

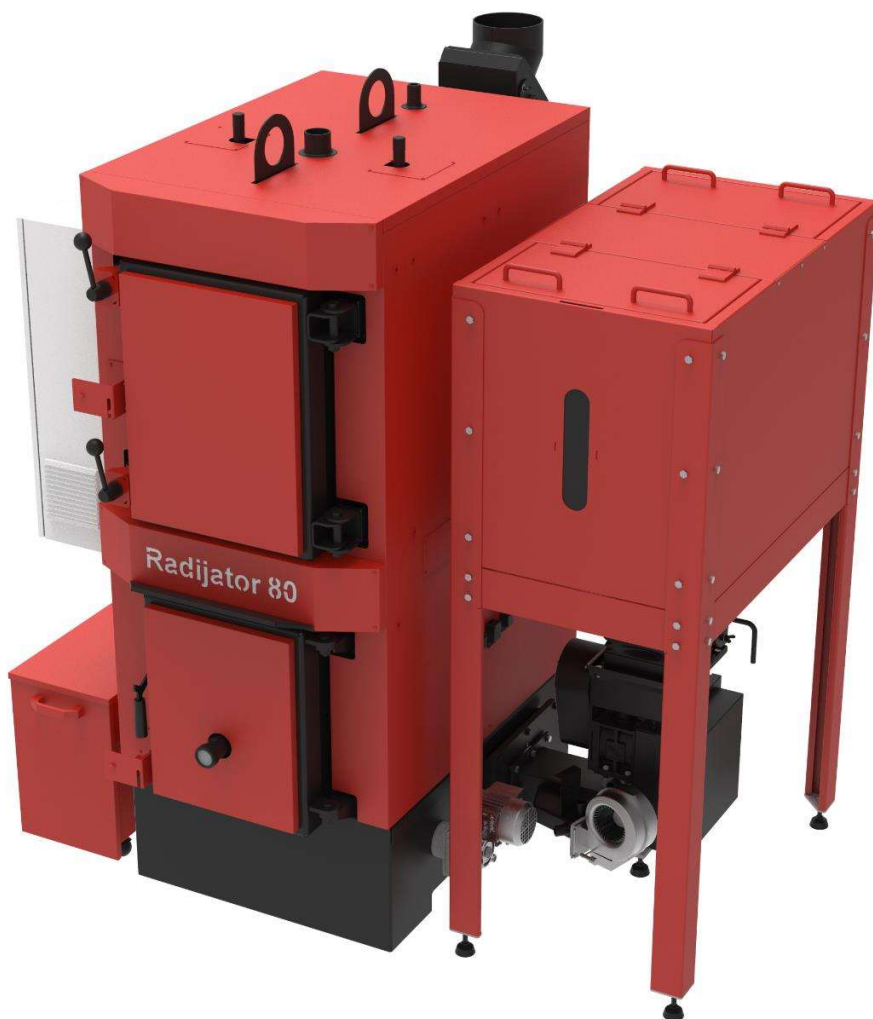


Management
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**Kotao
na BIOMASU/
BIOMASS
BOILER**

**SERIJA\SERIES
TKAN
60-300kW**



INSTRUKCIJE / INSTRUCTIONS

Montaža, korišćenje i održavanje kotla/ Installation, use and maintenance of the boiler

TABLE OF CONTENTS:

1. Important warnings;
2. Description of the boiler;
3. Installation;

General warnings;

Boiler room;

Connecting to the chimney;
4. Cross-section of the TKAN boiler with the description of elements;
5. Table with dimensions;
6. Hydraulic diagram;
7. Explanation on how the TKAN automatic controls system functions;
8. Maintenance of the boiler;
9. Warranty

1. Important warnings

GENERAL WARNINGS

- Upon removing the package, make sure that the delivery is complete and, in case that something is missing, refer to the seller who sold the boiler
- The boiler must exclusively be used for the purpose intended by the seller. No responsibility will be taken by the manufacturer for the damage caused to people, animals, or things in case of installation errors, regulation, maintenance, or improper use.
- In case of water leakage, remove the device from the electric power supply, stop the water supply, and inform the licensed service department or the licensed fitter.
- This manual is an integral part of the device and has to be kept with care and **ALWAYS** has to come with the device in case of changing owner or user, or in case of being connected to another installation. In case of being damaged or lost, request a new copy from the licensed seller.

IMPORTANT WARNINGS

We remind you that, while using the device on biomass or solid fuel and those in contact with electricity and water, it is required to follow safety measures:

- It is forbidden for children and persons with certain limitations without supervision to use the boiler
- It is forbidden to use the boiler on installations with an operating temperature higher than 90°C and operating pressure higher than 3 bars.
- It is forbidden to use easily flammable fuels (alcohol, oil) for the purpose of faster combustion of wood
- It is forbidden to store highly flammable materials near the boiler and furnace doors. Ash must be stored in sealed and inflammable containers.
- It is forbidden to incinerate waste and materials whose combustion produces flame or explosion hazards (e.g. plastic bags, sawdust, coal dust, mud, etc.)
- It is forbidden to perform any kind of intervention by the technician or cleaning before the boiler is removed from the electric power supply by removing the outlet from the electric network.
- It is forbidden to alter safety elements. A periodical inspection of safety elements is mandatory according to the laws of the country where the boiler was installed.
- It is forbidden to close ventilation openings in a room where the boiler is. Ventilation openings are necessary for proper combustion
- It is forbidden to expose the boiler to extreme weather. The boiler itself is not intended to be installed externally and does not have an anti-freezing system.
- It is forbidden to shut down the boiler if the external temperature might drop below ZERO (freezing hazard)
- To supply large industrial TKAN series boilers with electricity, three-phase electric energy is used. If the user uses generator units that turn on when electricity goes out, it is necessary to check if electric motors for transporting pellets have the same direction as when they are on the mains power supply. If motors are operating in opposite directions, great damages to the boiler may result.

The minimal distance from flammable materials

- Ensure the appropriate distance from flammable materials and, if necessary, provide their protection.
- The minimal distance from flammable materials is regulated by law – please seek information from professionals whose profession is heating and chimneys.
- The minimal distance between the boiler and flue gas discharge pipes from the materials of low and average flammability rate should be at least 100mm.
- The minimal distance from easily flammable materials is 200mm and the same applies to materials of an unknown flammability rate.

Fire hazard!

- Storing flammable materials and liquids close to the boiler is forbidden.
- It is mandatory to inform users of the necessary minimal distance between flammable materials and the boiler.

A ... inflammable	asbestos, stone, building stone, ceramic wall tiles, terracotta, stucco, glazed concrete (without organic additives)
B ... not easily flammable	drywall, glass fibers, and isolation panels (AKUMIN, IZOMIN, RAJOLIT, LIGNOS, VELOKS, HERAKLIT)
C1... slow burn rate	beech and oak wood, composite wood, felt, and isolation panels (HOBREKS, VERZALIT, UMAKARTA)
C2 ... average burn rate	pine wood, larch wood, and fir wood, composite materials
C3 ... easily flammable	asphalt, cardboard, cellulose materials, particleboard, cork, polyurethane, polystyrene, polypropylene, polyethylene, floor fibers

2. Description of the boiler

The goal of developing the TKAN boiler was such that RADIJATOR INZENJERING could offer the boiler to the market which is, according to its mechanical and thermal properties, distinctly intended for biomass fuel.

Using the general term 'BIOMASS', it is, of course, thought of pellets, but the possibility of firing with fruit pits, more precisely sour cherry and sweet cherry, should be pointed out as well. **If the user wants to use some unlisted form of biomass, the construction and development department of Radijator inzenjering, or the licensed seller should be contacted, because some specific types of biomass require special, specific combustion solutions.** While using mentioned fuels, the automatic control of main operation parameters is implied. With all listed examples of using biomass, a certain degree of fuel aridity is required.

On the other hand, market demands always lean towards even greater universality of fuel, therefore TKAN can also be fired with wood and, then, firing is manual.

The furnace of TKAN industrial boilers is significantly smaller than in traditional boilers on wood. Therefore, firing with wood and extracting ash is made harder. The conclusion is not to use them when combusting huge amounts of wood and just for a couple of days. In these situations, furnace shields and shields for ash cleaner screws should be used. They are represented in section 'Starting the boiler on wood'.

In this situation, the combustion is done under the forced draft of the fan, therefore TKAN in these conditions is more efficient than its predecessors which operate according to the free draft principle.

Industrial boilers TKAN series are manufactured in the following powers: TKAN 60, TKAN 80, TKAN 100, TKAN 150, TKAN 200, TKAN 250, and TKAN 300.

CONSTRUCTION

Speaking of the external design, furnace dimensions, firing and cleaning holes, TKAN preserved all good characteristics of previous models which distinguish RADIJATOR INZENJERING on the market.

The water part of the boiler, its method of exchanging heat between flue gases and water through the pipe exchanger, is adapted to biomass. Because of the fan, more precisely forced draft, the route of flue gases is longer than in standard boilers. Due to the same reasons, it is possible to flue gases deflectors, so-called turbulators that further increase the degree of utilization of the boiler. Turbulators are spirals made of pipe-like material. If, while using, (chimney) there is too much smoke on boiler doors in the firing phase or automatic controls system encounters difficulties when entering the combustion phase, it is technically justified to use the boiler without turbulators (or with a smaller number of).

The degree of utilization on pellets exceeds 90%. On normal modes, the temperature of flue gases on exit is around 160°C, and on maximum modes is below 180°C. These values can be read on the display at any moment.

Industrial TKAN boilers **have** the exchanger made of seamless pipes for the installation of **vents for thermal leakage protection**. On these boilers, the existing sockets enable easy installation of vents that directly load water into the boiler for thermal protection.

All parts of the water part of the boiler are made of seamless pipes (quality **ST 35.4**) and at least 5mm thick boiler sheets depending on the power of the boiler. Sheets are **1.0425 EU** standard (speaking of quality), more precisely **P265GH** standard **EUII**.

