



# Ladan

Wood gasification boiler

Instruction for use, installation and assembly  
of boiler.

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## General description:

We are introducing you the ecological wood gasification boiler of the output 18, 25, and 40kW. The hot-water boiler is designed for heating of apartment, family house, guest house, smaller industrial workshop and similar object. The boiler is designed for burning of wood only. Any dry wood can be used for burning, mainly logs till 550 mm length. Also wood of higher humidity can be used but then the nominal output is reduced and burning time prolonged. Due to its large feed hopper you can avoid the most demanding operation of preparation and cutting the wood into smaller pieces. It is recommended to feed fire with logs of approx. diameter 10-15 cm.

The ashes is only 1-2 % from amount of used wood (cleaning approx. once a week maximum) In consideration of very low level harmful pollutants production the operation of wood gasification boiler is very ecological.

Wood gasification boilers are well-tested and easy to use. The boiler is produced from the special boiler sheet steel of thickness 6 mm inner part and 4mm outer part. Fireproof shaped pieces inside the boiler are made from a special heatproof material, so the pieces are highly heat resistant, high strength and provide long service life. The body of the boiler is made as weldment of steel plates. It includes a feed hopper with a heatproof shaped piece that has an oblong opening (nozzle) for transit of flue gas. Under the nozzle there is a combustion space formed with the ceramic shaped pieces. In the rear part of the boiler there are vertical flue tubes which in the upper part go to the collecting channel with a make fire flap. Rear part of the collecting channel is fitted with an education pipe for connecting to the chimney. In the front of boiler is situated a fan with regulation flap for air inlet. The boiler body is insulated by mineral wool Nobasil of thickness 20mm which is located between the body and jacketing.

Primary and secondary air is preheated and in optimal ratio distributed into the combustion chamber and nozzle.

Wood gasification boilers are completely different from the current solid fuel boilers. The principle of burning is based on the gasification at high temperature (approx. 1100 °C).

Burning of wood-gas is supported by a fan which blows primary air into the combustion chamber and secondary air into the nozzle. This combustion system is very economical whereas saving approx. 40% of fuel. Boiler operation requires the minimum attendance due to the automatic operation of boiler. Loading chamber content is sufficient for about 8 to 12 hours operation at medium power. At minimum output level the boiler is operational even up to 24 hours. Set up mode is secured by the digital microprocessor control.

## Technical parameters:

<i>Type of boiler</i>	<i>LADAN</i>	<i>18</i>	<i>25</i>	<i>40</i>
<i>Boiler output</i>	<i>kW</i>	18	25	40
<i>Feed hopper capacity</i>	<i>dm<sup>3</sup></i>	75	113	180
<i>Door dimension /h-w/</i>	<i>mm</i>	270x450	270x450	270x450
<i>Prescribed chimney draught</i>	<i>Pa</i>	10	23	23
<i>Test overpressure</i>	<i>bar</i>	4	4	4
<i>Max. working overpressure</i>	<i>bar</i>	2	2	2
<i>Boiler weight</i>	<i>kg</i>	360	430	465
<i>Diameter of flue connection</i>	<i>mm</i>	160	160	160
<i>Boiler height</i>	<i>mm</i>	1125	1125	1370
<i>Boiler width</i>	<i>mm</i>	595	595	595
<i>Boiler depth</i>	<i>mm</i>	900	1100	1100
<i>Shielding of electric parts</i>	<i>IP</i>	21	21	21
<i>Electrical input</i>	<i>W</i>	70	70	70
<i>Hydraulic loss of boiler at 10k</i>	<i>mbar</i>	0,21	0,31	0,54
<i>CO emission class</i>		3	3	3
<i>Boiler efficiency</i>	<i>%</i>	90%	90%	90%
<i>Temp. of flue gas in nominal output</i>	<i>°C</i>	223	209	144
<i>Flow of flue gas</i>	<i>kg/s</i>	0,018	0,02	0,035
<i>Maximum noise level</i>	<i>dB</i>	57	57	57
<i>Specified fuel</i>	wood	Water content max. 20%		
<i>Average fuel consumption</i>	<i>kg/h</i>	5,5	7,6	9,5
<i>Recommended fuel size</i>	<i>mm</i>	150	150	150
<i>Max. length of logs</i>	<i>mm</i>	350	550	550
<i>Burning time in nominal output</i>	<i>hod.</i>	5,5	4,2	4,3
<i>Water volume in boiler</i>	<i>l</i>	55	75	93
<i>Voltage</i>	<i>V/Hz</i>	230/50	230/50	230/50
<i>Range of temperature of heating</i>	<i>°C</i>	60 - 90	60 - 90	60 - 90
<i>Range of tempering temperature</i>	<i>°C</i>	40 - 90	40 - 90	40 - 90
<i>Min. water temperature in service</i>	<i>°C</i>	60	60	60
<i>Operation temperature of water</i>	<i>°C</i>	80 - 90	80 - 90	80 - 90

<i>Safety valvel Regulus</i>		
- <i>temperature of inlet water</i>	<i>°C</i>	<i>Max. 15</i>
- <i>pressure of inlet water</i>	<i>Bar</i>	<i>2</i>
- <i>opening temperature</i>	<i>°C</i>	<i>100</i>

# Safety valve Regulus DBV1:

This valve serves to protect the boiler against overheating in case of power failure. In the compulsory circulation the circulatory pump is shut and thereby halting the flow of water in central heating system.

