



**BOILER OPERATING AND INSTALLATION  
INSTRUCTION MANUAL**

**BENEKOV S100**

**Dear client,**

thank you for purchasing the automatic hot water wood pellet boiler BENEKOV S100 and hence your confidence in BENEKOVterm s.r.o. of Horní Benešov.

To get used to a correct way of handling your new product right from the beginning, first read this operating manual, especially the chapter 7 and 8. Please follow the information below and observe the instructions of the manufacturer or the service company that installed your boiler.

This boiler was approved for operation in EU member states by Strojírenský zkušební ústav, s.p. (Engineering Testing Institute, state-owned-enterprise), Notified Body 1015, Authorized Body 202, Brno based on certificate no. B-30-00613-16 of 31.5.2016.

In accordance with Government Regulation No. 176/2008 Coll., Annex 1, section 1.7.4. it is an

**ORIGINAL INSTRUCTION MANUAL.**

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## **Table of Contents**

1. Boiler use and advantages .....	4
2. Technical specifications.....	4
3. Specified fuel .....	5
4. Boiler description .....	6
4.1. Boiler design .....	6
4.2. Control and safety elements of the boiler .....	13
4.3. Boiler accessories.....	13
5. Boiler placement and installation .....	14
5.1. Regulations and directives.....	14
5.2. Boiler placement options .....	16
6. Commissioning of the boiler - instructions for contracted service organizations .....	18
6.1. Electrical connection via connectors.....	18
6.2. Connection of the boiler to the heating system.....	19
6.3. Installation of ceramics into the boiler .....	20
6.4. Verification activities before start-up.....	21
6.5. Putting into operation .....	22
7. Boiler operation by user .....	22
7.1. Making fire in the boiler.....	23
7.2. Boiler operation.....	23
7.3. Boiler shutdown .....	23
7.4. Residual risks and their prevention.....	24
8. Boiler maintenance .....	25
9. Troubleshooting .....	26
10. Guidelines for sustained compliance with the environmental parameters of the product .....	28
11. Instructions for product disposal after the end of its service life.....	28
12. Guarantee and liability for defects .....	28

## 1. Boiler use and advantages

### Boiler use:

The BENEKOV S100 hot water boiler is designed for heating medium-sized buildings - shops, schools, recreational facilities, office buildings, establishments and other building facilities, whose heat output demand does not exceed 100 kW.

The BENEKOV S100 boiler is designed for burning wood pellets.

### Boiler advantages:

- automatic boiler operation
- possibility of combustion of renewable source of energy in the form of wood pellets
- mechanical fuel supply from standardized container (or general bunker) into the combustion chamber
- simple, time-undemanding operation and maintenance
- low operating costs
- low emission burden for the neighbourhood
- 3-draught design of the boiler body guaranteeing high efficiency
- Automatic ignition of the boiler as a standard
- Controlled combustion assisted by lambda probe
- modulation of thermal output in the entire power output range
- The boiler and the boiler body can be broken down into several smaller units, which simplifies its transport to the boiler room and installation
- possibility to connect ash removing device (optional)
- Simple, efficient design

## 2. Technical specifications

Tab. no. 1 Dimensions and technical parameters of boilers

Boiler type		BENEKOV S100	
Weight (boiler body + feeder to the boiler + turnstile)	kg	1345	
Water compartment volume	dm <sup>3</sup>	370	
Flue gas duct diameter	Mm	250	
Boiler heat transfer surface	m <sup>2</sup>	11,2	
Boiler dimensions: width x depth x height	Mm	Fig. no. 3, 4, 5	
Boiler class according to ČSN EN 303-5		4	
Maximum permissible operating pressure	bar	2,0	
Testing pressure	bar	4,0	
Recommended operating temperature of heating water	°C	65 - 80	
Lowest temperature of the inlet water	°C	60	
Hydraulic boiler loss	Δ T = 10 K	mbar	1,5
	Δ T = 20 K	mbar	0,4

Sound pressure level $L_{pA}$	dB	50 ± 3
Required chimney draft	mbar	0,25 – 0,35
Boiler connections - heating water	Js	G 2"
- return water	Js	G 2"
Supply voltage		400V / 16A / ~ 50 Hz
Electrical power input at rated power output	W	250
Electrical power input at minimum power output	W	90
Electrical power input in STAND BY mode	W	10
Electrical protection		IP 20

Tab. no. 2 Thermal technical parameters of the boiler with the combustion of wood pellets

Boiler type		BENEKOV S100
Nominal output	kW	99
Adjustable power output	kW	28,4 – 99
Fuel consumption	kg . h <sup>-1</sup>	6,9 – 23,3
Flue gas temperature		
- at rated output	°C	143
- at minimum output	°C	89
Efficiency	%	89
Mass flow rate of flue gas at the output		
- at rated output	kg . s <sup>-1</sup>	0,048
- at minimum output	kg . s <sup>-1</sup>	0,022

Tab. no. 3 Parameters of standardized fuel container

Boiler type		BENEKOV S100
Silo diameter	mm	2 500
Dimension of the filling opening in the fuel container	mm	octagon φ 2500
Weight of the basic fuel container module	kg	397
Weight of the additional fuel container module	kg	60
Capacity of the basic fuel container module	dm <sup>3</sup>	4000
Capacity of 1 pc of the additional fuel container module	dm <sup>3</sup>	2000
Firing time at rated output with full basic container module	h	99

### 3. Specified fuel

Prescribed (guarantee) fuel for BENEKOV S100 boiler is shown in the Table. no. 4.

Tab. no. 4 Prescribed fuel

Type of fuel according to ČSN EN 303-5	Average [mm]	Length [mm]	Bulk density [kg/m <sup>3</sup> ]	Water content [%]	Ash content [%]	Calorific capacity [MJ.kg <sup>-1</sup> ]
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C1 - wood pellets	φ 6 - 14	max. 30	600 - 650	max. 12	max. 1,5	min. 17
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**ATTENTION!** Poor fuel quality can significantly affect performance and emission parameters of the boiler.

The pellets must comply with the requirements of the standard ČSN EN 14961-2.

## **4. Boiler description**

### **4.1. Boiler design**

The boiler construction meets the requirements according to:

ČSN EN 303-5: 2013 - Heating boilers - Part 5: Heating boilers for solid fuels, hand and automatically stocked, nominal heat output of up to 500 kW - Terminology, requirements, testing and marking.

The main part of the boiler is the steel boiler body, made up of four basic units:

- Combustion chamber
- Combustion chamber stand
- Heat exchanger
- Heat exchanger stand.

All parts of the boiler body at the interface of flue gases and heating water and all the supporting parts of the stands are made of sheet metal with a thickness of 5 mm. In front of the 3-draft boiler body there is a combustion chamber with a burner; at the back of the boiler body there is a tubular heat exchanger providing for the decisive transfer of heat from flue gases to the boiler water.

The burner, located in the stirrer and mounted to the side wall of the stand, operates on bottom stoking principle. It consists of a refractory elbow (so-called retort) and an iron grate. The fuel feeder consists of a trough for fuel supply, a channel for supplying combustion air and a flexible interconnection that serves for pressure equalization under the fireplace and which prevents smoke penetration into the fuel tank during the combustion process.

The burner is fitted with a funnel-shaped ceramic reflector that directs the exhaust gas flow, and reduces fly dust. The reflector is fed with secondary air through the side wall of the combustion chamber which facilitates complete combustion.

Beside the boiler, there is a screw feeder, which provides for transport of fuel from the external container to the burner. The feeder consists of two screw conveyors (feeding from the bunker + feeding into the boiler) with a turnstile in between. This serves to create an air gap between the two screw conveyors, and to avoid any ignition of the fuel in the container. In addition to that, the cover of the feed from the bunker is fitted with an emergency fire extinguishing system, which leads to the transported fuel above the turnstile.

Depending on the position of the fuel feed screw towards the boiler drum the boiler is manufactured in two series versions:

- Right version - the fuel feeder is on the right of the boiler body when viewed from the front
- Left version - the fuel feeder is on the left of the boiler body when viewed from the front

Furthermore, according to the spatial disposition in the boiler room you can select three mounting positions of feeding from the bunker towards feeding in the boiler: side design (See Fig. No. 3), front design (See Fig. no. 4) and rear design (See Fig. No. 5).

The primary combustion air fan is placed on the side of the boiler upstream the feeder and is connected to the stirrer. The amount of combustion air (primary and secondary) is regulated by the control unit of the boiler.

