Manual and Installation book of boiler

Futura Bio 25-75kW

HEATING BOILERS • SOLAR PANELS • AIR CONDITIONERS
HEIZKESSEL • SOLAR TECHNIC • KLIMA ANLAGE

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With us heating makes economies!

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Table of contents

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4. Introduction

4.1) Advantages of Futura Bio:

✓ Solid quality

Heater and flue gas plates made from steel 5-8 mm thick (depend on kW version) , combustion chamber made from iron coast and ceramic. Boiler is welded by robots and obligatory pressure controlled

✓ Digital steering

The Electronic Control Unit regulates the flow of fuel and air for combustion and provides digital readings of boiler temperature, return temperature, and smoke temperature.

✓ Combustion chamber

Behind the lowest door, the combustion chamber with the ceramic combustion zone can be seen. There is plenty of room for easy cleaning and ash removal.
3 pass water heater zone, provide heating efficiency of 84-88 % !
When iron coast parts are installed in chamber, we can deinstall hopper and burn solid fuel like: wood or coal.

✓ Fuel tank 1,3 – 6 m³

Easy-to-load hopper with reversible door. The hopper can be loaded from either the back, right, or left side. Depend on capacity of the boiler , we have different volume of the fuel tank: f.e: 20 kW = 1,3 m³,
200 kW= 6 m³. For extra cost we can provide individual hopper volume to each boiler.

✓ Gear motor and automatic feeding system of the fuel

The gear motor turns the worm conveyor/auger and feeds the fuel into the combustion chamber at the proper rate.. The system provides automatically fuel to the combustion chamber. User has to manually ignite the burner and add every 3-4 day fuel to the tank.

✓ Safety systems

Boiler steering is equipped with STB – water overheating sensor, water tank 5 l is connected with anti-return flame system.

4.2) Short description

The Futura Bio boiler range is intended for biomass combustion – i.e. wood chips, saw dust, briquettes, pellets, corn and maize.
The advanced biomass combustion technique involves a ceramic or cast iron burner with a function of automatic fuel ignition and a special fuel feeding system. The device was designed in cooperation with Swedish specialists and tests were executed with the latest control and measurement equipment. The power range allows for heating surfaces between 200 and 3000 m^2. Futura Bio boilers operate in numerous hotels and boarding houses where customers expect the highest comfort of use combined with the lowest operation costs.

5. Technical data

BOILER MODEL		Futura Bio 25*	Futura Bio 50*	Futura Bio 75*	Futura Bio 100*	Futura Bio 150*	Futura Bio 200*	Futura Bio 300*
Boiler power range	Btu	85 K	175 K	260 K	345 K	515 K	685 K	1.1 M
Water capacity	Gal	27	45	65	82	Special order		
max. working pressure	PSI	30						
min. Input temperature	°F	145						
max. input temperature	°F	185						
Flue temperature	°F	248 - 345 °F						
Recommended chimney underpressure	Pa	.08 water/inch	.08 water/inch	.08 water/inch	.08 water/inch	.08 water/inch	.08 water/inch	.08 water/inch
Hopper volume	m3	0,54	0,54	1,26	1,26	1,26	Special order	
Weight	Lb	1200	1370	2100	2464	2804	Special order	
Power consumption	kW	0,18-1,1	0,18-1,1	1,3	1,3	1,3	Special order	

***Special order products**

The given data is for informational purposes only. The Manufacturer reserves the right to change them without prior notification because of the constant product improvement.

5.1) Structure of the boiler:

Bio is steel boiler delivered with fuel stoker and builded in special biomass burner. Biomass burner is builded already in Stoker. Burners head is made from steel or cast iron. Inside bur ner's head there is ceramic plate with many nozzles for secondary and primary air. Automati c feeding system with strong motorgear tranport different kind of fuel (brickets, pellets, woodchips).

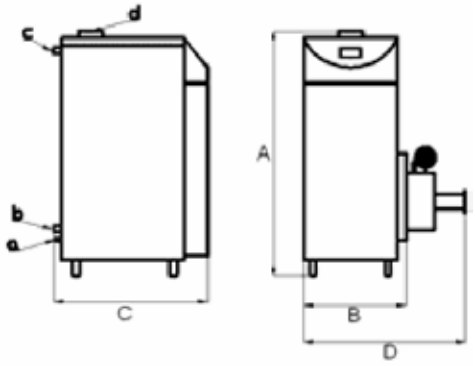
5.2) Special features of Futura Bio:

- Special Burner provides burning diffe rent fuels (woodchips, brickets, pellets)
- Big Fuel tank up to 3m^3
- Efficient >88%
- Strong motorgear (380V) easily crashes every kind of fuel
- Big loading doors helps filli ng up the fuel to the Tank
- Overhating protection system (STB) and burn back protection system guarantees safety of the unit

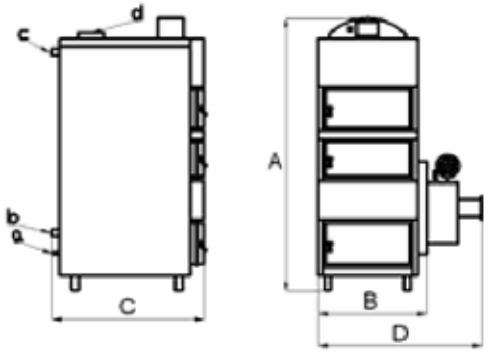
5.3) Scheme and dimensions of Futura Bio:

Futura BIO	25	50	75
A	62”	65”	74”
B	22”	30”	33”
C	41”	45”	52”
D	34”	41	50”
a	½"	½"	½"
b	1 ½"	2"	2"
c	1 ½"	2"	2"
d	6”	8”	10”

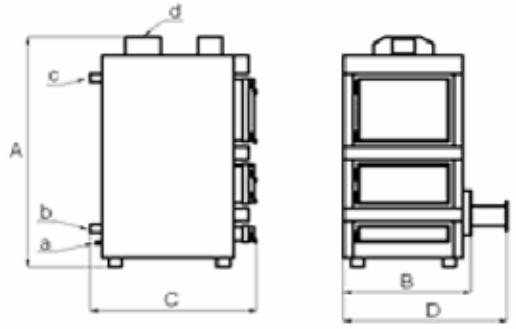
Futura Bio 25



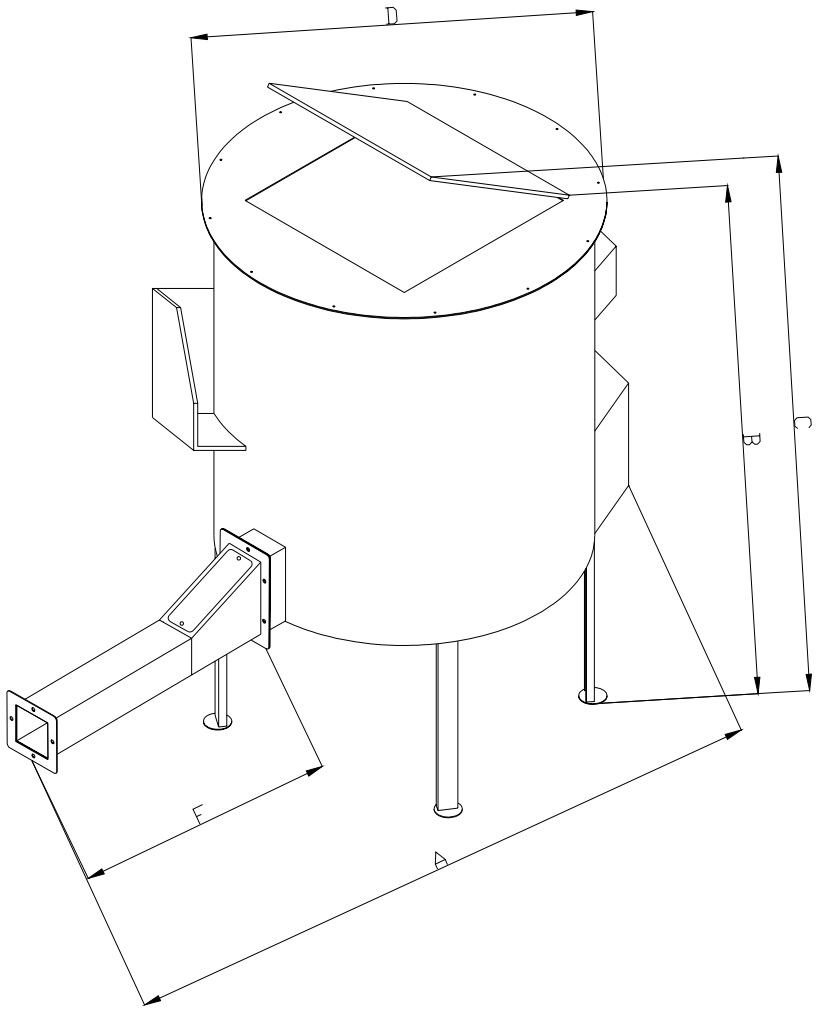
Futura Bio 50



Futura Bio 75



Silo 25-150



Kosz BIO	25-50	75-200
A	80”	77”
A*	120”	116”
B	63”	63”
C	91”	91”
D	38”	50”
F	30”	14”
F*	89”	54”

6. Using and service

6.1) Fuel

6.1.1) Chips, peat and sawdust

The best wood chips to be used are of the size 10-30 mm and made of longwood (P30). If the chip fuel is too coarse, made from sawings, or made from whole trees (the trunks are chipped with branches), malfunctions may result. See section
Malfunction in operation: Efficiency of device weakened.
You can use large- or small-sod peat, but not milled peat. If you want to obtain the same boiler efficiency by using large-sod peat as by using small-sod peat, then the feeding device must run a little longer on l-sod peat.
When sawdust is used, the work times must be longer and pause times shorter than with chips and peat. Sawdust is easy to use with peat or chips.