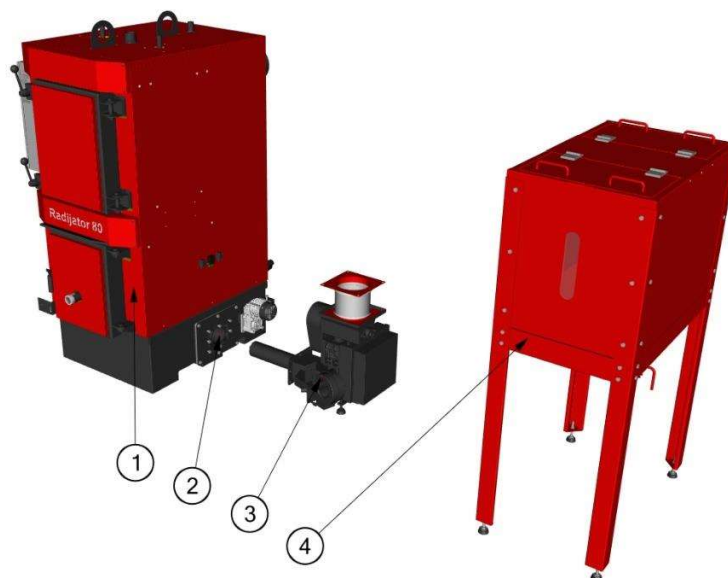
According to its principle of operation, the furnace is the so-called ‘spring’, where the fuel from the transport zone goes vertically upwards, that is springs to the combustion zone. It is made of massive insulation materials and grey cast iron. Fuel transport is ensured by screw conveyors. The fuel comes from the silo capable of holding from 457l to 1610l depending on the size of the boiler. When needed, it is easy to disassemble everything into three separate units: a silo (**picture 1, position 4**), a loading mechanism (**picture 1, position 3**), and a boiler with a furnace (**picture 1, positions 1 and 2**). A separate assembly within the furnace stands out – a semi-automatic boiler cleaning. Boiler TKAN 60 does not have a screw axle for ejecting ash inside the furnace. Boilers TKAN 80 and TKAN 100 have one screw axle each, and TKAN 150 and higher, that is TKAN 200, TKAN 250, and TKAN 300 have two screw axles for ejecting ash each.

A very important notice regarding the construction of TKAN industrial boilers is that it also enables additional equipment. The additional equipment is ordered prior to the boiler delivery, some elements can be additionally installed on spot, and some of them have to be factory installed.

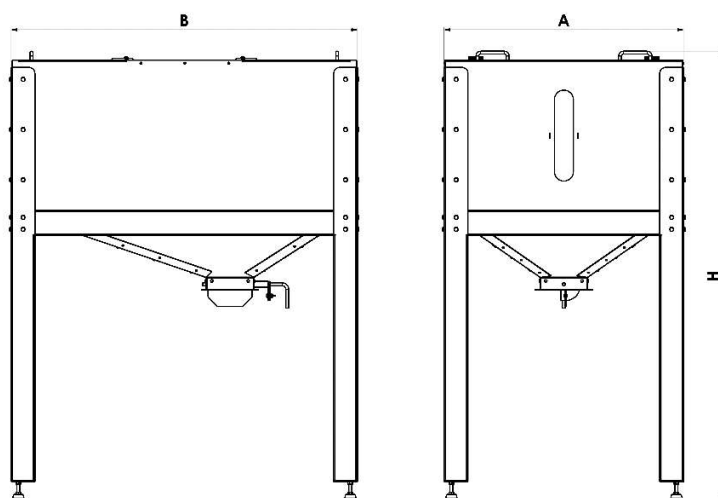
Additional equipment elements are:

-Larger daily silos are next to the boiler. Standard silos (picture 2) are listed in the table with dimensions, however, if a buyer has more space in the boiler room and prefers a larger, so-called daily silo in special dimensions, it is possible to order one made by Radijator inženjering. The delivery of this silo is possible additionally after the boiler is already placed in the boiler room.

-Multi-day containers for pellets. It is also possible to deliver silos of tens of tons in capacity and which are connected to a small daily silo with the screw conveyor system. Loading these silos is done from a so-called jumbo one-ton bag by bucket elevators. This equipment is also possible to be delivered additionally.



Picture 1 The representation of the dissassemblable boiler units



Picture 2. Standard silo for TKAN boilers

Table 1 - Silo dimensions

	DIMENSIONS				
	A	B	H	V	Pellet capacity
	mm			liters	kg
TKAN 80	606	1020	1736	290	180
TKAN 100	810	1176	1611	305	190
TKAN 150	1010	1456	1875	680	410
TKAN 200/250/300	1394	1830	1822	1600	1000
	1394	1830	2130	2330	1500
	1394	1830	2445	3115	2000

Boilers TKAN Integra 200/250/300 provide a possibility to have one of three silo variants installed in the boiler room, depending on the buyer's preference of course. Template measures are given in table 1.

3. Installation

3.1. General warnings



TKAN boilers are intended for the maximum working pressure of 3 bars and maximum working temperature of 90°C, therefore they fit into the category of hot water boilers. Operating at higher values than listed can cause great material damages and endanger human lives.



It is strictly forbidden to reduce cross-sections of safety supply valves. It is also strictly forbidden to install safety equipment whose working pressure is higher than 3 bars. It is recommended to install vents for thermal leakage protection in accordance with the law of the country where the equipment is installed.



The boiler has the fan, automatic controls system, the pellets transport mechanism eventually the furnace or pipe bundle cleaning mechanism. All these devices use a 230V or 3x380V power supply, therefore improper installation and careless handling can endanger human life by electrocution.



Before starting the boiler, check if the direction of the pellets transportation motor enables the supply of pellets into the furnace. In case generators are used in case of a power outage, also check if the direction of the motor directs pellets into the firing chamber. On the contrary, that can lead to permanent boiler damages.



During each intervention on the boiler's electric system (e.g. changing electric heater for firing, electric gear motor interventions or fan interventions, etc.) it is mandatory to shut down the main power supply by disconnecting the socket from the network installation. This way, possible electric shocks and endangering lives of technicians performing the intervention are avoided.



Solid fuel and forced draft boiler should be installed according to valid norms and law regulations. Every change either on the mechanical construction or on the electrical installation will be considered a violation of warranty terms and lead to their violation.

While bringing the boiler into the boiler room, it is very frequent that the entire boiler cannot fit through the existing door or some other object in the boiler room represents an obstacle. In such situations, it is very easy to disassemble the boiler into three basic assemblies:

- water exchanger with furnace
- pellets transport mechanism
- silo

The factory position of the silo is on the right side of the boiler. If the customer wants it on the left side, that must be emphasized while ordering.

Basic requirements that must be met during installation are:

When installing the boiler, pay attention to its side distance and rear distance from possible obstacles. In this way, the access point is created to clean ash from the boiler or even dismantle the assembly of the mechanism for transporting pellets. More details in section 3.2.

The boiler can be connected to an open central heating system, but to a closed central heating system as well. In case of the connection to a closed system, it is recommended to install the valve for thermal leakage protection, which is determined by the relevant laws of each country in which the boiler is connected. In this series of boilers, thermal safety valves with direct injection of cold water into the boiler should be used. There are appropriate sockets for mounting these valves on the boiler itself.

In the boiler room, where the boiler is installed, if there are frequent power outages use additional safety measures and measures to protect the boiler while operating. If there are parts of the installation that are "submerged", that is, they are at a lower level than the boiler and some heating bodies, then the open heating system is recommended.

The boiler has to be located at a safe distance from easily flammable materials.

The power supply of the boiler is 3x380V (except for TKAN 80) and 50Hz and the connection of all devices that the boiler contains should be done according to the valid regulations and the connection is made by a person with the appropriate authorization.

The connection to the chimney is also conducted according to the binding regulations the manufacturer's recommendations as well as, which can be seen in the following text.

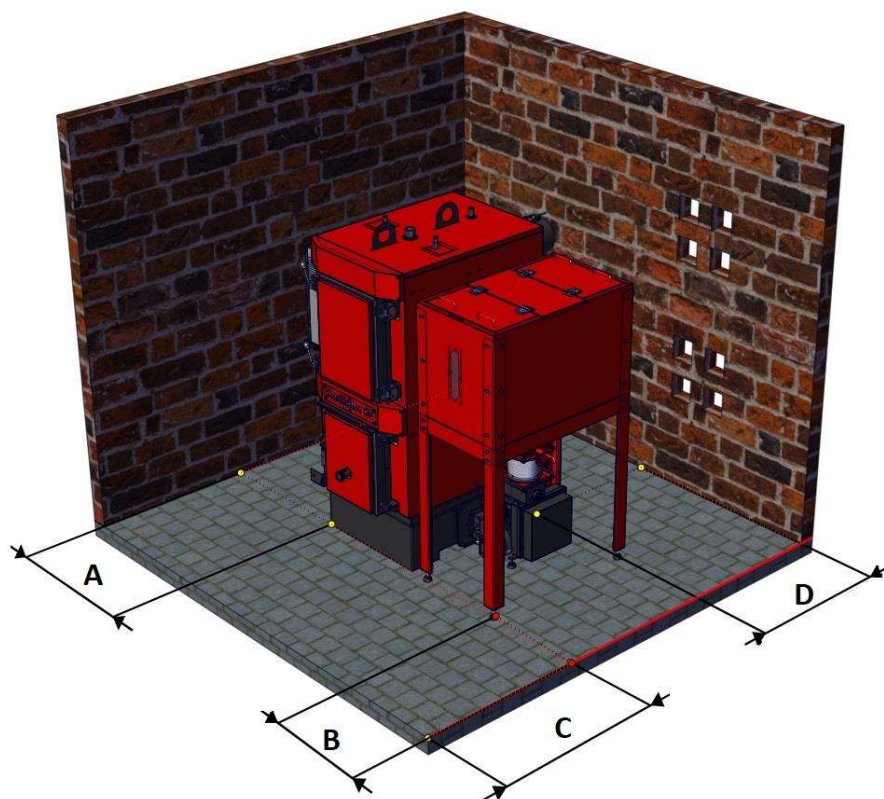
3.2 Boiler room

The boiler room must be secured against freezing.

The boiler base in the boiler room has to be made of inflammable material. Recommended distances of all four sides of the boiler in relation to the walls of the boiler room or some other rigid bodies (storage boiler, etc.) are shown in *picture 3*.