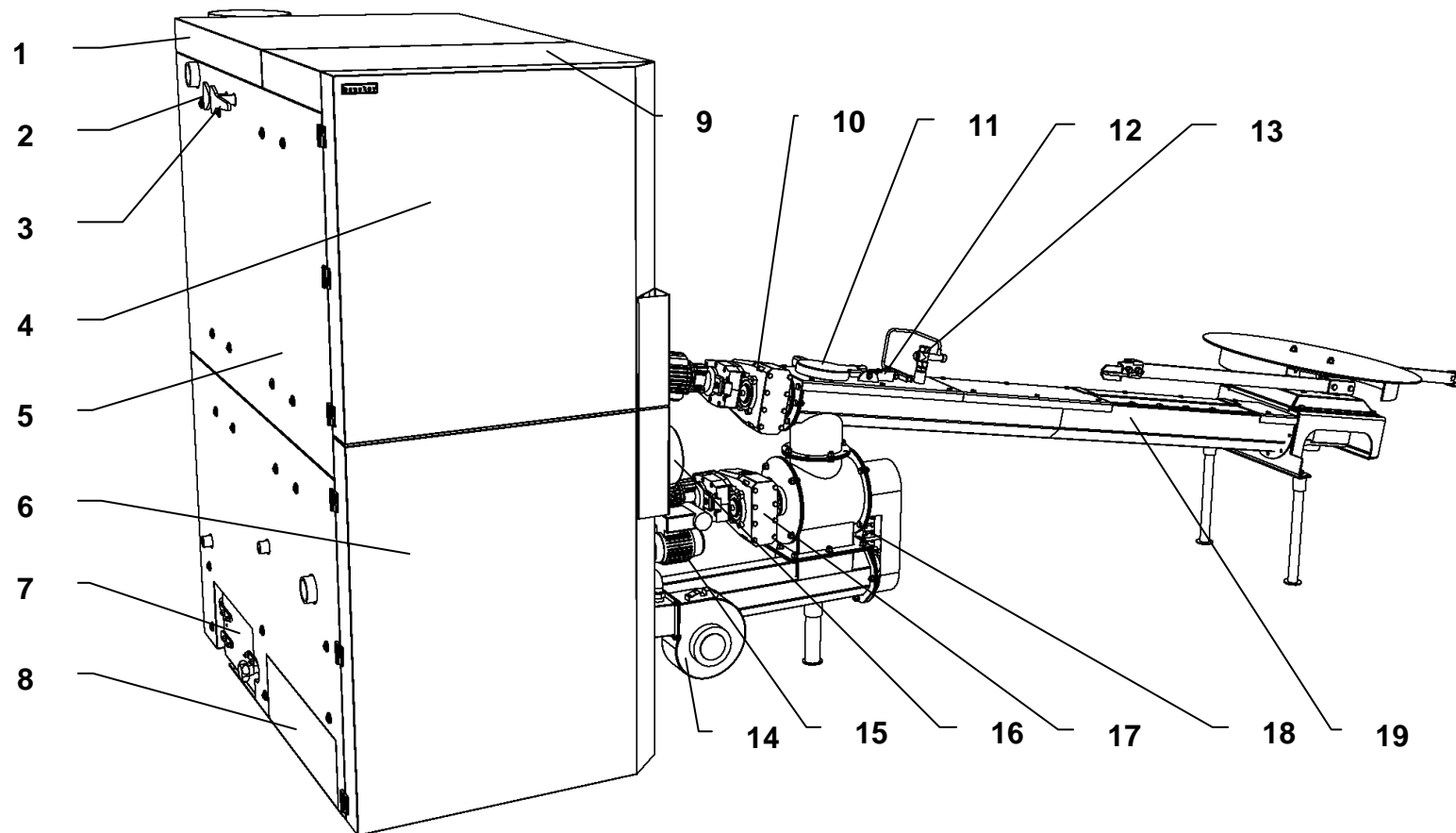
The inlet and outlet of the heating water for connection to the heating system is located on the outer side wall of the boiler and consists of two fittings with G 2 thread. The outlet fittings with G 3/4" threads on the same wall of the boiler are used for installation of the drainage valves: one for the combustion chamber, one for the tubular heat exchanger. At the rear of the boiler on the top, there is a flue gas exhaust adapter leading to the chimney.

The flue gas exhaust increases the chimney draft (especially in the cold state and ignition) and is an integral part of the boiler equipment.

Boiler body, its lid and doors are insulated with non-toxic insulation which reduces losses by dissipating heat to the surroundings.

Steel casing is provided with quality powder paint colour finish.

**Fig. No. 1 Front view of the BENEKOV S100 boiler**



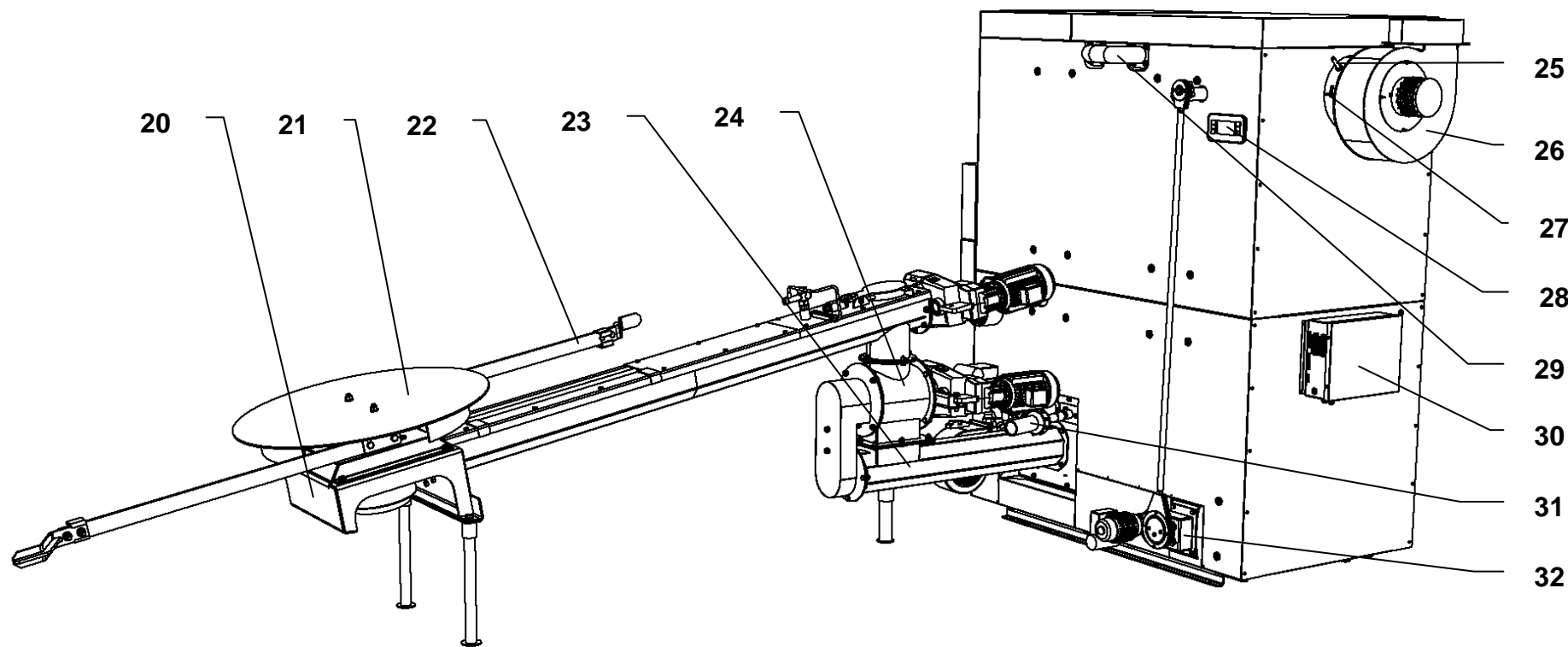
- 1. Boiler cover - rear part
- 2. Locking bolt of firing flap
- 3. Firing flap lever
- 4. Door top cover
- 5. Boiler body
- 6. Bottom door cover
- 7. Tubular heat exchanger cleaning door

- 8. Preparation for ash remover
- 9. Boiler cover - front part
- 10. Drive of feeding from the bunker
- 11. Cover of feeding from the bunker
- 12. Limit switch of the cover of feeding from the bunker
- 13. Emergency fire extinguishing system

- 14. Primary air fan
- 15. Rotating grate drive
- 16. Secondary air fan
- 17. Turnstile drive and feeding to the boiler
- 18. Turnstile chain
- 19. Feeding from the bunker