6.1.2) Pellets

Both wood and peat pellets can be used. The wood pellets can be made of chips, cutter chips or grinding mass of wood and forest industry. When adjusting the boiler pay attention to the fact that pellets require shorter work times and longer pause times than peat and chips due to the higher heating value.

6.1.3) Fuel moisture

The moisture content of wood chips and peat should be between 20% and 30% (M30). If the feeding in of the fuel is slow, the draught in the chimney is strong, and the fuel drier than recommended, the possibility of a backfire increases. When fuel moisture is greater than 35%, the efficiency of the burner will decrease rapidly and considerably more fuel is consumed than usual. When fuel more moist than
recommended is used, the moisture released may condense in the chimney. The operating life of a moist chimney is shorter than that of a dry chimney, and the draught is also worse.
As the moisture content of fuel increases it will freeze in a cold storage, and this may lead to malfunction in feeding. Should this happen, and if the fuel bin is located in a heated facility, it is recommended to feed fuel as often as possible for it to have time to melt.

6.2) Control

6.2.1) Application

RK-2006 controller is a modern microprocessor controller made in Surface Mount Technology.
The design of the controller enables easy and user-friendly operation.
RK-2006 controller is designed for temperature control of solid fuel fired boilers. The temperature of the boiler is kept on a level set by the user, by controlling the speed of the fan. The controller continuously monitors the temperature of the water in the boiler, shows it on the display and controls the central heating

pump and fuel feeder. To enable more precise temperature control of the heated rooms, the controller has been equipped with an input for room thermostat. Moreover, the controller is able to control the tap water pump.
The controller is also able to control the heater plug.

6.2.2) Connection

Before turning on the controller's power supply connect the following accordingly: power leads of the controller, fan, central heating pump and fuel feeder to appropriate sockets in the rear of the controller. The temperature sensors should be placed in appropriate measurement places which should be dry.

CAUTION! Before plugging in the controller to the power source check if the wiring system is properly grounded and if the terminal screws of the output connector are properly screwed.
CAUTION! The maximum total power of devices connected to the fan and pump outputs is 900W. The fuel feeder and igniter controlling outputs are not fused - appropriate fuse must be applied.

Outputs of the controller that are not used may remain unconnected.
Pictures 3. and 4. show the diagrams of electrical connection of the controller.
In a system with fuel withdrawal additional MP module should be used.

6.2.3) Operation

After turning the controller on all the elements of the display are lit for a while to check if they are working properly. The controller, when power appears, returns to its last state before turning off or power loss.

Front plate of the controller consists of:
1-Display indicating boiler temperature and respective parameters
2-Boiler overheating indicator
3-Fuel shortage indicator
4-Fan work indicator
5-Fuel feeder work indicator
6-Heater plug work indicator
7-Central heating pump work indicator
8-Hot water pump work indicator
9-Room thermostat and boiler temperature indicator (flashes while changing boiler temperature with the knob 10.)
10-Boiler thermostat knob and parameters setting knob with an OK button which confirms changes
11-button which switches between parameters
12-START/STOP and "cancel alarms" button which also turns on fuel ignition work
13-fuel feeder adjusting knob
14-manual fuel feeder button

Picture 1. Front plate of the RK-2006 controller

At the beginning of the boiler operation check if there is enough fuel in the feeder and add fuel if needed. By holding the manual fuel feeding button (14) you can add fuel to the boiler.
Basic operation of the controller is done by setting the desired temperature of the boiler with the thermostat knob, other functions are carried out according to the programmed parameters. If the controller is not in one of the parameter setting mode the knob (10) is the boiler's thermostat. The change of the thermostat setting is indicated by a lamp flashing for a few seconds.and the value is displayed on the display, e.g.[C 75] and it denotes the temperature of the water in the boiler which the regulator will be trying to achieve. You can check this value when you enter the parameter setting mode by pressing '<>' button for a short time. The boiler thermostat value will be displayed as first in this mode.
By pressing START/STOP button you can start and stop the fan work and also the control process.
In order to simplify the fuel ignition process the controller can turn on the heater plug-igniter.. If the controller is in STOP mode then by holding START/STOP button for 3 seconds you can turn on the ignition process and the controller enters WORK mode. It is indicated by the igniter indicator lit. The ignition time is set in service mode.

The controller enables easy fuel feeder control with the fuel feeder adjusting knob (13) which enables to set percent of time in which the fuel feeder is feeding fuel during fuel feeding period. While changing the knob settings the value is displayed on the display for a short time, e.g. [Fn30] and the fuel feeder indicator is flashing. Fuel feeding period time is set in user mode.

If the controller is not in the parameter setting mode the display shows water temperature in the boiler and the last character on the display denotes mode which the regulator is currently in:

for example: [70°-] - STOP mode
[70°C] - WORK mode
[70°c] - keeping burning in WORK mode
[70°U] - hot water heating in SUMMER mode
[70°u] - keeping burning in SUMMER mode
[70°d] – total bacteria control mode - hot water heating up to 75°C

Indicators below the display are assigned to appropriate outputs and if they are lit continuously it means that appropriate output is on.

6.2.4) Setting up user parameters

By pressing <> button you can enter the user parameter setting mode which is indicated by boiler thermostat indicator flashing quickly as the firs parameter and the boiler thermostat temperature value is displayed on the display. You can look through parameters by pressing '<>' button. After choosing the desired parameter (which is indicated by appropriate indicator flashing quickly and desired parameter value displayed) you can change value of the parameter by turning the knob. The change of the value is indicated by the value flashing on the display. You can confirm new settings by pressing OK button or return to previous parameter value by pressing STOP button. After that it is possible to choose another parameter with '<>' button. If you do not want to change the parameter value with the STOP button exit the user parameter setting mode or wait for 1 minute - the controller will exit the parameter change mode and will start indicating the temperature of the water in the boiler.

Table 1. User parameters list

Indicator	Display	Parameter	Min	Max	Step	Factory default
Thermostat	C 40	Boiler desired temperature	L 40	H 90	1°C	L 40
Fuel feeder	F 40	Fuel feeding period time in WORK mode	10	600	5s	40
	≡ 25	Fuel feeder work time in hold up mode	5	240	1s	25
	= 15	Fuel feeder pause time in hold up mode	5	250	1 min	15
	Fn 30	% of fuel feeding time in WORK mode	10	90	1%	fuel feeder knob
Central heating pump	co C	Central heating pump work when “C” (pump is off when “-“)	-	C		C
Hot water pump	cu u	Hot water heating up – total bacteria control in hot water tank	d	d		u
	50°	Water temperature in hot water tank				

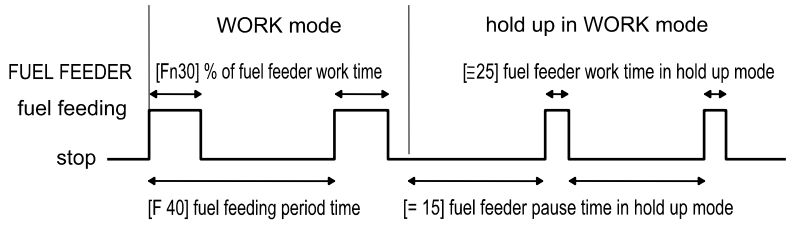
In the table above the first column shows quickly flashing indicator, the second column represents particular example display indications, in the next columns there are: parameter description, minimum and maximum amount allowed to be set, step of the value during the setup, the last column contains values programmed by the producer to which you can return by choosing [Prod] option in service mode.

I) Boiler work temperature

The boiler desired temperature [C 40] – is the temperature value which the regulator will be trying to achieve in WORK mode. It can be set directly by turning the thermostat knob and is indicated by displaying the value for a while on the display.

