

Futura Bio

Biomass-fired hot water boiler with automatic fuel feeding system



Futura Bio Standard



Futura Bio Pellets

Operating and maintenance manual Installation, operation and maintenance instructions

Congratulations on your purchase of a modern, energy-saving, biomass-fired boiler for central heating purposes.

Basic fuel:

Futura BIO Standard boilers: sawdust briquettes, sawdust, chips.

Futura BIO Pellets boilers: sawdust briquettes with the diameter of 6-10 mm.

Please read this documentation carefully before connecting and operating the product.



HEATING WITH BIOMASS

With us heating means saving...

1. Introduction

Thank you for choosing our Company and buying our product. We are convinced that our boiler will operate safely for many years as a cost-effective and reliable heat source for your hot water or central heating needs.

The boilers of the Futura series are recommended for users seeking modern solutions in combustion of solid fuels.

Our boilers do not require continuous firing up and fuel is metered and fed by an automated feeding screw system.

This instruction manual contains all basic information concerning the design, installation and operation of your boiler. If you read this instruction manual thoroughly and follow all instructions and recommendations, long-term and safe operation of the boiler will be ensured.

We recommend entrusting the installation of your boiler to authorised installers, who are trained in the area of installation of our boilers.

2. The purpose of Futura Bio series boilers

In Poland, biomass as the fuel for boilers becomes more and more popular and commonly used by entrepreneurs and farmers. It is utilised for generating thermal energy during the process of combustion in special devices designed for this purpose.

One of these devices is the Futura Bio series boiler in the Pellets or Standard version.

❖ Purpose and possible use of Futura Bio series boilers

The Futura Bio boilers are designed for burning biomass in the form of briquettes, sawdust and chips of proper size and, as a substitute, grains or cherry stones.

The Bio Pellets version presented here is designed for burning of pellets, i.e. granulated sawdust, with diameter of 6 – 10 mm and up to 4 cm. Also, sawdust can be burnt as a substitute. For special orders the boiler in this version can be adopted for burning of wood chips as large as 30 mm.



The boiler may be installed both in new and revamped boiler rooms with the aim of combustion process automation, improving the operating comfort and reducing of harmful emissions to atmosphere.

The Futura Bio boilers with built-in biomass burner can be used for heating of residential buildings, commercial buildings, shops, detached houses and so on.

The Futura boilers may be installed only in open-radiant type systems with forced or gravitational circulation, complying with the Polish standard PN-91/B-02413: "Heating and heat engineering. Protection of open-type water-based heating systems."

All works related to boiler room equipment, boiler installation and operation must be performed in compliance with valid standards and regulations.

Basic fuel for the Futura Bio Standard boilers:

For the Futura Bio Standard boiler with automatic fuel feeding the following fuels are recommended:

- Sawdust briquettes with diameter of 50 mm;
- Wood chips with maximum size of up to 3 cm;
- Sawdust with maximum content of non-combustible particles of 10%.

Maximum moisture content in fuel should not exceed 20%. To reach the rated boiler power, the calorific value of fuel should not be less than 16 MJ/kg.

When other fuel is used or moisture content is different than the recommended one, the manufacturer can't guarantee that the boiler will achieve the rated power and will operate properly. Using of excessively damp fuel significantly reduces the lifetime of boiler.

Substitute fuel for Futura Bio Standard boilers:

- Corn straw briquettes with diameter of 50 mm (when not too hard, 80 mm is allowed),
- Grains: oat,
- Sweet and sour cherry pits.

Basic fuel for Futura Bio Pellets boiler:

The Futura Pellets series boilers are designed for burning of sawdust biomass in the form of pellets with the diameter of 6-10 mm and length of up to 50 mm.

Pellets should meet the requirements of the ÖNORM M7 135 standard.

Calorific value of fuel should not be less than 18 MJ/kg, and moisture content should not exceed 10%.

Substitute fuel for Futura Bio Pellets boilers:

- Wood chips with maximum size of 25 mm.

Fuel recommendations:

Please remember that fuel pieces fed by the feeder should be of a proper size and fuel should not contain pieces greater than maximum allowable size recommended. Furthermore, fuel must not contain foreign bodies like stones, plastic or metal parts, cords, textiles, fabrics and so on).

Moisture content higher than recommended will accelerate the corrosion processes and cause premature wear of boiler components. Damages caused by above mentioned reasons are not covered by manufacturer's guarantee.

3. Design and specifications

The boiler was designed on the basis of many years of experience, with focus on high thermal and operating comfort, and with particular attention to protection of natural environment.

The boiler is designed in such a way that the parts being in contact with flue gas are also in contact with the water jacket of the boiler.

The boiler is of a three-pass type with heat exchange occurring on the surface of hipped convection ducts or, in the case of 200-250 and 300-350 kW models, vertical combustion tubes.

On the front side the boiler has a door to the combustion chamber, a hand hole for cleaning of convection ducts and, in 25-200 kW, with ash box doors. The doors exposed to high temperatures are equipped with fire protectors.

For sealing of doors a mineral fibre stuffing is used.

The boiler body is made of certified steel grades and argon-arc welded.

The Futura Bio boilers are equipped with automatic burner with screw-type feeder.

The controller controls operation of the burner and feeder, the central heating pump and the hot water pump and also communicates with the room thermostat. It is also possible to install a weather module which controls operation of the mixing valve.

Optionally, the 25 kW models can be equipped with a safety coil, i.e. a device which evacuates excess heat.

Futura Bio Standard

Specifications for Futura Bio Standard boilers

Boiler type		Futura Bio 25*	Futura Bio 38*	Futura Bio 50 *	Futura Bio 75*	Futura Bio 100*	Futura Bio 150*	Futura Bio 250*	Futura Bio 300 - 350*
Boiler power	Wood chips Sawdust briquettes	25	38	50	75	100	150	200-250	300-350
Efficiency	%	78-82							
Water capacity	dm ³	120	155	190	260	360	470	1600	1820
Maximum permissible pressure	bar	2							
Minimum inlet temperature	°C	65							
Maximum inlet temperature	°C	90							
Flue gas temperature at rated power	°C	200-340 °C							
Flue gas temperature at minimum power	°C	100-140							
Emission efficiency class		Thermal efficiency class 3							
Water-side resistance (pressure loss); Δt=10K	mbar	2÷20							
Water-side resistance (pressure loss); Δt=20K		0.5÷5							
Chimney negative pressure	Pa	15-20	15-20	20-25	20-25	25-30	25-30	25-30	30-35
Recommended minimum chimney height	m	8	8	8	8-10	8-10	12	14	14
Recommended chimney cross-sectional area	cm ²	400	400	400	600	600	600	1200	1500
Fuel tank capacity	dm ³	620	620	620	1130	1130	1130	1130	Upon order
Fuel consumption	kg/h	6.9	10.5	13.8	20.7	27.6	41.4	55.2	82.9
Approximate working time on one charge of fuel	At rated power and burning of sawdust briquettes h	51.2	33.7	25.6	31.1	23.3	15.6	11.7	-
Power consumption (depending on version)	W	850	850	850	850-2250	850-2250	850-2250	850-2250	850-2250
Heater power consumption (option)	W	400							

*) Products available upon special order.

All data presented above is for information purposes only and is subject to changes due to continuous product development.