Operational principle:

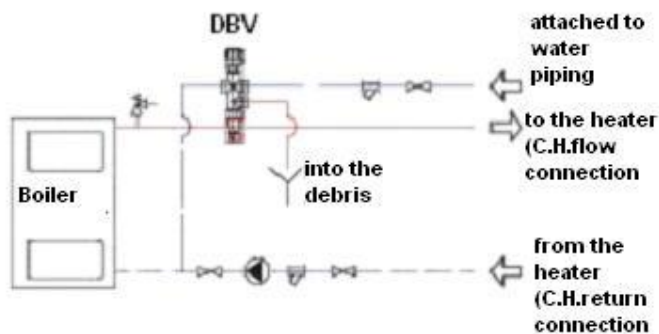
Safety valve is controlled by the outlet water temperature from the boiler. If the outlet water temperature reaches 100°, the valve opens. Incoming tap water cools down the boiler temperature and thus prevent overheating and possible damage of the boiler.

Warning:

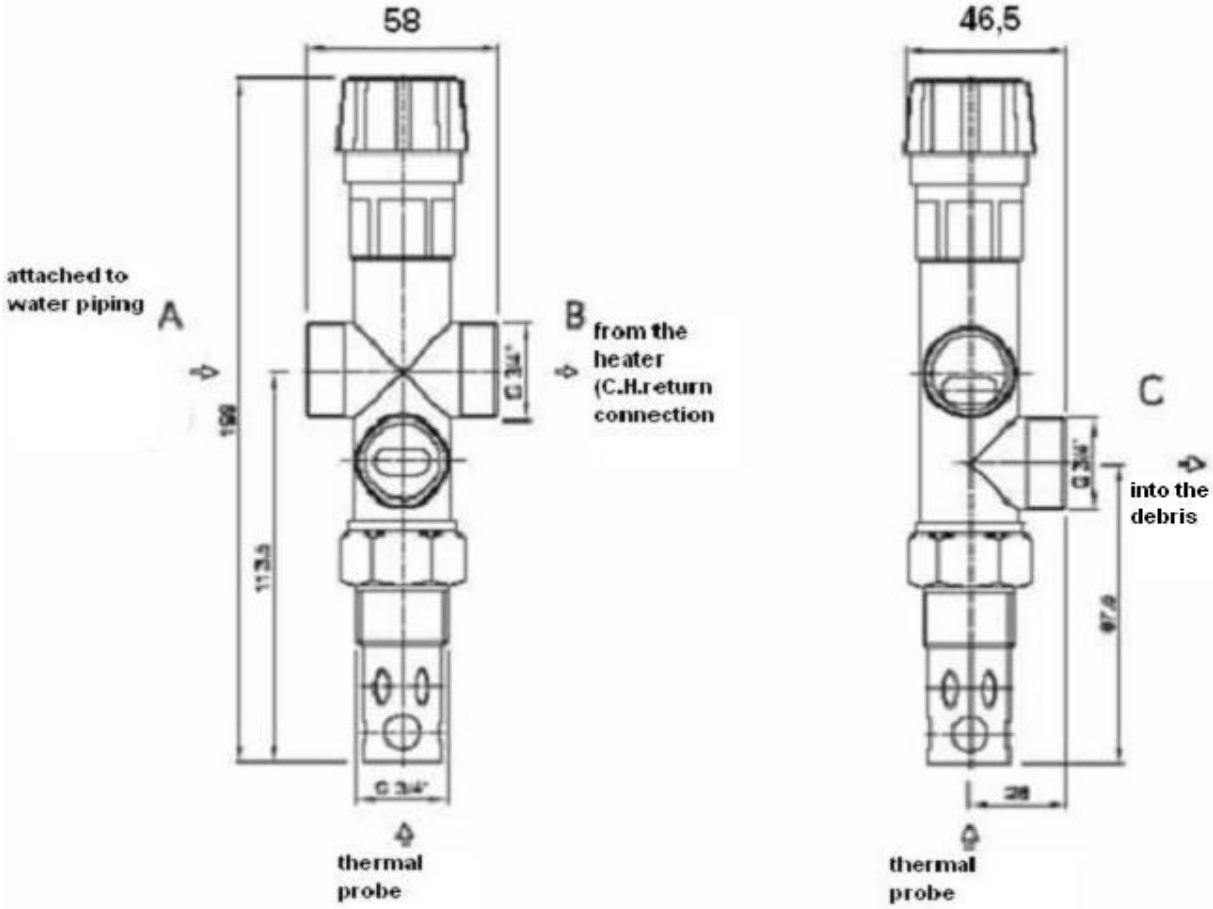
Boiler without a safety valve Regulus DBV1 is necessary to integrate in an open system with an expansion tank. The temperature of water used for the safety valve connection must be max. 15°C with overpressure max. 6 bar.

! The safety valve is not part of the boiler.