II) Fuel feeding parameters

To ensure proper temperature in the boiler fuel should be added periodically. Required fuel feeding period time depends on fuel energetic properties and boiler power.
To simplify setting of the fuel amount the controller has been equipped with fuel feeder knob which enables to set percent of time in which the fuel feeder is feeding fuel during fuel feeding period. While changing the value with the knob, the value is displayed on the display for a while.
The controller also enables manual fuel feeding by holding the manual fuel feeding button and it is possible at any time of the boiler work.
Fuel feeder period time in WORK mode [F 40] - time of repetitive fuel feeding period which consist of fuel feeder work time and fuel feeder pause time.
The percent of fuel feeding time in WORK mode [Fn30] - this value means percent of the whole fuel feeding period time, during which the fuel feeder is adding fuel. This value can be changed directly by turning the fuel feeding knob and doesn't depend on the main knob.
Fuel feeder work time in hold up mode [Ξ 25] - time of adding the fuel during in hold up in WORK mode.
Fuel feeder pause time in hold up mode [= 15] - time of fuel feeder pause in hold up in WORK mode.
Picture 2. shows graphically the fuel feeder work rules.



Picture 2. Fuel feeder work description

III) Central heating pump work

[co C] - WINTER/SUMMER mode - character 'C' indicates that the central heating pump is working. Inn the summer you may turn the heating off by choosing '-' value which denotes turning off the central heating pump and pressing OK with the knob which will cause the central heating pump to turn off. After leaving the user parameter setting mode on the display there will appear e.g. [70°U] which means hot water heating in SUMMER mode, or [70°u] which means hold up of burning.

IV) Heating up

- total bacteria controlling hot water tank [cu u] - the controller enables manual turn on of total bacteria control process in hot water tank. Choosing 'd' value and pressing OK with the knob will start the process, in which the boiler will be trying to achieve 75°C in the hot water tank. To begin the total bacteria control process the boiler must be in WORK mode (which can be switched on with START button). On the display there will appear e.g, [70°d]. After achieving 75°C in the hot water tank, the controller will return to its last state before choosing this option.

NOTICE. You may turn on the total bacteria control function at night when hot water is not used to prevent users from burn injury.

It is possible to read out the temperature value of the water in the tank, e.g. [50°]

6.2.5) Parameter setting - service mode

Table 2. Service parameters list

Indicator	Display	Parameter	Min	Max	Step	Factory default
Fan	∏100	Fan work power or max fan power when ∏r 1	50	100	10%	100
	∏r -	Automatic fan speed control	-	1		-
	∏n--	Fan work time	--,5	60	1s	--
	∏u 1	Fan pause time	1	99	1min	1
	d 20	% of fan in hold up switch off delay time	0	500	10%	20
	o 60	Fan power with igniter switched on	40	100	10%	60
	b 60	Time of extending of fan work time after switching off the igniter	5	300	5s	60
Feeder	c 85	Fuel feeder sensor temperature – protected from the ignition	--,60	95	1˚C	--
	cF 5	Fuel feeding period to extinguish	1	30	1min	5
	I- 2	Fule withdrawal time	---,1	240	1s	2
Igniter	R240	Ignition period (hold START for 3 sec.)	10	600	10s	240
Central heating pump	P 42	Central heating pump launch temperature	30	70	1˚C	42
	Ph 2	Central heating pump launch hysteresis	1	10	1˚C	2

	Pc 2	Central heating pump launch pause time for 30 sec.	--,1	99	1min	2
Hot water pump	u 50	Warm water temperature or the mixing pump launch temperature	30	60	1˚C	50
	uh 5	Hot water heating hysteresis	1	9	1˚C	5
	ur 1	No hot water-0, hot water priority-1, no hot water priority-2, mixing pump-3	0	3	1	1
Thermostat	L 40	Boiler minimum temperature	30	69	1˚C	40
	H 90	Boiler maximum temperature	70	90	1˚C	90
	h 5	Boiler temperature hysteresis	1	10	1˚C	5
	A 99	Boiler overheating temperature	90	99	1˚C	99
	Fb30	Fuel shortage testing time with 5˚C below the set boiler temperature	1	99	1min	30
	Prod	Back to factory defaults after pressing OK				
	out-	Output test – knob starts indicators subsequently	1	6	1	

In the table above, the first column shows a slowly flashing indicator on the front of the controller, the second column represents example display indications, in the next columns there are: parameter description, minimum and maximum values allowed to be set, step of the value during the setup, the last column contains factory defaults to which you can return by choosing [Prod] option.

You can enter the service mode by holding <> button for 3 seconds, the change will be indicated by fan the indicator flashing slowly as first parameter on the parameters list. You can look through parameters by pressing '<>' button. After choosing the desired parameter (which is indicated by appropriate indicator flashing slowly and desired parameter value displayed) you can directly change the value of the parameter by turning the knob.
Change of the value is indicated by the value flashing on the display. You can confirm new settings by pressing OK button or return to previous parameter value by pressing STOP button. After that it is possible to choose another parameter with '<>' button. If you do not want to change the parameters by pressing STOP button exit the user parameters setting mode or wait for 1 minute. The controller will exit this mode and will start indicating the temperature of the water in the boiler..

I) Fan work parameters

Fan work power [П100] - is the value of the work power of the fan. When " Пr" parameter is set to "1" this is maximum power of the fan which can be achieved by automatic fan control.
Automatic fan speed control [Пr 1] - it is on when this parameter is set to "1" and causes automatic fan speed decrease when temperature of water in the boiler reaches the temperature set by the thermostat. When this parameter's

value is set to "-" the fan smooth speed control is disabled and the fan can work with power set by " П" parameter.
Fan work time [Пn--] - time of momentary turning the fan on to remove accumulated gases. Setting the parameter to "-" turns this function off. This function can be active during hold up of burning in WORK mode.
Fan pause time [Пu 1] - time between fan work periods
Time of delay of fan turn-off in hold up mode mode [d 20] - defines how much time in percent fan work will be extended after feeding fuel when the boiler is in hold up mode (to inflame added fuel)
Fan power when igniter works [o 60] - fan power adjusted so that the igniter's temperature does not decrease during ignition of the fuel.
Fan work time extension after igniter turn off [b 60] - fan work time required to cool down the igniter
NOTICE. Turning the igniter on always causes the fan to turn on.

II) Fuel feeder protection

Fuel feeder sensor temperature - protection from igniton [c 85] - temperature at which the fuel feeder will be turned on to remove burning fuel in the feeder.
Fuel feeding time to extinguish [cF 5] - fuel feeder work time to remove burning fuel in the feeder.
Fuel withdrawal time [I----] – after each fuel feeding after 2 seconds the fuel withdrawal in the fuel feeder is activated. Fuel withdrawal is used in some fuel types. When the value is set to "----", the output for additional relay control is not used.

III)Fuel ignition

To make fuel ignition in the boiler easier, the controller has ability to control the heater plug-igniter.
Holding START button for 3 seconds starts the fuel ignition process and automatically switches the controller to WORK mode. Start of igniter is possible when the controller is in STOP mode. Depending on fuel type appropriate igniter time should be set so that the added fuel has time to inflame.
Ignition time [r240] - igniter turn on time after holding START/STOP button for more than 3 seconds adjusted to fuel type.

IV) Central heating pump work parameters

Central heating pump launch temperature [P 42] - temperature of water in the boiler at which the central heating pump starts..
The central heating pump work mostly depends on the room thermostat work, the pump is additionally turned on in case of overheat or damage of the boiler temperature sensor.
The central heating pump hysteresis [Ph 2] - this parameter defines what value should the water temperature decrease by in the boiler, below the central heating pump launch temperature for the pump to turn off.
Repeat time of the central heating pump launch [Pc 2] - in STOP mode or when room thermostat circuit is open, the central heating pump is launched for 30

seconds to mix water in heating circulation. This parameter defines the repeat time of the pump launch.
The parameter "-" turns this function off.

V) Domestic hot water preparation

or controlling the mixing pump which mixes the returning water in the boiler

Hot water temperature [u 50] - temperature which will be kept in the hot water tank.
Hot water heating hysteresis [uh 5] - this parameter defines what value should the temperature decrease by in the tank, so that the hot water pump turns on to heat up the water in the tank.
Parameter [ur 1] - [ur 0] value means no sensor and no hot water pump. The sensor is not taken into account during testing the faults, i.e. the sensor may remain unconnected,
[ur 1] value means that the hot water pump works with priority,
[ur 2] value means that the hot water tank works without priority
[ur 3] value means that in the heating system there is used a mixing pump that mixes the returning water in the boiler. In this case [u 50] value denotes the pump launch temperature with hysteresis [uh 5].

VI) Boiler work temperature setting

Minimal boiler temperature [L 40] - minimum temperature which can be set with the boiler thermostat knob.
Maximum boiler temperature [H 40] - maximum temperature which can be set with the boiler thermostat knob.
Boiler temperature hysteresis [h 5] - this parameter defines what value should the temperature of the water in the boiler decrease by, below temperature set with the thermostat knob so that the fan turns on.

VII) Boiler overheating protection

Boiler overheating temperature [A 99] - value exceeding which will cause permanent turn off of the fan to prevent the boiler from overheating. After the temperature increases above 80 °C the central heating pump turns on to cool down the boiler.
Overheating mode is indicated by the boiler overheating indicator and can be turned off by pressing STOP button when the temperature drops below this temperature.
The fan turns off and the pump turns on also in case of damage of the boiler water temperature sensor which is displayed on the display with [E 1].
STB - the regulator has also additional protection from overheating which is independent from the processor. In case of the temperature increases over 95˚C the control process is turned off by turning off the fan and launching the central heating pump. The control process will start again when the temperature drops below 89˚C.
Using the STB circuit enables more precise boiler work control and reduces overheating possibility.

