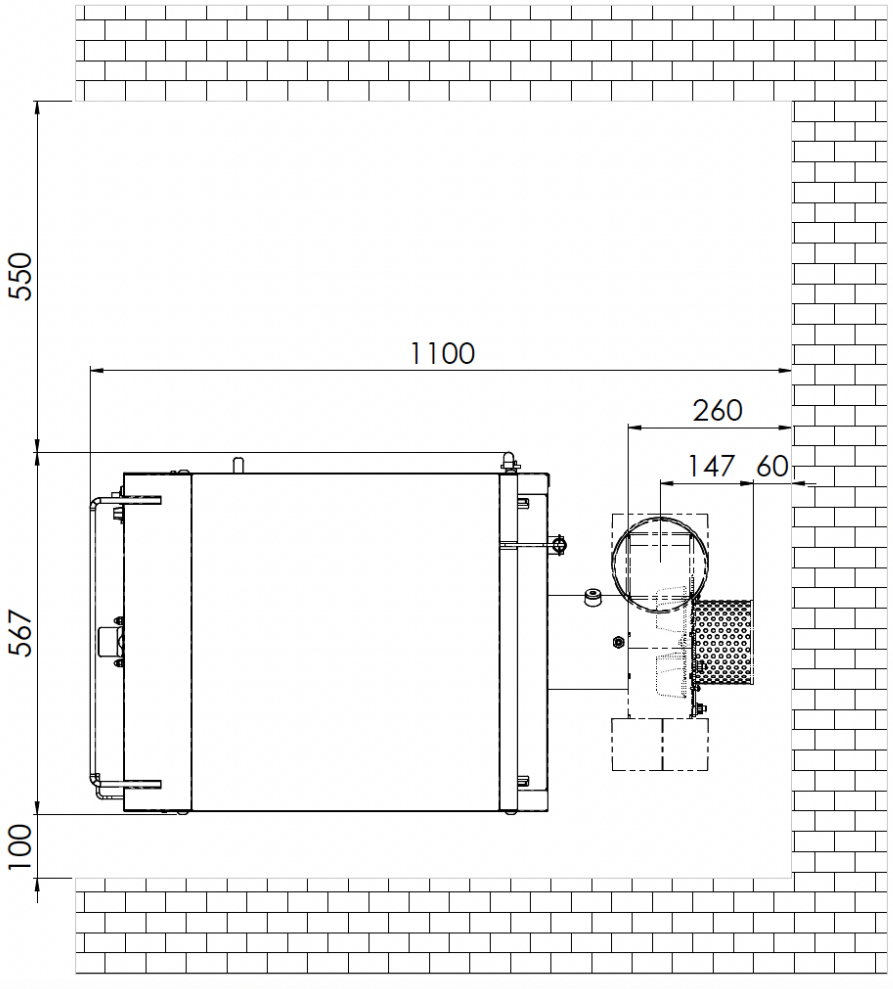
5 Boiler assembly and installation

5.1 Boiler placement

The boiler must be installed in such a way as to comply with the requirements of ČSN 061008 - Fire safety of thermal equipment.
The boiler shall be supplied with transport legs that allow transport by pallet truck. These are fixed with 4 M12 screws. The transport legs are dismantled after placing in the boiler room, see quick guide to installing, connecting and starting the boiler.

There must be a minimum clearance around the boiler (see picture below) for operator maintenance or possible servicing.
The boiler must be positioned on a non-combustible, thermally insulating base, extending at least 300 mm beyond the footprint of the lower door (see Boiler Diagram, items 10, 11) and at least 100 mm on the other sides.
The minimum permissible distances of the outer contours of the boiler from combustible materials (see EN 13501-1 for further specifications) must be at least 400 mm. Objects made of combustible materials must not be placed on the appliance and at a distance less than the safe distance from it.

Minimum boiler location dimensions according to ČSN 061008



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 mm2 so that the chimney is able to discharge more flue gases during the loading and flooding process.

	BN PLUS 25	BN PLUS 35
Recommended chimney flue diameter	200mm	250mm
Minimum flue diameter	160mm	180mm.

The height of the chimney should not be less than 3 m.

The chimney draft regulator is not recommended for conventional chimneys (with an operating draft of 10-30 Pa).

The boiler exhaust pipe must be firmly assembled so as to avoid accidental or spontaneous loosening 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 needed for combustion can be supplied to the boiler room directly from the outdoor environment or from the living space. Air supply from the living space is in a sense a better option, because it provides ventilation and also uses heat from the air that would be lost in conventional ventilation (heat savings are about 2%). At an output of 10 kW, the air consumption is about 20 m^3/hour, which corresponds to the hygienic minimum for air exchange of an apartment with a usual area.

When adding fuel (when the door is open and the boiler fan is running at full capacity), the air consumption is approx. 200 m^3/hour.

If the natural infiltration of the building does not provide a sufficient amount of air, it must be provided with a ventilation opening from the outside with an area of at least 50 cm2.The control grilles on the ventilation openings must be positioned so that they do not become clogged.

5.4 Heating system design, connection

5.4.1 Input and output wiring:

The inlet to the boiler is made with a 2 1/2" sleeve in which a G 6/4" reducer is mounted. The integrated mixing thermostat is installed by inserting it (together with a pair of the supplied gasket) into the aforementioned 2 1/2" sleeve, then inserting the fixing spring and screwing in the 6/4" reducer.

5.4.2 Why the boiler does not have to be connected with a mixing branch with return water temperature control?:

The boiler is equipped with an integrated mixing system - where the internal thermostat* (Boiler diagram item 33) together with the mixing duct system ensures that the temperature of all heat transfer surfaces is above 60°C. This protects the boiler against low-temperature corrosion even in a system without a controlled mixing branch (with a temperature-controlled mixing valve). This mixing works very well even in a single-circuit connection

* This is the original Blaze Harmony thermostat, which is supplied as an optional accessory to the boiler. It is placed in the boiler inlet. Of course, the thermostat is not supplied if the boiler is connected to a storage tank with a controlled mixing branch (Ladomat, etc.).

5.4.3 Residual boiler power

The wiring must be designed to ensure that the boiler's residual power is drained, e.g. due to a power failure (In the event of a power failure, the boiler fan is switched off and the boiler output is reduced. If the water temperature rises above 95°C, the water temperature controller shuts off the air inlets and combustion is completely interrupted. However, the hot fuel bed and lining continue to release heat for approximately 1 hour. The amount of residual heat is 5-10MJ depending on the actual power and fuel burn-up.)

5.4.4 The best way to drain residual heat

If possible, it is recommended that the boiler be wired so that the residual power is drained by gravity circulation to the storage tank or system (see recommended wiring). The standard circulator, has a clearance of approximately 3/4", which allows sufficient gravity circulation to drain the residual power. Any filters and dampers must not have excessive pressure drop (∑Kv < 10m3/hr).

5.4.5 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. Connecting **an emergency cooling system** (see Chapter 5.7).
2. 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).
3. Use a **backup power source on the circulation pump.** It is necessary to use a source with a sinusoidal shape of supply voltage.
4. Use a suitably connected **open expansion vessel** (excess power is drained by boiling when the pump fails). For more information, see Chapter 5.5.11.

5.4.6 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.

5.4.7 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.

5.4.8 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 installed in accordance with Chapters 5.5.5 and 5.5.6, if necessary. The water temperature control thermostat (see Boiler diagram position 33) is not installed in this case..