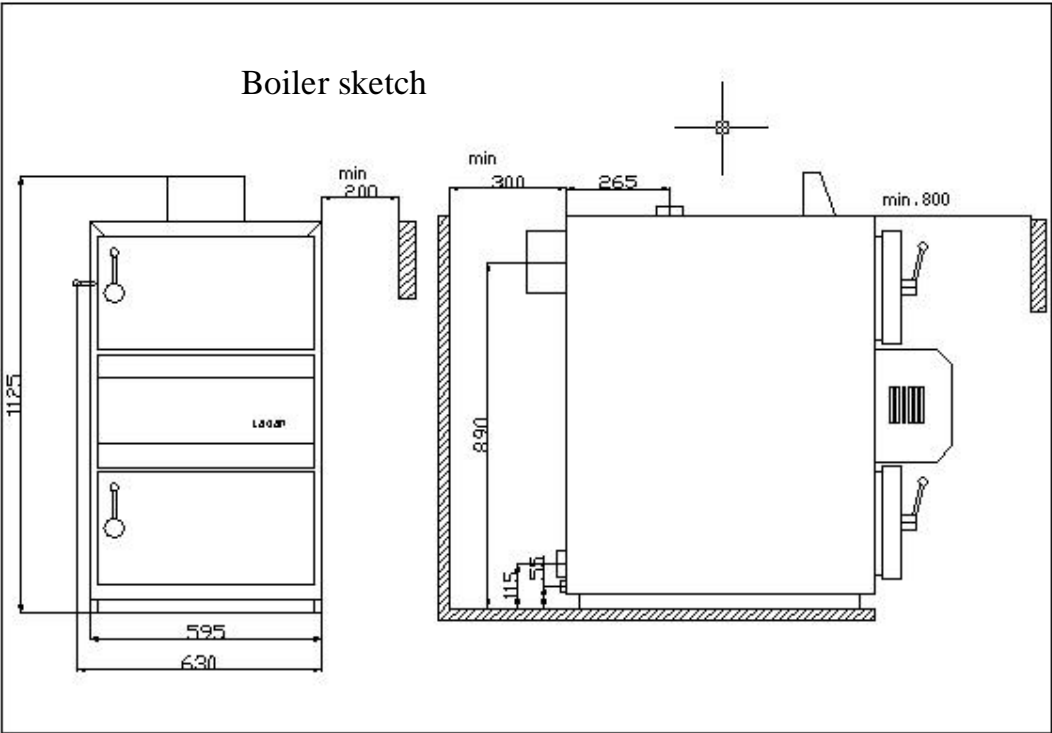
Scheme of safety valve DBV1 connection:



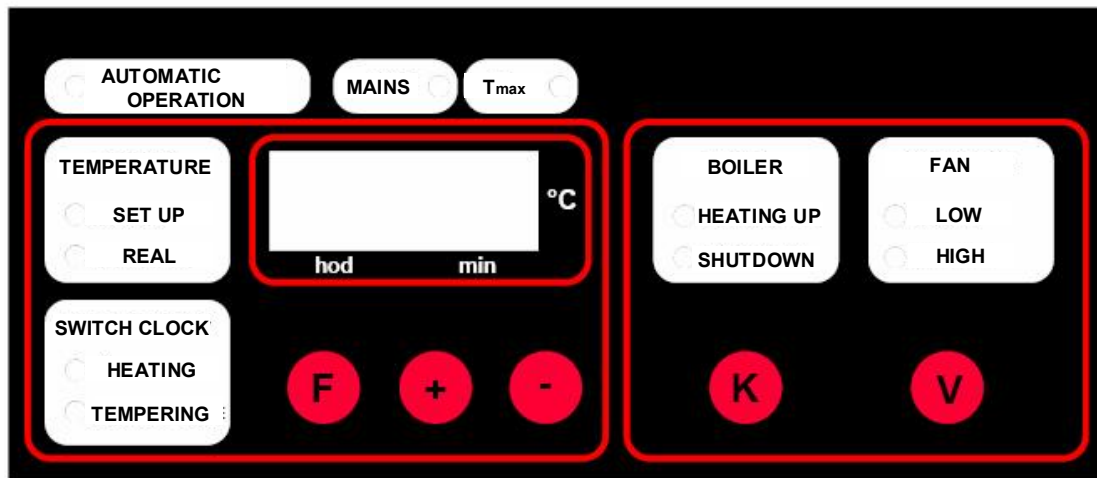
Scheme of valve:



Dimensions scheme:



## Description of electronic regulator:



### Burning up mode

The burning process can start by pressing button šKõ.

On the regulation panel the control lights are on (6), (11), (14), (15).

Control lights (11) and (14) are shining until control light (17) is turned on what means automatic operation. Control light (17) turns on, if the temperature of output water reaches 3°C less than set up temperature. If we set up temperature 70°C, control light turns on at 67°C.

After control light (17) turns on it can occur:

- a) switchover of fan to the low speed cycle, which shows control light (13).

The fan stays on the low speed cycle till the water output temperature is the same as set up temperature. In case that fan at low speed cycle cannot heat up the boiler to the requested temperature and temperature is decreasing, fan automatically switch over to high speed cycle.

In case the fan at low speed cycle heats up the boiler to the requested temperature then after reaching the temperature fan is automatically turned off.