VIII) Fuel shortage

Id during fuel firing start the water temperature does not increase by 5˚C in 120 minutes the control process will be turned off and the fuel shortage indicator will be lit.
You can cancel this mode by pressing STOP button.
Fuel shortage testing time during work mode [Fb30] - in WORK mode if the temperature of the water in the boiler drops below the temperature set with the thermostat, by the hysteresis value and does not increase by 5˚C in the programmed time the control process will be turned off and the fuel shortage indicator will be lit.
You can cancel the fuel shortage alarm by pressing STOP button.

IX) Factory defaults

You can return to standard settings permanently set by the producer, by choosing [Prod] option on the display and pressing OK button – there will appear the "----" character on the display for a while and the controller will return to service mode. After activating this function the controller sets each value of parameters showed in the table. This function is available when the control process is stopped.

X) Testing the outputs

To make checking the regulator work easier it is possible to test particular output circuits. This function is available in service mode only if the control process is off, i.e. the regulator was in STOP mode before switching to service mode. Choosing [out-] on the display allows to choose each output with the knob, selected output will be indicated by appropriate indicator. Pressing OK turns on the selected output for a while.
Characters on the display mean as follows:
[out1] - fan output
[out2] - fuel feeder output
[out3] - additional fuel withdrawal output
[out4] - igniter output
[out5] - central heating pump output
[out6] - hot water pump or mixing pump output

XI) Exiting service mode

Pressing STOP button will exit the service mode.
You will also exit the mode when no buttons are pressed for 1 minute.

6.2.6) Additional functions

To improve comfort in heated rooms, the controller has been equipped with an input allowing to connect any kind of room thermostat with contact output. When temperature in the room is below the desired temperature the central heating pump is turned on and the room thermostat indicator is lit.

It means that the boiler should keep temperature set by the knob of the room thermostat. After reaching desired temperature in the room the central heating pump is turned off and the indicator turns off and the boiler switches to hold up mode, in minimum temperature.

CAUTION. In case of not having room thermostat in the system, the room thermostat input contacts must be short-circuited.

6.2.7) Controller failures

The regulator is constantly testing if its internal circuits and temperature sensors are working correctly. After detection of fault, the controller is acting appropriately to type of fault to protect the boiler and the fuel feeder. In case of failure turn off the regulator, permanently plug the central heating pump to the power source, ensure appropriate fuel burning in the boiler and contact the service.

Table 3. List of faults and fault responses

Display	Fault	Response
E1	boiler temp. sensor	fan turn off, fuel feeder turn off, central heating pump launch, STOP
E2	fuel feeder sensor	fan turn off, fuel feeding for extinguish [cF 5], STOP
E4	fuel feeder sensor	fan turn off, fuel feeding for extinguish [cF 5], STOP
E8	hot water temp. sensor	no hot water control, not taken into account if [ur 0]
E16	fuel feeder knob	reaches the value of 30%

The most important protective function of the controller is the boiler overheating protection. It's carried out by STB circuit and the software.
If [E 1] appears on the display it means fault in the boiler sensor circuit or temperature beyond the measurement range, i.e. below 0˚C or above 100˚C. Appearing of [E 1] error on the display after pressing STOP button, despite the temperature drops below 90˚C may indicate permanent damage of boiler temperature sensor (e.g. if the boiler was overheated above 150˚C).
Appearing of [E 1] error causes the control process to stop.
The controller's task is also has to prevent fuel in the fuel feeder from burning. If fuel feeder temperature sensor detects temperature above programmed temperature e.g. [c 85], [E 4] error will be displayed. If fuel feeder temperature sensor was damaged, [E 2] error will be displayed. In both cases fuel feeder will be launched for [cF 5] time and the control process will be stopped. You are not able to cancel the alarm with the STOP button before the fuel feeder extinguishing [cF 5] time passes. Appearance of [E 6] error on the display is caused by [E 2] error and [E 4] error at the same time and may indicate that fuel feeder temperature sensor circuit is open or the sensor is damaged as a result of temperature increase above 150˚C.
[E 8] error displayed on the display indicates that hot water temperature sensor circuit is damaged and causes turn-off of hot water control, other functions are carried out without changes.

[E 16] error indicates that the fuel feeder knob is damaged. In this case, the controller sets the set value of feeding time at 30%.

CAUTION. In case of more than one fault on the display there will be displayed the value which is the sum of all fault numbers, e.g. [E5] means occurring of faults [E1] and [E4]
CAUTION. The controller is equipped with properly protected semiconductor temperature sensors. In spite of this measurement places where the sensors are placed should be dry.

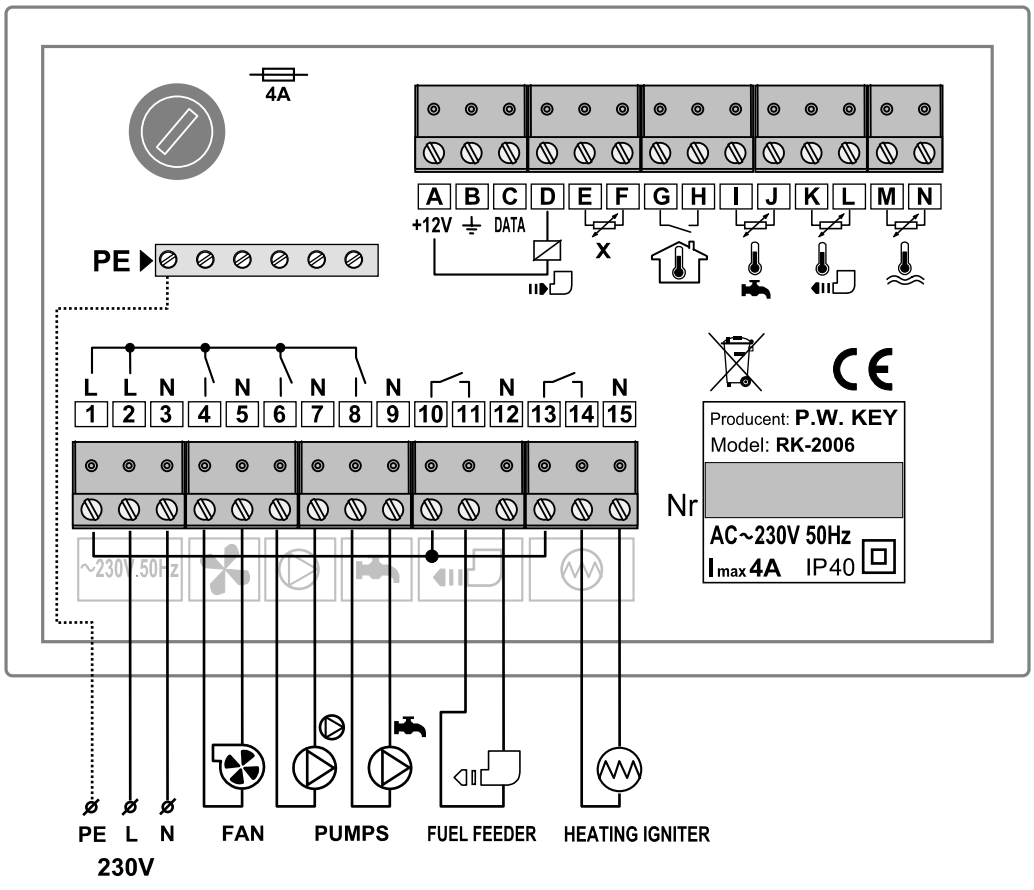
6.2.8) Controller removal

In case of removal necessity of the regulator proceed as follows:
- disconnect the power of the boiler and the controller from mains
- remove the regulator from the slot in the boiler
- disconnect all connectors with cords from the controller