These distance values allow safe access when firing, enough space for cleaning, and free access to the fan, pellet transport mechanism, electric ignition heater, and charging and discharging valve. The boiler on its side opposite the silo should be distanced from the wall 500 to 600mm and only when there is a semi-automatic cleaning of the furnace. That space is needed for handling the ash dump

If the boiler does not have semi-automatic ash cleaning, then, it is enough to be 100mm away from the wall. On the silo side, the boiler should be 400 mm to 900 mm away from the wall (measured from silos) depending on the power of the boiler. These measures are given below in the table for each power. This room is needed in case of any major interventions on the pellet transport mechanism, that is, in a situation where it needs to be dismantled from the boiler. The space at the back of the boiler should allow easy access to the chimney and ash cleaning holes on it. From the front side of the boiler, it is required to ensure easy opening of all doors and eventually allow the installation of pneumatic cleaning.



Picture 3 Positioning the boiler in the boiler room

Table 2 Positioning the boiler in the boiler room

Boiler type	DIMENSIONS			
	A* (mm)	B (mm)	C (mm)	D (mm)
TKAN 60	100	400	1000	800
TKAN 80	500	400	1000	800
TKAN 100	500	400	1000	800
TKAN 150	500	550	1000	1000
TKAN 200	600	650	1000	1000
TKAN 250	600	900	1000	1100
TKAN 300	600	900	1000	1100

NOTICE: All boilers except the TKAN 60 boiler have semi-automatic cleaning.

The boiler room must have necessary ventilation, that is, openings big enough for the fresh air to enter and exhaust air to leave.

The total surface of these openings is a minimum of 200cm² for power up to 80kW and for power over 80kW the surface has to be larger by another 2cm² per kW.

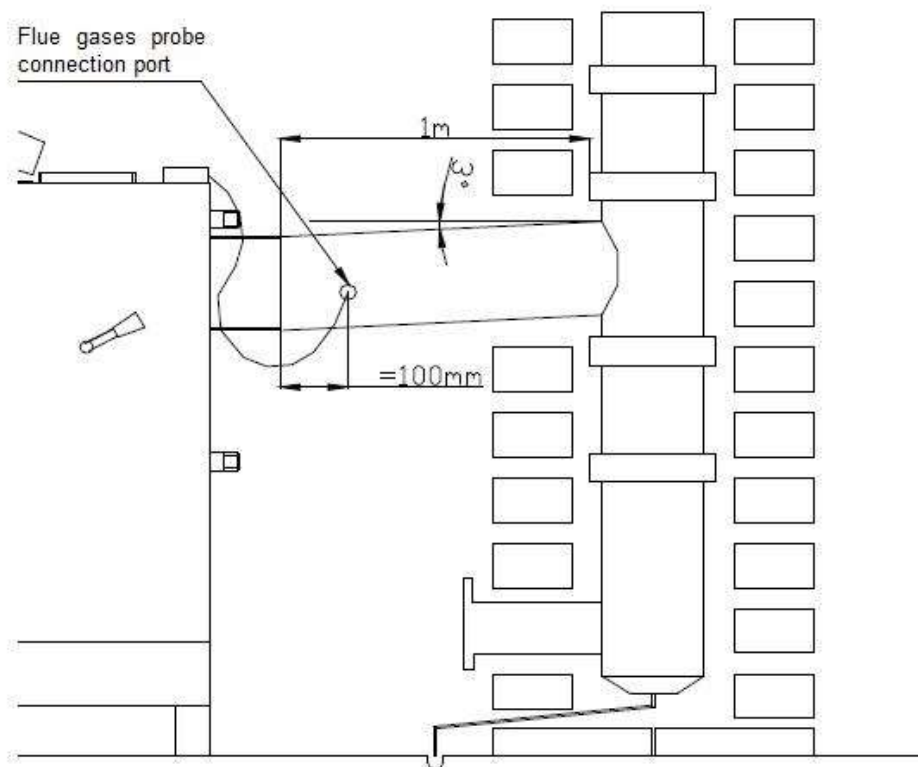
$$A = 200 \text{ cm}^2 + \frac{2 \text{ cm}^2}{\text{kW}} \times (\sum Q_n - 80 \text{ kW}) \quad \sum Q_n = \text{possible powers over 80kW}$$

The lack of sufficient ventilation in the boiler room can cause numerous problems in the operation of the boiler. The main problem is the inability to achieve high outgoing water temperatures, that is, not achieving maximum power leading to condensation in the boiler.

- ✓ Take into account the necessary minimum space required to access the safety elements and to execute cleaning and service operations of electrical and mechanical components;
- ✓ Make sure if the degree of electrical protection is in accordance with the characteristics of the room where the boiler is to be placed;
- ✓ It is forbidden to expose the boiler to extreme weather conditions. The boiler itself is not intended for external mounting and does not have an anti-freezing system;
- ✓ It is forbidden to close the ventilation openings in the room where the boiler is located. Ventilation openings are necessary for proper combustion.

3.3 Connecting to the chimney

The most optimal placement of the boiler on the chimney is such that the line connecting the center of the exiting point of flue gases from the boiler and the center of connection point to the chimney is in a slight rise (up to 3%) (see **picture 4**).

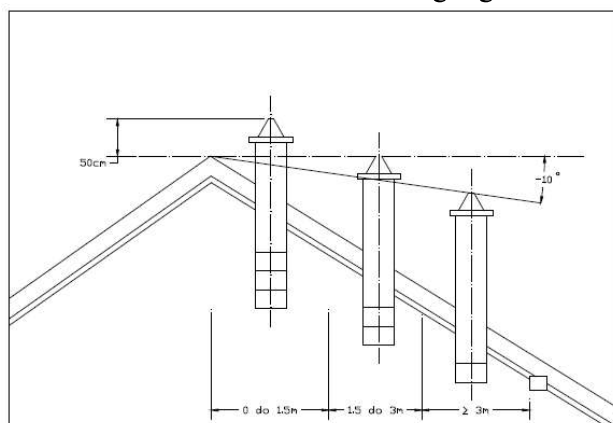


Picture 4 - The representation of how to connect to the chimney

Arches should be avoided if possible, and if not then the maximum number of arcs is (2). It is desirable to insulate the smoke channel from the boiler to the chimney, especially if there are arches and longer sections.

On the smoke pipe, approximately 100mm from the chimney of the boiler, an opening should be drilled, and install an insert for flue gas temperature probe. Without the flue gas temperature information, there is no automatic boiler operation mode. The chimney itself should be made of ceramic pipes, there should be 3 - 5 cm thick insulation around them and the final outer layer is brick or special chimney elements. If the chimney is not made of ceramics though, but of brick, the surface of the light section of such a chimney must be 30% larger than this area of the ceramic chimney.

The chimney must also have a cleaning door and they must seal well. The chimney exit on the roof has to be in accordance with certain regulations. There are two different cases: if the angle of the roof is smaller than 12° and if the angle of the roof is greater than 12° . For an angle smaller than 12° , the height of the chimney above the roof is 1m and for an angle greater than 12° , see picture 5.



Picture 5. Height of the chimney

If you think that the chimney is too powerful and that too much cold air flows through the boiler, at the exit of the boiler there is a flap that can reduce the flow of exhaust gases. The chimney needs to be cleaned regularly or at least once a year.



If the chimney is not of the correct height, cross-section, or if it is not cleaned, complications in boiler operation might occur. First of all, a high-temperature mode of operation is not possible, i.e. there is no maximum operating power, the consequence of this is the occurrence of condensation which affects the service life of the boiler.

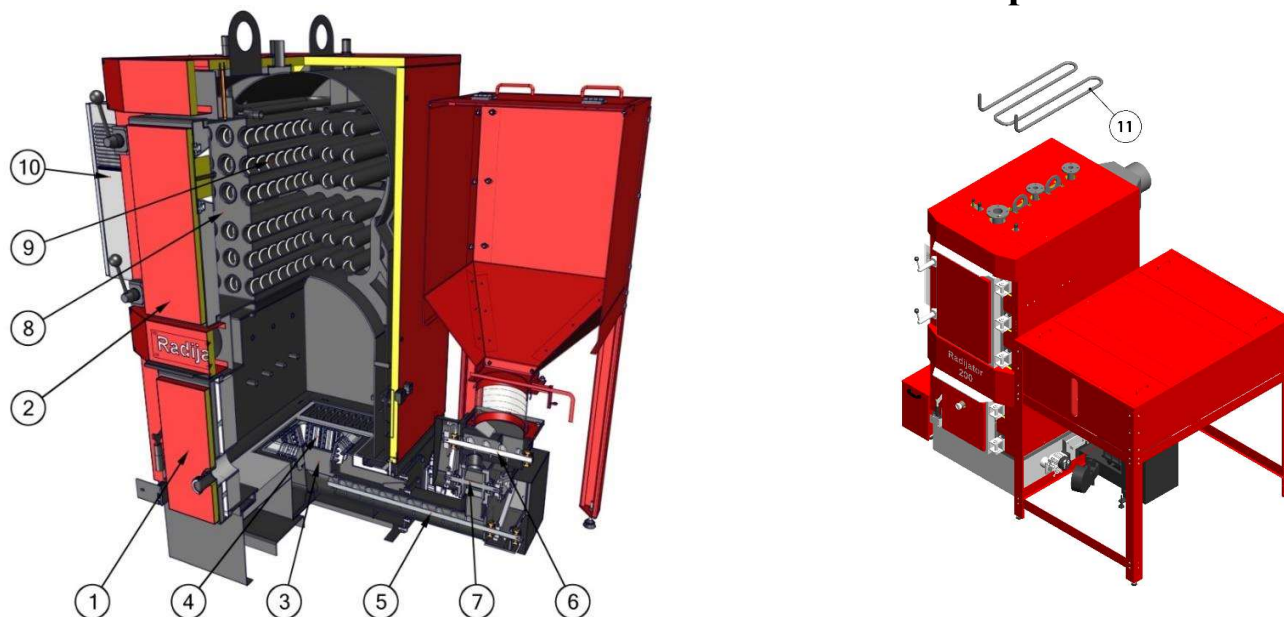


A weak chimney is the main reason for having a smoke on the upper or lower door, especially at higher fan speeds during the ignition or during operation of the boiler.