Figure: Schematic drawing of Futura Bio Standard boiler (model 25)

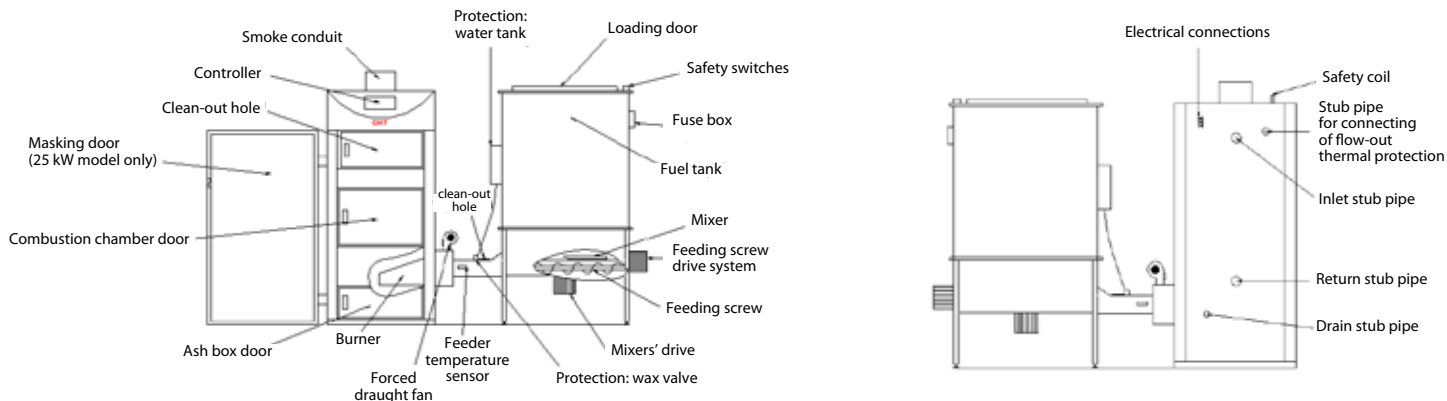
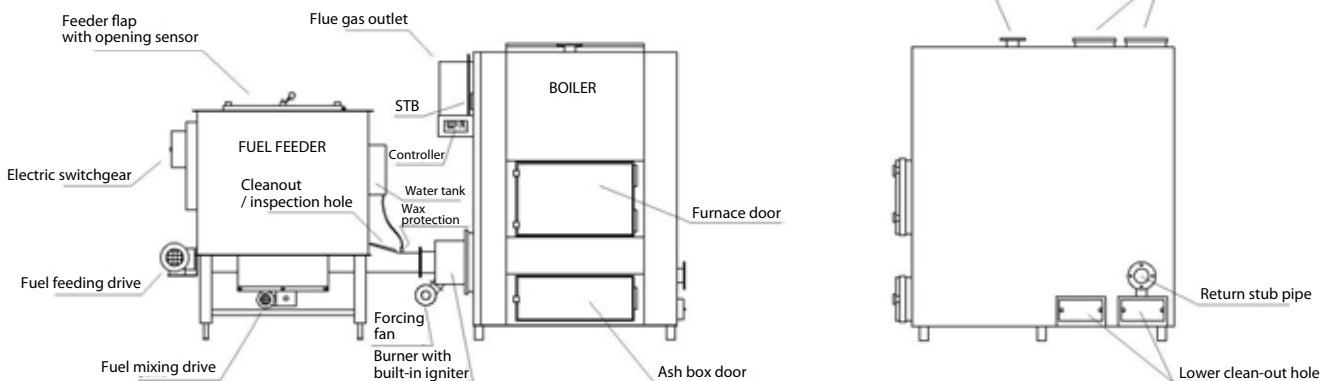


Figure: Schematic drawing of Bio Standard boilers, version 200-250 and 300-350 kW



Dimensions

Futura Bio St	25	50	75	100	150	200-250	300-350
A	1570	1660	1865	1895	1960	2100	2400
B	560	750	845	1010	1010	1550	1550
C	1025	1130	1310	1310	1350	3000	3000
D	850	1025	1265	1430	1435	1900	1900
a	1/2"	1/2"	1/2"	1/2"	1/2"	3/4"	3/4"
b	1 1/2"	2"	2"	2"	2"	Flange – see drawing	Flange – see drawing
c	1 1/2"	2"	2"	2"	2"	Flange – see drawing	Flange – see drawing
d	160	200	250	250	300	510x315	510x315

Figure: Boiler dimensions (25 kW models)

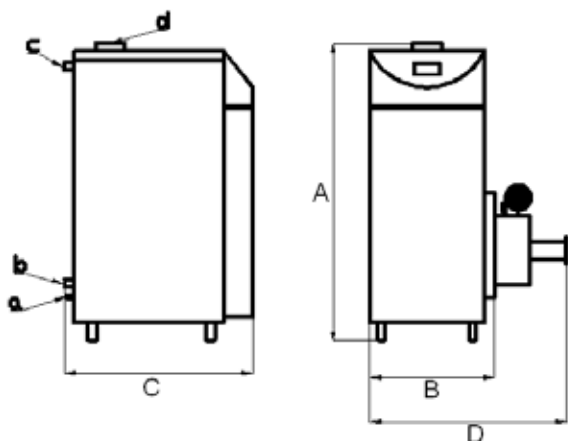


Figure: Boiler dimensions (50 kW models)

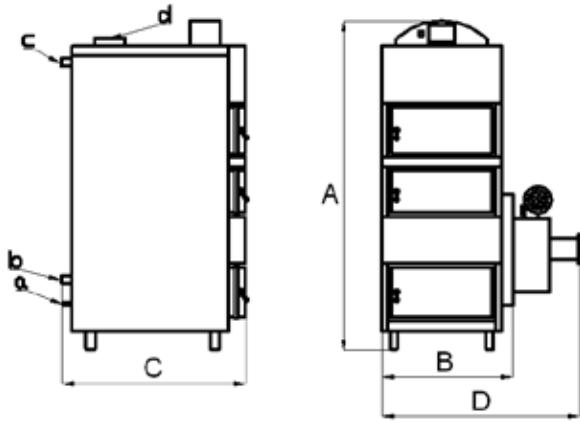


Figure: Boiler dimensions (75 kW and 100 kW models)

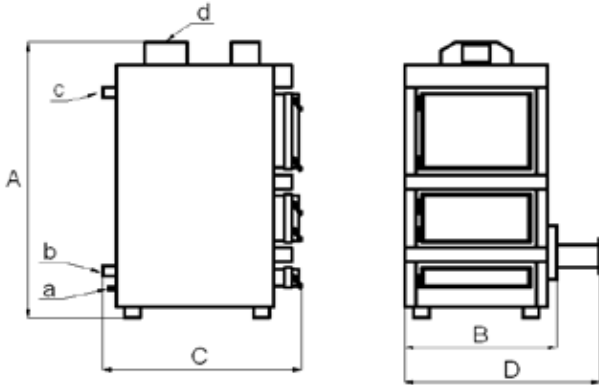


Figure: Boiler dimensions (150 kW models)

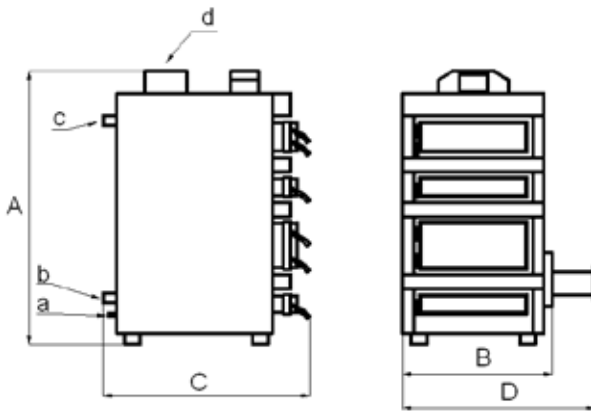
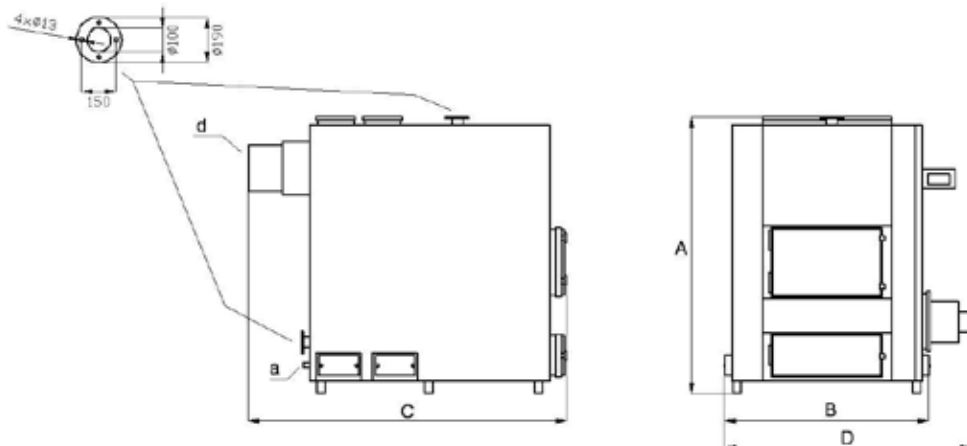
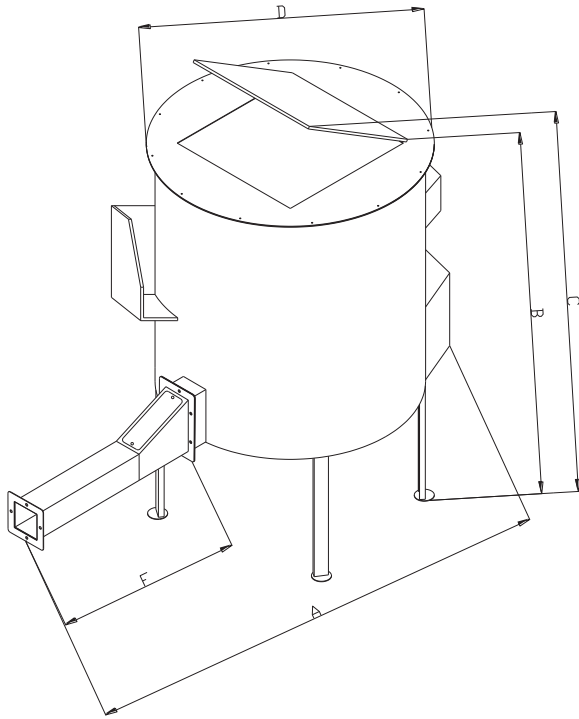