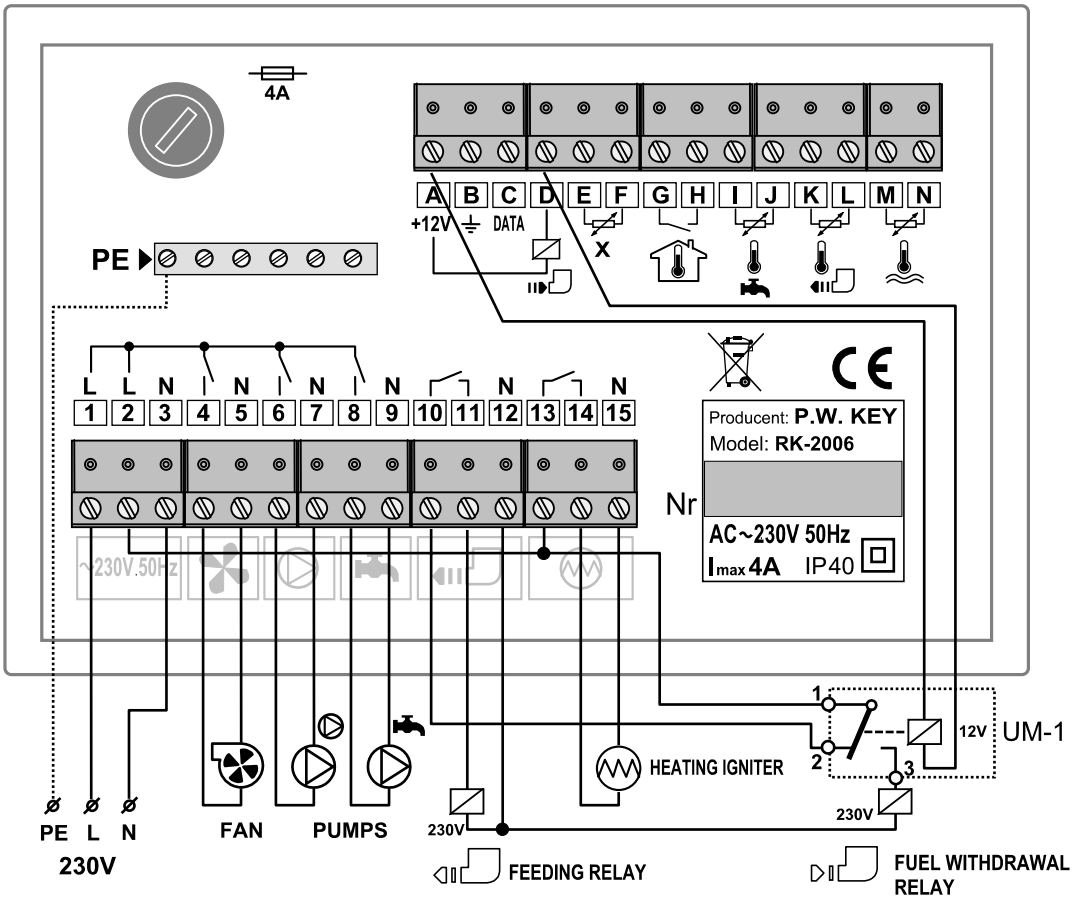
6.2.9) Technical data

Voltage:	230V ±10%, 50Hz
Power consumption (without fan and pump):	< 4VA
Temperature measurement range	0–99°C ±1°C
Boiler temperature adjustment range	30–90°C ±1°C
Programmed boiler overheating protection	90–99°C ±1°C
Hardware boiler overheating protection	>95°C ±1°C
Central heating pump launch temperature	30–70°C ±1°C
Dimensions (HxWxD)	96x144x94
Total fan-out:	max 4A/230V

Producer: P.W. KEY www.pwkey.pl



Picture.3 RK-2006 controller connection diagram



Picture.4 RK-2006 controller connection with fuel withdrawal diagram

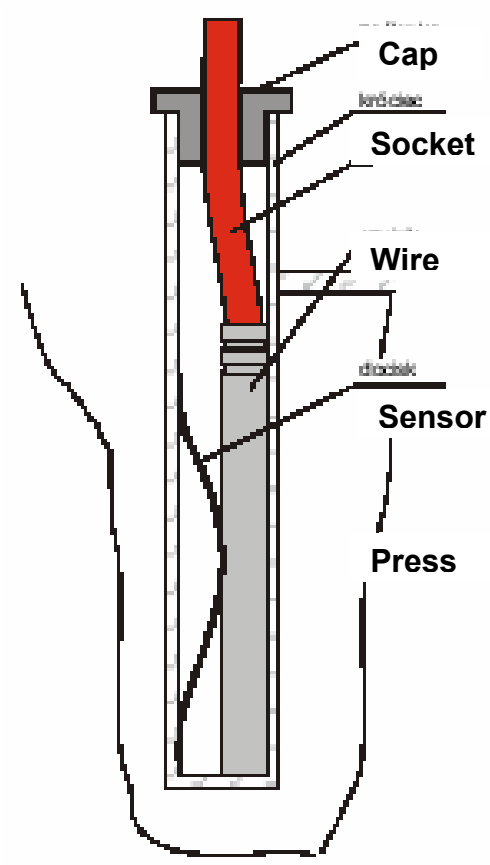
6.2.10) Notes

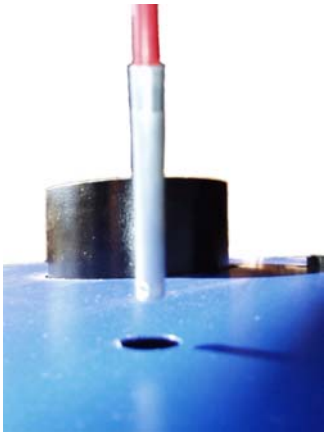
Indicator	Display	Parameter	User
Thermostat	C 40	Boiler desired temperature	
Fuel feeder	F 40	Fuel feeding period time in WORK mode	
	≡ 25	Fuel feeder work time in hold up mode	
	= 15	Fuel feeder pause time in hold up mode	
	Fn 30	% of fuel feeding time in WORK mode	
Central heating pump	co C	Central heating pump work when “C” (pump is off when “-“)	
Hot water pump	cu u	Hot water heating up – total bacteria control in hot water tank	
	50°	Water temperature in hot water tank	

Indicator	Display	Parameter	User
Fan	∏100	Fan work power or max fan power when ∏r 1	
	∏r -	Automatic fan speed control	
	∏n--	Fan work time	
	∏u 1	Fan pause time	
	d 20	% of fan in hold up switch off delay time	
	o 60	Fan power with igniter switched on	
	b 60	Time of extending of fan work time after switching off the igniter	

Feeder	c 85	Fuel feeder sensor temperature – protected from the ignition	
	cF 5	Fuel feeding period to extinguish	
	I- 2	Fule withdrawal time	
Igniter	R240	Ignition period (hold START for 3 sec.)	
Central heating pump	P 42	Central heating pump launch temperature	
	Ph 2	Central heating pump launch hysteresis	
	Pc 2	Central heating pump launch pause time for 30 sec.	
Hot water pump	u 50	Warm water temperature or the mixing pump launch temperature	
	uh 5	Hot water heating hysteresis	
	ur 1	No hot water-0, hot water priority-1, no hot water priority-2, mixing pump-3	
Thermostat	L 40	Boiler minimum temperature	
	H 90	Boiler maximum temperature	
	h 5	Boiler temperature hysteresis	
	A 99	Boiler overheating temperature	
	Fb30	Fuel shortage testing time with 5˚C below the set boiler temperature	

6.3) Assembling of thermo-gauge





The thermo-gauge is the integral part of control unit. For popper working of control unit it is necessary to install the sensor suitably in order to the measured temperature was as the most similar to real temperature of water in boiler. It is necessary to provide the rightest contact of sensor with internal surface of socket through proper press as well as the infatuation the inlet. The wire of sensor should lead in such way not to be exposed on overheating.

Socket should not be fill with oil, water or other active substances. The usage of silikone pastes in order improvement of thermal conductance is only acceptable.

6.4) Feeder

6.4.1) Destiny

Machines type AAP are automatic feeders, prepared to burning recycle fuels such as: scraps briquettes, straw, silvers, sawdust, waste paper, peat briquettes, etc.
Automatically controlled fuel feeder allows to work longer without need of taking out ash from ash – pan.
Electronic steering system allows to keep temperature which you prefer and it allows to connect to room thermostat and weather steering.

6.4.2) Basic Technical Information

Parameters		I	II	III
Tank length	m	0,7	1,0	1,3
Tank height	m	1,6	1,6	1,6
Tank width	m	0,7	1,4	2,4
Container capacity	m^3	0,7	1,5	3,2
Feeder length behind burner	m	1,83	2,1	3,1
Drive type		Nord or SIM		
Ventilating fan		WPa - 120	WPa - 120	WBs – 3a
Steering scheme		PINOKIO		
Tension feed	V	380	380	380
Power consumption	kW	1,3	1,65	2,5

6.4.3) Construction of machine

Structure of automatic fuel feeder type APP:

1) Feeder – upper part,
2) Feeder – lower part with feeding worm,
3) Burner,
4) Motoreductor drive,
5) Steering scheme,
6) Protection scheme – tank with water, safety – valve,
7) Ventilator (fan).

l) Installation and set machine in motion

Automatic fuel feeder should be connected to heating mechanism (boiler) by properly trained workers.

To protect escape of gases from burning combination burner with fire box of boiler must be tightened.

Tank should be standing horizontal. You can do this by regulation screws in the legs and place it to stand still on the ground.

Only qualified electrician can connect steering machines to electric net and rotary pomp.

Installed steering equipment:

- Orange thermostat – turns off the feeder after it reach temperature 95º C. It must be installed in the muff ½ inch screwed into brass cover of sensing device for oakum or teflon;
- Grey thermostat – it protects before application fuel to the boiler, when the temperature fall down below 30º C;
- Red sensing device on electric line – it measure real temperature of working boiler. This sensing must be working in dry conditions, that means in muff without water or it should be installed on boiler escape tube.