5.4.9 Boiler connection without storage tank

The boiler can be connected to a system with forced or gravity circulation.
Wiring without a storage tank is only recommended if the installation meets the conditions in chapter 1.

5.4.10 The condition of non-separability of the system:

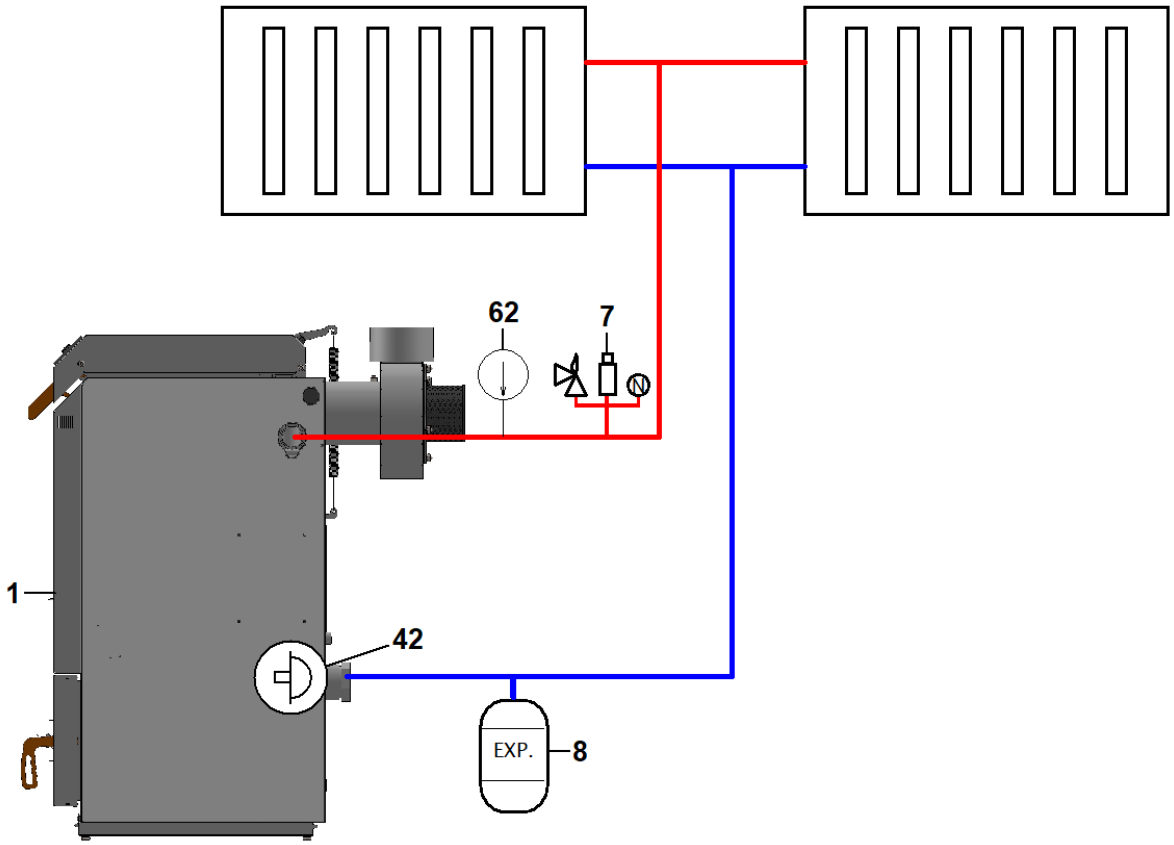
The system must be designed to allow a minimum of 30% of the boiler output to be drawn off (e.g. a master control with a room thermostat or a system with thermowells cannot be used). The control elements (valves of individual branches or bodies) must not be closed in such a way as to reduce excessively the capacity of the system to draw power.

5.5 Circuit diagrams

Each connection must be fitted with a thermomanometer located as close as possible to the boiler water outlet (see wiring diagrams). The thermomanometer is not part of the boiler