On the panel there are shining control lights (6), (8), (15), (17). Fan is turned on again by decreasing the temperature by 5°C of temperature. This switching mode is repeated as necessary. ( So called **AUTOMATIC OPERATION**).

- b) boiler shutdown by switch clock to the tempering mode, see next chapter  
õSwitch clockõ.

#### Boiler shutdown

The boiler is shutdown by pressing the button õKõ, or when the output water temperature decrease under 30°C. Into the SHUTDOWN mode or AUTOMATIC OPERATION mode is possible by pressing the button õKõ once again.

#### Setting of the boiler parameters

Setting of the boiler parameters is possible with these buttons:

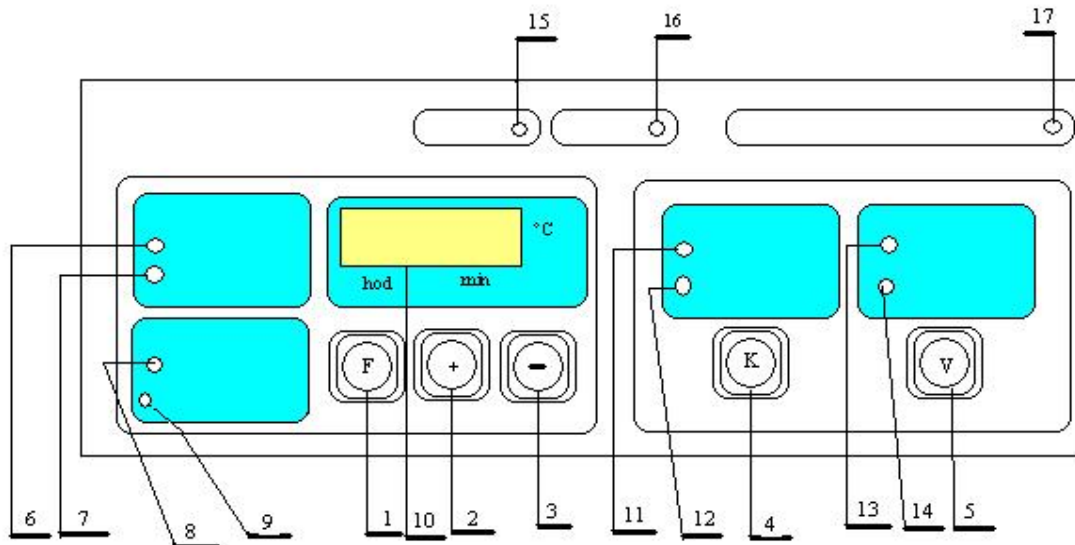
õFõ- Function selection

õ+õ- increase of chosen value

õ- õ- decrease of chosen value

## Actual temperature of output water

At basic state is indicated **Real temperature** of output water and display shows temperature value in °C . Each time when you press button ðKð you will jump in to the basic state.



## TEMPERING

1. Function selection button
2. Button for chosen value increase
3. Button for chosen value decrease
4. ON/OFF button of boiler
5. Fan control button
6. Control Light ó display shows the actual water temperature
7. Control Light ó display shows the requested (set up) water temperature
8. Control Light ó switch clock in heating mode
9. Control Light ó switch clock in tempering mode
10. Display
11. Control Light ó starting-up the boiler
12. Control Light ó boiler in shutdown mode
13. Control Light ó indicates the slow running fan
14. Control Light ó indicates the fast running fan

15. Control Light ó indicates the voltage
16. Control Light ó indigation of the maximum temperature exceeding
17. Control Light ó boiler in the automatic operation mode

Output water temperature setting up.

After first pushing the button  $\bar{0} F \bar{0}$  select indication REQUIRED TEMPERATURE of heating  $\bar{0} TH \bar{0}$  (Temperature High) and with buttons  $\bar{0} + \bar{0}$  and  $\bar{0} \acute{0} \bar{0}$  set up the desired temperature in the range from 60 to 90 °C.

After second pushing the button  $\bar{0} F \bar{0}$  select indication REQUIRED TEMPERATURE of tempering  $\bar{0} TL \bar{0}$  (Temperature Low) and with buttons  $\bar{0} + \bar{0}$  and  $\bar{0} \acute{0} \bar{0}$  set up desired temperature in range from 40 to 90 °C.

Setting up the boiler output

Boiler output depends on:

- calorific value of wood (15 000 ó 18 000 kJ/ kg)
- dampness of wood is recommended up to 20%
- gasification surface of wood
- quantity of air input

Quantity of air input can be changed by pressing button  $\bar{0} F \bar{0}$  . From indication  $\bar{0}$ Required temperature $\bar{0}$  we will get in to the option  $\bar{0}$ OUTPUT SET UP $\bar{0}$  PH a PL

PH= high speed cycle of fan in range 10-100

PL= low speed cycle of fan in range 0 - minus 10 from PH

Fan revolutions can be changed with  $\bar{0} + \bar{0}$  and  $\bar{0} - \bar{0}$  buttons. It is recommended to setup revolutions of fan to the values PH=60 and PL= 0-10.

Switch clock

Switch clock is used for setting up the time interval for tempering.