Figure: Boiler dimensions (200-250 and 300-350 kW models)

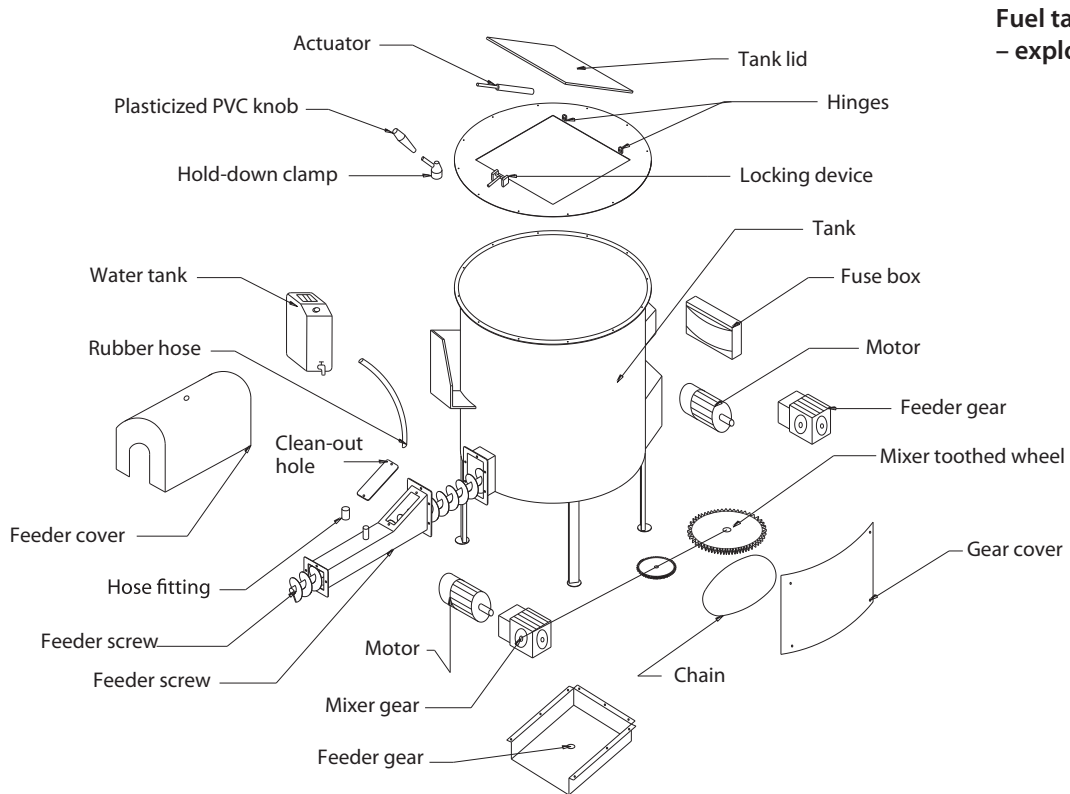


Fuel tank
Dimensions



BIO St basket	25-50	75-200
A	2040	1950
A*	3040	2950
B	1600	1600
C	2300	2300
D	960	1270
F	740	360
F*	1740	1360

* for versions with extended feeding screw



**Fuel tank –
– exploded view**

Futura Bio Pellets

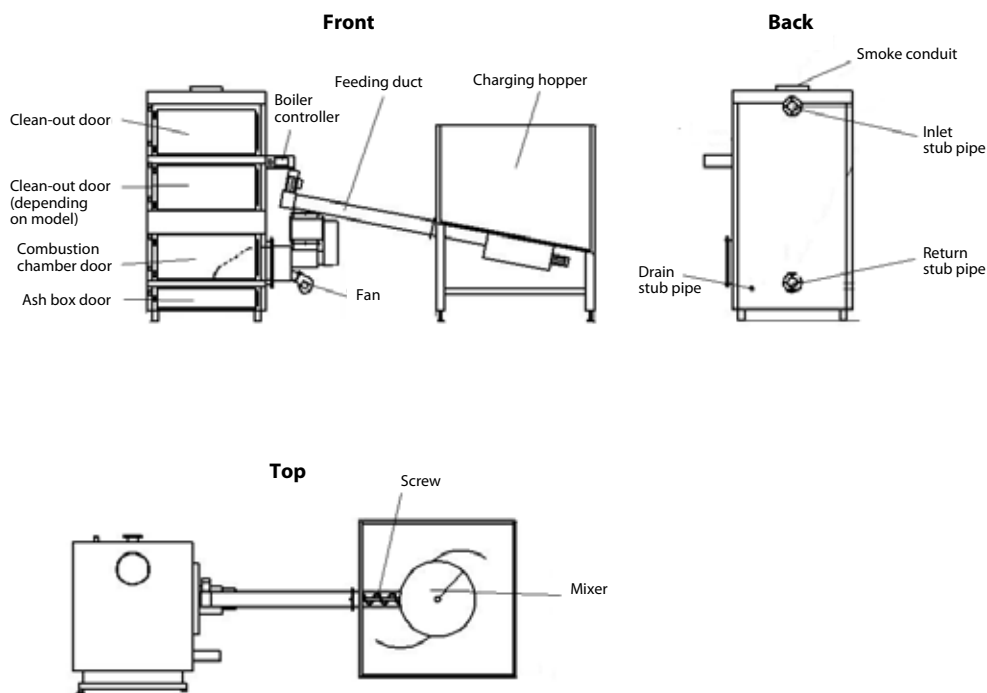
Specifications for Futura Bio Pellets boilers

Boiler type			Futura Bio Pellets 25*	Futura Bio Pellets 100*	Futura Bio Pellets 200 - 250*	Futura Bio Pellets 300 - 350*
Boiler power	pellets	kW	25 +/-8%	100 +/-8%	200+250	300-350
Efficiency		%	82-86%			
Water capacity		dm ³	120	490	1600	1820
Maximum permissible pressure		bar	2	2	2	2
Minimum inlet temperature		°C	55	55	55	55
Maximum inlet temperature		°C	85	85	85	85
Flue gas temperature at rated power		°C	180-340			
Flue gas temperature at minimum power		°C	100-140			
Water-side resistance (pressure loss); Δt=10K		mbar	2÷20			
Water-side resistance (pressure loss); Δt=20K			0.5÷5			
Chimney negative pressure		Pa	15-20	20-25	20-30	30-40
Recommended minimum chimney height		m	8	10	12	14
Recommended chimney cross-sectional area		cm ²	400	600	800	1500

*) Types available upon special order.

All data presented above is for information purposes only and is subject to changes due to continuous product development. Dimensions of boiler and tank may differ from given above.

Figure: Schematic drawing of Futura Bio Pellets boiler



The Futura Bio Pellets boilers models 200-250 and 300-350 kW have identical design as Futura Bio Standard boilers, models 200-250 and 300-350 kW (fuel tank as shown above).

Design of biomass-fired boiler with tank and screw feeder.

The drawings and photos presented below show the design of Futura Bio Pellets boiler with fuel tank and feeding system.

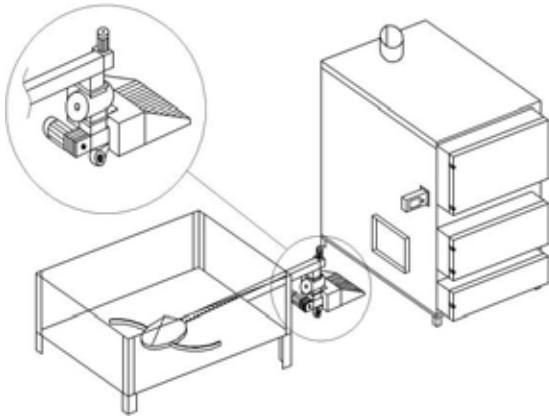


Figure: Schematic perspective view of the Futura Bio Pellets boiler

Mounting of fuel tank in the Futura Bio Pellets boiler is made upon individual orders; the capacity and dimensions of fuel tank is then matched to customer's requirements.