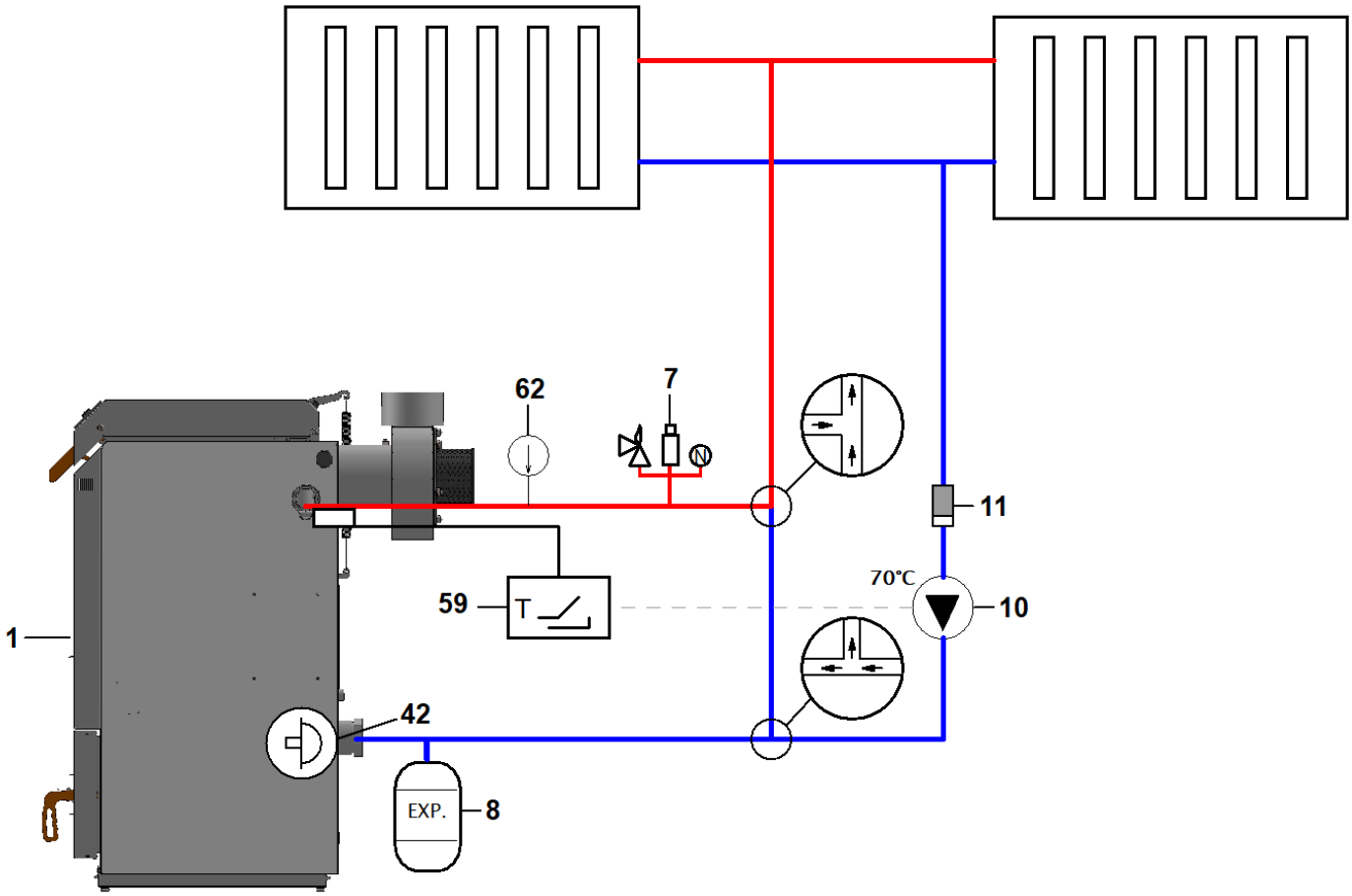
5.5.1 Diagram 1 – gravity connection

The dimensions of the pipe are determined by the designer by calculation



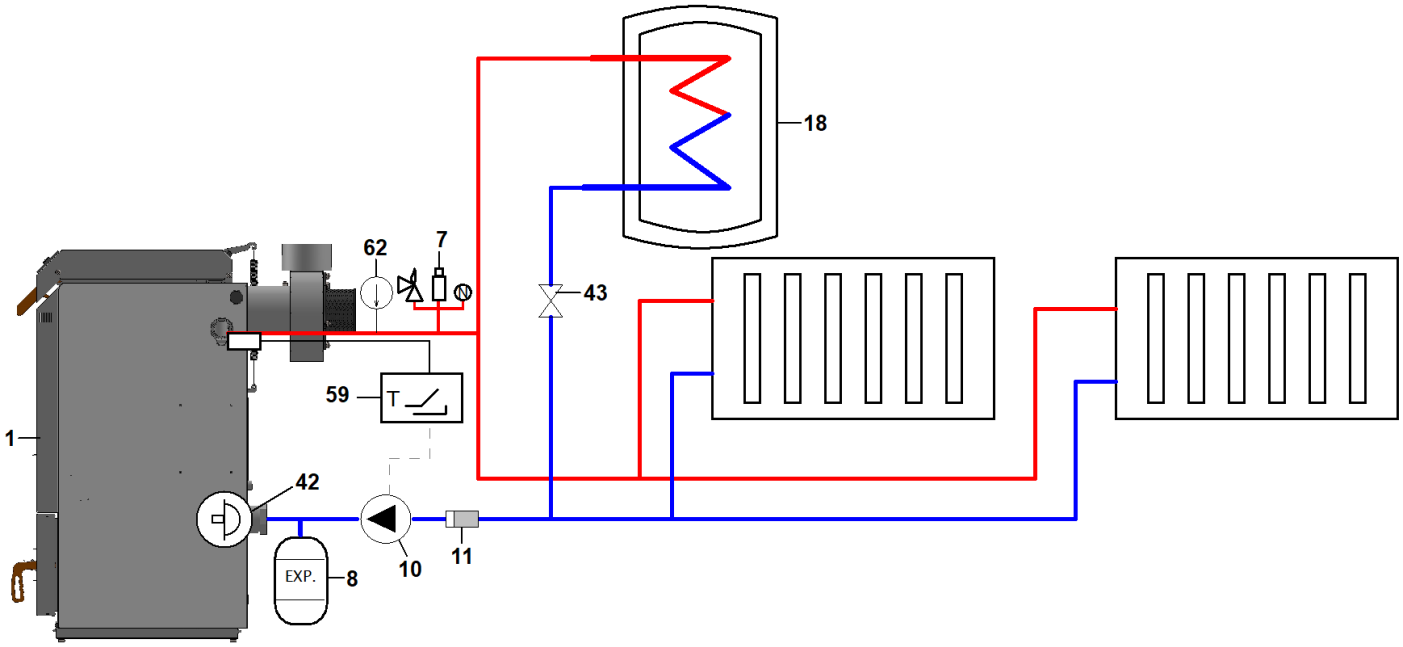
1 – boiler BLAZE NATURAL PLUS, 7 - safety group (air-vent valve, manometer, safety pressure valve), 8 - expansion vessel , 42 – integrated anti-condensation thermostat, 62 - thermomanometr

5.5.2 Diagram 2 – forced connection with self-cooling to the heating system



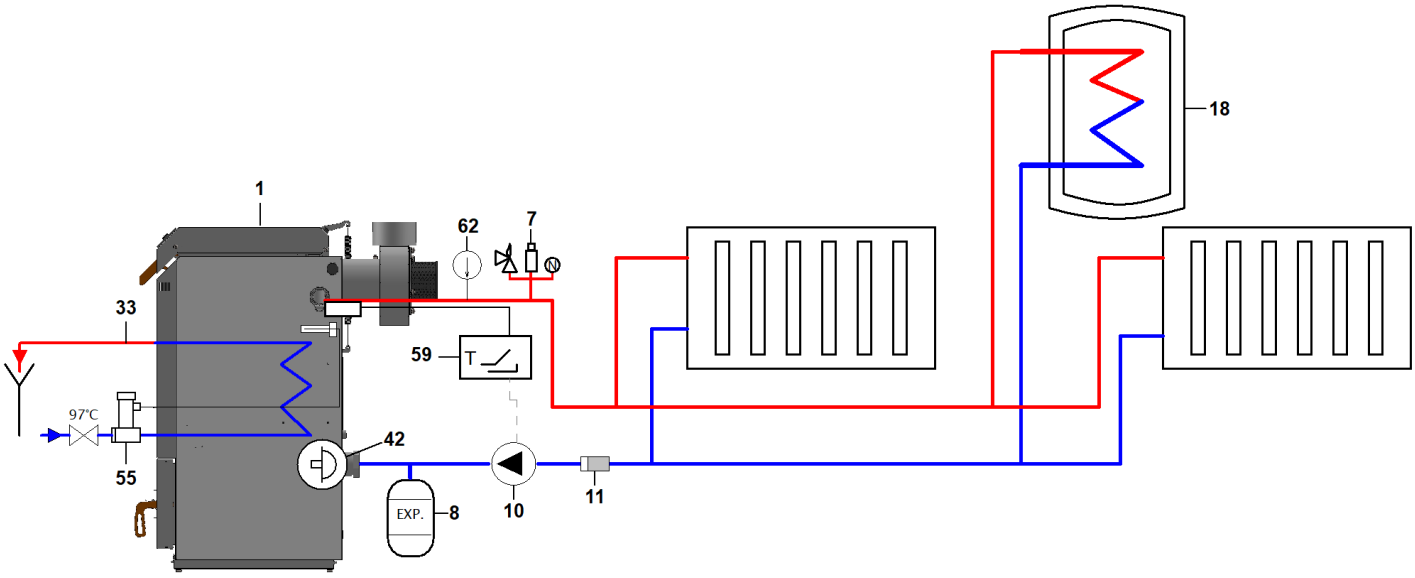
1 – boiler BLAZE NATURAL PLUS, 7 - safety group (air-vent valve, manometer, safety pressure valve), 8 – expansion vessel , 10 – boiler pump, 11 – filter, 42 – integrated anti-condensation thermostat, 59 - Pump thermostat (set to 70°C), 62 - thermomanometr

5.5.3 Diagram 3 – forced connection with self-cooling to the boiler



1 – boiler BLAZE NATURAL PLUS, 7 - safety group (air-vent valve, manometer, safety pressure valve), 8 - expansion vessel , 10 – boiler pump, 11 – filter, 18 – HDW tank, 42 – integrated anti-condensation thermostat , 43 - balancing valve (ball), 59 - Pump thermostat, 62 - thermomanometr