Fig. no. 2 Rear view of the BENEKOV S100 boiler

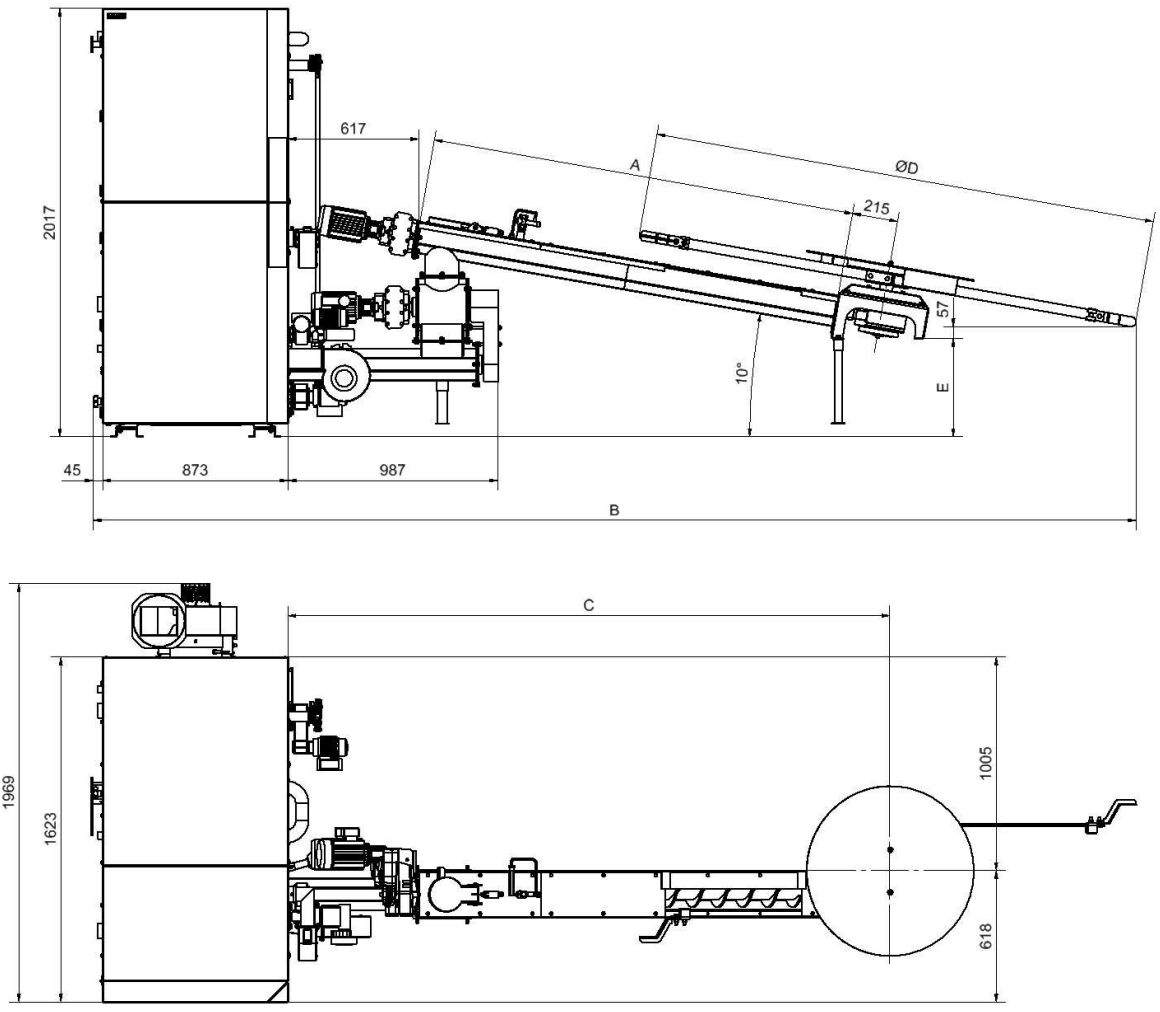


- 20. Stirrer bed
- 21. Stirrer
- 22. Flexible blades of stirrer
- 23. Feeding to the boiler
- 24. Turnstile
- 25. Lambda probe

- 26. Flue gas exhaust
- 27. Flue gas temperature sensor
- 28. Control unit display
- 29. Combustion chamber and heat exchanger link

- 30. Boiler control unit switchboard with safety thermostat
- 31. Automatic ignition
- 32. Automatic heat exchanger cleaning drive

**Fig. no. 3 Basic BENEKOV S100 boiler dimensions with lateral arrangement of feeding from the bunker**

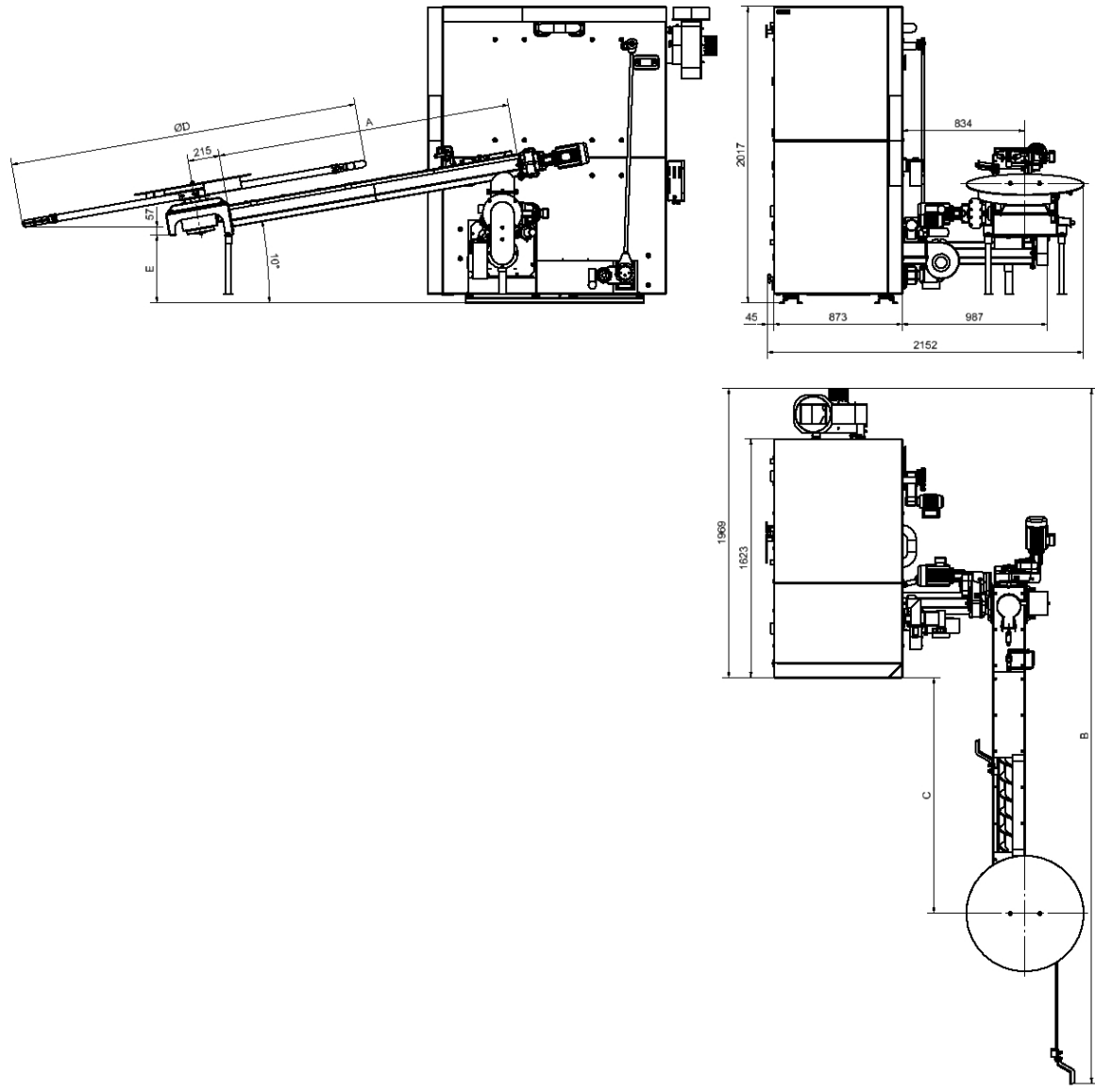


**Tab. No. 5 Parametric BENEKOV S100 boiler dimensions with lateral arrangement of feeding from the bunker**

		A* [mm]	B [mm]	C [mm]	D [mm]	E [mm]
<b>Feeder for container φ 2500 mm (4000 dm<sup>3</sup>)</b>	<b>Arrangement with 2 m feeder</b>	<b>2000</b>	<b>4912</b>	<b>2835</b>	<b>2374</b>	<b>462</b>
	<b>Arrangement with 3 m feeder</b>	<b>3000</b>	<b>5897</b>	<b>3820</b>	<b>2374</b>	<b>288</b>
	<b>Arrangement with 4 m feeder</b>	<b>4000</b>	<b>6882</b>	<b>4805</b>	<b>2374</b>	<b>114</b>
	<b>Arrangement with 5 m feeder</b>	<b>5000</b>	<b>7867</b>	<b>5790</b>	<b>2374</b>	<b>-60</b>

\* Dimension "A" is specified by the client when ordering based on spatial layout of the specific boiler room.