Tank 5m³



Tank 2m³

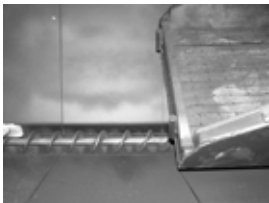


Tank 3m³



A system of 2 tanks with external feeding system.

Optionally, installing of automatic ash removal system is also possible.



Ash removal system



Ash container

Design of biomass-fired boiler type Futura Bio Pellets



Fuel tank



Fuel mixer with cone and blades



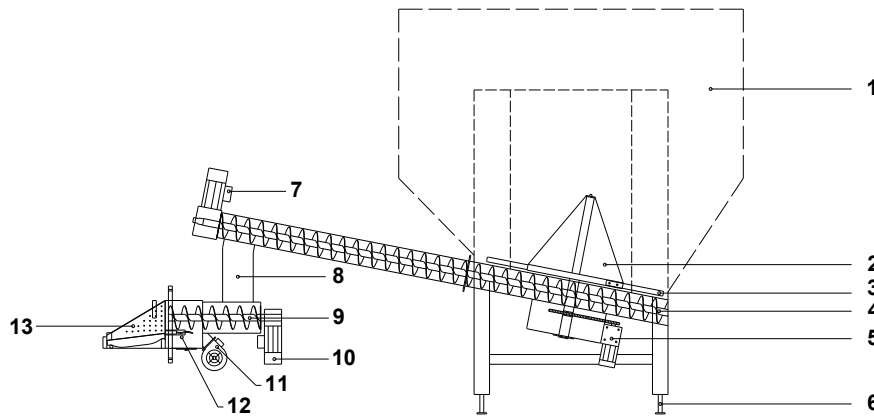
Mixer drive



Burner charging feeder drive



Burner with cast iron insert



1. Fuel tank installation space
2. Fuel mixer
3. Fuel mixer blades
4. Screw conveyor
5. Fuel mixer drive
6. Adjustable tank support
7. Fuel feeder drive
8. Charging duct
9. Burner charging feeder
10. Burner charging drive
11. Forced draught fan
12. Fuel igniter
13. Burner with cast-iron insert



Furnace door



Forced draught fan



Electrical protection



View of flame

Figure: Dimensions of Bio Pellets 25 kW boiler

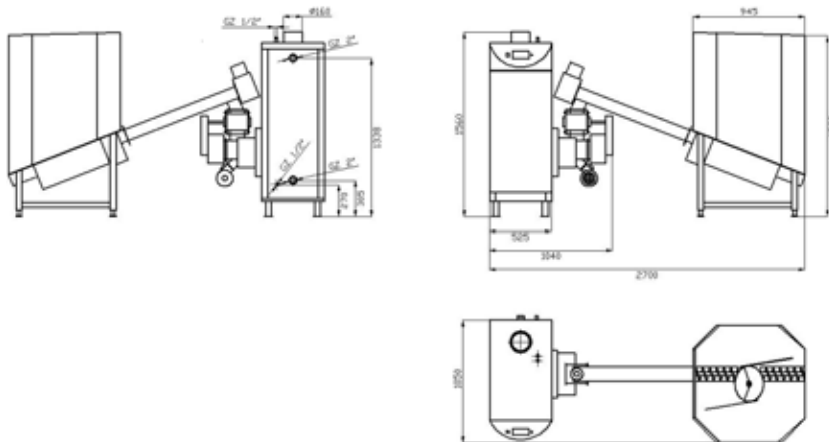


Figure: Dimensions of Bio Pellets 100 kW boiler

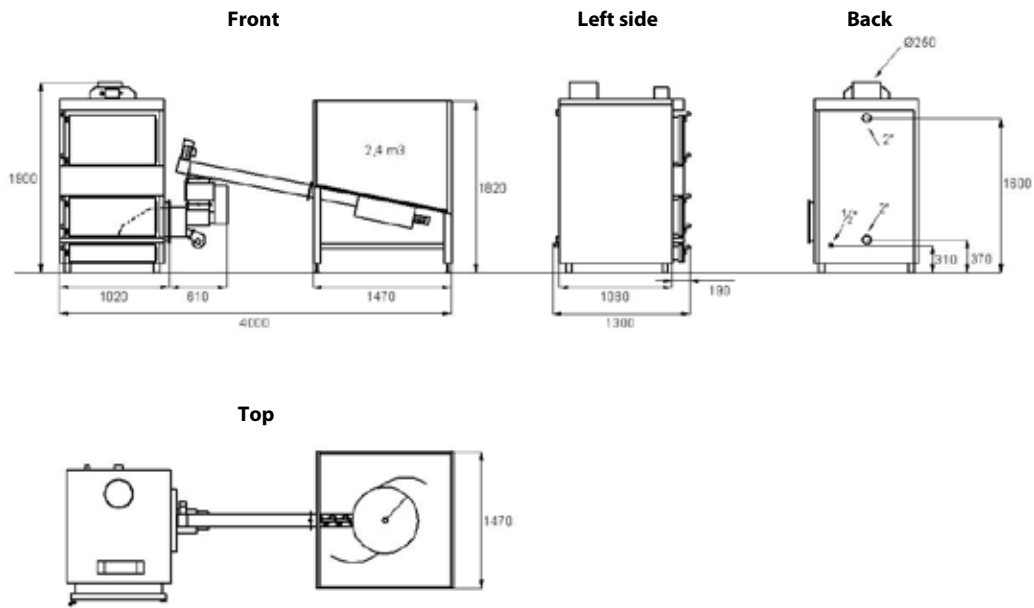


Figure: Dimensions of Bio Pellets 200-250 kW boiler

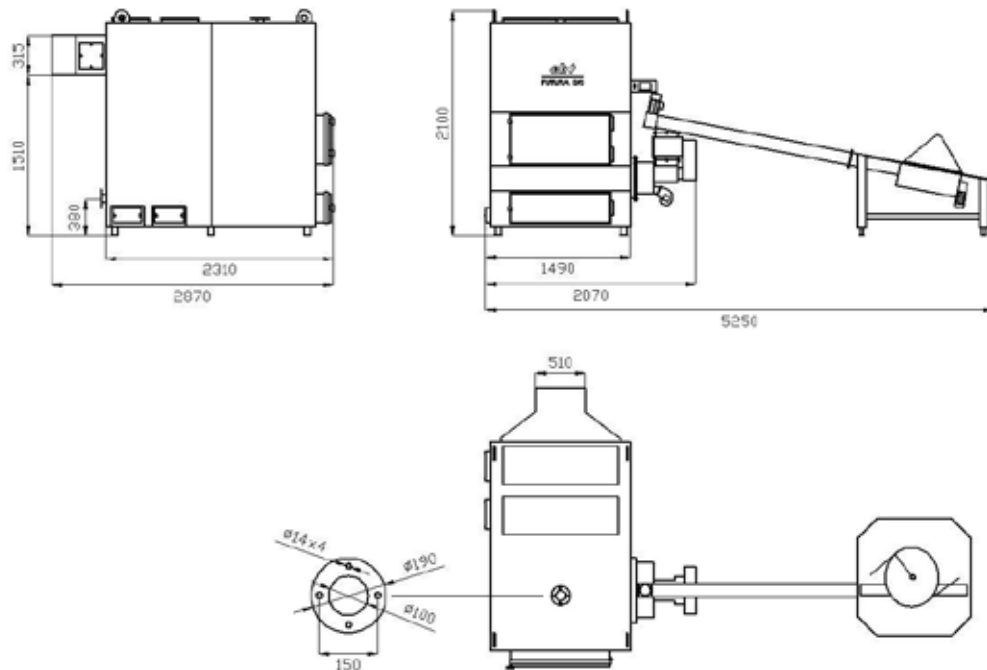
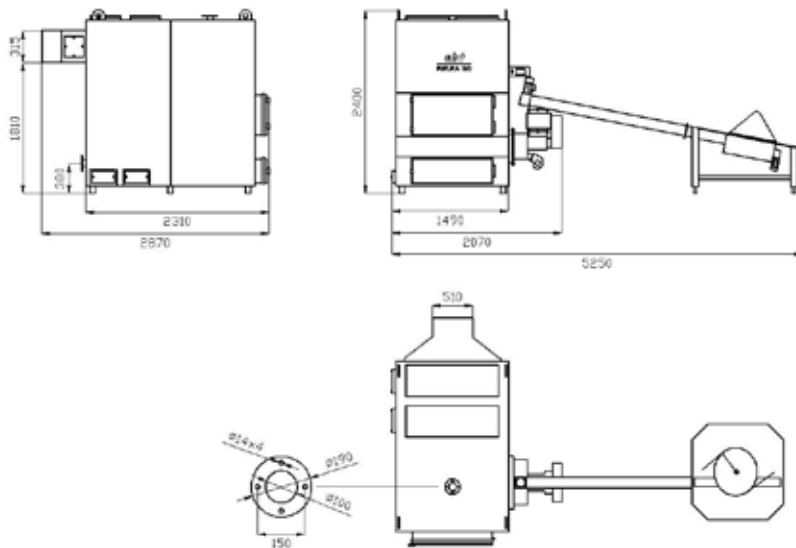