To the boiler controller we can install the central heating pump, which will be starting after reached 35ºC.

6.4.4) Parameters of setting

Work of the feeder is regulating by the controller.

When boiler reached temp. more then 95ºC, the orange Thermostat will turn off the feeder. To start again the work of the feeder you need in Thermostat put off the black nut and press the small button in it.

The grey Thermostat, which sensor is situated on the burner should be set up at temp. 15-35ºC. If this Thermostat will be set up on higher temperature, then the feeder could not start again after the chosen temp.

6.4.5) Dimensions

Dimension	*Shortage*		*APP-2*	*APP-3*
Overall length	L	mm	2065	3015
Width	A	mm	750	1310
Length	B	mm	1500	2400
Height	H	mm	1600	1600
Distance from APP to the boiler wall	S	mm	600	670
Height with opened hopper door.	H1	mm	2200	2200
Burner length in the boiler	S1	mm	460	820
Distance form the canal to the ground	M	mm	400	400
The Transmission width	N	mm	250	265

6.4.6) Periodic checking

Twice a year or as often as needed (depending from quality of fuel) it is necessarily to check few parts. Then follow below points:

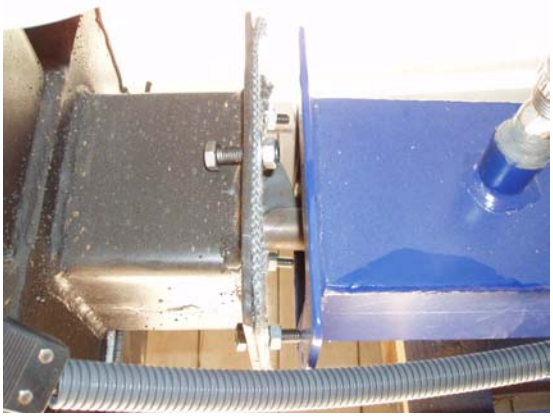
- Check that the blower works properly. If the propeller blades have gathered dust, they need to be cleaned.
- Check the joints of the casting parts of the burner head and the frame.



- Check that the air holes of the burner head are open.

- Check and empty, if necessary, the ash box of the burner head. When using wood chips made from whole trees, you should use up the contents of the fuel bin at times and remove the layer of stick from the bottom.

- Check that all the air-intake apertures of the boiler are closed, check the air-tightness of the joints between the chimney and the boiler, and all the joints of the burner device, in order to maintain a proper draught in the chimney, because this will keep the fuel bin smokeless.



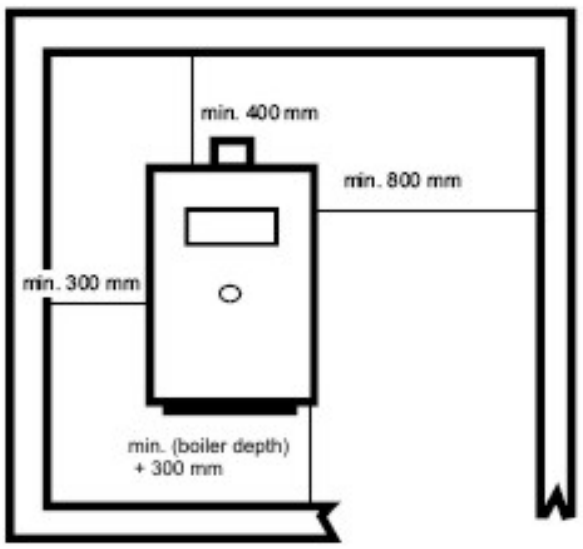
- Check that there is no blockage in the chimney or the chimney joint, and make sure that the draught in the chimney is sufficient.
- Check that there is not too much ash inside the burner head.
- Note that the cell feeder does not entirely prevent smoke from entering into the bin. It merely stops the progress of the fire.

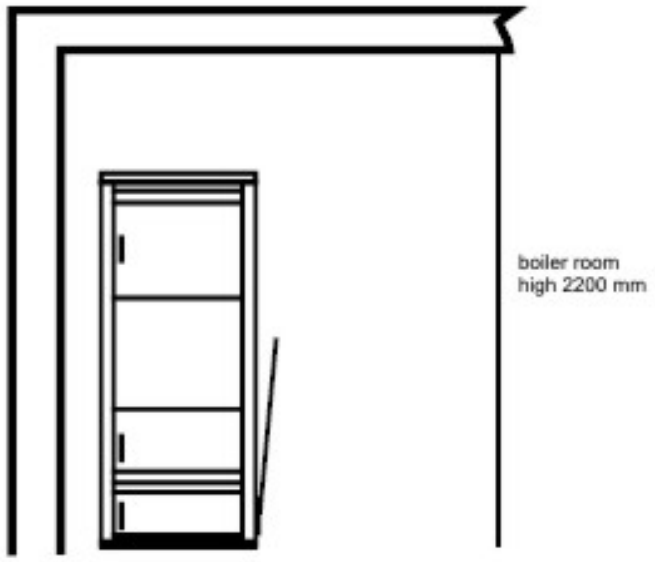
7. System

7.1) Standards

- Heating System – during installation and operation of the boiler it is very important to keep safe distance from the inflammable materials. The boiler is allowed to work only in open type heating systems!
- Electrical installation – the boiler's power supply is 230V/50Hz
- Chimney – It must be done with respect to current norms and regulations. Due boiler gasses temperature 90-100 C it is obligatory to put the INOX or other material tubes into the chimney. Required chimney draught is 0,1 – 0,2 mbar. Installation according to ADJ does entail some testing of the chimney, which may be carried out by a sweep
- Important sources of guidance installers: 98/37/EEG; 89/336/EEG; 73/23/EEG; EN 55014-1, 1993 /A1, 1997; EN 55014-1; EN 55014-2 C1 1998; EN 61000-3-2; EN 61000-4-2, -3-4-5-6-11, Level2; EN 50165; EN 50165 C1; EN 60335-1; EN 303-5; EN 12809; EN 13394

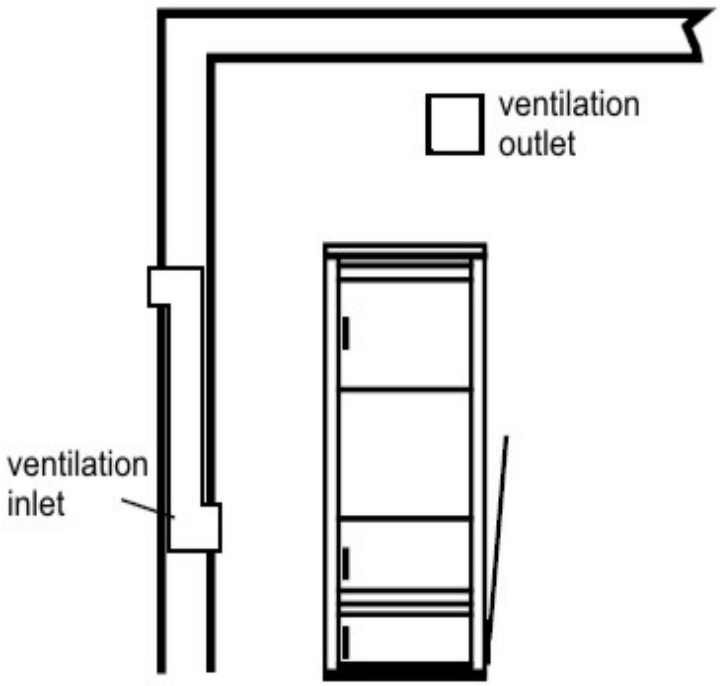
7.2) Localization of the boiler:





- Placing on flammable foundation.
- place the boiler on non-flammable and thermal insulating pad which should protrude not less than 20 mm outside boiler's dimensions;
- If the boiler is located in the basement it is required to place it on a base raised not lower than 50 mm over floor's level. The boiler and the fuel hopper must stand vertically and can be leveled using the regulating screw in fuel hopper's leg.
- The (230V/50Hz) electric socket should be easy to access.

7.3) Ventilation:



Accordantly with regulations each boiler room has to have the ventilation inlet and outlet in aim of assurance of correct boilers work and users safety. Lack of ventilation inlet or it's stocking is the most frequent cause of incorrect work of boiler (the fumidity, condense water, impossibility of higher temperature obtainment). Ventilation outlet has instead in task of offtake from room used air and harmful gases. In boiler room with chimney with natural draught it is not it allowed to use mechanical ventilation.