**Fig. no. 4 Basic BENEKOV S100 boiler dimensions with front arrangement of feeding from the bunker**



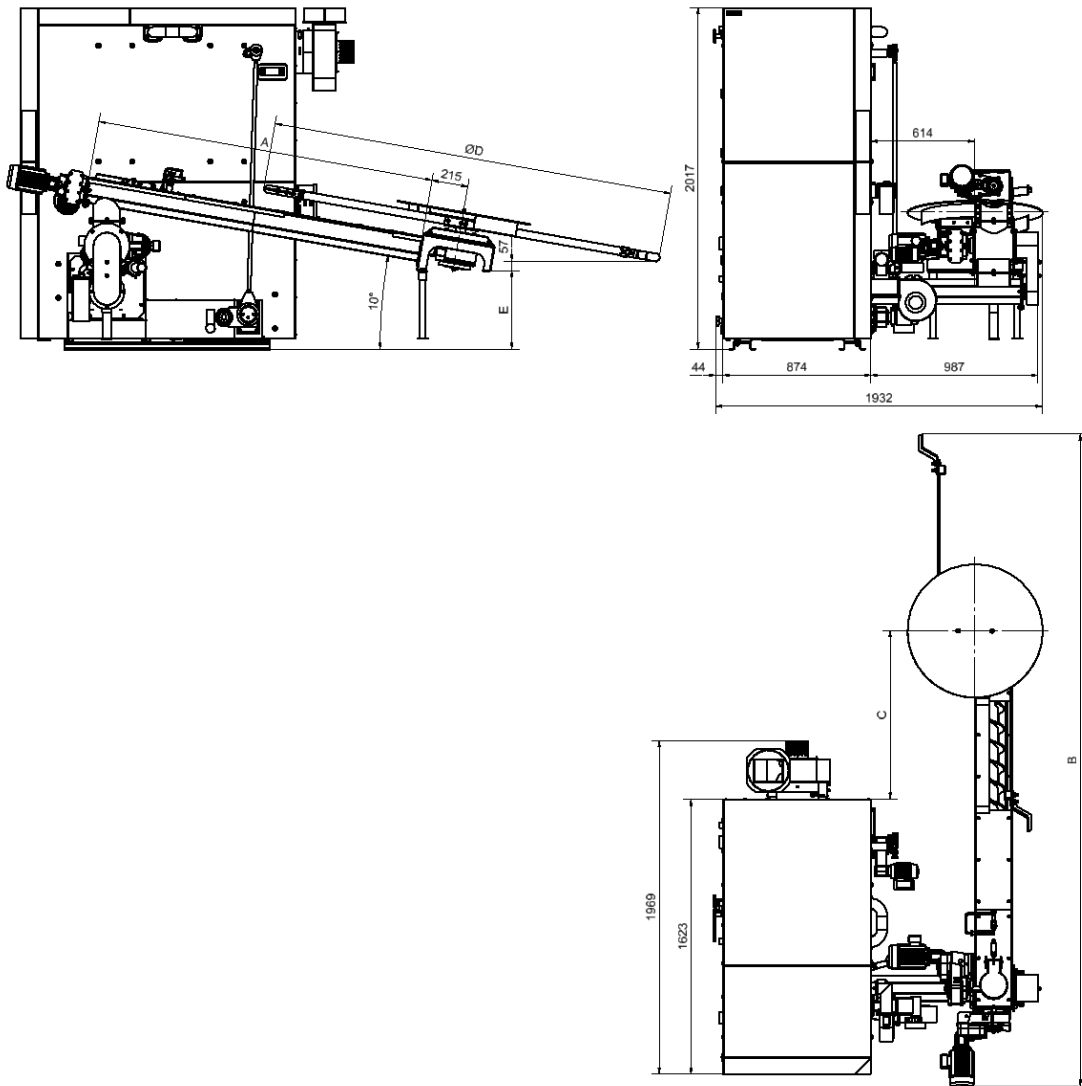
**Tab. no. 6 Parametric BENEKOV S100 boiler dimensions with front arrangement of feeding from the bunker**

		A* [mm]	B [mm]	C [mm]	D [mm]	E [mm]
Feeder for container $\varnothing$ 2500 mm (4000 dm <sup>3</sup> )	Arrangement with 2 m feeder	2000	4730	1603	2374	462
	Arrangement with 3 m feeder	3000	5715	2588	2374	288
	Arrangement with 4 m feeder	4000	6700	3573	2374	114

	Arrangement with 5 m feeder	5000	7685	4558	2374	-60
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\* Dimension "A" is specified by the client when ordering, based on the specific boiler room design.

Fig. no. 5 Basic BENEKOV S100 boiler dimensions with rear arrangement of feeding from the bunker



Tab. no. 7 Parametric BENEKOV S100 boiler dimensions with rear arrangement of feeding from the bunker

		A* [mm]	B [mm]	C [mm]	D [mm]	E [mm]
Feeder for container φ 2500 mm (4000 dm <sup>3</sup> )	Arrangement with 2 m feeder	2000	impossible			
	Arrangement with 3 m feeder	3000	4835	1981	2374	288

	Arrangement with 4 m feeder	4000	5820	2966	2374	114
	Arrangement with 5 m feeder	5000	6805	3951	2374	-60

\* Dimension "A" is specified by the client when ordering based on spatial layout of the specific boiler room.

## **4.2. Control and safety elements of the boiler**

Control and regulation of the boiler is ensured by a control unit - see separate instruction manual.

Safety components that monitor the safe operation of the boiler:

- The emergency thermostat is used to prevent the system from overheating. The manufacturer sets the thermostat at 95 °C, i.e. at a higher temperature than the setpoint that can be set on the boiler. The emergency thermostat is positioned on the rear wall of the boiler in the control unit cabinet.
- Thermal protection of the motor (thermal contact) is part of both fuel feeder motors and is used to protect them from overheating in the case of fuel feeder blockage. It also retroactively stops the fan, so as to avoid burning of the fuel in the container in the event of a fault. During normal operation, the motor working temperature is up to 85 °C - such warming does not mean a failure.
- The turnstile is a device that mechanically separates the fuel between the screw conveyors (feeding from the bunker + feeding into the boiler). In the event of re-ignition of the fuel in the boiler feeding (e.g. during power outage for a longer time) the fuel in the tank does not ignite. Furthermore the turnstile serves as a partial fuel crusher, so in the event that a longer piece reaches the turnstile, the turnstile crushes this piece into smaller ones.
- The cover limit switch of the bunker feeder shuts down the screw feeder and fan when the cover is open. After its proper closure the boiler is put back into operation.
- The emergency fire extinguishing system is another security feature preventing burning of fuel through to the container. A temperature increase above 95 °C at the feeding out of the bunker results in thermostatic valve opening and the space is cooled with cooling water from the water main.
- Firing flap is located between the second and the third draft in the top part of the boiler body and serves to regulate the flue gas temperature at the boiler outlet. When operating the boiler when the flue gas temperature is higher than 100 °C the firing valve must be closed, i.e. firing flap lever on the side of the boiler must be rotated as much as possible forwards and secured with a locking screw. When firing (with cold chimney) or during long term operation of the boiler at lower output it is recommended to operate the boiler with the firing valve slightly open so that the flue gas temperature does not drop below 80 °C. In this case, the firing flap lever must be rotated downward (backwards) and secured by a locking screw.

## **4.3. Boiler accessories**

Standard accessories:

- Operating instructions and installation manual, which include a warranty card
- Operating instructions of the boiler control unit
- List of contracting service organizations
- Rotary grate
- Flue gas exhaust
- Automatic ignition
- Ceramic reflector
- Cleaning rake
- Emergency fire extinguishing system with a paraffin plug
- Stove sealant (310 mL)

Optional accessories:

- Basic container module with a diameter of 2500 mm
- Additional fuel container module with a diameter of 2500 mm
- Room thermostat, respectively equithermal control by SIEMENS

Optional accessories are not included in the basic price of the boiler.

## 5. Boiler placement and installation

### 5.1. Regulations and directives

A boiler for solid fuels can be installed by an organization authorized to install these devices. The installation must be made in accordance with the project subject to applicable regulations.

The heating system must be filled with water that meets the requirements of CSN 07 7401: 1992 and importantly its hardness must not exceed the required parameters.

Tab. no. 5 Heating water parameters

Parameter	Unit	Value
Hardness	mmol/l	1
Ca <sup>2+</sup>	mmol/l	0,3
Concentration of total Fe + Mn	mg/l	0.3 (recommended value)

#### A) Regarding the heating system

ČSN EN 303-5:2013	Heating boilers - Part 5: Heating boilers for solid fuels, hand and automatically stocked, nominal heat output of up to 500 kW - Terminology, requirements, testing and marking.
ČSN 06 0310:2014	Heating systems in buildings - Design and installation.
ČSN 06 0310:2014	Heating systems in buildings - Safety devices.
ČSN 07 7401:1992	Water and steam for thermal energy equipment with working pressure up to 8 MPa.

#### B) Regarding chimney

ČSN 73 4201:2010	Chimneys and flues - Design, implementation and connection of fuel consumers.
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#### C) Regarding fire regulations

ČSN 06 0310:1997	Fire safety of heat installations.
ČSN EN 13 501-1+A1:2010	Fire classification of construction products and building structures - Part 1: Classification according to the results of response to fire tests.

#### D) Regarding the electric network

ČSN 33 0165:1992	Regulations for electrical engineering. Marking of wires with colours or numbers. Executive provisions.
ČSN 33 1500:1990	Regulations for electrical engineering. Revisions of electrical equipment.
ČSN 33 2000-1 ed.2:2009	Low-voltage electrical installations - Part 1: Basic terms, determination of basic characteristics, definitions.
ČSN 33 2000-4-41 ed.2:2007	Low-voltage electrical installations - Part 4-41: Protective measures to ensure safety - Protection against electric shock.
ČSN 33 2000-5-51 ed.3:2010	Electrical installations of buildings - Part 5-51: Selection and assembly of electrical equipment - General requirements.
ČSN 33 2000-7-701 ed.2:2007	Low-voltage electrical installations - Part 7-701: Single-purpose equipment and in special premises - Premises with tub or shower.
ČSN 33 2030:2014	Electrostatics - Guidelines for the elimination of hazards due to static electricity.
ČSN 33 2130 ed.2:2009	Low-voltage electrical installations - Internal electrical wiring.
ČSN 33 2180:1979	Regulations for electrical engineering ČSN. Connection of electrical devices and appliances.
ČSN 33 2350:1982	Regulations for electrical engineering. Regulations for electrical equipment in difficult climatic conditions.
ČSN 34 2130 ed.2:2009	Safety requirements for flexible cords and cord lines.
ČSN EN 55 014-1 ed.3:2007	Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 1: Emissions.
ČSN EN 55 014-2:1998	Electromagnetic compatibility - Requirements for household appliances, electric tools and similar apparatus - Part 2: Immunity - Product family standard.
ČSN EN 60079-14 ed.3:2009	Explosive atmospheres – Part 14: Design, selection and erection of electrical installations.
ČSN EN 60335-1 ed.2:2003	Electric appliances for household and similar purposes - Safety - Part 1: General requirements.
ČSN EN 60335-2-102:2007	Electric appliances for household and similar purposes - Safety - 2-102: Particular requirements for appliances burning gas, oil and solid fuel containing electrical connections.
ČSN EN 60445 ed.4:2011	Basic and safety principles for man-machine interface, marking and identification - Marking of conductors with colours or letters and numbers.
ČSN EN 61000-3-2 ed.3:2006	Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment with input phase current $\leq 16$ A).
ČSN EN 61000-3-3 ed.2:2009	Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current $\leq 16$ , not subject to conditional connection.