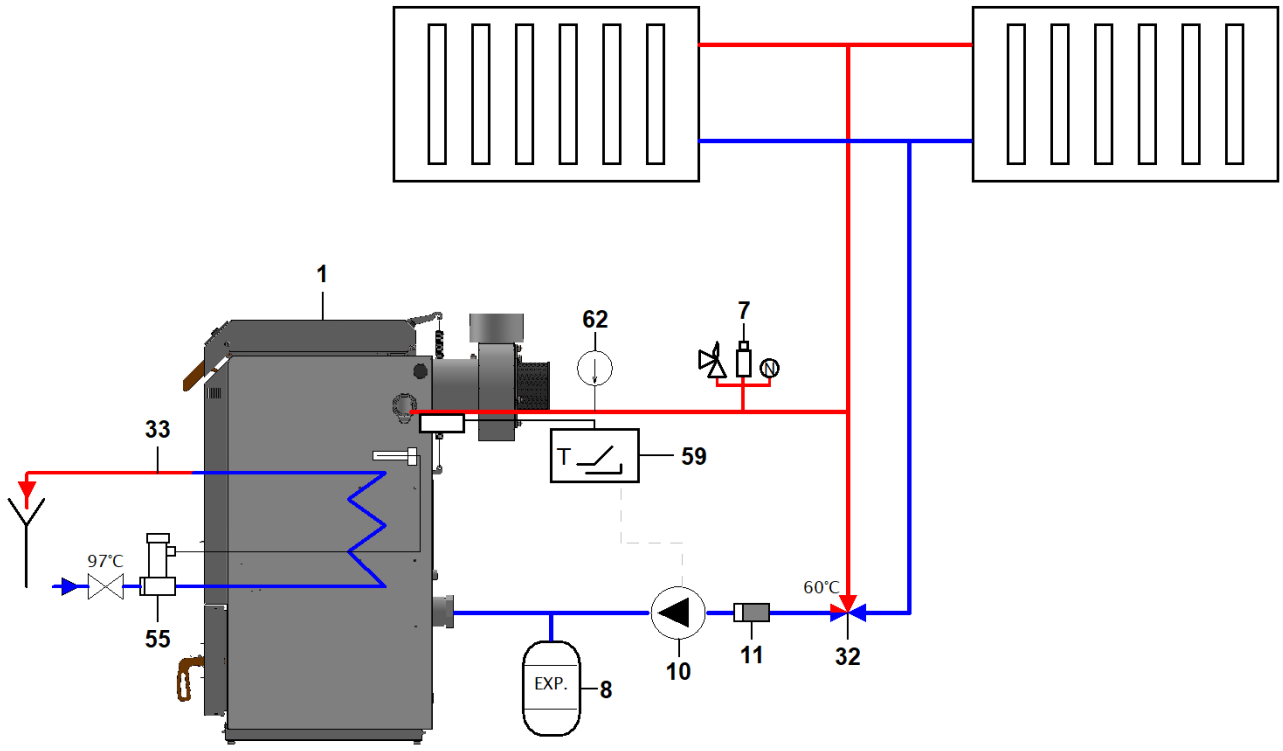
5.5.4 Diagram 4 – forced connection with emergency aftercooling



1 – boiler BLAZE NATURAL PLUS, 7 - safety group (air-vent valve, manometer, safety pressure valve), 8 - expansion vessel, 10 – boiler pump, 11 – filter, 18 – HDW tank, 33 - aftercooling water outlet, 42 – integrated anti-condensation thermostat, 55 - aftercooling thermostatic valve, 59 - Pump thermostat, 62 - thermomanometr

5.5.5 Diagram 5 – forced connection with thermostatic mixing valve and emergency aftercooling

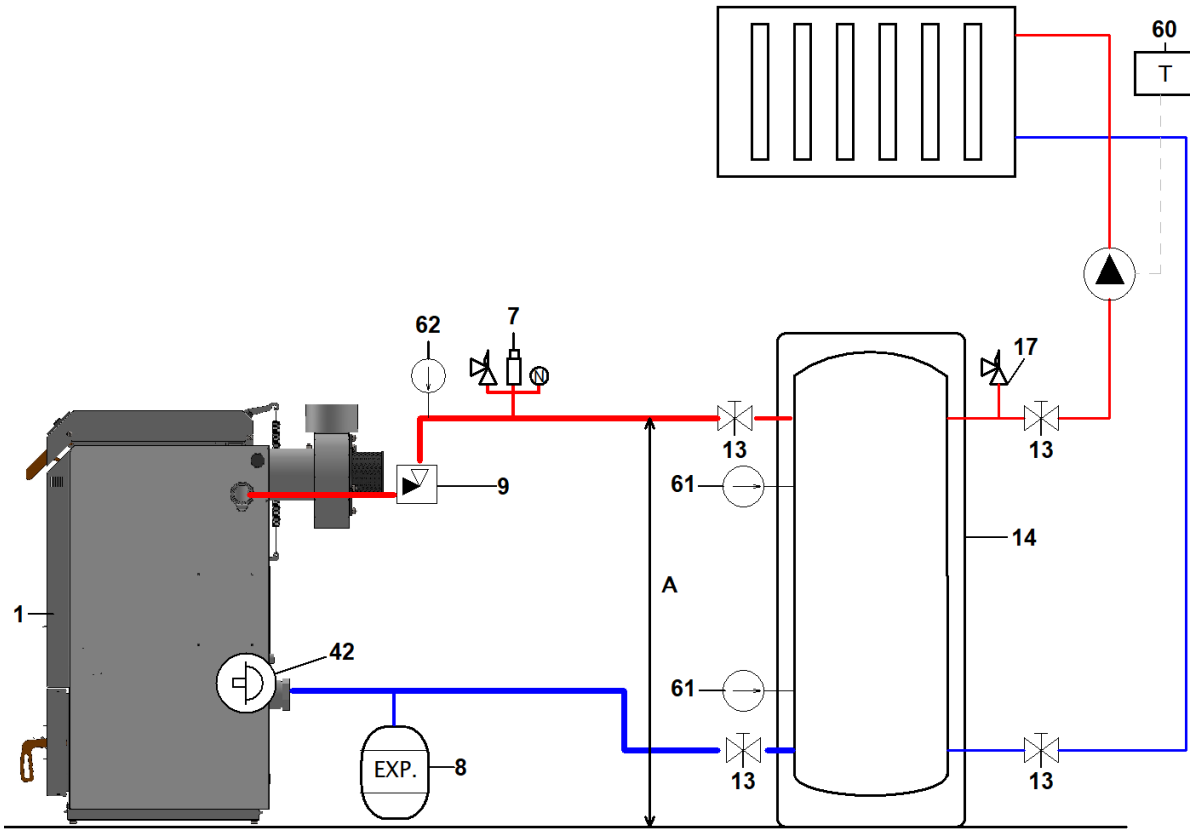
example of connection to an existing circuit where reverse protection has already been implemented. The integrated mixing thermostat is removed from the boiler



1 – boiler BLAZE NATURAL PLUS, 7 - safety group (air-vent valve, manometer, safety pressure valve), 8 – expansion vessel, 10 – boiler pump, 11 – filter, 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, 32 - thermostatic mixing valve , 33 – safety cooling coil, 55- aftercooling thermostatic valve, 59 - Pump thermostat, 62 - thermomanometr

5.5.6 Diagram 6 – forced boiler-tank circuit with thermostatic valve for return protection

This diagram is used if the boiler is not equipped with an integrated thermostat for return protection.