Figure: Dimensions of Bio Pellets 300-350 kW boiler



4. Safety

The design of Futura Bio boilers incorporates modern solutions concerning solid fuel combustion. To ensure safe operation and use of the boiler, please read this manual carefully and always follow the guidelines and recommendations given in it.



The boiler is supplied with electric power 400 V / 50 Hz. Incorrect installation or improper repair may endanger life or health by exposing to electric shock.

OCCUPATIONAL HEALTH AND SAFETY GUIDELINES

1. Prior to boiler start-up, read this operating and maintenance manual.
2. Before starting the boiler up, check if it was installed properly in both electric and hydraulic aspects.
3. Never use solvents, petrol or similar substances for lighting of fuel.
4. Never step into fuel tank and poke fuel manually when the boiler is operating.
5. Never open electric box or fuse box when the boiler is not disconnected from the electric power source, otherwise a risk of electric shock may occur.
6. Fuel can be charged only when fuel feeder is stopped.

5. Boiler installation procedure and installation requirements

General requirements

The boiler room where the boiler is to be installed must meet the requirements of Polish standard No. PN-87/B-02411.



Each boiler fired with solid fuel has to be installed in accordance with valid standards and legal regulations. Unauthorised modifications of mechanical or electrical part of boiler structure will be regarded as breach of warranty conditions causing its immediate termination.

First start-up of the boiler should be performed by authorised manufacturer's service staff.

The heating system should be built according to the following guidelines:

- a) The boiler should be installed in the open-type system.
- b) The boiler should be installed at a safe distance from combustible or flammable materials.
- c) Electric power supply is 400 V/ 50 Hz; the boiler should be electrically connected according to valid regulations and standards by a qualified electrician who has all necessary licences.
- d) The boiler should be connected to the chimney in compliance with valid regulations and manufacturer's recommendations.
- e) A chimney draught regulator must be installed.

Requirements for boiler location

The boiler should be located in a place which meets the following fire-fighting requirements:

- The boiler should be placed on a non-combustible surface.
- The boiler foundation must be made of non-combustible and heat-insulating material and must extend beyond the boiler external dimensions at least 20 mm.
- If the boiler is to be located in a basement, it is required to locate it on a pedestal with the height not less than 50 mm above floor level. Both the boiler and fuel tank should stand vertically and be precisely levelled.

Safe distance to inflammable materials



- During boiler installation and operation the minimum distance of 200 mm to medium-flammable materials should be maintained.
- In the case of very flammable materials like paper, wood, plastics and so on (flammability class C3), this safe distance must be increased to 400 mm.
- If the inflammability of materials is very high, the safe distances specified above must be doubled.

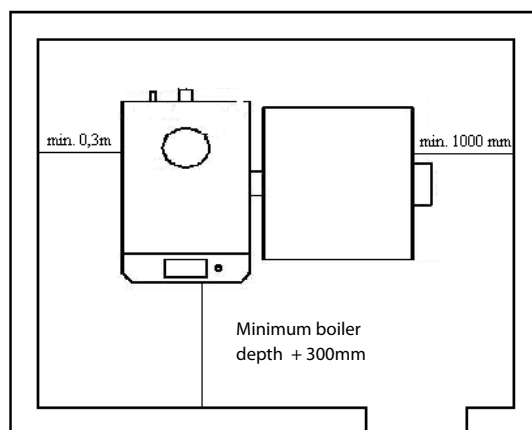
Flammability classes of materials

Flammability class	Material
A – non-flammable	Sandstone, concrete, brick, plasterwork made of inflammable material, ceramic tiles, granite
B – partially flammable	Cement-wood substrate, glass fibres
C1 – hardly flammable	Beech wood, oak wood, plywood
C2 – moderately flammable	Pine wood, larch wood, spruce wood, cork, rubber substrate
C3 – highly flammable	Asphalt, celluloid, polyurethane, polystyrene, plastics, PVC

The boiler location should ensure easy access for maintenance and service operations:

- On the charging hopper side the clearance distance of at least 1000 mm must be maintained (whenever possible, it is the best to have such clearance equal to the length of charging hopper together with feeding duct).
- The clearance between back side of the boiler and boiler room wall should not be less than 400 mm.
- It is essential to ensure easy access to connection points for hydraulic system, chimney and electric power supply (3 x 400 V / 50 Hz).

Figure: Boiler location scheme



The dimensions specified on above drawings are the minimum clearances necessary for uninterrupted and comfortable operating and servicing of the boiler.

Minimum distances to building partitions, dependant on the boiler power, are specified by relevant regulations concerning in-house boiler rooms fired with solid fuels.

Electrical connections

The external devices and auxiliary equipment of the boiler should be electrically connected by qualified electrician with the appropriate licences. The external equipment and boiler accessories, if any, should be connected, according to the markings, to power supply outputs located on the back cover of boiler housing. Electric diagram is also included in instruction manual for the controller.

- Power supply: 400 V / 50 Hz.
- Outputs for external devices: 230 V.

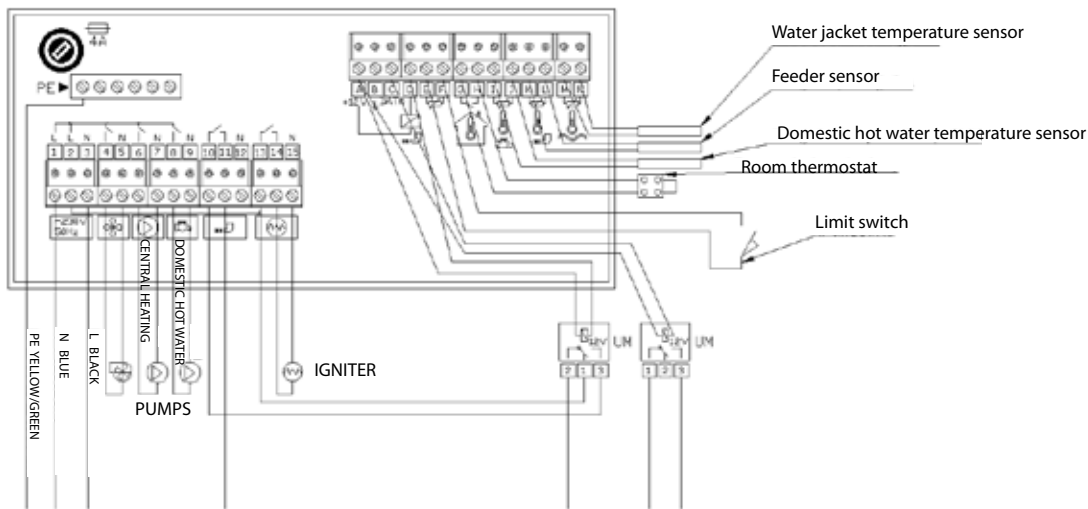
The boiler itself should be connected to a separate power line protected by fast-acting cut-out with nominal current of 16 A.