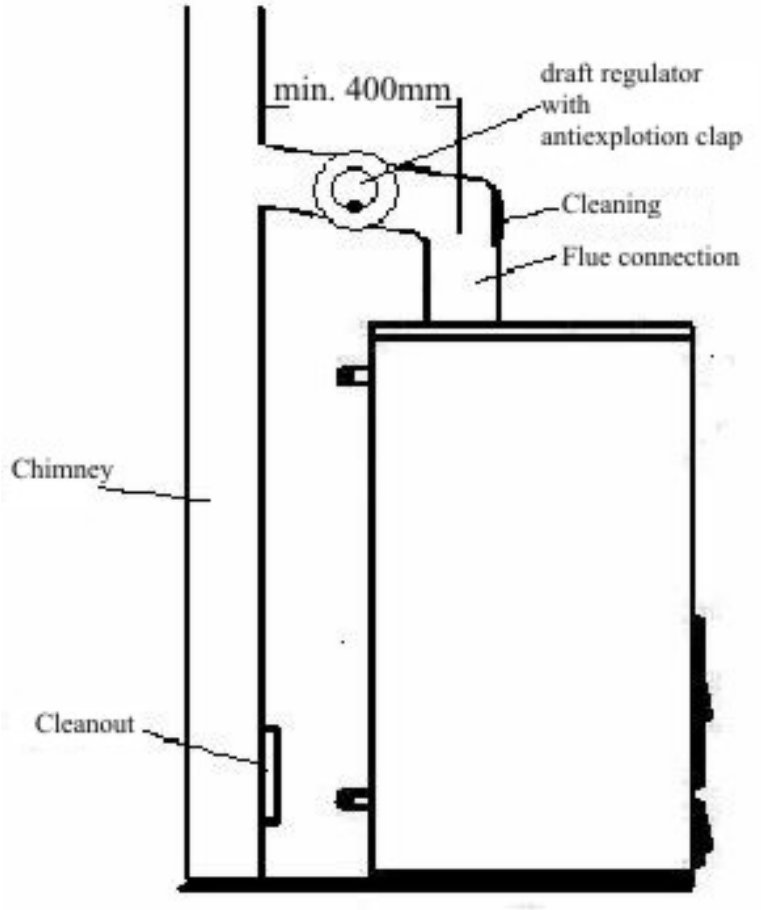
7.3.1) Ventilation inlet

- The channel of ventilation inlet should have dimension of 50 % area of chimney intersection, no fewer than 20 x 20 cm
- Channel should be 1m over floor
- In ventilation hole or in channel should be installed device to control of air flow, however such to forbid decrease of intersection more than to 1/5
- Ventilation duct should be made from incombustible material

7.3.2) Ventilation outlet

- Channel should be made of brick and min. intersection of it should be 25% of chimney intersection however not smaller than 14 x 14 cm
- Inlets can not have any closing it intersection devices
- Spout should be under ceiling of room, led out on roof at least 1,5 m
- Ventilation duct should be made from incombustible material

7.4) Chimney connection:



- Flues should be made in accordance with current regulations.
- To reduce the resistances of flow of flue gases the connection with chimney should be led in straight line and possible change of direction should be made with gentle arcs.
- Boilers can be assembled into flues from brick with aligned internal welds
- Combustion duct should begin from floor line
- About 30cm. over floor should be to situated cleanout with tight lock
- Intersection should be approximate to square with regard on smaller resistances of flue gases flow
- The minimum intersection of chimney amounts 20 x 20 cm
- The dams of brick between duct and wall should not be smaller than 12 cm
- Chimney should be led out over roof

- The location of chimney outlet depends from the degree of roof droop and stages of the flammability. The roof with angle of droop to 12º - the chimneys should stand over roof ridge 0.6m, roof with angle of droop over 12º - the chimneys should stand over roof ridge in case of easily flammable coverings 0,6m however in case of incombustible or difficultly flammable covering, the outlet can occur 0,3m over roof ridge.
- Assembly of draught regulator is recommended, which in case of too big underpressure in chimney opens and suck in the air from the boiler room and does not pull it through boiler causing the temperature uncontrolled rise. Interrupter this should be set on required value in dependence from power of boiler

7.5) Boiler selection

Simple boiler selection formula:

Q = P x k

Boiler power (W) = Heated surface (m^3) x k factor (W/m^3)

Value of k factor
70-100 for best insulated buildings (and modern heating system)
100-130 for average insulated buildings
130-180 for worst insulated buildings (and traditional heating system)

7.6) Pressure

In-circuit pressure of the gravitational system calculates according to the formula:

Pressure (bar) = h * p * g

where:
h= height of water prism in m
p= water mass density (kg/m^3)
g= 9.81 m/s^2

or according to the formula:

Pressure = h * g (dr – df)

where:
h= difference of height between the the centre of radiator and boiler in m
g= 9.81 m/s^2
dr= return water mass density
df= flow water mass density

7.7) Open dish capacity

General formula for the minimum usable capacity of the open dish:

Vn = 1,1v * p * .v

where:
v – system water volume
p – water mass density in base temperature of10°C
.v – growth of water mass density with temperature rise– for systems with 90/70 (flow/return) parameters the value of this factor is: 0,0287

7.8) Accumulation tank

Safety for solid fuel boilers according to EN 303-5

The protection of the solid fuels boiler provided for by the norm EN 303-5 is **exchanger** protecting the device, which assures the accompanying of excess warm. Such exchanger giving back the excess of warmth can be the through heater of water built so that warmth is passed on without external energy or buffor tank.

Minimal volume of the tank calculates according to the formula passed in norm EN 303-5:

$$VSp = 15\ TB\ *\ QN\ [\ 1\ -0{,}3\ (Q\ H\ /\ Q\ min\ )\ ]$$

VSp . volume of accumulation tank (litres)
TB . burning time in h
QN . nominal heating power in kW
Q H. building heating demand kW
Q min. minimum heating power in kW

7.9) Boiler installation systems:

7.9.1) Open system

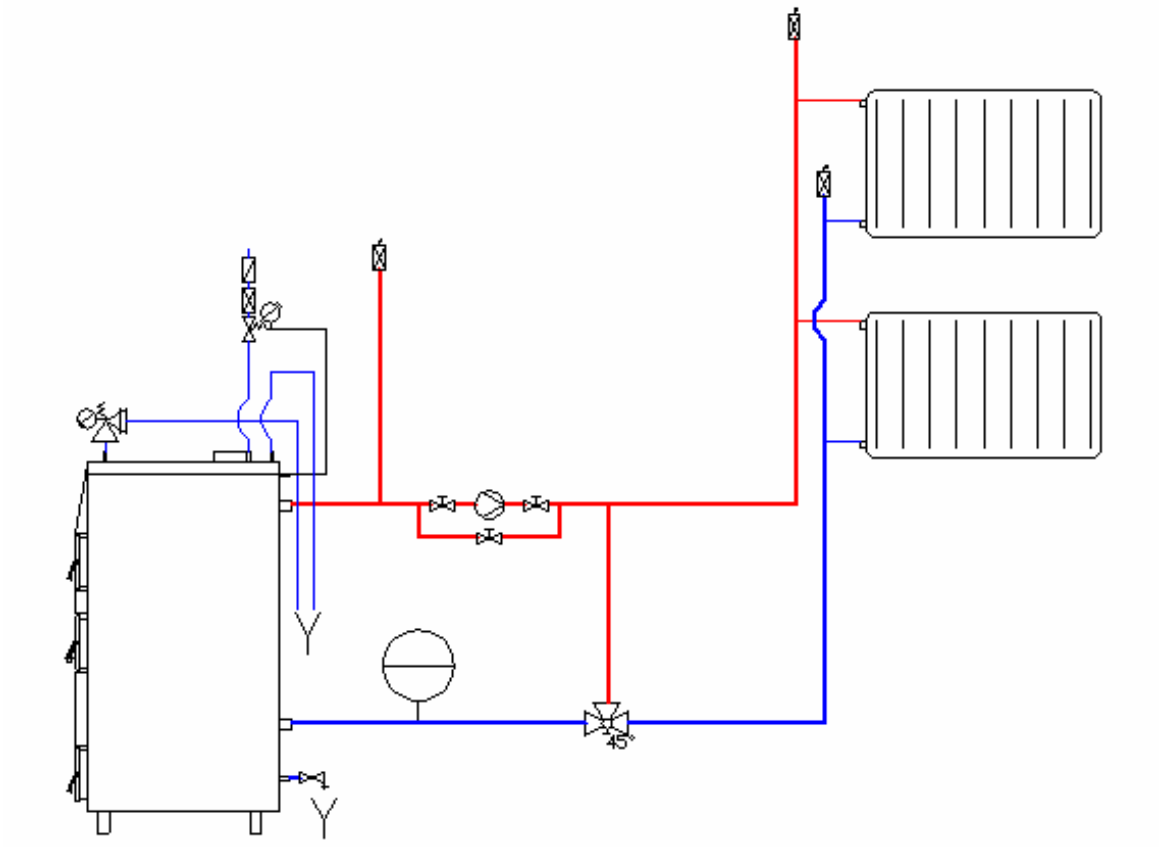
The b bottom of the safety tank must be placed:

In natural circulation systems or with pump on heating water H ≥ 0.3 [m] over the highest point of the system.