#### E) Regarding noise

ČSN EN ISO 3746:2011	Acoustics - Determination of sound power levels and sound energy levels of the sources of noise using sound pressure -
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ČSN EN ISO 11202:2010	Survey method with measuring lateral surface over a reflecting plane. Acoustics - Noise emitted by machinery and equipment - Determination of emission sound pressure levels at a work station and at other specified locations using approximate environmental corrections.
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#### **F) Regarding machine equipment**

ČSN EN 614-1+A1:2009	Safety of machinery - Ergonomic design principles - Part 1: Terminology and general principles.
ČSN EN 953+A1:2009	Safety of machinery - Guards - General requirements for the design and construction of fixed and movable guards.
ČSN EN 1037+A1:2008	Safety of machinery - Prevention of unexpected start up.
ČSN EN ISO 12100:2011	Safety of machinery – Basic concepts, general principles for design.
ČSN EN ISO 13857:2008	Safety of machinery - Safety distances to prevent danger zones being reached by the upper and lower limbs.

## **5.2. Boiler placement options**

### **Boiler placement with regard to the electric network:**

- The boiler must be positioned so that a plug socket (400V / 50Hz) is always accessible.
- The boiler is connected to the mains with a fixed and flexible power supply cord with standardized plug.
- Protection against electric shock must be made in accordance with valid ČSN EN standard (see chap. 5.1.)

### **Boiler placement with regard to fire regulations:**

#### **1. Positioning on a floor made of incombustible material**

- Place the boiler on an incombustible thermally insulating pad exceeding the boiler floor plan on all sides by 20 mm.
- If the boiler is located in the basement, it is advisable to place it on a substructure at least 50 mm high. The boiler must stand horizontally so any unevenness of the substructure must be eliminated by screwing or unscrewing the foot of the fuel container beneath the fuel screw feeder.

#### **2. Safe distance from flammable materials**

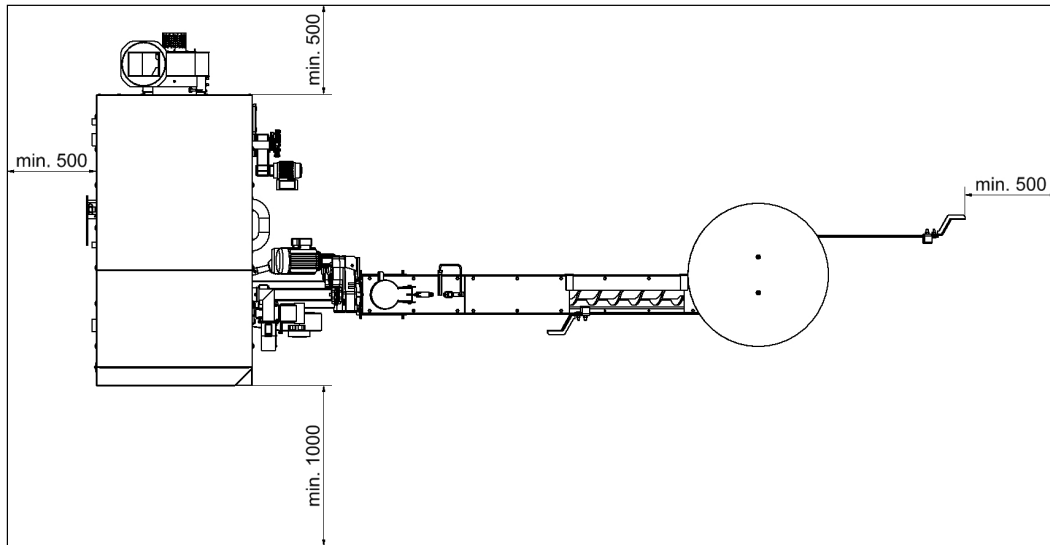
- The minimum allowable distance of the outer contours of the boiler and flue gas ducting from flammable materials (see detailed specifications in ČSN EN 13 501-1+A1:2010) during installation and operation of the boiler must be at least 400 mm.

### **Boiler positioning with regard to the necessary handling space:**

- Basic environment AA5 / AB5 according to ČSN 33 2000-1 ed.2:2009
- The handling space left in front of the boiler must be at least 1000 mm
- The minimum distance between the rear part of the boiler and the wall must be 500 mm
- The gap on the side of the fuel container must be at least 500 mm
- The gap on the side of the boiler body must be at least 500 mm for the possibility to clean the convective surfaces of the boiler body and connection of the ash remover



- At least 500 mm above the boiler for cleaning of the boiler body convective surface
- Above the fuel tank at least 1000 mm for the possibility of full opening of the fuel container cover.



**Fig. No. 6 Placement of the boiler in the boiler room**

**Boiler positioning with regard to the chimney:**

- The BENEKOV S100 boiler is connected to the chimney using a metal pipe with a diameter of 250 mm.

**Fuel placement:**

- Pellets are recommended to be stored in their original packaging from the manufacturer (PET bags or "big bags") in a dry place.
- Do not store fuel behind the boiler or store it next to the boiler within a distance shorter than 400 mm.
- The manufacturer recommends keeping the min. distance between the boiler and fuel at 1000 mm or to store the fuel in a different room away from the boiler.

The room where the boiler is installed must be provided with permanent intake and outlet of air for combustion and ventilation. The air consumption of the BENEKOV S100 boiler at nominal output capacity is approximately  $300 \text{ m}^3 \cdot \text{h}^{-1}$ .

According to regulations, an authorized person must perform the connection of the heating system pipeline or heater heating element pipeline.

**NOTE:** When connecting the boiler to the heating system the lowest point as close to the boiler as possible must be equipped with a drain tap.

## **6. Commissioning of the boiler - instructions for contracted service organizations**

Commissioning can only be performed by a contracted service organization authorized to conduct this activity.

### **6.1. Electrical connection via connectors**

In the course of putting the boiler into operation there is no need to tamper with any electrical connection of the boiler's control unit switchboard. Wiring of electrical components of the boiler and peripheral devices (e.g. pump) is outlet via the connectors, which allows for a quick and easy disconnection from (or connection to) the boiler control unit switchboard.

Depending on the variant and equipment the boiler may be fitted with connectors marked with the following symbols:



- Fuel feed drive connector



- Fan connector



- Circulation pump connector



- Ash remover connector



- Flue gas exhaust connector



- Automatic ignition connector



- Room thermostat connector, respectively the equitherm control



- Spontaneous combustion sensor connector



- Lambda probe connector



- Limit switch connector

Spare connector plugs (e.g. for connecting a room thermostat, circulation pump, etc.) are placed in a package in the boiler during transport from the factory. Prior to putting the boiler in operation it is necessary to fit all these loose connector plugs to the switchboard, even if they are not used.

When connecting the connectors you must avoid any confusion. Please connect the connector plugs and sockets with the identical symbols.

Before connecting the room thermostat, respectively equitherm control, it is necessary to remove bridging from the plug of the relevant connector. The room thermostat connector, respectively equitherm control can only be connected to a thermostat with free potentialless contact (eg. SIEMENS REV, HONEYWELL CM...). No external voltage can be connected to any of these terminals.