Generally it is possible to set up six consecutive periods of time in course of 24 hours. By pressing button  $\bar{0} F \bar{0}$  from indication OUTPUT SET UP we get into the option of first period interval. The display shows notice SH1 and indicator TEMPERING light up. After one second diplay shows the time indication when the tempering starts. The time indication can be changed by  $\bar{0} + \bar{0}$  and  $\bar{0} \acute{0} \bar{0}$  buttons. By pressing the button  $\bar{0} F \bar{0}$  SH1 is displayed and HEATING light up. After one second it is possible to set up the heating time. The time must be set up in time sequence. Boiler automatics does not allow you to set up an incorrect time interval. After repeated pressing the button  $\bar{0} F \bar{0}$  displays notice SH2 and it is possible to set up the second time interval. In this way it is possible to set up all six time intervals. Time intervals which have the same time indication at TEMPERING and HEATING are ignored. At the end with presing  $\bar{0} F \bar{0}$  button the actual time is to be set up. After one second it is possible to set up the actual time. All settings must be confirmed by  $\bar{0} K \bar{0}$  button.

Heating up of the boiler : during heating up the maximum fan revolutions are set up to the value which was already set up by attendance in PH mode, so between 10-100. This set up of revolutions will last till the boiler reaches the temperature selected in TL or TH level. Indicator light of automatic operation lights up at mode TH or TL minus 3°C . Boiler starts to work according to the set up mode depending what is set up in the actual time / SH1 up to SH6/. After reaching temperature TH or TL level the fan turns off. If the temperature decrease by 3°C the fan turns on at minimum revolutions defined in PL. If the temperature increase the revolutions of fan are decreasing proportionally from T minus 10°C up to minimum revs. Subsequently the fan turns off at reaching TH or TL temperature.

### **Pump work:**

Heating: pump turns on at TH minus 10°C  
pump turns off at TH minus 13°C

Tempering: pump turns on at TL minus 3°C  
pump turns off at TL minus 5°C

The pump turns on if:

- temperature of water in the boiler is over 90°C
- control light of failure lights up
- in case of breakdown of temperature sensor

### **Room thermostat:**

Before the connection of thermostat into the digital regulation board it is necessary to remove the short cable which is connected to the room thermostat place. Here we connect a room thermostat. If temperature in the room raises to required value then fan and pump turn off themselves and boiler is automatically switched to the tempering temperature TL. If room thermostat reconnect again the fan and pump turn on and the boiler heat up to the TH or TL temperature.

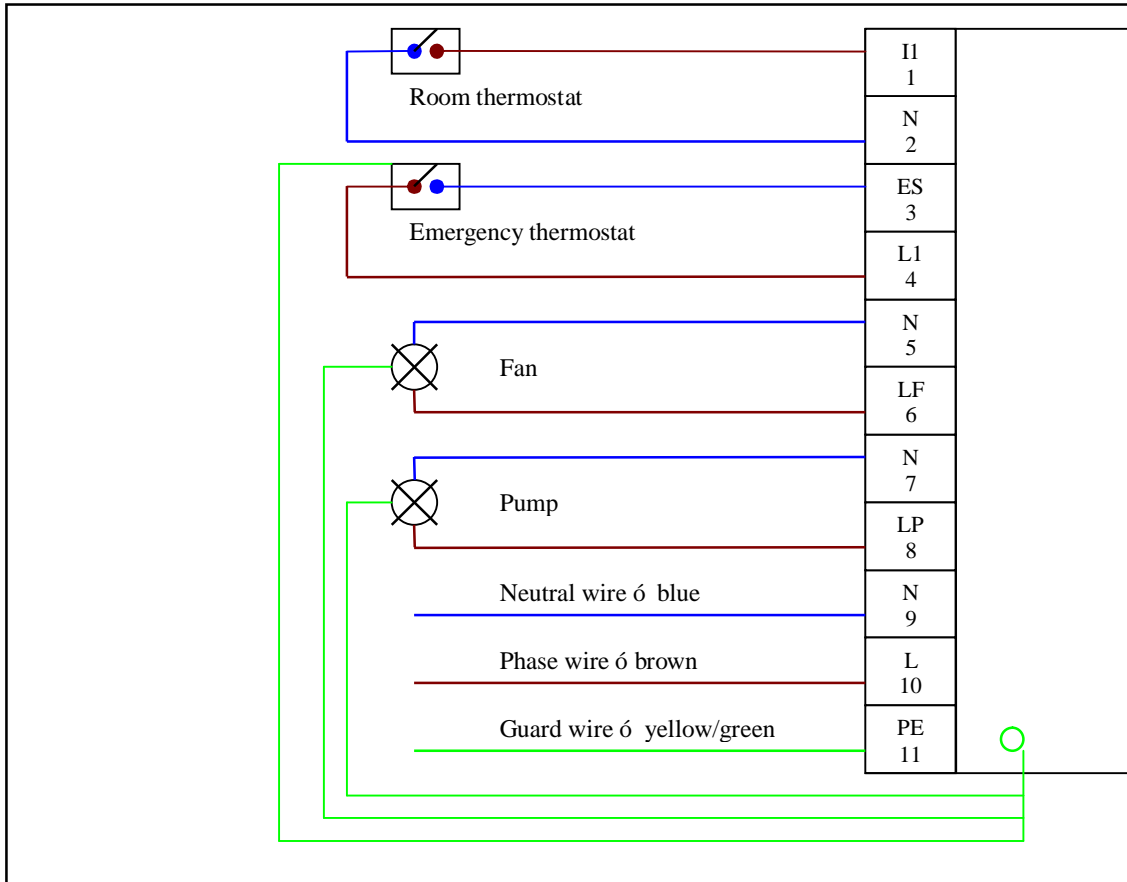
If the room thermostat is off / room is already heated up/, the pump working as follows:

Turn on at TL + 15°C, Turn off at TL + 10°C

### **Other indications**

The boiler is connected into the mains if the MAINS shines on. If the temperature in the boiler exceeds 95°C T max control light shines on and fan turns OFF in emergency. The fan is automatically turned on if the boiler temperature or at emergency thermostat drops below 80°C.

Connector connections:



## Boiler operation:

Before making fire it is necessary:

- familiarize with the attendance of electronic boiler regulation
- check water pressure in the central heating system
- check if the boiler is connected to the mains

Making fire in the boiler

- set the heating temperature
- set the tempering temperature
- select the fan speed
- set program / SH1 ó SH6/
- set actual time
- through the upper door insert paper, chips, small pieces of wood and to the rest of feeding chamber add more logs
- chimney flap must be opened!
- fire up the paper and close feeding door
- open the lower door and let the fuel approximately 20 min. flare
- after 20 min. close the lower door and chimney flap
- push down šKš button to get run the burning mode

Refilling a loading chamber

- stop the fan by pressing šKõ button
- open the chimney flap
- CAREFULLY! open the feeding (upper) doors
- refill the fuel
- close the upper door and chimney flap
- press button šKš to return to the previous state of the boiler

## Warning

Be careful not to get any fuel during the refilling between the chimney flap and the flange. It would make impossible to close flap correctly.

Cleaning the boiler:

When using dry wood and optimum fuel gasification the combustion chamber and heat exchanger get sooted minimally. However, when using wet wood the walls of combustion chamber can be covered with a layer of tar and the boiler does not have an adequate efficiency.

We remove the tar in combustion chamber once a week by burning with ajar feeding door and chimney flap. If there is a lot of ash in the feeding chamber it is necessary to remove it.

The ash and dust in the combustion chamber should be removed regularly every 3-5 days.

Tubes of the heat exchanger should be cleaned once a month. Before cleaning the heat exchanger it is necessary to remove cover of heat exchanger thereby creating access to the tube heat exchanger. The heat exchanger tubes are to be cleaned with a special brush.

### **Cleaning of the air inlet:**

Clean air conduit of primary and secondary air is an essential condition for efficient combustion in the boiler. It is recommended to clean the air conduit minimally once per heating season.

After removing a fan and air inlet cover we can see the two tubes that lead air into the nozzle and to two holes at the upper door. These holes should be cleaned with a small brush and vacuum cleaner. Turn on the fan and check by hand the clearness of air.

Put the cover of air inlet and fan back. Then it is necessary to set up the shutter of the secondary air. We screw the shutter to stop with a screwdriver and then turn counter-clockwise 1-2 turns.

Before the summer season starts, we totally clean the boiler loading chamber, combustion chamber and tubes in the heat exchanger.

### **Maintenance and repair of the boiler:**

During operation of the boiler it is necessary to check the water pressure in the system, door tightness, chimney shutter tightness, heat exchanger cover tightness and the right fan operation. It is recommended to have the boiler checked by a professional service worker once before the beginning of the heating season. Especially to check the correct function of the safety valve, temperature sensor, emergency thermostat and regulation.

### **Door tightness:**

The door is attached to the boiler in three points. Two hinges and one door handle. In case of door leakage it is possible to screw in the door handle but also draw close the hinges. We unscrew and counter the nuts. CAUTION!!! Before manipulation with nuts on the right side the door must be closed and handle screwed in to the backstop.

### **Chimney shutter tightness:**

At cleaning of the heat exchanger it is necessary to clean also seating surface of the shutter and shutter itself.

### **Running the fan:**

Fan cleanness is one of the conditions for reliable operation of boiler. The fan should be checked and serviced.

### **Draught of chimney:**

Flue draught must have the specified value 23 Pa.

- **Small flue draught** shortens the service life of the boiler ó creating tar inside the

boiler, condensation and smoke during the fuel loading.