1 – boiler BLAZE NATURAL PLUS, 7 - safety group (air-vent valve, manometer, safety pressure valve), 8 - expansion vessel, , 9 -special gravity back-flow valve , 13 – valve, 14 – buffer, 17 – air-vent valve, 42 – integrated anti-condensation thermostat, 60 - room thermostat of the system pump, 61 - thermometer , 62 – thermomanometr

Table of conditions for solitary connection of boiler with storage tank

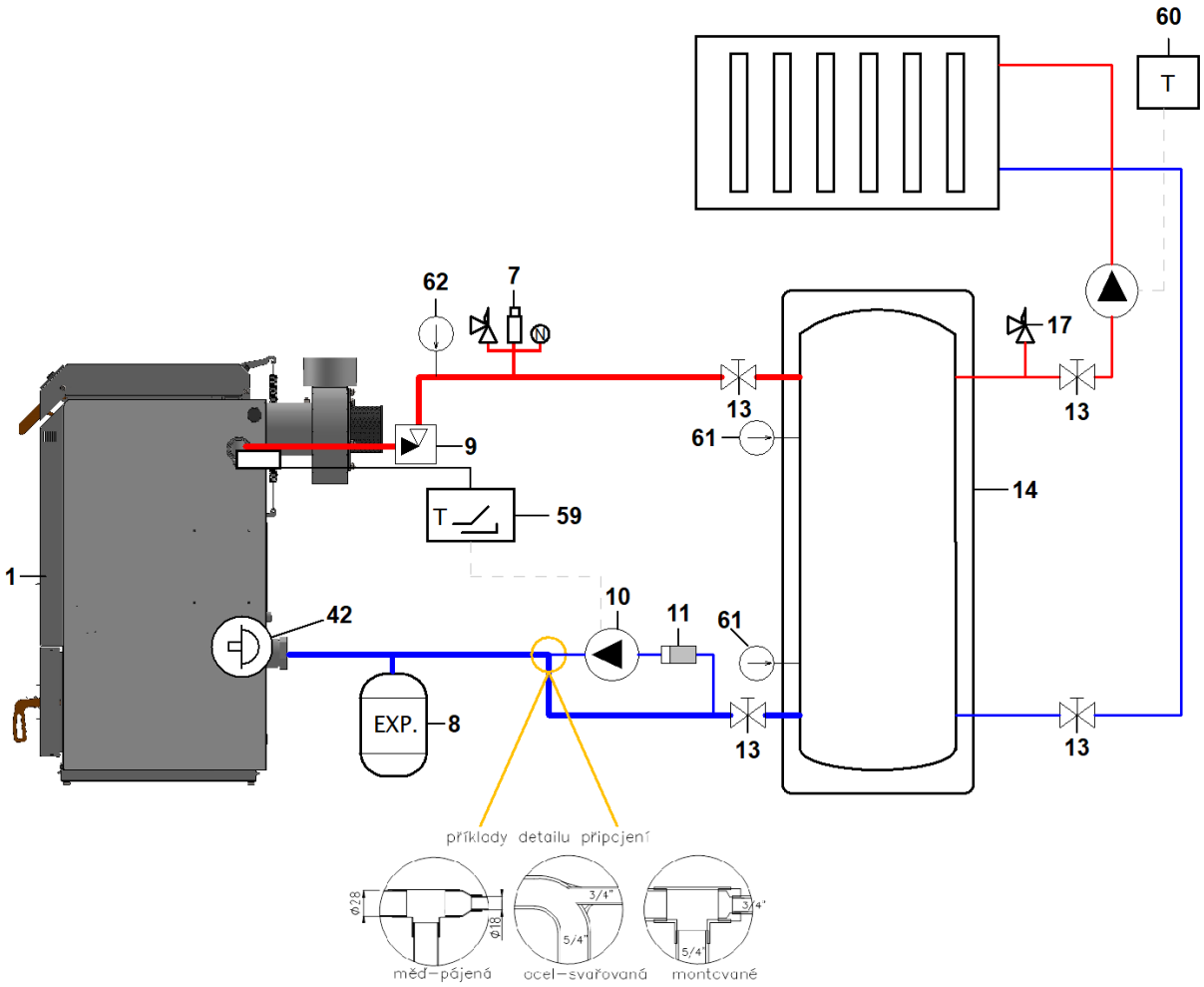
Model	A - minimum height of the entrance to the storage tank from the floor	Dimensions of the copper piping between the boiler and the storage tank	Dimensions of the steel pipe between the boiler and the storage tank
BLAZE NATURAL PLUS 25	160 cm	42 mm	6/4“
BLAZE NATURAL PLUS 35	190 cm	42 mm	6/4“

It is necessary to observe the conditions for solitary connection, see chapter 5.5.5

5.5.7 Diagram 7 - Combined connection with storage tank with injector

It is used where conditions do not allow sufficient boiler-tank circulation alone (the boiler-tank circulation alone is able to charge the tank to e.g. only 50-70% of capacity)

The safety cooling exchanger for the removal of excess heat is not connected.