If there is too much smoke on the door and in the boiler room during the ignition of the boiler, or the flue gas temperature does not rise enough for the boiler to start operating and all because of the insufficiently strong chimney, it is technically justified to remove the wire turbulators from the pipe exchanger.

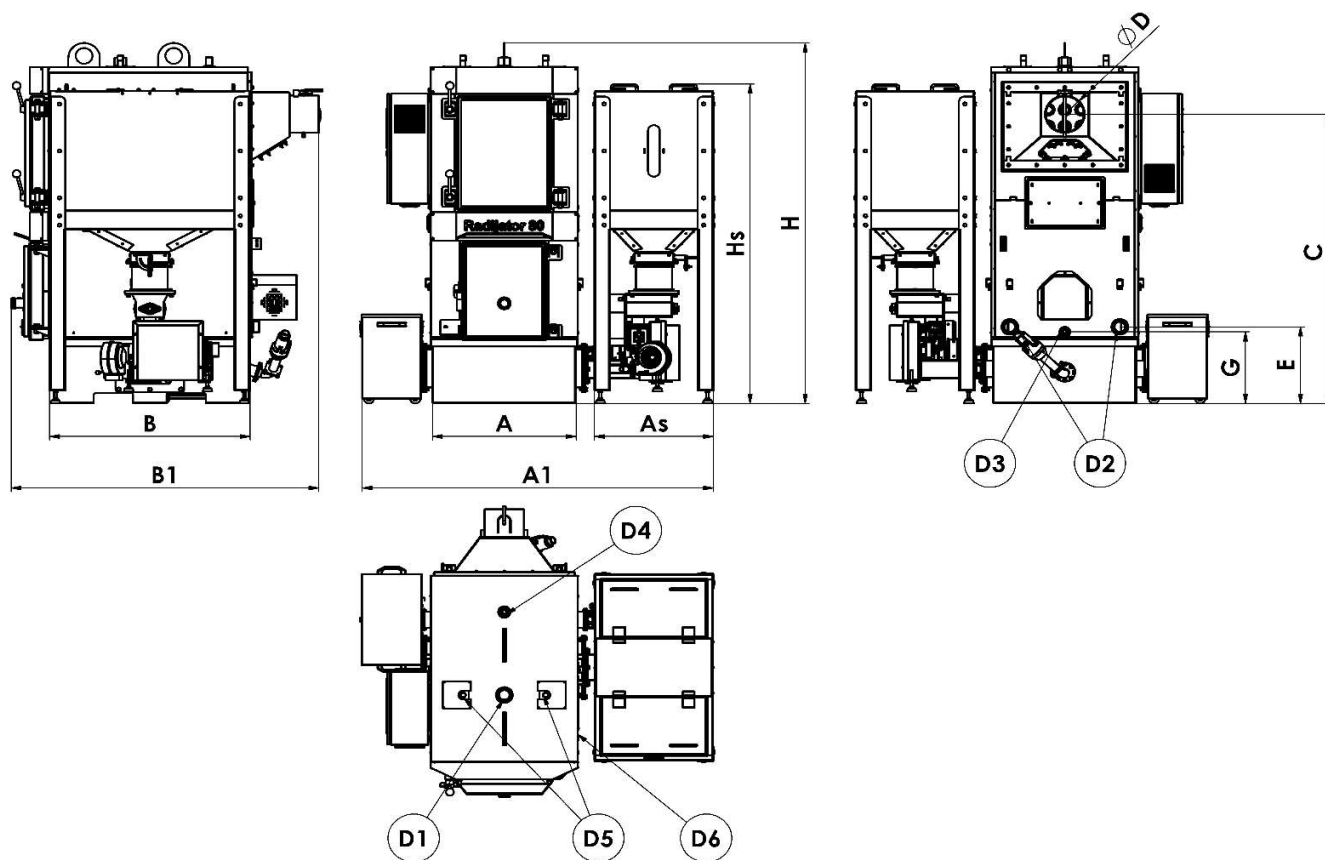
4. The cross-section of the TKAN boiler with the description of elements



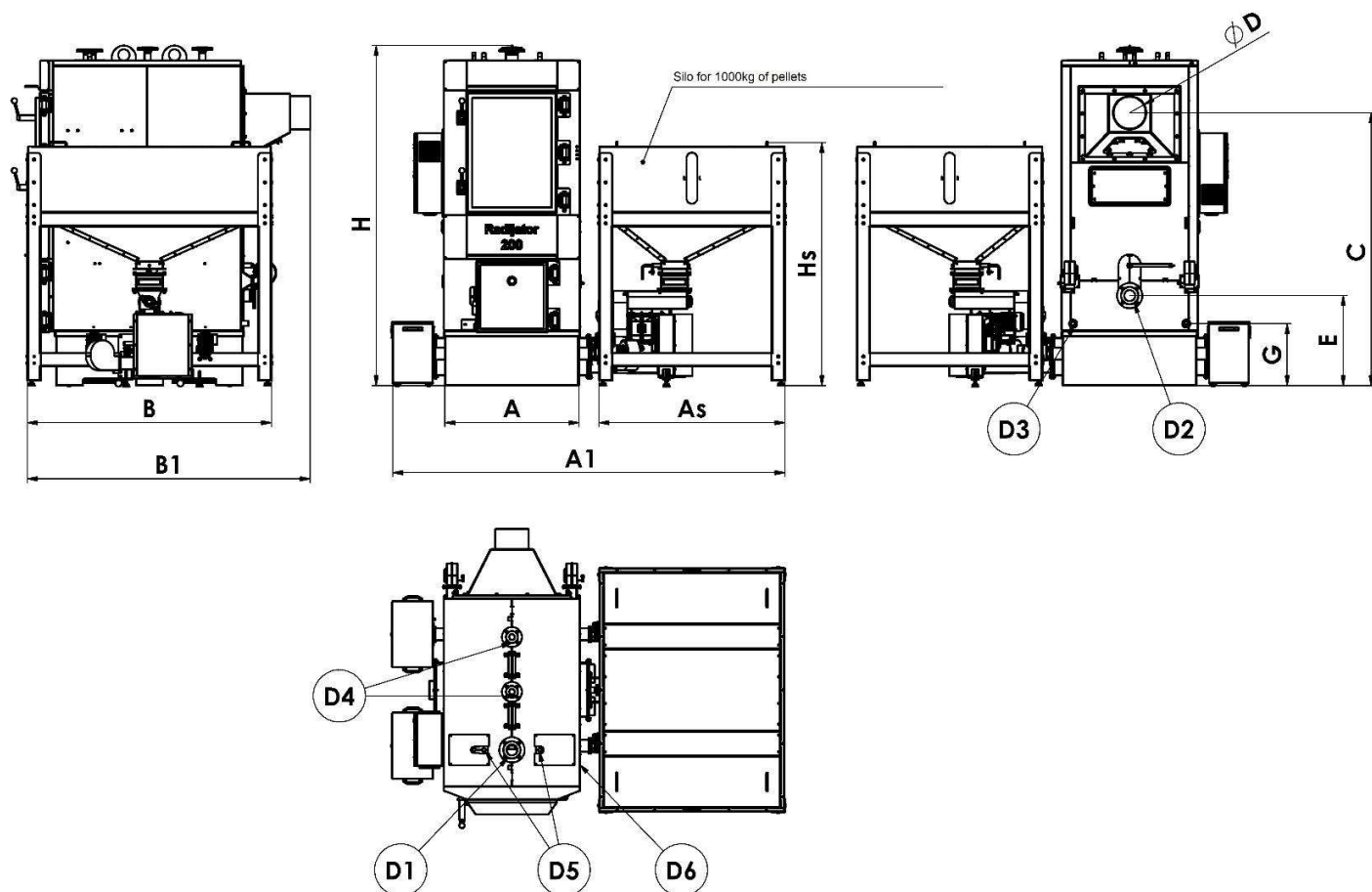
Picture 6 - The cross-section of the TKAN boiler

1. Door for firing and ignition
2. Door for cleaning the pipe exchanger and the boiler itself
3. Furnace
4. Cast iron segments
5. Lower axle of the screw conveyor
6. Upper axle of the screw conveyor
7. Cellular dispenser/doser (valve)
8. Pipe exchanger
9. Turbularors
10. Automatic controls system
11. Thermal safety exchanger

5.The table with dimensions



Picture 7 - The design with dimensions and connection ports for TKAN 80, TKAN 100, and TKAN 150



Picture 8 – The design with dimensions and connection ports for TKAN 200, TKAN 250, and TKAN 300

Ports/connections:

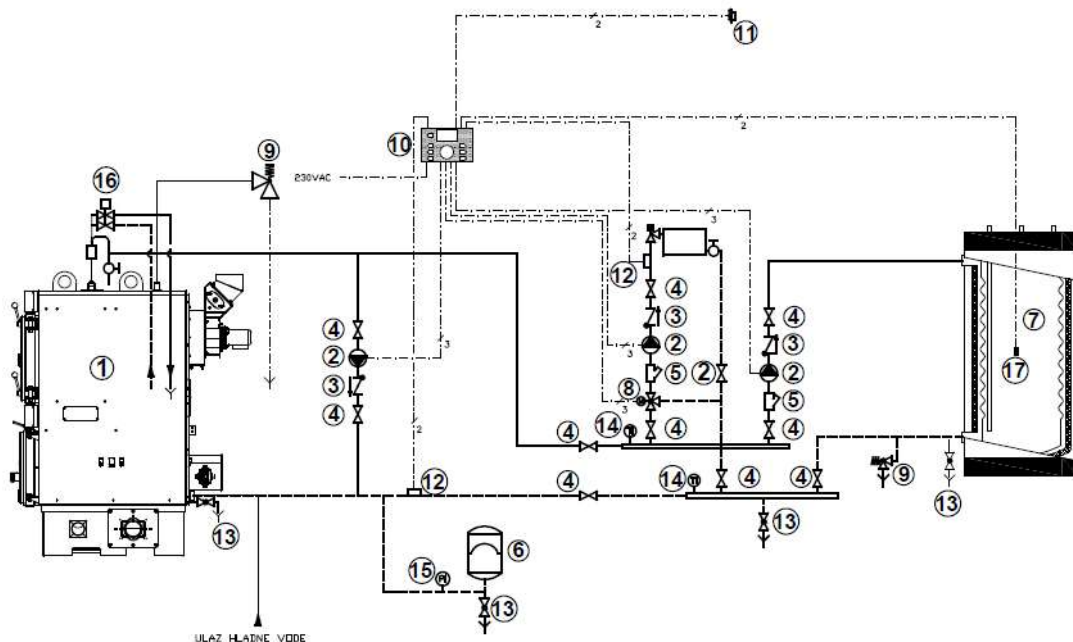
- D1- hot water
- D2- cold water
- D3- charging and discharging
- D4- safety group (I – safety pressure valve; II – open system supply)
- D5- thermal protection valve
- D6- probe of tie thermal protection valve

The design with dimensions for TKAN 200, TKAN 250 and TKAN 300 renders a silo that can carry 1000kg of pellets, in the table with dimensions are given the values for the same silo. In case the buyer decides for another variant of the silo it is necessary to contact Radijator inženjering to obtain information related to the dimensions of that silo.