**Solution:** insert the chimney, put a special extension on the chimney or use a suction fan in chimney.

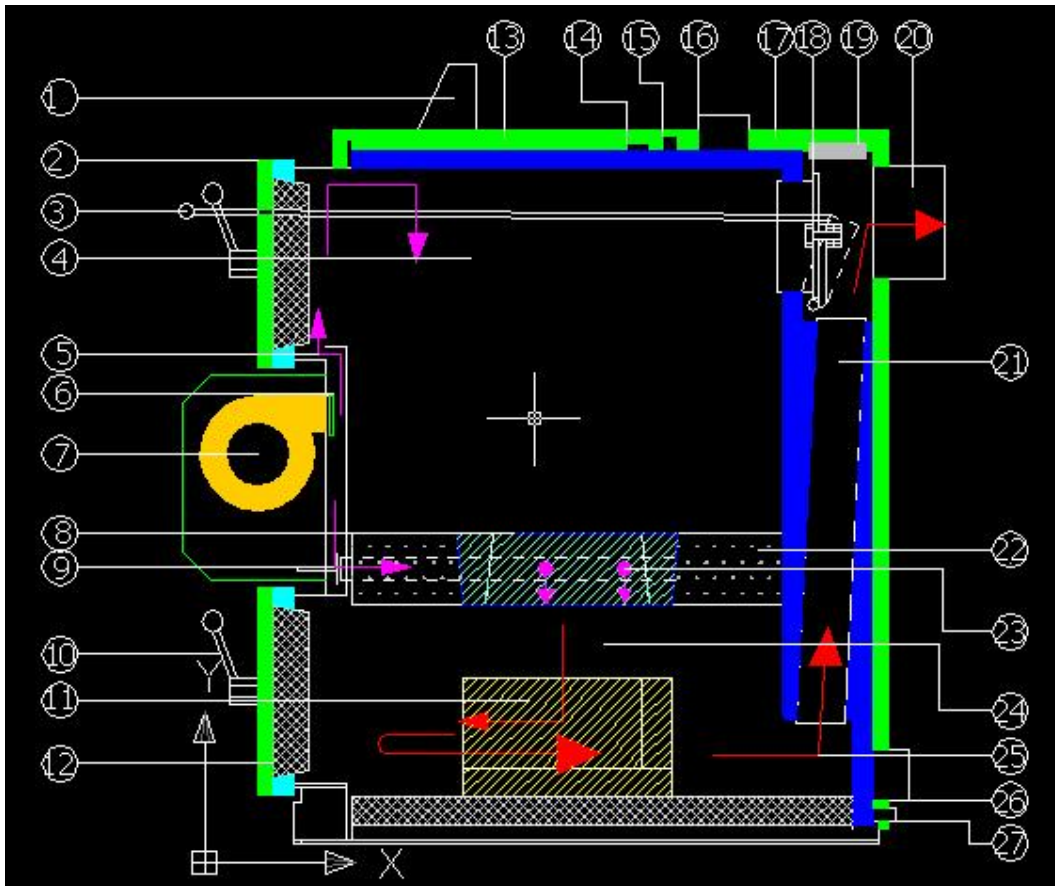
- **Strong flue draught** of chimney increases the consumption of fuel, higher heat loss in the chimney, lower boiler efficiency and lower boiler output.

**Solution:** install a throttle valve between the flue and boiler.

### **Troubleshooting:**

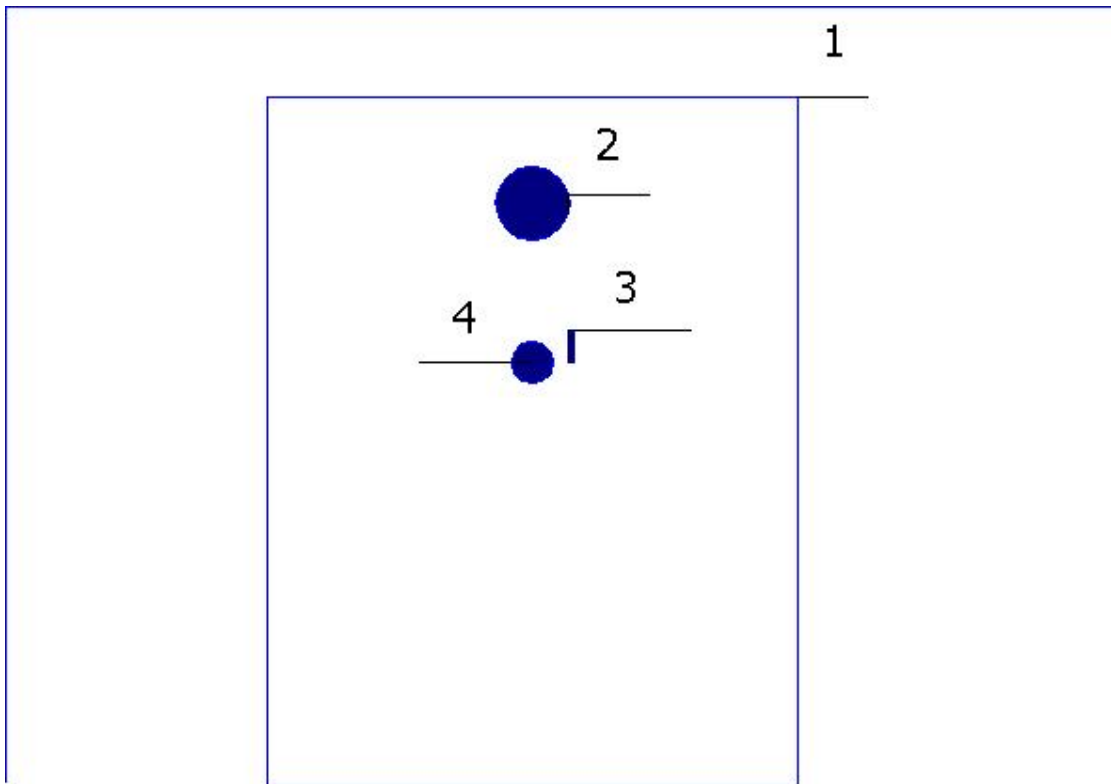
Defect	Cause/Remedy
Boiler has a lower output as it was a new one	<ul style="list-style-type: none"> <li>- Clean up air inlet system</li> <li>- Clean up blades of fan</li> <li>- Use dry wood</li> </ul>
After closing the flue shutter the boiler burns for a while and then smoke	<ul style="list-style-type: none"> <li>- Insufficient quantity of primary air</li> <li>- Clean up the primary air inlet</li> <li>- Check the shutter opening behind the fan</li> </ul>
In combustion chamber are bigger pieces of unburnt logs.	<ul style="list-style-type: none"> <li>- Nozzle opening Increased</li> <li>- Change the nozzle</li> <li>- Set the air inlet into a closed position and turn 3 turns back from the closed position.</li> </ul>
Smoke escape over the closed door.	<ul style="list-style-type: none"> <li>- set up the door, check the tightness of the door</li> <li>- Change the sealing cord of the door</li> </ul>
Flue shutter does not open.	<ul style="list-style-type: none"> <li>- Flue shutter is stucked with tar</li> <li>- Increase the boiler temperature</li> <li>- Use the dry wood</li> <li>- Open flue shutter manually</li> </ul>
After opening the upper door and chimney shutter the boiler room is full of smoke	<ul style="list-style-type: none"> <li>- Low flue draught</li> <li>- The flue diameter should be bigger than the diameter of boiler flue connection. It is recommended 200mm.</li> <li>- Chimney height should be minimum 8m</li> <li>- Assembly suction fan</li> <li>- Increase the chimney height</li> </ul>
Boiler does not seal	<ul style="list-style-type: none"> <li>- Contact service worker or dealer</li> </ul>
Failure of electronic regulation	<ul style="list-style-type: none"> <li>- Contact service worker or dealer</li> </ul>