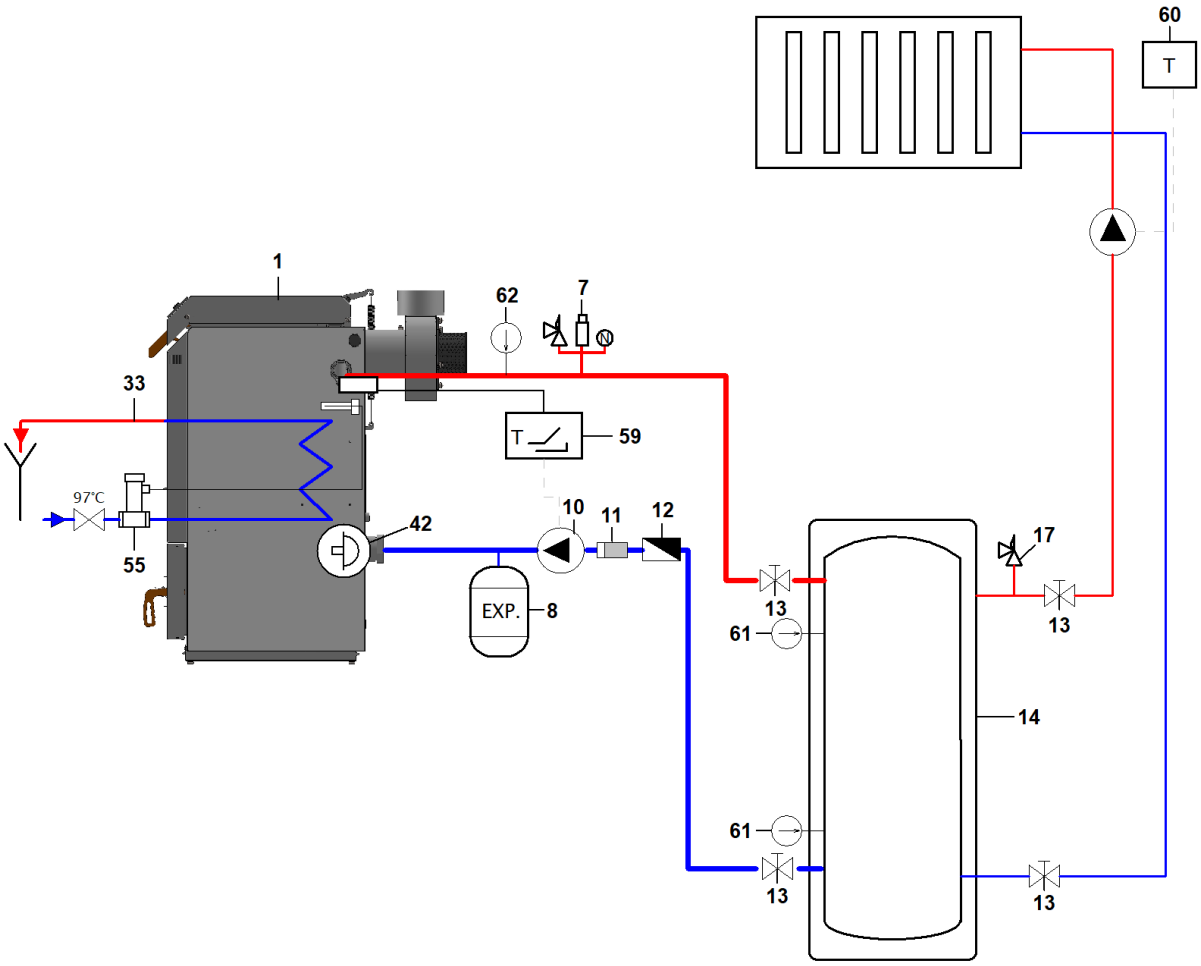


1 – boiler BLAZE NATURAL PLUS, 7 - safety group (air-vent valve, manometer, safety pressure valve), 8 - expansion vessel, 9 -special gravity back-flow valve, 10 – boiler pump, 11 – filter, 13 – valve, 14 – buffer, 17 – air-vent valve, 42 – integrated anti-condensation thermostat, 59 - Pump thermostat (switching temperature 85°C), 60 - room thermostat of the system pump, 61 - thermometer, 62 - thermomanometr

5.5.8 Diagram No. 6 - forced connection with storage tank

Used where conditions do not allow even partial boiler-tank circulation alone

A safety cooling exchanger for the removal of excess heat is connected.



1 – boiler BLAZE NATURAL PLUS, 7 - safety group (air-vent valve, manometer, safety pressure valve), 8 - expansion vessel, 10 – boiler pump, 11 – filter, 13 – valve, 14 – buffer, 33 - aftercooling water outlet, 42 – integrated anti-condensation thermostat, 55- aftercooling thermostatic valve, 59 - Pump thermostat (switching temperature 70°C), 60 - room thermostat of the system pump, 61 - thermometer, 62 - thermomanometr

5.6 Connecting self-cooling

For cooling, domestic water from the water supply system with an inlet pressure of 2-4 bar (at higher pressures it is necessary to install a relief valve) and a temperature of up to 25 °C is used. The water supply must not depend on electricity (domestic waterworks cannot be used). A WATTS STS 20 cooling valve safety with an opening temperature of 97 °C, or Regulus BVTS, can be used.

The cooling water inlet is connected to the bottom sleeve (39) via the safety valve, and the cooling water outlet is connected to the top sleeve (37). The outlet from the cooling loop is led by a hose, for example, to the sewer. We recommend mounting a filter on the inlet.

If the water temperature in the boiler exceeds 97 °C, the safety valve opens and water from the water supply system begins to flow through the cooling loop - the residual power of the boiler is thus dissipated.

ATTENTION!!! It is important to make sure that the safety fitting is correctly connected to the cooling water INPUT to the heat exchanger. The safety cooling exchanger MUST NOT be under constant pressure, otherwise there is a risk of damage.

5.7 Electrical connection

The boiler includes a flex cord with a plug that plugs into a standard 230V socket. The boiler controller does not contain outputs for switching pumps etc.

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

6.1 Cove - loading

Before flooding, the following must be checked and, if necessary, secured:
- whether the heated object (possibly together with the storage tank) will remove the heat produced (see chapter 6.3).
- the functionality and the heating system (amount of water - pressure, if freezing has occurred,...) .
- the tightness of the upper and lower doors.
- the functionality of the flue pipes (condition, tightness,...).
- functionality of the feed and combustion chamber (condition, correctness of assembly,...).
- if the side and rear heat exchangers, or the combustion and feed chambers, are not excessively blocked.
- the functionality of the control and safety elements of the boiler and heating system (safety valves, boiler water temperature controller, thermostats, etc.).

1) Lift the handle of the feed door and open the door slightly. If the boiler is shut down and cooled for a long time, the fan will run at full power. If the boiler has been in operation or shut down for a short time and is still warm (fan running at reduced power), press the "LOADING" switch on the controller. Wait a few seconds for the fan to run at full power and then open the door.

2) If there is enough charred residue in the bottom of the boiler (min. 20 cm), it is usually enough to light a piece of paper and throw it on the layer of coals. Then add a few pieces of fuel. This ensures that the flames do not shoot upwards, but flow through the layer of embers, igniting them.

3) If there is not a sufficient layer of charcoal residue at the bottom of the boiler, stack smaller logs in the feed chamber. This layer should roughly fill the bottom tapering portion of the feed chamber. On top of this layer, stack small chips or trimmings. Place the lit crumpled paper on top of the chips. It is advisable to have the paper cover the entire area of the fuel loaded and then add more logs on top of the lit paper so that the flames do not shoot upwards but down through the layer of wood.

4) Close the top door so that it remains 1 to 2 cm ajar (this is achieved by closing the door with the closing handle pushed in). Allow to heat up as required (approx. 5 min).

5) When you are satisfied that the fire has started (by looking into the window or by the rising temperature of the flue gases), load the boiler with fuel (see section 6.2). Close the door. If the fire is properly fired, the boiler will reach its rated output within 30 min. If the flame is dying out or stalling, the top door can be opened briefly to start the fire.

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.

Especially before the boiler is started up for the first time, but also after cleaning, check the correct assembly of the ceramic parts in the lower combustion chamber. Incorrect assembly deteriorates the combustion quality and causes excessive clogging of the boiler and chimney.
It is also important to place a plug under the rear fittings, otherwise the boiler may be damaged.

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 first logs should be smaller (to make it easier for the fuel to burn). 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 jet. It is also advisable to place several smaller logs on top to form a stable layer (loose fuel does not usually form a suitable stable layer).

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 down position (unless the weight of the turbulators lifts it by itself). 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.

6.2 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.

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.

6.3 Setting the desired power

The boiler output can be controlled:

Based on flue gas temperature - Electronic regulator (with control wheel on the regulator panel) maintains the flue gas temperature and thus the boiler output 100% of the output corresponds to a flue gas temperature of approx. 160°C, 30% of the boiler output corresponds to a flue gas temperature of approx. 110°C

The water temperature regulator is factory set to 95°C and has a self-adhesive seal. It is forbidden to tamper with the temperature controller or to reset it in any way.

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.

6.4 Setting automatic stable heat

The boiler is equipped with the so-called automatic stoker function, which switches off the fan before the fuel charge is completely burnt out. This leaves a base layer of carbon residue in the boiler until the next load. Burnout detection on the base layer is provided by a movable detection arm in the front wall of the feed chamber. This arm is pressed against the wall by the fuel after it has been added. During operation, the fuel level gradually drops and the arm is gradually exposed. When the fuel level drops below the end of the detection arm, the arm is released and tilted into the loading chamber by the action of the counterweight. This closes the air dampers and at the same time switches off the fan (via the limit switch).

By opening the loading door, a pressing mechanism coupled to the door presses the detection arm against the wall of the loading chamber so that it does not obstruct the insertion of fuel. By closing the door, the pressure mechanism releases the detection arm again. The correct operation of the mechanism can be verified by manually pushing the elongated body protruding from the sloping wall of the boiler front cover with the door open (when pushed, the detection arm is tipped into the boiler feed chamber).