## 6.2. Connection of the boiler to the heating system

### Legend to Fig. No. 7:

1. Outlet of flue gas into the chimney
2. Heating water outlet from the boiler
3. Heating water inlet into the boiler (return)
4. Fill and drain opening of the combustion chamber
5. Fill and drain opening of the heat exchanger

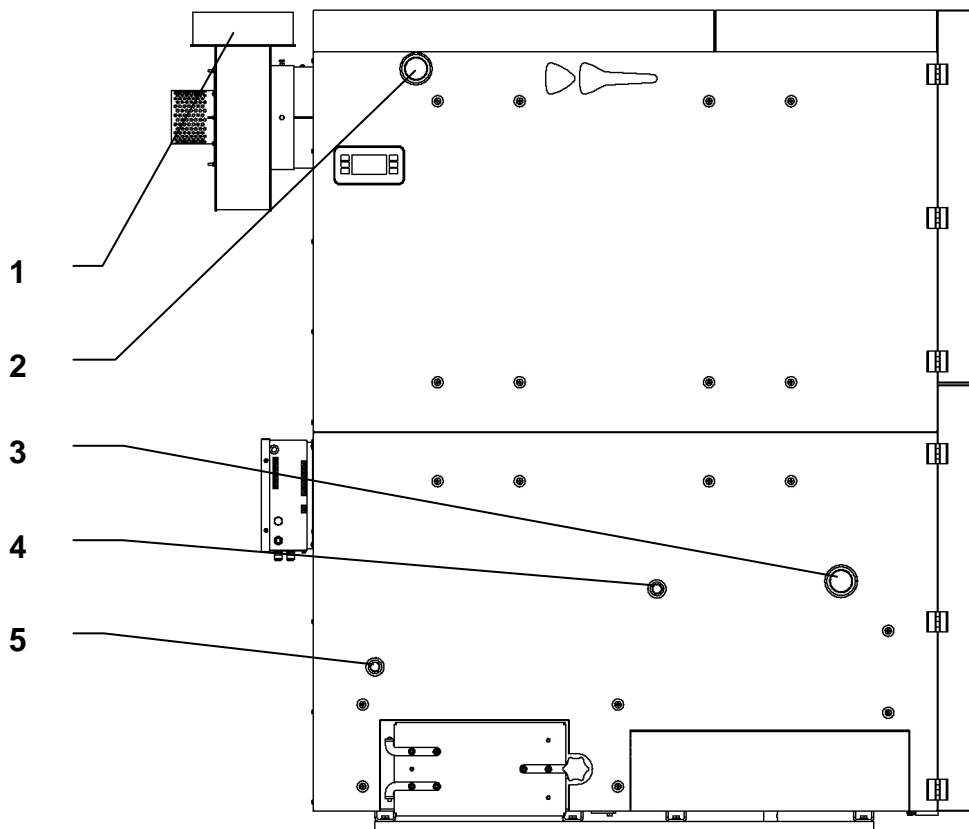


Fig. No. 7 Inlets and outlets of the BENEKOV S100 boiler

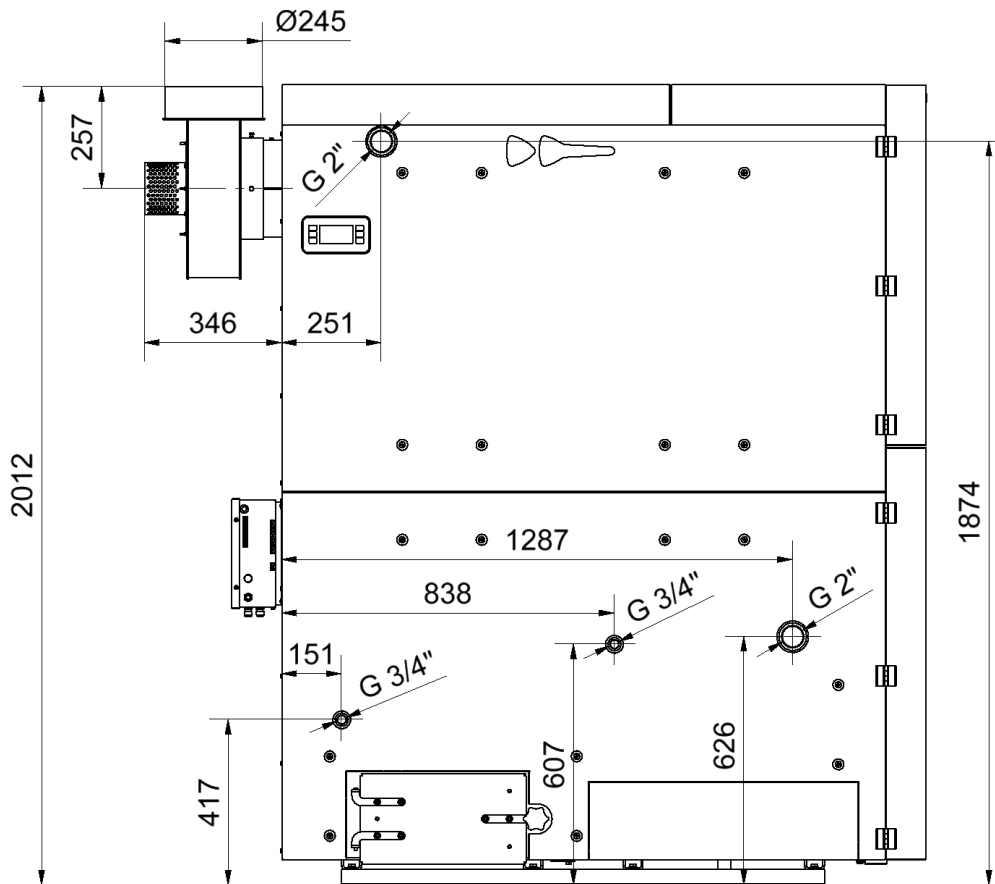


Fig. no. 8 Connection dimensions of BENEKOV S100 boiler

### 6.3. Installation of ceramics into the boiler

Fitting of ceramic parts into the combustion chamber of the boiler is shown in Fig. No. 9, i.e.:

- Fit the ceramic reflector assembly (Pos. 2, 3 and 4) in the combustion chamber above the burner (pos. 1) so that the central opening in the reflector is aligned with the burner. The side of the ceramic reflector with an aperture (Pos. 2) must be on the right side in the right boiler design when viewed from the front, or on the left side in the left boiler design. The secondary air supply (Pos. 5) can then be inserted from the side of the boiler completely into the inner cavity of the ceramic reflector.
- Place 2 pieces of ceramic plates (Pos. 6) on the upper beams of the combustion chamber (Pos. 7) using the shape lock mutually into one another and push the assembly to the rear wall of the combustion chamber

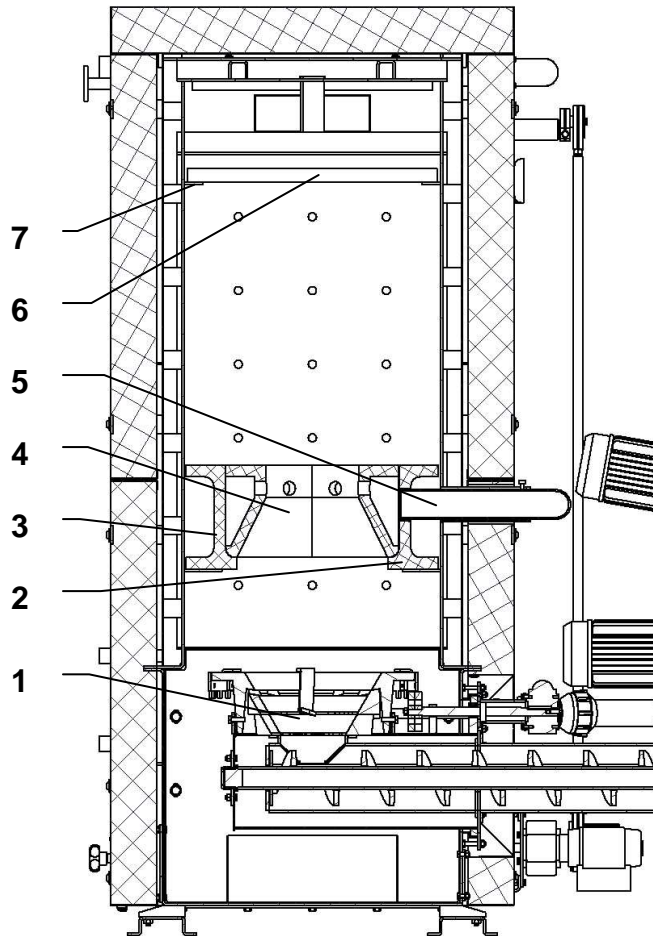


Fig. no. 9 Section through the combustion chamber of the boiler

**Legend to Fig. No. 9:**

1. Burner
2. Ceramic reflector side with an opening
3. Ceramic reflector side without opening
4. Ceramic reflector body (2 pcs)
5. Secondary air supply
6. Ceramic plate (2 pcs)
7. Upper beams

**6.4. Verification activities before start-up**

The following checks must be performed before start-up:

- a) Filling the heating system with water

**Care should be taken to thoroughly fill the boiler and the entire heating system with water and then the system should be vented. When filling the boiler with heating water it should be borne in mind that the boiler body is composed of two vessels interconnected from the top (combustion chamber + exchanger), so you must fill both these containers with separate holes - see Fig. 7, pos. 4 and 5.**

The water used for filling boiler and heating systems must be clear and colourless, without suspended solids, oil and aggressive chemicals. Its hardness must comply with ČSN 07 7401: 1992 and it is essential that in case the water hardness does not comply, it must be treated. Even multiple heating of water with a higher hardness does not stop salt build-up on the walls of the exchanger. 1 mm of calcite reduces the heat transfer from metal to water at the given point by approximately 10%.

Heating systems with an open expansion tank allow direct contact between the heating water and the atmosphere. During the heating season the water expanding in the tank absorbs oxygen which increases corrosion and at the same results in significant water evaporation. Refilling can only be performed with water treated according to ČSN 07 7401:1992. The heating system must be thoroughly flushed in order to wash out all impurities.

During the heating season it is necessary to maintain a constant volume of water in the heating system. When refilling the heating system with water no air must be sucked into the system. The boiler and heating system water must never be discharged or taken for use except in emergencies like repairs etc. Water discharge and filling with new water increases the danger of corrosion and scaling.