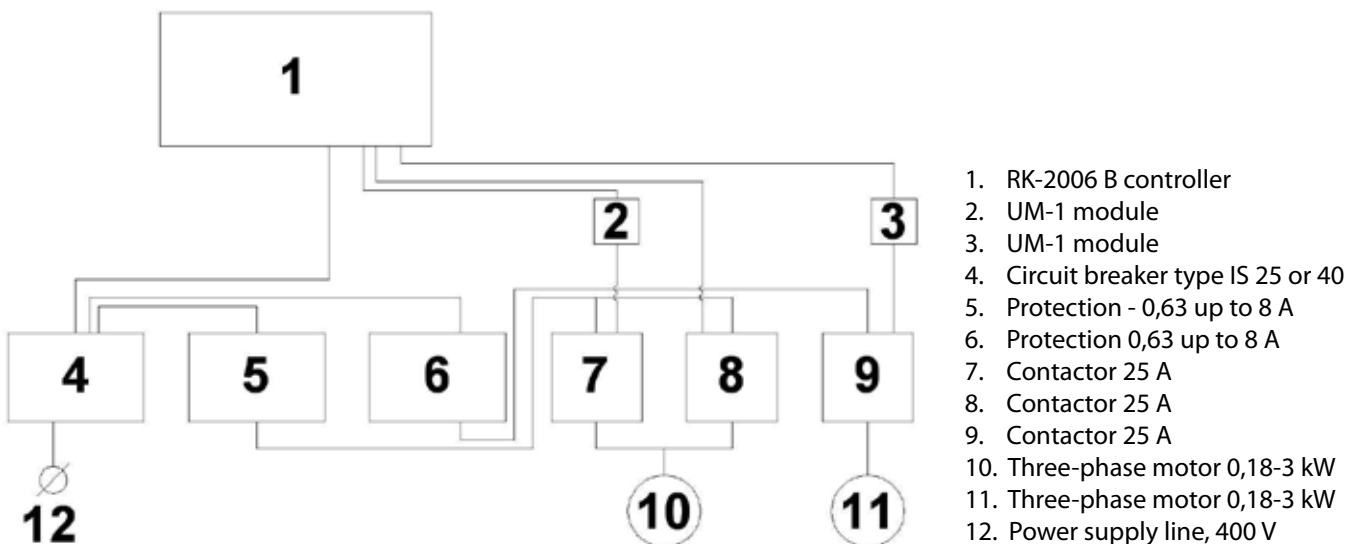
No other electric al devices may be connected to the line supplying the boiler!

The electric cables must be thoroughly fixed along their entire length and must not touch boiler water jacket or flue gas outlet.

Prior to any repairs the electric supply must be disconnected.



Drawing: Wiring diagram for basic controller type RK 2006L2B



Drawing: Electric wiring diagram

Hydraulic connection

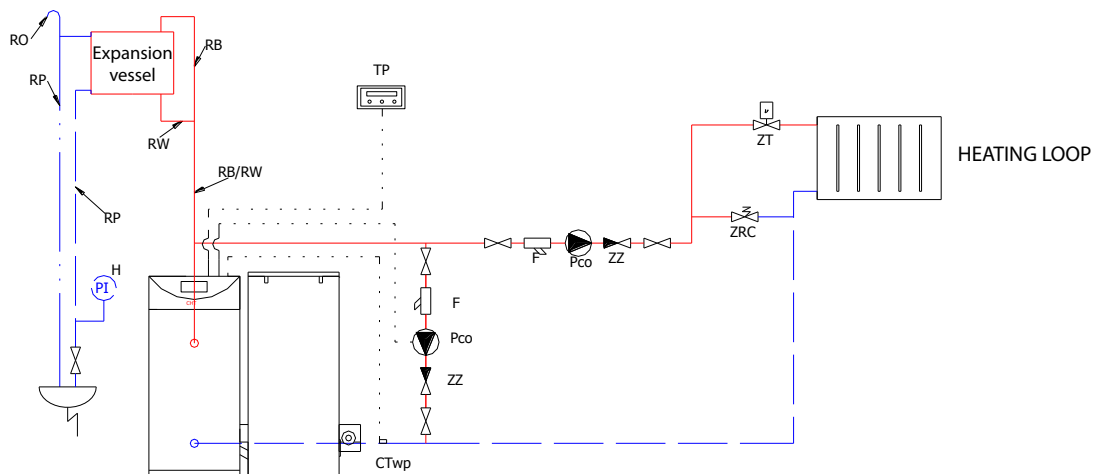
Hydraulic connection consists in connecting the system supply and return pipes to appropriate stub pipes of the boiler.

Recommendations concerning installation of the boiler:

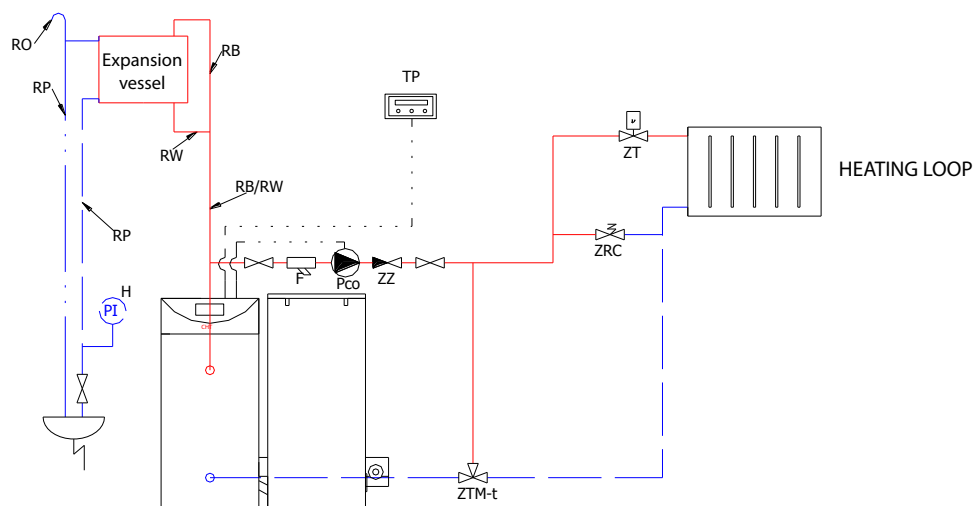
- The system must meet all valid legal regulations, codes and conform to the best building practices.
- The boiler can be operated only in open-type heating systems meeting the requirements of Polish standard PN-91/B-02413 concerning protection of open-system water heating devices and expansion vessels.
- No isolating valves are allowed between the boiler and expansion vessel.
- The hydraulic system of boiler room must ensure the minimum return water temperature at the level of 55 °C. The requirement can be met e.g. by using three-way temperature valves (like the valves type TV manufactured by ESBE Company), mixing pump or other devices able to ensure the required return temperature automatically.
- During boiler operation, the recommended temperature difference between supply and return is 10-20 °C.

Exemplary schemes of hydraulic connection

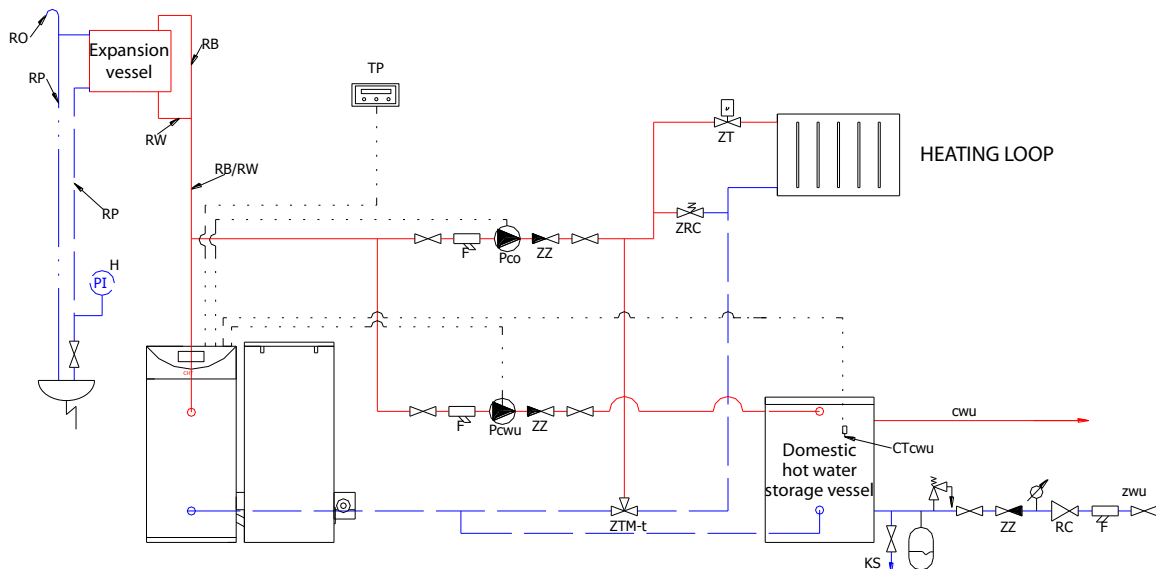
Radiator-type central heating system with one heating loop and mixing pump



Radiator-type central heating system with one heating loop and mixing valve



Radiator-type central heating system with one heating loop, mixing valve and storage-type water heater



Oznaczenia na schematach

co	Central heating	ZTM -t	Three-way mixing valve (thermostatic valve)
cwu	Domestic hot water	ZT	Thermostatic radiator valve
RW	Expansion pipe	ZB	Safety valve
RB	Safety pipe	zwu	Domestic cold water
RP	Overflow pipe	NPW	Domestic water membrane-type expansion vessel
RS	Tell-tale pipe	KS	Drain valve
RO	Vent pipe	O	Vent
Pco	Central heating water circulation pump	RC	Pressure reducer
Pcwu	Domestic hot water storage vessel filling pump	zwu	Domestic cold water
Tp	Room thermostat	MN	Pressure gauge
F	Filter		
ZZ	Check valve		
ZRC	Pressure differential valve		

Requirements for boiler water

Water used for filling the boiler and central heating system should meet the requirements of PN-93/C-04607 standard.