The optimum base layer should roughly fill the lower tapering part of the loading chamber. The base layer must not contain smouldering fuel residues as these will clog the boiler with tar during shutdown. We therefore do not recommend adding small batches of fuel. We recommend that the last pieces of the fuel load be smaller (split logs) so that they break down more easily into the base layer during the burn.

6.5 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

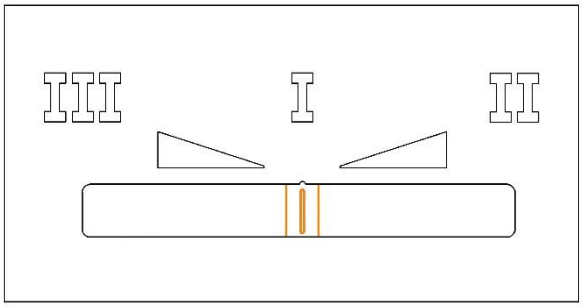
chamber that the flame is touching have the same color on the entire surface. Smoke that does not clear away even when the humidity is low is coming out of the chimney - **it is necessary to increase the amount of secondary air (move the shutter to the right)**

Pre-drying air (left half of the orifice plate range) is only intended for fuel that burns very poorly when adjusted in the middle position of the orifice plate (soft wood, large uncut or insufficiently dried logs).

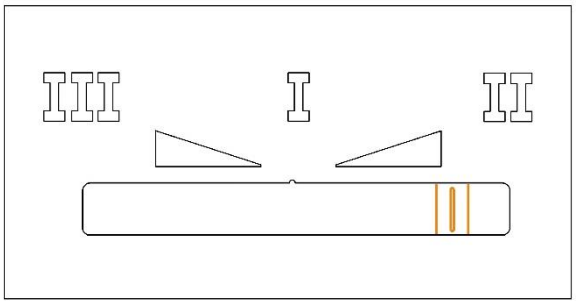
Improper use of pre-drying air (with good fuel quality) can cause the walls of the chamber and the stoking door to overheat and become damaged.

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.

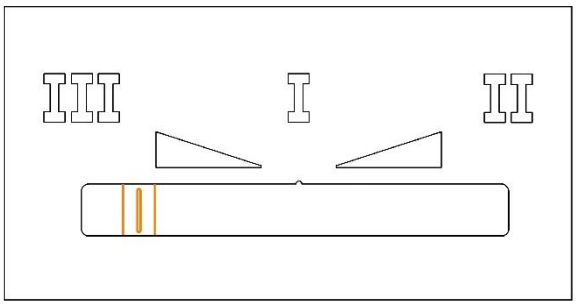
The amount of secondary air is adjusted with the sliding shutter (position 8 on the diagram).
Orientational secondary air setting according to fuel type:



- Usual wood - screen in the middle.



- Hardwood (beech, oak), dry wood chips, wood briquettes - more secondary air - screen on the right .



- Soft wood, large unchipped or insufficiently dry logs - minimum amount of secondary air (maximum primary and pre-drying air) - screen on the left.

6.6 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 jet into the combustion chamber during operation. Nevertheless, we recommend checking and removing the ash layer from the bottom of the feeding chamber once a month. For fuels with a higher ash content (wood chips) this should be done more frequently (once a week).

The exchanger (if there are no mechanical turbulators) must be checked at least once a week, and if it is clogged, it is necessary to remove the turbulators and clean the pipes with cleaning tools.
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)

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).

Every 2 weeks it is necessary to remove the plug (see Boiler diagram item 41) and check or remove any deposits in the space under the rear heat exchanger. Every 2 weeks remove any deposits from the walls of the lower combustion chamber (above the fittings and above the door e.g. with a spatula, behind the rear fittings with a hook).

Regular cleaning and maintenance of the boiler is essential to maintain the longevity of the equipment. If the boiler is not cleaned regularly and properly, all parts are subject to increased thermal stress and risk of damage. Damage caused by neglected boiler maintenance is not covered by the warranty!

The ash must be placed in fireproof containers with lids.

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

6.7 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.

6.8 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. Tightness - the correctness of the seating is known by the fact that there is a smoothly pressed edge of the sealing surface (boiler body) in the cord. If it is rough - covered with soot and tar deposits, it indicates a leak. This is particularly likely to occur on the inner cord of the feed door.

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

6.9 How (not) to drown properly

It is recommended to pay attention to the Operating Instructions of the boiler. Especially the sections that describe how to operate the boiler correctly so that the combustion is of good quality. Poor quality combustion reduces efficiency, pollutes the surroundings, shortens the life of the boiler, and causes excessive fouling of the flue gas passages or "clogging" of the turbulators. Think of turbulator stalling as a valuable warning that something is wrong with the boiler operation.

Possible errors and recommendations for boiler operation:

- **Improper plugging into a clean boiler** ... We recommend filling the funnel with pieces of fuel (well dry, ideally hard) so that after the fire is started and the door is closed, the flame remains stable (it may weaken, but it must not wane or go out).
- **Unsuitable fuel** ... Large pieces, too many gaps, damp or all together. Softwoods in particular are harder to burn and require to be dry, split (up to about 15cm). Too long pieces, they can buckle. Logs should be no longer than 33/50cm. For inferior fuel, we recommend a higher power setting. Do not put large pieces at the bottom (not enough to fall apart and get stuck above the funnel) Do not put large pieces on top (they will not char and will splinter after shutting down). It is recommended to stack irregular pieces together with minimal gaps
- **Inappropriate II air setting (see instructions.)...**e.g. softwoods usually require pre-drying air. Hardwoods and wood chips more secondary air.
- **Insufficient fuel rate**...always recommend full rate (half rate burns short and hardly forms a quality stable layer.
- **Too low output** ... especially when combined with a clogged boiler or unsuitable fuel.
- Operation with a clogged boiler ... ash in the lower chamber and exchanger passes. The metal walls of the flue passages and chamber (for BN PLUS, the lower door above the fittings and the door opening) should be cleaned. If there is a lot of ash at the bottom of the feed chamber, allow to burn out completely, sweep down and remove.
- **Adding fuel in a state where no extraction is ensured** ... The tank and the object will not absorb the heat from the fuel charge and shutdown will occur with smouldering fuel - it is necessary to determine the free capacity of the tank before adding it (limit temperature e.g. 60°C in frost, 50°C when the outside temperature is above 0°C).
- **Burning of non-standard fuels**... Wood chips, sawdust, etc. require more operator requirements (flooding, feeding, power control, and air adjustment).
- **Inappropriate operation intervention** ...Shutdown before burn down to staggered layers, restart operation time (by panel selection or peeking).

7 Possible defects and their solutions

7.1 Overheated boiler

If the boiler water temperature exceeds 90°C, the controller shuts down the boiler (switches off the fan). If the temperature exceeds 95°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 (22) 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

(In the event of a power failure, the boiler fan is switched off and the boiler output is limited. If the water temperature rises to 95°C, the water temperature controller shuts off the air inlets and the combustion is interrupted completely. However, the hot fuel bed and lining continue to release heat for about 1 hour. The amount of residual heat is 5-10MJ, depending on the actual power and fuel burn-up.)
When the boiler's electrical supply is interrupted (mains failure, switched off by the main switch)Boiler operation without electricity
The boiler is capable of working only with the chimney draft. For this

7.3 Operation of the boiler without electricity

The boiler is only able to operate permanently on the chimney draft. At a chimney draft of 10 Pa the boiler operates at 30%, at a draft of 20 Pa at about 75% power. Higher output on natural draft can be achieved by removing the economizer from the flue gas exchanger. This will increase the flue gas temperature and create more draft in the chimney.