Table 3 Dimensions of boilers

Boiler type			TKAN 60	TKAN 80	TKAN 100	TKAN 150	TKAN 200	TKAN 250	TKAN 300
Power		kW	60	80	100	150	200	250	300
Working pressure		kPa	300	300	300	300	300	300	300
Test pressure		kPa	450	450	450	450	450	450	450
Volume of water in the boiler		L-cca	276	368	460	690	920	1150	1380
Weight of water + weight of the silo		kg	655+ 106	915+ 100	1073+ 110	1665+ 162	2260+ 180	2800+ 220	3080+ 220
DIMENSIONS	A	mm	680	730	730	850	1005	1260	1260
	A1		1355	1787	2080	2395	2945	3456	3455
	As		610	610	810	1010	1394	1394	1394
	B		1020	1020	1176	1456	1830	1830	1830
	B1		1518	1565	1727	2070	2121	2546	2546
	C		1125	1573	1573	1681	2044	2114	2114
	ØD		200	200	200	250	250	300	300
	E		675	417	417	785	675	707	707
	G		360	389	389	360	465	467	467
	H		1564	1960	1960	2151	2547	2663	2663
	Hs		1740	1736	1611	1875	1822	1822	2070
	D1	col	6/4"	2"	2"	2"	DN80 NP6	DN80 NP6	DN80 NP6
	D2		6/4"	2"	2"	2"	DN80 NP6	DN80 NP6	DN80 NP6
	D3		1/2"	1/2"	1/2"	1/2"	1"	1"	1"
	D4		3/4"	3/4"	3/4"	3/4"	DN40 NP16	DN40 NP16	DN40 NP16
	D5		1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"
	D6		1/2"	1/2"	1/2"	1/2"	1/2"	1/2"	1/2"


6. Hydraulic diagram



Picture 9 – Hydraulic diagram of TKAN 80

1. Hotwater boiler on pellets
2. Circulation pump
3. Non-return valve
4. Shut-off valve
5. Dirt sifter
6. Closed expansion vessel
7. Hot sanitary water boiler
8. Three way mixing valve
9. Safety valve
10. Control unit – regulator
11. External temperature sensor
12. Pipe temperature sensor
13. Tap for filling and emptying
14. Thermometer
15. Manometer
16. Thermal safety valve
17. Hot water boiler sensor

7. Explanation on how to use TKAN automatic controls


 **The first initiation of the boiler is performed by the technician certified by Radijator inženjering. Training for the user of the boiler is mandatory.**

Accordingly, that person is licensed to report the initiation time of the boiler and its condition at that particular time to the service department while keeping a copy of the initiation report. A warranty and user's manual are given to the buyer. One copy of the warranty is sent to the manufacturer.

If the warranty isn't followed, it isn't valid.

Only boilers initiated by the licensed technician are subjected to a complete two-year warranty.

The following text is intended for the user of the boiler, as a reminder to be able to initiate the boiler by himself or herself in case of shutting down the boiler (e.g. cleaning)..

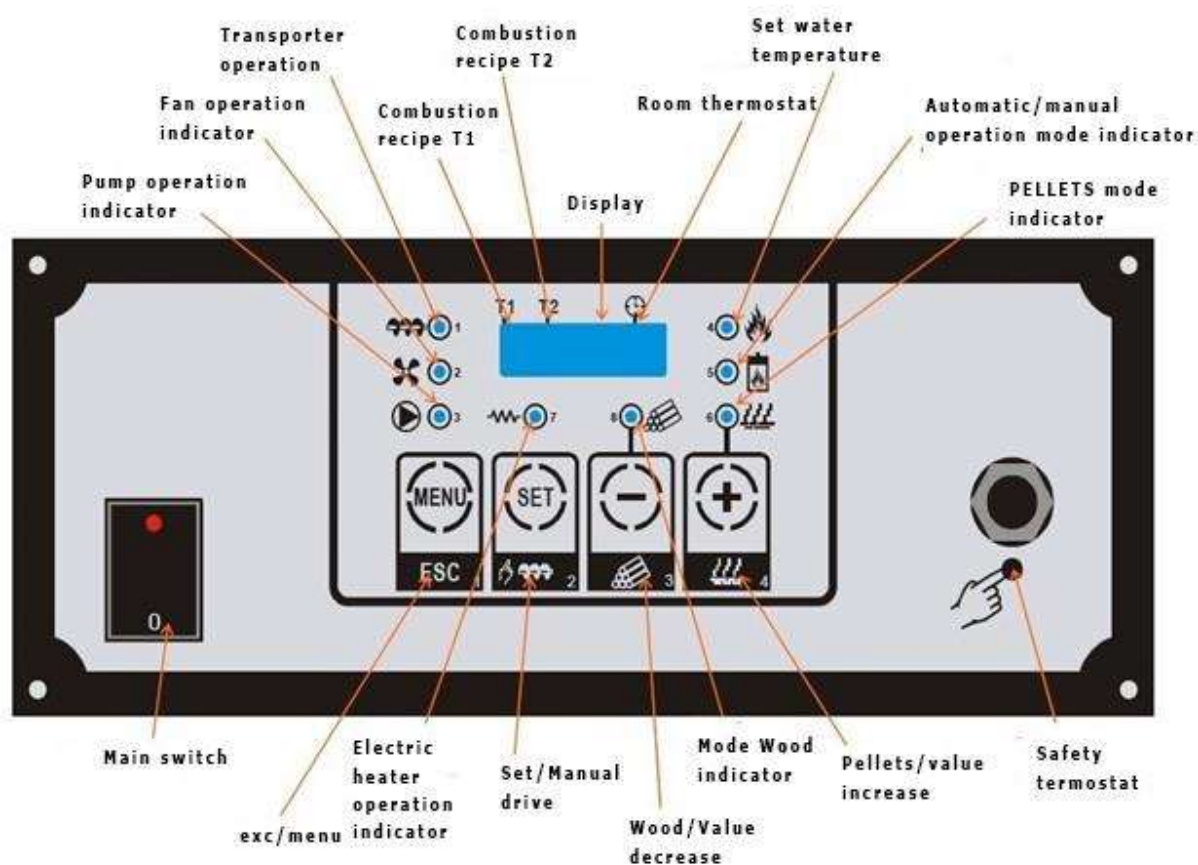
 ***Parameters related to the operation of the boiler available to the user are located on the display. Other parameters located in the so-called hidden menu shouldn't be changed without the consent of the technician who initiated the boiler or the factory itself.***

Automatic controls display

The control panel is comprised of:

The main switch, safety thermostat button, display, group of control keys (buttons), group of light diode indicators

The following picture represents the control panel.



Picture 10. The representation of the control panel

Control buttons

In the bottom right corner of each command button, there is a number.

- **TURN ON-OFF PELLETS/+ CONTROL BUTTON 4:** Initiates the system on pellets as fuel when held for 5 seconds. Also, shuts down the system in which pellets are used as fuel by holding this key for 5 seconds. By pressing in the Menu, the value of parameters is increased.
- **TURN ON-OFF WOOD/+ CONTROL BUTTON 3:** Initiates the system on solid fuel when held for 5 seconds. Also, shuts down the solid fuel system by holding this key for 5 seconds. By pressing in the Menu, the value of parameters is decreased.
- **SET/Screw CONTROL BUTTON 2:** While held in the mode OFF, manual loading of pellets into the furnace starts. During this process, the LOAD message will appear on the display. Manual loading of the furnace with pellets stops upon release of this key.

Pressing in the **MENU** the display of the parameter code changes to the value and saving new settings is allowed.

- **ESC/Menu CONTROL BUTTON 1:** This key enters/exits the MENU. If you are changing settings and press this button, changes in settings will not be saved.

NOTICE:

In the OFF mode or SHUT DOWN mode you can reset the Alarm display by pressing keys + or -, but if the cause of the alarm is still present the alarm will start again.

Light diodes

1. **Light diode Screw: ON:** ON when the auxiliary combustion fan works.
2. **Light diode Fan: ON:** when the auxiliary combustion fan works.
3. **Light diode Pump P: ON:** when the pump works. BLINKS when the pump is shut down by the room thermostat.
4. **Light diode Boiler: ON:** when the water temperature in the boiler goes below value T-BOILER[A03] – ModulationDelta1 [A05]. BLINKS when the water temperature in the boiler is above the set value. OFF when the water temperature in the boiler is above temperature T-BOILER [A03].
5. **Light diode Exhaust: ON:** when the exhaust temperature is above T-EXHAUST-ON[F18]. BLINKS during the pre-shutdown mode.
6. **Light diode Pellets: ON:** when the boiler works in pellets mode. BLINKS during the pre-shutdown mode (pre-shutdown time[t06]).
7. **Light diode Initiation heater: ON:** when the initiation heater works.
8. **Light diode Wood: ON:** when the boiler works in solid fuel mode.
9. **Light diode Recipe 1: ON:** when Recipe 1 is selected.
10. **Light diode Recipe 2: ON:** when Recipe 2 is selected.
11. **Light diode Chrono: ON:** when the Chrono output is closed.