Connection of safety coil (option for 25 kW model).

Safety temperature limiting device (cooling coil, heat exchanger):

Safety temperature limiter (STB) protects the boiler against overheating in case of interruption of water circulation (e.g. power outage) and cannot be used for preparation of domestic water. The device has supply and return lines. The return line should be connected to the drain to cooling sump, and supply line with cold water pipe.

Specifications for safety temperature limiting device:

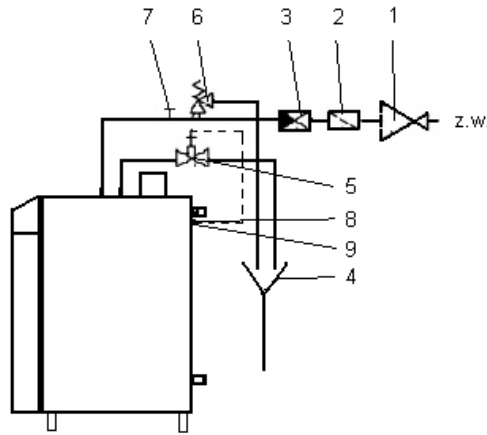
Minimum supply pressure: 2 bar
 Maximum working pressure: 6 bar
 Connection: 1/2", male thread

Installation of safety temperature limiter (optional)

Models equipped with STB have this device built-in at the factory.

Other equipment, i.e. thermal outflow protection, safety valve, check valve and cleaning funnel must be accessible after the installation is finished. Since for functional test the drain must be visible, the drain funnel should be used!

Figure: Connection of safety temperature limiting device



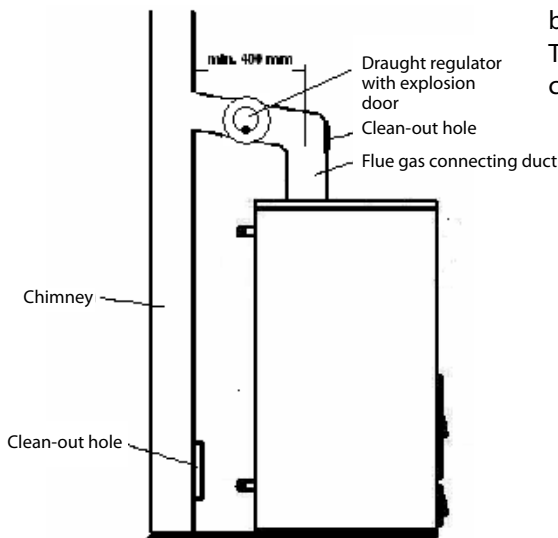
Minimum supply pressure for safety temperature limiting device: 2 bar

The connection must not be isolated (closed) manually.

1. Pressure regulating valve (only for connection to water supply with pressure above 6 bars).
2. Filter.
3. Check (non-return) valve.
4. Drain funnel.
5. Thermal outflow protecting valve (opens at temperature of 95 - 98 °C), i.e. type SYR 3065.
6. Safety valve.
7. Cleaning funnel.
8. Thermal outflow protection sensor (temperature-controlled valve).
9. Connector for connecting the thermal outflow protection sensor.

Connecting to the chimney

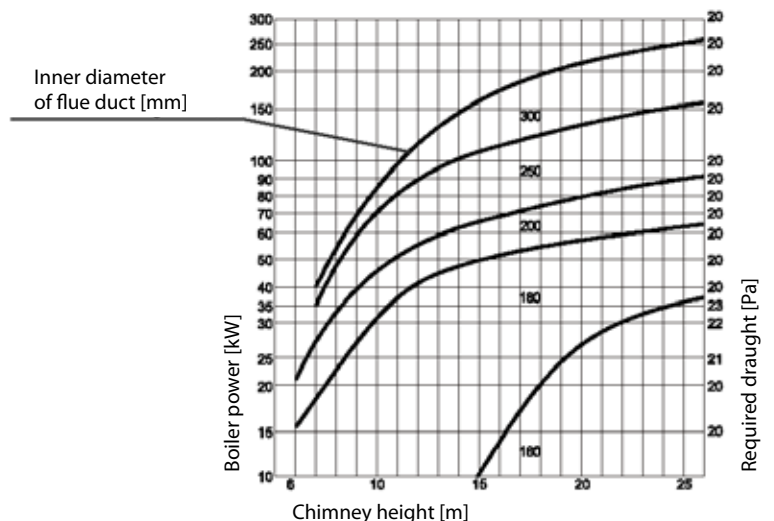
Figure: Connecting to the chimney



Flue gas ducts should be built in accordance with currently valid regulations.

Negative pressure in the chimney should be maintained at the level specified in the Table. Chimney diameter can be selected using the graph below.

The chimney diameter must not be less than the diameter of flue gas connecting duct.



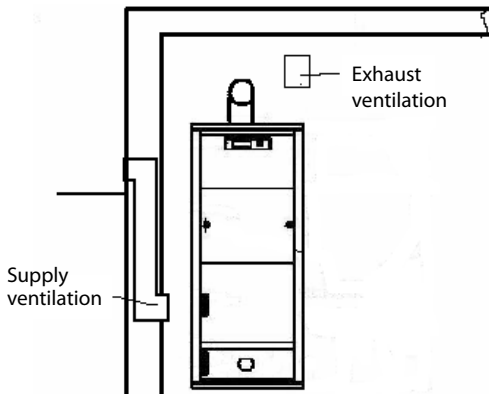
The manufacturer recommends application of the chimney systems which are resistant to condensate soaking-through. The chimney should be made of acid-resistant materials and thermally insulated along its entire length.

The part of ducting which connects the boiler with the chimney, the so-called flue gas connecting duct, should be slightly ascending towards the chimney. To reduce flue gas flow resistance, this duct should be straight, and all necessary changes in direction, if any, should be made in the form of gentle bends.

Near the chimney bottom, some 30 cm above the floor the clean-out should be installed.

The manufacturer also requires installing the draught regulator and explosion door in the chimney system.

Ventilation of boiler room



According to regulations to ensure users' safety and proper operation of boilers each in-house boiler room has to be equipped with supply and exhaust ventilation. When there is no supply ventilation at all or the existing one is choked, in most cases the boiler will operate incorrectly (excess smoking, water condensation, inability to reach higher temperatures), while the purpose of exhaust ventilation is to evacuate used air and harmful gases from the boiler room. In boiler rooms equipped with natural draught chimney the mechanical ventilation is not allowed.

Figure: Ventilation in the boiler room.

Supply ventilation.

The supply ventilation duct should have the cross-sectional area equal to one-half of chimney cross-section area, but its dimensions should never be less than 20 x 20 cm.

The supply ventilation outlet should be located 1 metre above floor.

In air supply opening or in duct the air flow regulating device should be installed, however, this device should not restrict the cross-sectional area available for air flow by more than 80 percent.

The air supply duct should be made of non-combustible material.

Exhaust ventilation

The exhaust ventilation channel should be made of brick, with cross-sectional area equal to at least 25% of chimney cross-sectional area, but with dimensions not smaller than 14 x 14 cm. No devices restricting the area available for air flow are allowed in the inlet openings. Exhaust opening should be located under room ceiling and led out on a roof by at least 1.5 metre. The duct should be made of incombustible material.