7.4 A bay without electricity:

Before flooding, the following must be checked and, if necessary, secured:

- whether the heated building or the storage tank will remove the heat produced (see chapter 6.3).
- the functionality of the heating system (amount of water - pressure, if freezing has occurred,...)
- tightness of the upper and lower doors
- functionality of flue pipes (condition, leakage,...)
- functionality of the feed and combustion chamber (condition, correctness of assembly,...)
- whether the side and rear heat exchangers, or the combustion and feed chambers, are not excessively blocked

For operation without electricity, remove the economizers from the flue gas exchanger. This will increase the flue gas temperature and thus the chimney draft (If the flue gas temperature does not exceed 250°C, the effect of removing the economizers on consumption is insignificant. In addition, the chimney flue usually passes through the building and as a result a significant part of the flue gas heat is transferred to the heated space).

1. boiler enough charred residues (min. 20 cm), usually it is enough to light a piece of paper and throw on a layer of coals. Add a few small pieces of fuel at a time. This ensures that the flames do not shoot upwards, but flow through the layer of embers, igniting them.
2. If there is not a sufficient layer of charcoal residue at the bottom of the boiler, we stack smaller logs in the feed chamber. Lay them in such a way that there are gaps (crossed) between them. This layer should roughly fill the lower tapering part of the stoking chamber. On top of this layer, stack small chips or cuttings. Place the lit crumpled paper on top of the chips. It is advisable to have the paper cover the entire

area of the fuel loaded and then add more logs on top of the lit paper so that the flames do not shoot upwards but down through the layer of wood.

3. If the chimney is not completely cool and has the necessary draft, the fire will slowly burn down.
4. After ignition, load the boiler with fuel.
5. Close the top door so that it remains 1 to 2 cm ajar (this is achieved by closing the door with the closing handle pushed in). Allow to heat up as required (approx. 5 min).
6. When you are satisfied that the combustion is stable (by looking into the viewing window or by the rise in flue gas temperature), close the door When properly executed, the flame is not extinguished and the output gradually increases. If the flame is dying out or stagnating, the upper door can be opened to start the fire.

The use of flammable liquids is prohibited. It is forbidden to increase the rated output of the boiler in any unacceptable way during operation.
No combustible objects of any kind may be placed near the boiler. Ashes must be placed in non-combustible containers with lids.

A boiler operated in this way must be kept under constant supervision. It must be ensured (by covering, closing the combustion air opening) that the water temperature does not exceed 95°C.
In the event of a power failure, only a boiler connected to the system (or with a storage tank) with self-circulation may be operated.

7.5 Other defects and their solutions

Defect	Cause	Removal
The electronic controller is not working (switch backlight or indicator light is not on).	Burned internal fuse in the controller.	Replace fuse (service technician, qualified electrician).
	Loose or disconnected fork of supply cable, damaged wire.	Check power supply, power fork, cable, replace damaged part (service technician, qualified electrician).
	Damaged controller.	Replace the controller (service technician, qualified electrician).
Mechanical water temperature controller not working properly	Regulator shaft loose	Remove front cover, adjust, tighten set screw (service technician)
	Damaged mechanical regulator	Replace regulator (service technician)
	Incorrectly adjusted air inlet dampers	Remove air distribution panel, adjust (service technician)

It is not possible to exclude economizers.	Poor combustion quality, long interval between exchanger cleaning. Frequent boiler shutdowns with large quantities of fuel (overheating).	Vinegar can be used to loosen - dissolves tar.
The fan is not spinning.	The emergency thermostat is open.	When the boiler water temperature drops below 80 °C, unscrew the emergency thermostat cap and press the switch with a suitable object (e.g. pencil).
	Fan impeller stuck.	Remove the cause (foreign body, blockage).
	Controller fuse blown.	Replace the fuse (service technician, qualified electrician).
	Motor inoperative.	Replace the motor (service technician, qualified electrician).
	Damaged controller.	Replace the controller (service technician, qualified electrician).
No permanent layer remains in the boiler.	Leaking dampers on air inlets	Disassemble air panel, adjust dampers (service technician).
	Controller did not receive the stochastic switch signal (fan spins even when detection arm is deflected, red LED does not light up).	Find the cause (switch not mechanically closed, switch not working, broken wire) - Troubleshoot (qualified electrician, service technician).
	Detection arm not deflected - e.g. immobilized by tar build-up - frequent boiler shutdowns with large amounts of fuel (overheating), or otherwise malfunctioning (loose retaining bolt of the storage body, etc.)	Disassemble the air panel and remove the fault.
Exhaust fan makes excessive noise	Impeller is contaminated with tar - Frequent boiler shutdowns with large amounts of fuel (overheating). Leaky internal feed door cord	Disassemble fan motor, clean. Remove cause of fouling

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/m3 (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/m3.
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/m3 (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 m3 (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^3, and about 20W per 1m3 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^3)
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^3 (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 NATURAL PLUS boilers

a) Inlet water control thermostat of the integrated mixing system

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

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 equipment has been manufactured and tested according to the valid documentation and complies with the valid EN303-5 Boilers for central heating.

The warranty period for the boiler is 2 years. The warranty period for the pressure part of the boiler is 5 years.

The warranty applies only to a boiler that is operated in accordance with the instructions given in the assembly, installation and operating instructions and commissioned by an authorised company.
The warranty does not cover parts subject to normal wear and tear (ceramic fittings, sealing cords).

The warranty covers the free replacement of defective spare parts. A new spare part will be sent to the sales department of BLAZE HARMONY s.r.o. within 24 hours of reporting the claim. If the defective spare part is not delivered to the sales department of BLAZE HARMONY s.r.o. within 14 days of receipt of the new part, the warranty on the product (boiler) is hereby terminated. The warranty does not cover travel costs associated with the replacement, which will be charged according to the current travel costs.

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.

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 NATURAL PLUS boiler to the following address:

BLAZE HARMONY s.r.o.
Trnávka 37
751 31 Lipník nad Bečvou
Czech Republic

Or by email to: zarucak@blazeharmony.com

16 Annex to warranty card for the customer - user

Record of performed warranty and post-warranty repairs and product inspections			
Date of record	**Work performed**	**Contractual service organization (signature, stamp)**	**Customer's signature**

17 Declaration of Conformity of BLAZE NATURAL PLUS 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 NATURAL PLUS 25, BLAZE NATURAL PLUS 35

Description of the device:
Hot water gasification boiler for wood, with manual fuel supply, designed for heating family houses and other similar buildi ngs 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

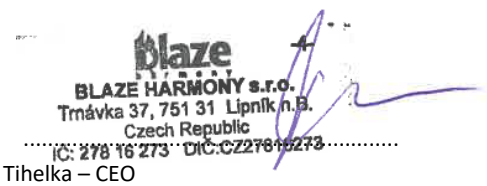
Conformity assessment:
Certificate No. B-01926-21 dated 22.11.2021, valid until 30.11.2023, issued by the Engineering Testing Institute Brno, Hudcova 56b, 621 00, ID No.: 00001490, was used for conformity assessment.

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: **21**
In Lipník nad Bečvou, 8.9.2021

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



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

BLAZE HARMONY s.r.o.
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