Display

Display\Mode\Alarms\Temperature: The 4-digit/letter display shows the water temperature in the boiler, operation mode, and eventual alarms

Display	Description	Display	Description
OFF	Turned off (OFF)	Mod	Modulation
Chc	Check	NRn	Standby
Acc	Ignition	Si c	Safety mode
Stb	Stabilization	SPE	Shutdown
rec	Reignition	ALt	Alarm system turned off

Display	Description	Display	Description
ESi c	Safety thermostat socket is open – manual reset button	SPAc	Accidental shutdown
Si c	Safety mode	Sond	Reading out of reach probe
Acc	Failed ignition		

NOTICE:

- Turning the thermoregulator on via the main switch, the Product code, and the Firmware version are displayed for two seconds.

Display	Description	Display	Description
St08	Product code	Ur 10	Program version

The initiation of the biomass boiler

- The boiler is connected to the hydraulic system.
- Make a 4mm diameter hole on the upper side of the smoke pipe in the area close to the boiler's smoke exit.
- Make sure that the pellets transportation mechanism is firmly supported on the floor, that the flap of the fan is completely open and that the flap guide for the safety air from 15 to 20mm. (pictures 11 and 12)



Picture 11. The position of the flap of fan

Picture 12. The position of the completely open flap of the fan

- Connect the sockets (three-phase and single-phase) on the back of the boiler to the main mains power supply. The three-phase one is necessary for the doser motor to work, while the single-phase one is necessary for the dryer fan.
- Load a smaller amount of pellets into the silo and close it.
- Prior to the ignition phase, remove shields from the furnace.
- In this phase, it is necessary to load the pellets into the combustion chamber via the pellets feeding system. That way, we achieve continually distributed pellets from the combustion chamber to the silo. The initiation of the pellets feeding system can only be done during the operation and OFF is shown on the display. Then, by pressing control button 2 which in its bottom right corner has the screw feeder symbol, the system starts. While holding the button, the system is working. Upon releasing the button, the system stops.

Load the chamber with pellets via so-called manual command somewhat lower until you reach parts made of grey cast iron, as represented by picture 13.



Picture 13. The representation of the level of the pellets

- Now that we have pellets in the combustion chamber and when it's in the ignition zone of the heater, we can initiate the boiler.
- Initiation is performed by pressing and holding the control button 4 more than 3 seconds. In the bottom part of this button, the loose material, more precisely pellets symbol is shown.
- When starting the ignition, Chc is written on the display, and in these couple of seconds only the fan works. In this phase, automatic controls are checking if all necessary devices are actually connected.
- The next step is Acc on the display. This is the ignition phase display. Then, except for the fan, the ignition heater activates which can be seen on the automatic controls because signaling lights 2 and 7 are on. In the ignition phase, at one point, we can expect the feeder system to start and the level of the pellets in the chamber to be refilled. Ideally, pellets are up to the very top of cast iron parts after this refill.
- The boiler is in the ignition phase until flue gasses don't go over the temperature determined by the F18 parameter. According to factory settings, this temperature is 50°C. Firstly, smoke appears, and between 7 to 10 minutes flame as well.
- Once flue gases exceed the ignition temperature limit, the display shows Stb. This means that the boiler is in the flame stabilization phase, that is automatic controls are measuring if flue gases have a sufficient increase in a certain time period. The fan works according to the stabilization phase parameter, and the chamber is refilled with pellets according to the parameters of the screw feeder in the stabilization phase. Once this factor is met, the boiler goes into operation mode.
- The boiler is in operation mode when nothing is shown on the display except for the current water temperature in the boiler. Wait 20 to 30 minutes and see if pellets burn at the top of the combustion chamber. In this period, also monitor the temperature of flue gases. That is done by pressing control button 1 shortly, button 3, and finally button 2. Then, on the display, the number denoting flue gases temperature is shown.
- To automatic controls, a room thermostat can be connected should the user request. In this case, it is important to set the room temperature which is the main parameter for the boiler to operate, and the water temperature in the boiler (70°C). Once the room thermostat is activated, the boiler primarily requires to increase the room temperature, having in mind that it is limited by the set

water temperature inside. There is a possibility that the boiler stops before the set temperature of the room thermostat is reached and, in this case, the set water temperature in the boiler should be increased to, for example, 70°C.

- The combustion of pellets, no matter the power of the boiler, is necessary to be set in a way that it is on top of the combustion space (refer to picture 14). This is achieved by setting pellets dosing and the amount of air. In case that the level of flames starts decreasing, it is necessary to prolong the dosing period or decrease the amount of air. If the level of flames is increasing, we can decrease the loading time or increase the amount of air. To determine parameters precisely, it is necessary to monitor the operation for at least one hour.

NOTICE: Always adhere to the nominal or peak power of pellets combustion, that is when pellets are burning on top of the burner. In this case, decreasing thermal power is done by decreasing the set temperature of water in the boiler or set temperature of the room thermostat.

Place where pellets are 'playing' during combustion



Picture 14 The representation of the perfect combustion of pellets

Warning: It is mandatory to analyze flue gases upon installing the boiler.

Measure percentage of oxygen (O₂).

The initiation of the biomass boiler

In case that the user wants the boiler to run on solid fuel, the following steps should be done:


- If the boiler has never before run on pellets but is being used for the first time on solid fuel, it is necessary to force a small number of pellets into the combustion chamber. This way, a so-called false air through doser channels is prevented.
- Through the lower door prepare a small amount of wood and ignite. Upon getting a stronger flame, add fuel. For the purpose of less smoke, open the flap inside the boiler by pulling the lever on the side of the boiler that is into the open position.
- Pay attention to signal lights number 6 and 7. If light 6 is on, that means the boiler is in the Pellets operation mode. Control button 4 should be held for more than 3 seconds. That turns off Pellets mode. Right after, press control button 3 and hold more than 3 seconds. That initiates Wood operation mode
- After 20-30 minutes when the boiler is in normal operation mode, return the flap inside the boiler into the operating mode by pulling the lever on the side towards the front door of the boiler.
- The combustion chamber mustn't be covered with ash dumps etc. because the necessary air for combusting wood or coal is provided through that space.

Brief instruction on how to use automatic controls

RECHARGING THE FURNACE WITH PELLETS, PREPARING FOR IGNITION

- Insert pellets into the silo
- The main display has to indicate **OFF**



- Press and hold the . While holding the button, the feeder is working and the display is indicating **LOAD PELLETS**.


STARTING THE IGNITION ON PELLETS, STOPPING THE OPERATION ON PELLETS

- Flip the main switch





- Press the  button and hold for 4-5 seconds.

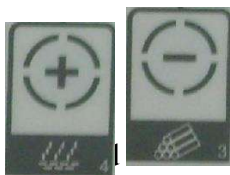


- Stopping the operation of the boiler on pellets is done by pressing the  and holding it for 4-5 seconds.

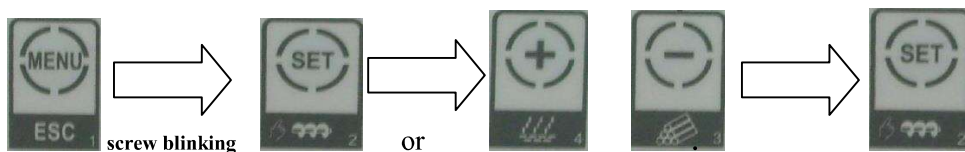
CHANGING THE DOSING TIME OF THE FEEDER WHILE IN THE OPERATING MODE



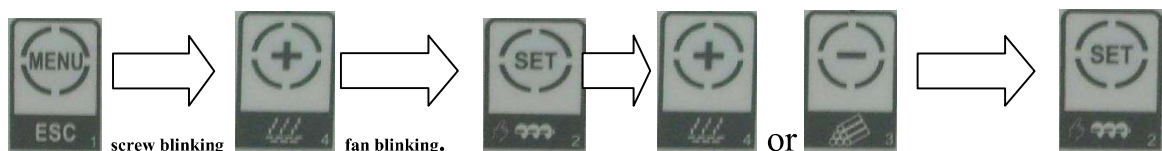
- Press the  button quickly. If light 1 next to the screw symbol is blinking, press the , with



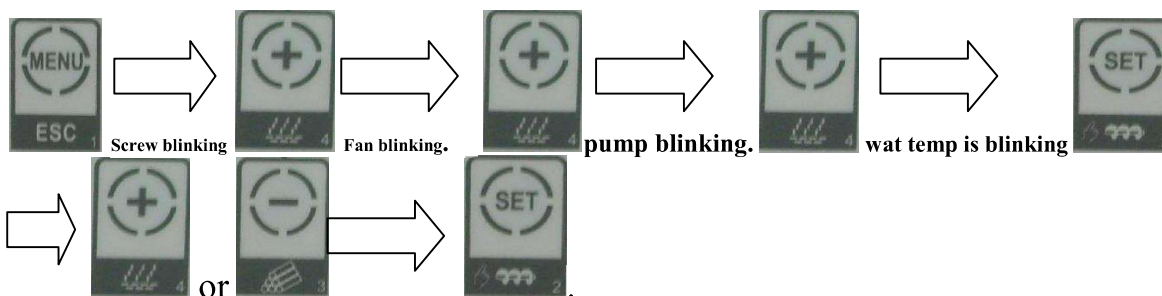
change dosing values of the screw to desired and press the SET again



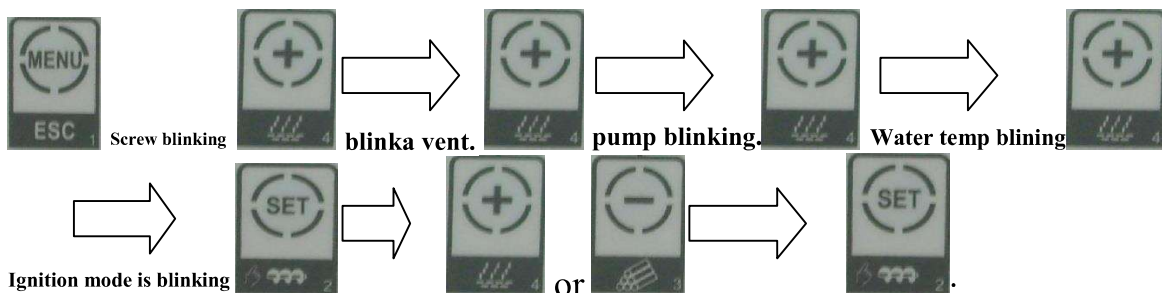
CHANGING THE POWER OF THE FAN IN THE OPERATION MODE.