If it is necessary to refill the heating system with water only do this when the boiler is cold to prevent damage to the steel heat exchanger.

b) Heating system tightness

c) Connection to the chimney - must be approved by a chimney sweeping company

d) Provide for proper sealing of the grate into the mixer by means of stove sealant (with a temperature resistance of 1200 °C)

e) Electric connection

The sockets are connected so that the protective plug is upwards and the phase conductor is connected to the left tube when viewed from the front. The same applies to double sockets.

The assembly completion and heating test must be recorded in the "Guarantee certificate".

## **6.5. Putting into operation**

1. Fire the boiler.
2. Bring the boiler to operating temperature. The recommended operating temperature of the output heating water is 65 to 80 °C.
3. Check the boiler tightness again.
4. Carry out the heating test according to relevant standards (see the Guarantee certificate)
5. Acquaint the user with the boiler operation - see chapter 7.
6. Make a record in the Guarantee certificate.

## **7. Boiler operation by user**

## **7.1. Making fire in the boiler**

1. Check the water volume in the heating system.
2. Check whether the stop valves between the boiler and the heating system are open.
3. Check the circulation pump/pumps functionality.
4. Clean the burner and bottom of the combustion chamber.
5. Fill the container with prescribed fuel - see Chap. 3. If the container is equipped with a lid, close the container after refilling in order to avoid potential false air intake into the burner through the screw feeding device.
6. Connect the boiler to the mains (400V/50Hz) via power cord with plug.
7. Put the control unit into operation (see separate control unit instruction manual).
8. If the boiler is equipped with automatic ignition, leave the boiler without intervention. The control unit evaluates the status of the boiler and makes fire (see separate control unit instruction manual). During the boiler firing and operation the door must be permanently closed.
9. If the boiler is not equipped with automatic ignition, it is necessary to make fire manually (see separate control unit instruction manual). Using the control unit manual mode deliver the fuel into the combustion chamber of the boiler. Leave the screw feeder device switched on until the fuel appears in the burner (1 cm below the edge of the grate). Subsequently switch the screw off, place fire setting material on the fuel (eg. paper, dry wood chips, PEPO, solid alcohol or other material intended for this purpose), ignite it switch on the fan and let it flame up (approx 1-2 minutes). Then add a small amount of prescribed fuel with a shovel to the fire setting. In the event that the fire is extinguished, repeat the manual firing procedure. Close the door and let the fire flame up well (about 3-5 minutes).

## **7.2. Boiler operation**

After fuel flame-up the boiler switches (see separate control unit instruction manual) to automatic operation, which includes the fan, as well as cycling of the fuel screw feeder. The control unit display visualizes the basic data regarding the boiler operation.

During a power outage (400 V, 50 Hz) the boiler control unit remembers its status and restores to this when the power returns.

If the heating water temperature exceeds 95 °C, the emergency thermostat will respond to shut down the boiler irrespective of the control unit. When you turn off the emergency thermostat the control unit indicates overheating.

The emergency thermostat can be switched on only when the temperature falls below the set value by about 20 °C. This is done by unscrewing the black cap on the emergency thermostat and pushing the colour button. The black cap must subsequently be restored to its place.

To prevent unwanted switching of the safety thermostat due to the thermal inertia of the boiler, it is recommended to operate the boiler at outlet heating water temperatures up to 80 °C.

In case of repeated switching off of the boiler by the emergency thermostat, the boiler must be shut down and the user must determine the cause of the repeated overheating.

## **7.3. Boiler shutdown**

Before the boiler is shut down, it is necessary to use manual screw feeder control to push the hot fuel from the feed area of the boiler and burner into the ash tray drawer. This is not necessary for short repairs when an operator is present.

## **IMPORTANT ADVICE:**

- This appliance is not intended for use by persons (including children) whose physical, sensory or mental disability or lack of experience and knowledge prevents them from using the appliance safely.
- It is unacceptable to leave children unattended near the boiler when it is in operation.
- If there is a danger of combustible vapours or gases building-up in the boiler room or there is work involving a temporary fire or danger of explosion (gluing of floorings, painting with combustible paints, etc.) taking place in the boiler room, the boiler must be shut down before beginning any work.
- When transporting fuel into the combustion chamber before firing, it is necessary to check the amount of fuel in the burner visually, not by inserting hands into the screw feeder. **There is a risk of injury from the rotating screw shaft.**
- It is forbidden to fire the boiler using flammable liquids.
- When using the automatic ignition, the flue gas must be in operation. Otherwise there is a risk of explosion of the gases accumulated in the combustion chamber.
- Possible observation of flame during boiler operation is possible by opening the door. If it is necessary to open the door during boiler operation (e.g. for removal of ash from the ash tray compartment), it should be noted there is an increased danger of sparks and smoke development in the boiler room. If this happens the door must be closed immediately. The door must only be opened with caution during boiler operation, i.e. slightly ajar at first then wait until the exhaust gases from the combustion chamber are extracted and only then open it completely.
- During operation it is forbidden to overheat the boiler in any manner.
- It is not allowed to place any articles made of flammable materials on the boiler or within a distance smaller than the safe distance from it (see chap. 5.2).
- All flammable substances must be at a minimum distance of 1500 mm from the boiler when removing ash from the boiler. The ashes must be put into incombustible containers with lids.
- When operating the boiler at a temperature below 60 °C, the steel boiler body is covered with dew and so-called low-temperature corrosion occurs, which reduces its service life. Therefore, the boiler must be operated at a temperature of 60 °C and higher.
- After the heating season, it is necessary to thoroughly clean the boiler including the flue gas duct. The boiler room must be kept clean and dry.
- It is forbidden to interfere with the boiler structure and wiring.
- The boiler is operated with a fan.
- The boiler is operated at an overpressure at the flue gas outlet.
- The boiler operates in conditions without condensation.

## **7.4. Residual risks and their prevention**

Risks arising during operation of the boiler under the conditions of expected use and logically foreseeable misuse have been minimized using currently available technology.

Despite its design, structure and technical features, during the operating life of a boiler certain residual risks remain.

These risks in particular result from inattention by the boiler operator and failure to observe safety rules during operation.

To further reduce these risks and ensure your safety we bring to your attention certain residual risks that cannot be removed by any technical design.

### **a) Electrical risks**

- Mounting, maintenance and repairs of electrical parts of the boiler must be carried out only by professionally qualified personnel in accordance with applicable technical regulations and standards;
- Supply wiring must comply with applicable regulations;
- Power supply cable and wiring of the boiler must be regularly checked and maintained in the prescribed condition;



- In the event of any damage to electrical equipment, the boiler must be shut down, unplugged from the mains and a qualified repair must be undertaken;
- It is forbidden to interfere with the wiring of safety circuits, or perform any unauthorized interventions, which are related to the equipment's safety and reliability.

#### **b) Thermal risks**

- The boiler must not be exposed to higher working pressures than prescribed;
- It is forbidden to overheat the boiler;
- The boiler must be protected against low-temperature corrosion by a suitable connection with an automatic return temperature protection;
- The boiler can burn only specified fuel;
- It is prohibited to store flammable liquids near the boiler;
- Minimize the risk of ignition by setting suitable attenuation parameters;
- During boiler operation pay maximum attention to the risk of burns from sources of heat.

#### **c) Risks posed by fuel handling**

- Handling fuel results in emission of solid particles. Therefore, the operator should wear appropriate protective equipment according to the degree of dust generation;
- Because it is a fuel, it is necessary to observe appropriate fire regulations and keep a suitable portable fire extinguisher accessible.

#### **d) Ergonomic risks**

- The boiler must stand horizontally in the boiler room;
- It is forbidden to put hands into the screw feeder;
- All doors, lids and covers must be completely closed during boiler operation.

## **8. Boiler maintenance**

**NOTE:** Before performing maintenance and cleaning the boiler and/or feeder mechanism, it is necessary to make sure the boiler is disconnected from the power supply (plug pulled out of the socket). Risk of injury!

- 1.) It is necessary to ensure timely refuelling. If a small amount of fuel remains in the container, it must be refilled immediately to prevent extraction of "false air" and a smoked container. Ensure proper closing of the fuel container cover.
- 2.) If the boiler is correctly adjusted, the ash has the form of a fine grey powder, which accumulates in the ash tray drawer. The combustion compartment has self-cleaning design and in the course of normal operation the boiler's ash tray drawer has to be emptied once a week. It is necessary to use protective gloves for this activity.
- 3.) In continuous operation of the boiler it is recommended to clean the heat transfer surface of the boiler body once a month. The heat transfer surfaces can be subject to clogging, which can greatly affect the heat transfer and thus the efficiency of the boiler. Occasional cleaning of the inside of the grate (on a monthly basis) should not be forgotten. Its clogging impairs the flow of combustion air to the burner nozzles. The boiler must be shut-off by the main switch at least 1 hour before cleaning the grate. After the heating season the entire boiler must be carefully and completely cleaned.
- 4.) The minerals contained in the wood pellets can form hard deposits during operation in the area of the furnace. This can subsequently cause a complete blockage of the screw shaft of the feeding mechanism. To avoid the risk of this phenomenon, it is recommended to check the burner zone at least monthly and in the event of hard deposits on the grate, mechanically remove the grate and any stuck material.
- 5.) It is further recommended to perform occasional external cleaning of drives and fans. Cleaning must be done using a dry brush. The boiler must be disconnected from the power supply during this time.