6. Operation of the boiler

Commissioning

First start-up is carried out by authorised manufacturer's technicians (payable service).

The initial works carried out in order to prepare the boiler for start-up should include the general inspection of technical condition of boiler room, installations and systems, including inspection and control of boiler equipment and systems, check of flue gas evacuation ducts tightness, inspection of circulation pumps and so on.

Before first start-up the chimney should be preheated!

Futura Bio Standard.

Firing up

1. Fill the tank with fuel.
2. Connect the boiler to power supply line (put the cable plug into a wall socket).
3. Start manual fuel feeding mode until fuel appears in the burner (see the controller instruction manual).
4. Light up fuel on the burner by using paper and small pieces of wood or other kindling material.
Wait until fuel flames up well, then start the fan to support combustion (if the boiler is equipped with fuel igniter, firing up will be performed automatically upon switching the igniter on).

5. Set the required temperature. If it is a first firing of the boiler, set controller automatic mode parameters: fuel feeding time and intervals between fuel feeding operations during start-up and working cycle (see instruction manual for boiler controller).
6. Fuel feeding times should be so programmed that the previous fuel portion burns completely before the next one is fed, and at the same time the flame stability is maintained. Settings should be made so that fuel does not pour through into ash box and the embers do not move backwards to the feeder. It is the best when combustion takes place on two-thirds of burner's surface area.
7. During firing-up it is important to avoid pouring the fuel to the ash box; otherwise the flame on burner may go out.
8. Also, it is necessary to adjust the volume of combustion air fed to the boiler by adequate setting of the fan operation (using fan shutter or from controller level). The volume of air should be so adjusted that the flame is light red, and its length remains stable.
9. Periodically (at least once a week) check the settings of fuel feeder and burner, as well as the combustion process in the boiler.

Damping

To damp a fire in the burner, it is necessary to switch the controller to STOP position. After few minutes, when the fire is dying down, switch on the manual operation of feeder and push out the remaining embers from the burner to ash box.

Then empty the ash box from ash and remaining embers and close the boiler door.

After several hours check the furnace, because if the embers are not removed completely, re-firing of fuel may occur.

In case of fuels which fall freely on the fuel tank bottom under its own weight, switch off the mixer in fuel tank by switching off the overcurrent protection in fuse box located on boiler tank.

Futura Bio Pellet

Firing up

1. Fill the tank with fuel.
2. Connect the boiler to power supply line (put the cable plug into wall socket).
3. Start fuel feeder (or feeder fill-up) until fuel appears in the burner (see controller instruction manual)
4. Press the START button – firing up will be performed automatically.
5. Set the required temperature. If it is a first firing of the boiler, set controller automatic mode parameters: quantity of starting fuel portion, fuel feeding time and intervals between fuel feeding operations during start-up and working cycle for minimum and maximum boiler output (see instruction manual for boiler controller).
6. Fuel feeding times should be so programmed that the previous fuel portion burns completely before the next one is fed, and at the same time the flame stability is maintained. Settings should be so made that fuel does not pour through into ash box and the embers do not move backwards to the feeder. It is the best when combustion takes place on two-thirds of burner's surface area.
7. During firing-up it is important to avoid pouring the fuel to the ash box; otherwise the flame on burner may go out.
8. Also, it is necessary to adjust the volume of combustion air fed to the boiler by adequate setting of the fan operation (using fan shutter or from controller level). The volume of air should be so adjusted that the flame is light red, and its length remains stable.
9. Periodically (at least once a week) check the settings of fuel feeder and burner, as well as the combustion process in the boiler.
After initial adjustment the controller will automatically adjust the metering of fuel and air for the set boiler output.

Damping

To damp a fire in the burner, it is enough to switch the controller into STOP position – damping will occur automatically. The burner damps each time the set temperature is reached.

Attention: Combustion of various fuels on grates under the burner may cause burner damage. These grates are designed for burning the remaining embers from the burner and are not intended for continuous combustion.

Note:

Before starting the boiler check if the water protection operates properly. The tank should be filled with water and the valve open, so as water remains in tubing.

In case of water depletion in the tank, check the tightness of wax plug located on the feeder. If leaks are found, remove used wax and put in a new one.

After each trigger event of protection, pour the sleeve with wax again and fill up the tank with water. Periodically check the amount of water in the tank.

The boilers require periodical attendance every 8 hours; during such inspection the fuel level, fire in the burner and temperature of water in the boiler are to be checked.

7. Maintenance

Boiler daily maintenance:

- Includes checking of fuel quantity in fuel tank and removal of ash.
 - Ash should be removed each 3 – 7 days, depending on the boiler working load and ash content in fuel. In case of fuel containing greater amount of impurities the burner should be cleaned from carbon deposits once a day.
- Outer surface of boiler housing should be cleaned by using slightly damp cloth and cleaning detergents.

Weekly maintenance:

- Open fire door and check condition of flame.
 - Periodically remove slag, if appears in the furnace of burner in large amount.
- Depending on fuel quality, the burner can be cleaned every several days or weeks. To clean the burner, switch it off by pressing the button on burner controller and, starting the manual feeding mode, push the remaining embers to the ash box. Wait until the device switches off and the burner cools down, then open the door and remove ash and slurry which can possibly choke the air supply openings from burner's grate. Slurry on the burner also hinders firing up of fuel.

Monthly maintenance:

- Perform weekly maintenance operations, and then:
- Damp the boiler and inspect heat exchange walls for deposits.
- To this end, open the clean-out door or unscrew cover (two versions) and check thickness of deposit on boiler walls. The models above j 150 kW have two clean-out holes. If thickness of deposit exceeds 1.5 - 2 mm, cleaning is necessary. Clean using steel brush, and remove scraped deposit from convection channels. Depending on the model, clean out holes are located on the front, top or side of the boiler. For boilers above 100 kW it is recommended to clean them every two weeks at least. Walls of combustion chamber can be cleaned through charging door.

- Check if there isn't too much waste material in charging hopper and remove if necessary.
 - Once a month the boiler should be damped, ceramic and cast iron parts of the burner removed and cleaned from impurities.
 - Check the patency of air nozzles in the burner, clean if necessary. Air duct in the burner can be cleaned after removing the outer part of burner.
 - Check the condition of door sealing stuffing, and, if necessary, replace with new stuffing material.
- It is recommended to use combustion catalysts which facilitate burning of soot on boiler walls and reduce emission of carbon dioxide to atmosphere. When using such agents, the boiler can be cleaned less frequently. The agent should be poured to the burner every several days.



Maintenance of feeder

- In the boiler is left inoperative for a prolonged period of time, then:
- Once three months start the feeder for 15 minutes, to avoid jamming of screw inside pipe.
 - Clean the pipe from fuel remainders, empty the tank and clean the burner.
- The feeder is so designed that expensive maintenance is not necessary. The feeder should be cleaned from dust or remaining of fuel or ash on time from time basis. Clean the motor housing on regular basis. The reducing gears are filled with synthetic oil and, apart from external cleaning, do not require any maintenance. Never use solvents for cleaning, since such liquids may damage sealing rings.
- On a current basis, check the reducing gear operation. Also, check the following:
- Condition of seals – no leakages of oil or grease are allowed.
 - Noise level – increase of operating noise can indicate the damage of motor or gear-motor bearings.
 - Smoothness of running – if operation is not smooth, the cause can be in gear motor or the screw driven.

- Condition of threaded connections – tighten if necessary.
- Surface condition. Periodically clean the motor from impurities and dirt which can hinder heat exchange.
- At least once three months lubricate the moving element of the boiler (gears with chain, hinges and so on).

Motor

The motor bearings are of closed type and are lubricated with long-term grease, therefore in normal conditions the bearings do not need maintenance or re-lubricating for the period of 20.000 working hours, but no longer than three years.

Upon expiration of above period of time it is recommended to replace motor bearings.

Reducing gear

The reducing gear is filled with synthetic oil which, in normal conditions, should be replaced every 20,000 working hours, but at least every three years.

If oil replacement is necessary, please use one of oils specified below:

The table below specifies lubricants that can be used for lubricating of worm gear-motors:

Oil type		Oil type										
Oil type	Working temperature range											
Synthetic oil	ISO VG 220 -25 ... 60°C	Depol GS220	Energyn SG-XP 220	-----	-----	-----	Renolin PG 220	Küster-synth GH-6-220	Glygoyl HE 220	Optiflex A 220	Shell Tivela WB TivelaS 220	Tribol 600/200