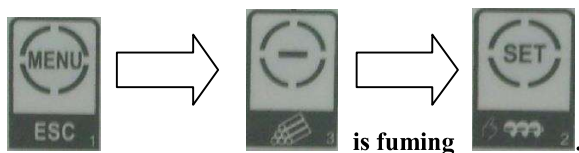
CHANGING THE SET WATER TEMPERATURE IN THE BOILER.



CHANGING THE IGNITION MODE MANUAL OR AUTOMATIC.



READING THE FLUE GASES TEMPERATURE.



ENTERING THE HIDDEN MENU.



Press and hold  right after press  and hold both buttons for five seconds. Right upon entering the hidden menu, the display CL 00. That is the first parameter.

Errors on starting the boiler

All possible errors in the initial operation phase, that is during ignition can be split into three big groups:

- **Group I** Errors during ignition relating to the situation without sparks, smoke, or any flame for more than 20 minutes from the moment of starting the ignition heater.
- **Group II** Errors during ignition relating to the situation in which flame appeared but the boiler shut itself down after a certain period (a few minutes).
- **Group III** The boiler successfully ignited and was working for a few hours. Reached the set temperature and, for a longer time, there is no need to turn on neither the dosing system nor the fan (this situation is mostly overnight). Right after, the temperature is dropping and the user wants a higher temperature (mostly in the morning), and the boiler receives a signal to enter the ignition phase, but there is no flame.

Group I

Possible **cause 1.**

- **PROBLEM 1** – The flap of the fan for primary air is closed. The fan is located on the doser.
- How to solve **PROBLEM 1** – Open the flap completely.

Possible **cause 2.**

- **PROBLEM 2** – The hose connecting air channels from the fan to the heater is not properly set.
- How to solve **PROBLEM 2** – Affix the air hose both to the case of the heater and to the air channel pipe

Possible **cause 3**

- **PROBLEM 3** – Space deep in the furnace where pellets are combusted is full of uncombusted remnants, that is cinders, therefore, there is no contact between pellets and hot air.
- How to solve **PROBLEM 3** – Clean the depth of the furnace, primarily larger cinders mechanically and smaller cinders can be vacuumed.

Possible **cause 4**

- **PROBLEM 4** – Pellets used are highly moist.
- How to solve **PROBLEM 4** – Try drier pellets.

Possible **cause 5**

- **PROBLEM 5** – Mains voltage to which the boiler is connected is significantly lower than 220-230V, therefore the power of the heater is lesser.
- How to solve **PROBLEM 5** – Priključiti mrežni ispravljač napona ili potpaliti ručno.

Possible **cause 6**

- **PROBLEM 6** – The boiler is switched from automatic to manual operation mode. If during the entire ignition phase, the heater light isn't on, then the boiler is certainly in manual mode.
- How to solve **PROBLEM 6** – Refill pellets.

Possible **cause 7**

- **PROBLEM 7** – The boiler is switched from automatic to manual operation mode. If during the entire ignition phase, the heater light isn't on, then the boiler is certainly in manual mode.
- How to solve **PROBLEM 7** – Switch the boiler to the automatic ignition mode.

Possible **cause 8**

- **PROBLEM 8** – The electric heater malfunctioned. Disconnect the boiler from mains voltage and measure the electrical resistance of connection cables of the electric heater.
- How to solve **PROBLEM 8** – Replace the electric heater

Group II

Possible **cause 1.**

- **PROBLEM 1** – Fan speed in the ignition phase. Fan speed for primary air in this phase is determined by parameters Uc00 and Uc01. If the speed is drastically changed in comparison to the factory set one, it is not good to either drastically decrease or increase it. In case the fan, while igniting, is weak, the temperature of flue gases doesn't increase and if it is too powerful, it is possible to rapidly consume pellets in the chamber which leads to decreasing temperature of flue gases while igniting.

- How to solve **PROBLEM 1** – Set values of parameters Uc00 and Uc01 to the factory values or near-factory values.

Possible **cause 2**

- **PROBLEM 2** – Fan speed in the flame stabilization phase. The boiler enters the ignition phase, smoke appears, the display indicates Stb which means it's in the flame stabilization phase but after that, the boiler shuts down. The most common cause of this is a too weak fan in the stabilization phase which is determined by parameter Uc04.
- How to solve **PROBLEM 2** – Increase fan speed using parameter Uc04.

Possible **cause 3**

- **PROBLEM 3** – Too big or too small amount of pellets in the stabilization phase. If there are not much or too many pellets while the display is indicating Stb, that is stabilization, flame congestion can occur and the boiler may return to the shutdown phase. The amount of pellets in the stabilization phase is regulated by parameter CL04.
- How to solve **PROBLEM 3** – value of parameter CL04 to the factory value or near-factory.

Possible **cause 4**

- **PROBLEM 4** – The boiler entered the stabilization phase but still enters the shutdown phase because the temperature increase is not sufficient. Particularly stagnation, that is marginal drops of the temperature of flue gases is noticeable at the moment of refilling the furnace with pellets.
- How to solve **PROBLEM 4** – Increase the temperature of flue gases for system to enter Fire ON and that is parameter F18. That way, it is harder for new pellets entering the combustion chamber to reduce the temperature of flue gases because the flame is stronger because it was given more time until refilling. This problem is the most common in case of weak chimneys or the traction of a chimney is weak due to some other reason.

Possible **cause 5**

- **PROBLEM 5**– The boiler entered the stabilization phase but after some time enters the shutdown sequence.
- How to solve **PROBLEM 5** – The ash dump was forgotten to be put back into the boiler or to be closed firmly.

Group III

Introduction

When the boiler reaches the set temperature of the water inside or the temperature of the air in the room with the room thermostat, it enters the standby phase, more precisely the flame maintaining phase or the original standby phase. The best example of this way of working is the night mode. The basic goal of this phase is to maintain phase, more precisely embers in the furnace during the multi-hour standby. That is achieved by initiating periodically both the pellets feeder and fan at certain time intervals.

- When the boiler reaches the set temperature, it enters the flame maintaining phase. After a certain time period, as it is determined by parameter t04 (minutes), the feeder starts working and fans are activated. In these periods, the boiler is activating until the start command is given due to reaching the set temperature.
- One process of the feeder and fan lasts according to the parameter t05 (seconds).
- During the process of initiating the feeder its operation is determined by the active operation period determined by parameter CL09 (seconds) and by the pause period determined by parameter CP09 (seconds).
- During the flame maintaining process, the primary combustion fan is initiated and has power determined by parameter Uc09.

Possible operation errors related to the flame maintaining phase:

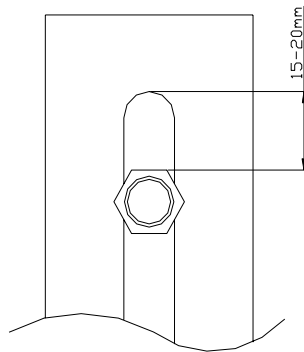
- The boiler, despite the functional flame maintaining phase, has an insufficient amount of pellets to start and operate in the normal mode.
- Removing the cause of this error:
 1. Decrease parameter t04, more precisely increase the frequency of the operation of the feeder and fan in the standby phase.
 2. Increase the length of the process, that is parameter t05.
- Large quantity of uncombusted pellets during the initiation of the boiler.
- Removing the cause of this error:
 1. Increase parameter t04
 2. Decrease parameter t05
 3. Decrease the power of the fan for primary combustion in the flame maintaining phase parameter Uc09

Starting the boiler on biomass

- Fill the silo with fuel. The silo has the capacity of 240l. It is required to close the silo's lid.
- Make sure that the safety flap of the silo is positioned so that the length of the flap moving channel is 15-20mm (see picture 15)

If the safety flap is in the lower-end position, all air goes through the fuel mass and does not allow flames to return. If the flap is in the upper-end position, all air goes to combustion nozzles in the grey cast iron. The transport channel and the screw might get so hot and the fuel silo might burst in flames.

Picture 15. The representation of the position of the safety flap



- Inspect if the fan, motor and chainwheel are in their box intact after being transported and put in the boiler room.
- Inspect if the probe for measuring the temperature of exhaust fumes placed inside the smoke pipe. Without the probe in the pipe, it is impossible for the boiler to operate.
- Supply electricity to automatic controls and refill pellets, that is some other fuel up to one-half of the furnace. That is the height when the fuel inside becomes visible through the lower door of the boiler. Refilling the furnace can be done in two ways: repeatedly turn the boiler on and off or by using the special intended function, which is thoroughly explained in section AUTOMATIC CONTROLS.

If the boiler's starting function ON is executed properly, automatic controls will have the electric combustion heater light on. The electric heater is located in the lower zone of the furnace and if it is in contact with fuel, after 5 to 6 mins, smoke can be smelled in the furnace.

Then, open the flap due to the possibility of smoke bursting through the lower and upper door.

When the initial flame bursts and the temperature of flue gases exceed 50 °C, the boiler enters the operating cycle and starts refilling fuel automatically.

- After approximately 50 minutes, inspect the temperature of flue gases (explained in section AUTOMATIC CONTROLS) and if it is relatively high over 180°C, close the boiler's flap. If the flap remains open longer, flue gases might exceed 250°C after which the boiler enters the self-shutdown phase, that is the flame self-maintaining phase.

The basic two parameters which the user regulates based on the type of fuel and flame intensity are: the time needed to supply fuel into the furnace button 9 and the fan's power (rotation per minute) button 8

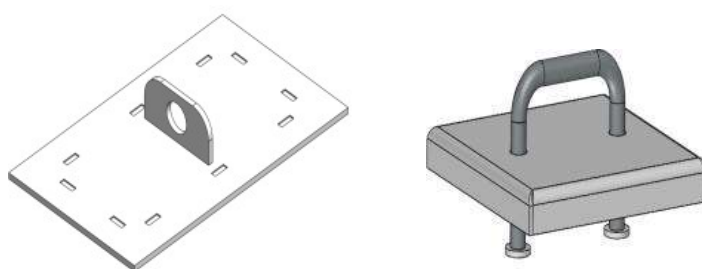
These two parameters, at all times, have to be in such correlation that the combustion process is always done at the top of the furnace. The combustion should be such that there is no fuel spilling out of the grey cast iron furnace nor returning flames toward the silo.