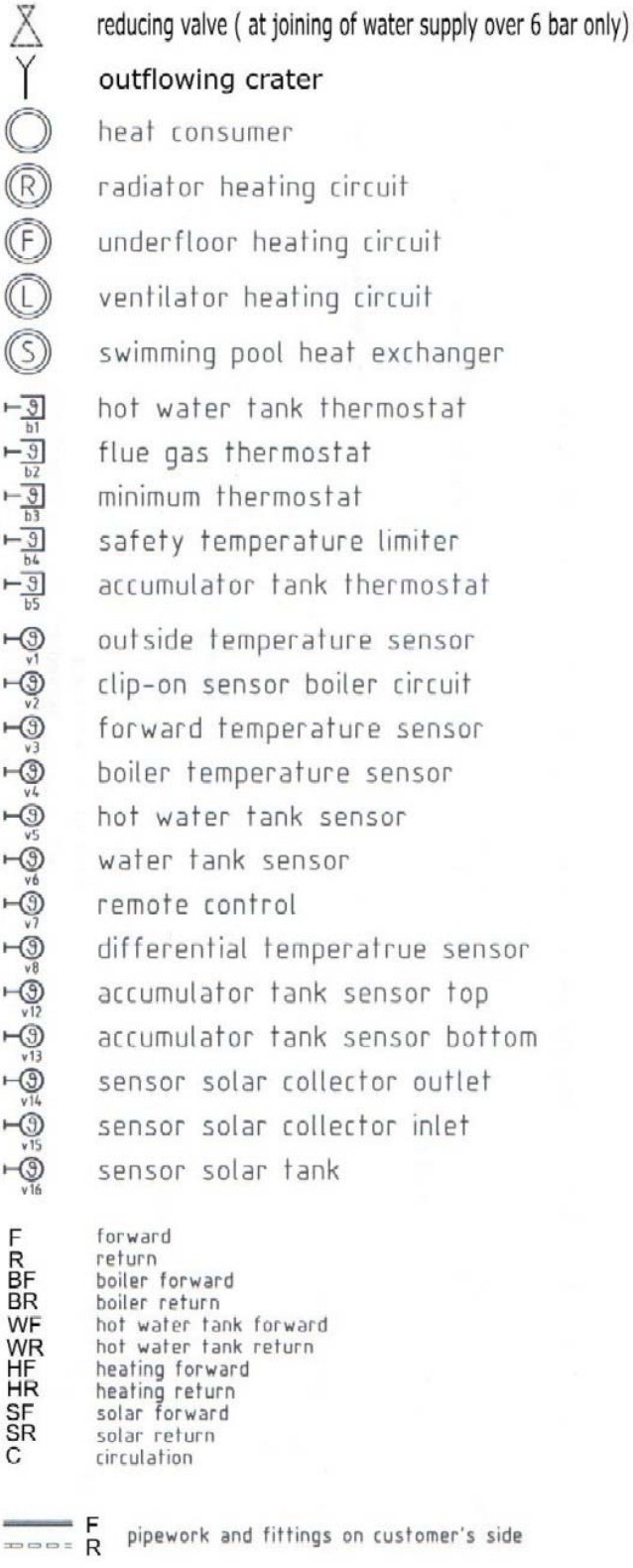
In systems with pump installed on return water: H ≤ 0.7Hp [m]

7.9.2) Closed systems

Warning! – To collect boiler in closed system it is important to build in the boiler cooling loop and then make a right connection:



safety valve
manometer
thermometer
expansion tank
return valve
return valve to shut off
flap trap gravity operated
air vent
manual mixing valve
stop valve
dirt catcher
regulating valve
relief valve
5° thermal valve
drain tap
heating pump
hot water tank loading pump
boiler circuit pump
transfer pump
loading pump
hot water tank loading valve
reversing valve
motor mixing valve
two-way valve
thermostat valve

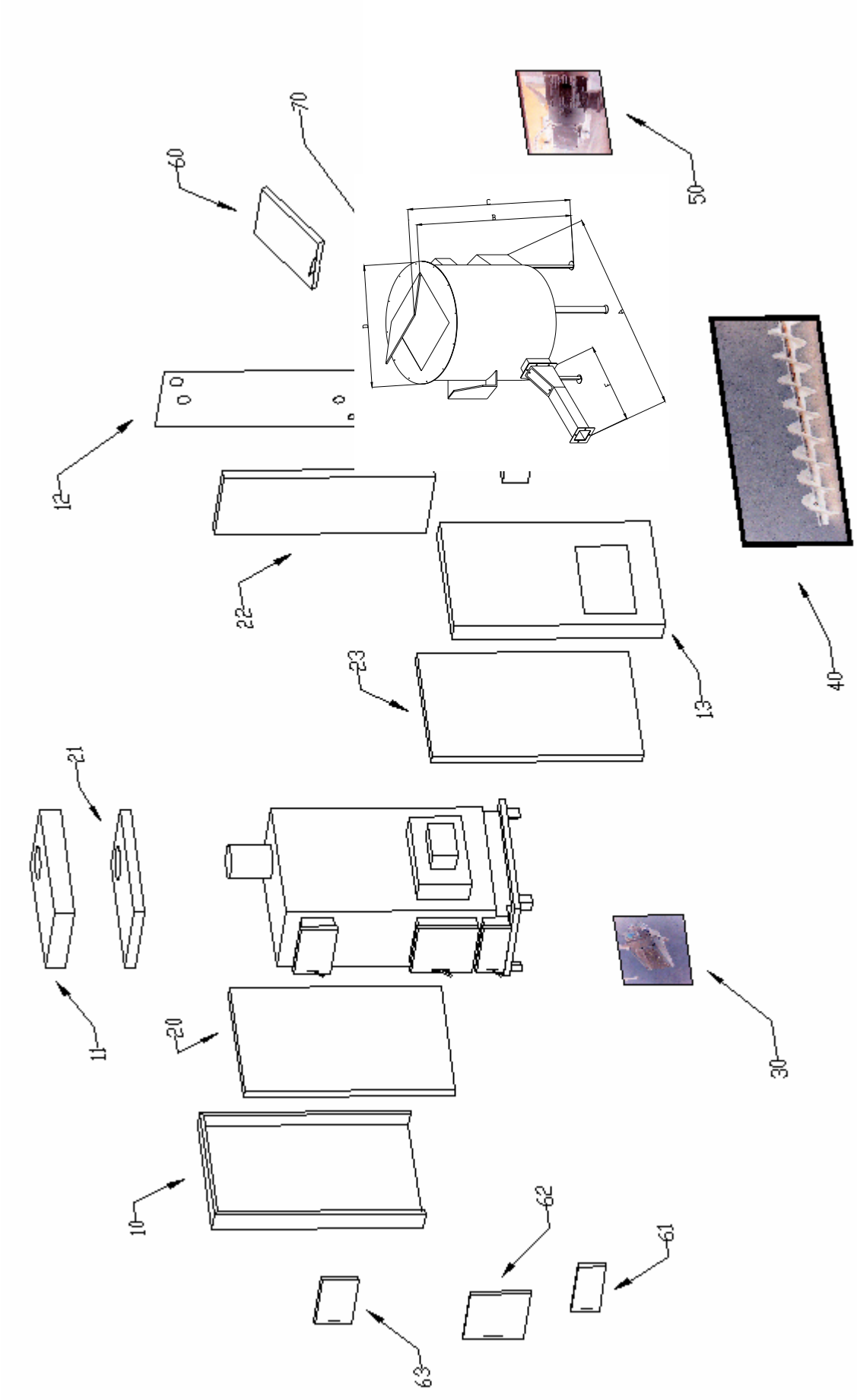


reducing valve (at joining of water supply over 6 bar only)
outflowing crater
heat consumer
radiator heating circuit
underfloor heating circuit
ventilator heating circuit
swimming pool heat exchanger
hot water tank thermostat
flue gas thermostat
minimum thermostat
safety temperature limiter
accumulator tank thermostat
outside temperature sensor
clip-on sensor boiler circuit
forward temperature sensor
boiler temperature sensor
hot water tank sensor
water tank sensor
remote control
differential temperatrue sensor
accumulator tank sensor top
accumulator tank sensor bottom
sensor solar collector outlet
sensor solar collector inlet
sensor solar tank

F	forward
R	return
BF	boiler forward
BR	boiler return
WF	hot water tank forward
WR	hot water tank return
HF	heating forward
HR	heating return
SF	solar forward
SR	solar return
C	circulation

F
R
pipework and fittings on customer's side

8. Parts



No.	*Description of the symbol*	*Symbol – code*
10	Left side insulation	BIO.10.L
11	Upper insulation	BIO.11.L
12	Back side insulation	BIO.12.L
13	Right side insulation	BIO.13.L
20	Left side mineral wool	BIO.20.L
21	Upper mineral wool	BIO.21.L
22	Back mineral wool	BIO.22.L
23	Right side mineral wool	BIO.23.P
30	Burner	BIO.30
40	Grill	BIO.40
50	Engine	BIO.50
60	Tank doors	BIO.60
61	Ash doors	BIO.61
62	Main doors	BIO.62
63	Upper doors	BIO.63
70	Tank	BIO.70
80	Controler	F.P.15.D.Ś.