- 6.) A refractory ceramic reflector and ceramic plates are located above the boiler burner. They do not require any special attention. Any fly ash deposited on the surface of the reflector can be regularly removed, but it does not affect its function.
- 7.) For a reliable operation of the turnstile during fuel feeding into the screw feeder, it is necessary to maintain proper tension of the chain, i.e. the deflection in the middle between the sprockets must be in the range of 6 to 10 mm. If the deflection is bigger, the chain must be replaced. When checking the tension and handling of the chain the boiler must be shut down. Risk of hand injury!
- 8.) In case of a screw fuel feeder blockage its motor is protected against damage by the thermal contact (working temperature of the fuel feeder motor is up to 85 °C), which after exceeding the critical temperature shuts down both feeder motors and the fans. If this happens, the boiler must be shut down and repaired.  
NOTE: Before performing this operation it is necessary to make sure the boiler is disconnected from the power supply (plug pulled out of the socket).
- 9.) Since pressurising occurs in the burner area during fan operation, it is necessary to ensure perfect tightness of the boiler (boiler door, the top covers of the boiler body, etc.).
- 10.) Occasionally perform a visual check of the emergency fire-fighting equipment.
- 11.) In the event of an emergency (electricity outage for long periods, etc.) or if fuel burns through the increase in temperature opens the thermostatic valve and any fuel is extinguished with water from the water main.  
Before restarting the boiler it is necessary to remove wet fuel, and fire the boiler in a standard manner (see chap. 7.1.).
- 12.) The gearboxes are filled with synthetic oil in compliance with factory standards therefore no further maintenance is required.

## **9. Troubleshooting**

If you have problems with the operation of the boiler, try some of the following solutions:

<b>SYMPTOM</b>	<b>CAUSE</b>	<b>SOLUTION</b>
The display does not show any data.	The boiler is not connected to the mains.	Connect the boiler to the mains (400V/50Hz) via power cord with plug.
	Boiler controller failure.	Replace the boiler controller.*
Screw feeding device does not work.	Boiler drive cable is disconnected (or damaged).	Connect (or replace) the boiler drive cable.*
	Boiler drive is damaged.	Replace the boiler drive.*
	There was a motor overheating and thus the motor thermal protection was activated.	Let the motor cool, after cooling the motor will restart automatically.
Repeated activation of the motor thermal protection.	The fuel feeder contains an obstacle (stone, etc.).	Demount the fuel feed screw and remove the obstruction. Reassemble the feeder.*
	The fuel contains a substantial quantity of dust.	Remove unsuitable fuel from the boiler, refill the container with prescribed fuel.
	The alignment of the drive, screw shaft and burner is not correct.	Disassemble the fuel screw feeder, clean and reassemble it with emphasis on ensuring the alignment of the individual components.*
The screw shaft rotates, though the fuel is not	The container does not contain fuel.	Refill the container with prescribed fuel.

transported into the combustion chamber.	Overall wear of the screw shaft.	Replace the screw shaft.*
	The turnstile chain was damaged.	Replace the turnstile chain.*
Boiler fan does not work.	Boiler fan cable is disconnected (or damaged).	Connect (or replace) the boiler fan cable.*
	The fan is damaged.	Replace the boiler fan.*
The fan is noisy in operation.	The fan was clogged by dust.	Clean the boiler fan.*
	The fan bearings are worn.	Replace the entire boiler fan.*
The fan does not rotate during boiler modulation at the lowest output values.	The set values of the fan speed are too low.	Increase the fan speed on the boiler controller so as to guarantee its smooth operation.
Water from the emergency fire-fighting equipment leaked into the fuel feeder.	The fuel burnt through to the fuel feeder, which activated the thermostatic valve.	Remove wet fuel from the feeder, fill the container with new dry fuel and start-up the boiler.
Water from the emergency fire-fighting equipment leaks into the fuel feeder.	The thermostatic valve on the feeder leaks.	Replace the thermostatic valve.
The walls of the fuel tank are covered with droplets of water.	The boiler is filled with wet fuel.	Refill the container with dry fuel.
	The temperature in the boiler room is low (about 12 °C or less)	The boiler room requires a higher air temperature (boiler room wall insulation, installation of heating radiator to the boiler room, etc.).
The boiler cannot reach the rated output during operation.	A short time passed after firing in the boiler.	Let the boiler thoroughly flame up.
	Fuel dosing is set to a lower output.	Adjust the fuel dosing according to the control unit instruction manual.
	The boiler uses non-prescribed fuel (high humidity, lower calorific capacity, etc.)	Refill the container with prescribed fuel.
The flue gas temperature is higher than specified in the instructions.	The boiler is clogged with soot.	Clean the heat transfer surfaces of the boiler body.
	The boiler is overheating.	Reduce fuel dosage.
	High chimney draft.	Install a chimney flue draw limiter (this activity must be performed by a specialized company).
	Ceramic reflector is not installed in the boiler body.	Install a ceramic reflector according to the instruction manual.
	The firing flap in the boiler body is open.	Close the firing flap using the cleaner lever and firing flap and secure it with a locking screw with a plastic head.
Smoke appears in the boiler room or fuel container.	Low chimney draft.	Have a chimneysweeper check the value of the chimney draft. If the measured value is less than the value required (see instructions), it is necessary to make adjustments to the chimney.
	The boiler door and / or the top cover of the boiler body and / or the fuel tank cover is not closed properly.	Duly close the boiler door and / or the top cover of the boiler body and / or the fuel tank cover properly.

	The sealing cord of the boiler door and / or the top cover of the boiler body are worn (damaged).	Replace the worn (damaged) sealing cords.*
	The fuel container is empty.	Refill the container with prescribed fuel.
The boiler body gets clogged with soot after a short time.	Low volume of combustion air.	Increase the boiler fan output (see the control unit instruction manual).
	The boiler is overheating.	Set the boiler output to nominal value (see the control unit instruction manual).
	The fan is damaged.	Replace the boiler fan.*
	The grate is clogged with ash and dust.	Clean the grate.
Caking ash on the grate.	Other than prescribed fuel is used for combustion.	Fill the container with prescribed fuel - see Chap. 3).
Emergence of a significant part of unburned fuel in the ash tray drawer.	Fuel dosing is not set correctly.	Reduce the dosage of fuel in the burner (see the control unit instruction manual).
	Moist fuel is used for combustion.	Refill the container with prescribed (wet) fuel.
	The output of the fan is adjusted incorrectly and the air flow blows fuel out of the burner.	Reduce the boiler fan speed (see the control unit instruction manual).

\* - This activity can only be performed by a service organization trained and authorized by BENEKOVterm s.r.o.

## **10. Guidelines for sustained compliance with the environmental parameters of the product**

Continuous environmentally friendly operation of the boiler requires full compliance with the provisions of this manual, especially:

- Burn only fuel whose parameters are guaranteed by the manufacturer for fuel within the range specified in chap. 3
- Comply fully with the provisions of chap. 7 to 9

## **11. Instructions for product disposal after the end of its service life**

Since the product is made of common metal materials, it is recommended to dispose of the respective parts as follows:

- boiler body, casing - via KOVOŠROT
- other metal parts - via KOVOŠROT
- SIBRAL insulation material - standard waste
- ORSIL T insulation material - standard waste
- TECHROCK insulation material - standard waste

## **12. Guarantee and liability for defects**

The manufacturer provides a warranty for the boiler for a period of 24 months from the date of sale to the end user, assuming that it will be used and operated in accordance with the conditions specified in the instruction manual.

The user is obliged to entrust the boiler installation, commissioning and troubleshooting, going beyond chap. 7 and 8 only to a professional contractual service accredited by the boiler manufacturer BENEKOVterm s.r.o., otherwise the guarantee is void.

A precondition for the warranty is the installation of the boiler in the heating system so that the temperature of the water returning to the boiler is monitored AUTOMATICALLY at a minimum value of 53 °C. This can be achieved through a variety of hydraulic circuits depending on the controller used in the boiler. More information - see "Technical documentation for installation of automatic boilers."

The solution should be proposed by a designer, based on knowledge of the complete heating system.

If the boiler is operated in accordance with the instructions provided in the "Boiler operating and instruction manual", it does not need any special service interventions.

The "Certificate of quality and completeness of BENEKOV boiler" serves as a "Guarantee Certificate" after having been completed by contractual service organization.

The boiler must be subjected to regular maintenance - see chap. 8.

The manufacturer shall not be responsible for any loss of profits, goodwill or contracts, or any incidental, special or consequential damages arising in connection with the use or inability to use this product.

Each notice of defect must be made immediately after its detection, always in writing or by telephone. In the event of a claim it is always necessary to provide the serial number of the boiler.

The manufacturer shall not admit a claim if the above instructions are not followed.

The guarantee does not apply to cases caused by improper operation of the device, failure to comply with the technical conditions of operation, normal wear and tear, wilful damage and damage to the equipment which arose due to unavoidable and natural disasters (fire, water, theft, violent damage, etc.).

No warranty applies unless the seller duly completed the warranty certificate.

The manufacturer reserves the right to make changes to the product, such as innovations, that may not be included in this manual.



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