It is possible to set the combustion in the boiler correctly in about an hour. It is ungrateful to state the approximate values of these parameters due to different conditions when starting the boiler.

Starting the boiler on solid fuel

In case that the user prefers the boiler working on solid fuel, the following steps should be done:

- Place supports for iron grates as well as grates of grey cast iron in the boiler's furnace. This is the additional equipment and these parts should be separately ordered. This entire assembly is completely disassemblable as seen in picture 16.
- Put the ignition fuel on grates and ignite manually. When flame appears turn on the 'Wood' mode in automatic controls. If the boiler was previously in the 'Pellets' mode turn this mode off.
- In the 'Wood' mode, combustion is done by air coming from the fan being used during firing with pellets as well. The air itself passes through the pellets furnace so that this space mustn't be covered with ash dumps or any other protections.



Picture 16. The representation of the lid which covers the chamber where pellets come out and which covers the chamber of the screw which leads ash into bins

8. Boiler maintenance

TKAN boiler requires daily and periodical cleaning.

- Daily (at least weekly) cleaning also applies to the boiler's space of grey cast iron where we, by constantly ejecting ash, enable more efficient operation of the electric heater for firing and more efficient combustion, that is larger amount of air through air channels in the grey cast iron. Also, ash starts piling up during the day on the floor, in the area around the furnace itself. According to average combustion parameters, 100kg of pellets produce 1kg of ash, but this information significantly varies depending on the type and quality of ash.
- Each 7 to 10 days, shutting down the boiler is recommended, cooling off a few hours, and manual or, the best, vacuuming depths of the combustion chamber. This removes even larger pieces of uncombusted pellets which can cause unpleasant sound while the boiler is working and decrease the lifespan of the screw spiral which pushes pellets into the combustion space.
- Once a month, it is necessary to open the upper door for cleaning as well, remove turbulators and remove layers of tar and soot from pipes of the exchanger. Everything removed at that point is picked on the upper surface of the furnace roof or in the smokebox.

Too much ash in pipes of the exchanger decreases utilization of the boiler and leads to excessive temperatures in the furnace which can cause deformations to it, that is to the lower door.

NOTICE: Depending on the mode and working conditions, quality of pellets, that is biomass, listed cleaning periods may even be more frequent.

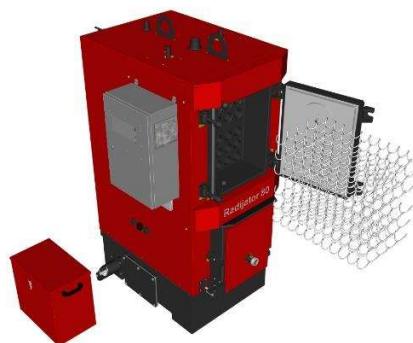
If condensation occurs in the boiler while using it, it is necessary to deal with the condensation and to coat the entire boiler from inside with basic cleaners or at least with aqueous solution of builder's lime. That way, the neutralization of acid due to condensation is done.



This way, conserve the boiler imperatively at the end of the heating season. In that situation, close all holes on the fireplace to avoid air circulation through the fireplace because that can result in the appearance of moisture inside.



Servicing the fireplace is one of the most important factors for its long working life. Between two seasons, it is particularly important to clean the fireplace and neutralize the acid as described



Picture 17. The representation of removing the turbulator from the TKAN boiler, disassembling cast-iron segments of the furnace, and cleaning the ash bin

9. Warranty

1. Radijator inženjering covers different warranty periods for various parts (as listed in the following text) only if the following warranty conditions are met:

The boiler has to be connected according to all hydraulic diagrams from the technical instruction manual, especially pay attention to safety valves, thermal leakage protection, the mixing valve-pumps for protecting the cold end of the boiler, that is, against condensation, range of the working pressure of the boiler, range of the working temperature of the boiler, conditions of the boiler room, etc. (see point 6)

The boiler has to be connected to the chimney of a regulated cross-section, characteristics, isolation, and height (see point 3.3). The smoke channel from the boiler to the chimney has to be done by the technical instruction manual..

The boiler also has to have listed electric connections from the technical instruction manual, especially characteristics of the room thermostat, characteristics of the mains voltage which has to be within certain limits..

The user has to follow the listed instructions on how to use and maintain. (See point 8)

2. Warranty statement

We state:

- that the product has regulated and declared quality properties. We oblige to, on the request of the buyer if he/she timely within warranty period submits the repair request, cover all repair costs so that the product will operate according to its declared properties,
- that the product will work flawlessly within the warranty period provided that the use, operation, and installation instructions are followed,
- that we will be ready to remove all product malfunctions and have all necessary spare parts in stock within the warranty period,
- **the warranty period starts from the DAY OF PURCHASE AND LASTS 60 MONTHS OR 72 MONTHS FROM THE PRODUCTION DATE (the production date is located on the label at the back of the boiler).**
- **THE 60-MONTH WARRANTY APPLIES ONLY IF THE BOILER IS REGULARLY SERVICED BY THE RADIJATOR INZENJERING CENTRAL MAINTENANCE in the period listed for it (hereinafter). the warranty applies if the warranty paper is certified by the seller and if the purchase date is written and if the receipt is attached. IT IS ALSO IMPORTANT TO HAVE INITIATION WARRANT (certified by the licensed maintenance department)**

3. The 1-year warranty period applies to the following parts:

- All UCFL series bearings,
- electrical heater for ignition,
- bearings of cellular safety transporter (valve)

4. The 2-year warranty period applies to the following parts:

- electric gear motor,
- torque transmission chain 083,
- lower screw coil,
- primary air fan,
- secondary air fan,
- automatic control system of the boiler with safety valve,
- smoke gases probe,
- boiler water temperature probe.
- cast iron segments for combustion,
- electric connectors,
- insulation materials on doors and cleaning holes,
- parts of cellular safety transporter (valve) made of grey and modular cast iron

5. Warranty period doesn't apply:

- unless the regular maintenance is done after each heating season,
- in case of the replacement of parts during the annual maintenance in accordance with the instructions,
- in case of malfunctions caused by the buyer because of unprofessional handling
- if the product was installed unprofessionally, contrary to the valid regulations in that aspect,
- if it is found that the hydraulic diagram was not made according to the recommendations of company Radijator inženjering the buyer used the product outside of declared properties in normal circumstances,

6. Warranty period isn't valid:

- if it is found out that malfunctions were removed by an unauthorized person or an unauthorized maintenance department,
- if during the repair the original parts were not used and installed,
- upon the expiration of the warranty period.

7. When reporting malfunctions, it is mandatory to provide the following information:

- name and type of the product,
- date of purchase,
- factory or workshop number of the fireplace,
- brief malfunction description, that is the description of a defect,
- exact address and contact number, mail.

8. Regular yearly maintenance

Regular maintenance is done at the end of each heating season from April 15th to August 31st and is charged according to the set price list of Radijator inženjering company. The maintenance procedure, performed by technicians performing regular yearly maintenances authorized by the company, include the following operations:



NOTICE: The servicing technician is obliged to inspect all listed parts (from the list) of the dosing unit and exchanger and if it comes to the replacement of any parts the user receives the aforementioned warranty and the additional 12-month warranty for the boiler body (exchanger) as well. The warranty can be extended up to 5 years from the initiation date. The maintenance and extension can be done by the person sent by the central maintenance department of Radijator inženjering. The warranty isn't valid to unchanged parts upon completing maintenance.

Maintenance procedure:

1. Disassembling the pellet silo from the pellet transporter;
2. Disassembling the pellet transporter from the boiler;
3. Removing both chains, sprockets and bearings from the furnace
4. Disassembling combustion parts from the furnace and cleaning the space beneath the boiler parts for cleaning; Inspecting the condition of parts and the gap between them;
5. Cleaning the space of pipes where the lower screw spiral rotates;
6. Lubricating all bearings of upper and lower screw axle and inspecting their functionality. The bearing mustn't have aggravated rotation or have any cracks on the case. On the contrary, the bearing is replaced. If it is determined that damages on bearings was caused by certain solid object or accumulated dust, bad quality of pellets in the pellets transporter, Radijator inženjering charges the value of the bearing. If the damage of the bearing was caused by the withdrawal of flame into the pellet transporter because of improperly set parameters while using, Radijator inženjering charges the value of the bearing;
7. Removing chains from both sides of shaft of the cellular safety transporter (valve) and



inspreting functionality of bearings in the valve. If the rotation of bearings is made aggravated, replace them from both sides. If the damage of valve bearing was caused by a solid object not from the boiler itself falling in (user's mistake or pellet manufacturer's mistake). Radijator inženjering charges the value of the bearings;

8. Inspect the sharpness of rotor's edges;
9. Remove the fle gases probe and clean it from deposits;
10. Inspection of primary and secondary fan and cyclone fan if the cyclone is in the boiler as the additional equipment;
11. Inspection of sealing of upper and lower door;
12. Inspection of boiler's exchanger maintenance;
13. Inspection of the pollination system if the pollination system is on the boiler as the additional equipment;
14. Inspecting the condition of cyclone on the boiler if the cyclone is on the boiler as the additional equipment;
15. Inspecting the condition of cleaning coils and electric motor redactor on them;
16. Inspecting the functionality of firing fan.



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036/399-140, 399-150

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GARANTNI LIST/GUARANTEE LIST

Tip kotla / Boiler type

Fabrički broj/ Factory No.

Garantni rok/ Guarantee period

60 MESECI/ 60 MONTHS

Datum proizvodnje/

Date of manufacture

Potpis ovlašćenog lica/

Signature of Authorized person

pečat/stamp

Prodato u firmi/Company of Sale

Adresa / Address

Telefon/Phone

Datum prodaje/ Date of Sale

Potpis/Signature

pečat/stamp

*Potrošač ima sva prava na osnovu Zakona o zaštiti potrošača ("Sl. glasnik RS", br. 62/2014). Garancija ne isključuje niti utiče na prava potrošača koja proizilaze iz zakonske odgovornosti prodavca za nesaobzornost robe u ugovoru. / The consumer shall exercise all rights under the Consumer Protection Law ("OJ of RS" No 62/2014). The guarantee does not exclude nor affect the consumer's rights derived from the legal liability of the seller for any lack of conformity of the goods under a Contract.