## Scheme of boiler Ladan 25 kW:



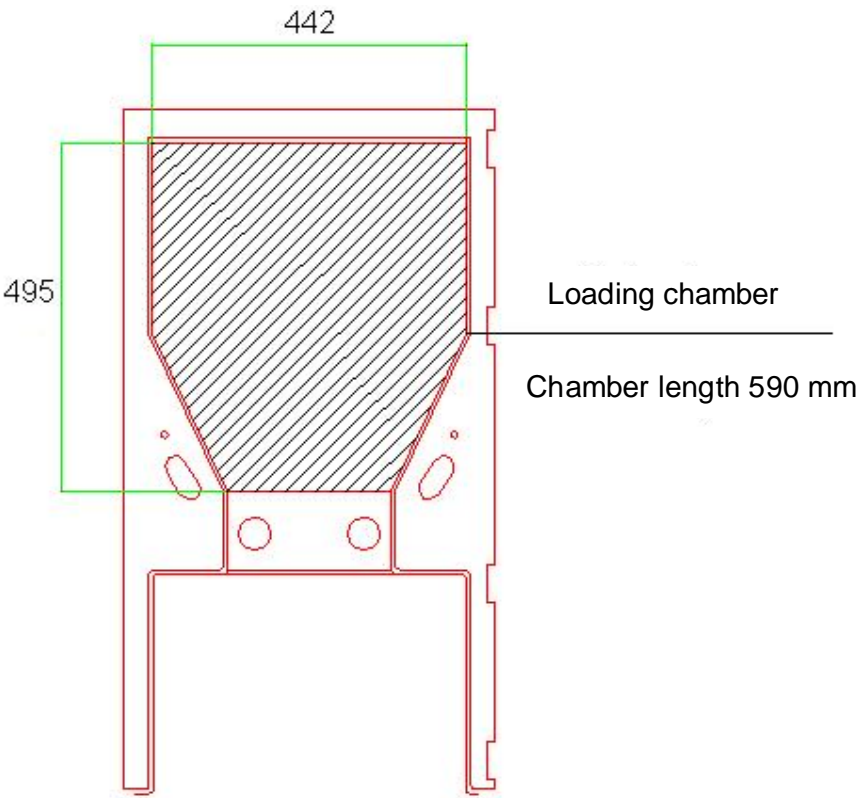
- |                                |   |
|--------------------------------|---|
| 1. Electronic regulation       | 14. Thermometer                           |
| 2. Upper door                  | 15. Thermal fuse / emergency thermostat / |
| 3. Pull rod of chimney shutter | 16. Water output socket                   |
| 4. Loading chamber             | 17. Upper back cover                      |
| 5. Conduit of primary air      | 18. Make a fire flap                      |
| 6. Fan shutter                 | 19. Cover of heat exchanger               |
| 7. Fan                         | 20. Flue branch                           |
| 8. Fireproof nozzle            | 21. Heat exchanger tubes                  |
| 9. Covering of secondary air   | 22. Fireproof concrete                    |
| 10. Door handle                | 23. Secondary air                         |
| 11. Fireclay shaped bricks     | 24. Combustion chamber                    |
| 12. Lower door                 | 25. Direction of flue gas                 |
| 13. Upper front cover          | 26. Return water socket                   |
|                                | 27. Filler hole                           |

Display of thermal sensor and emergency thermostat.



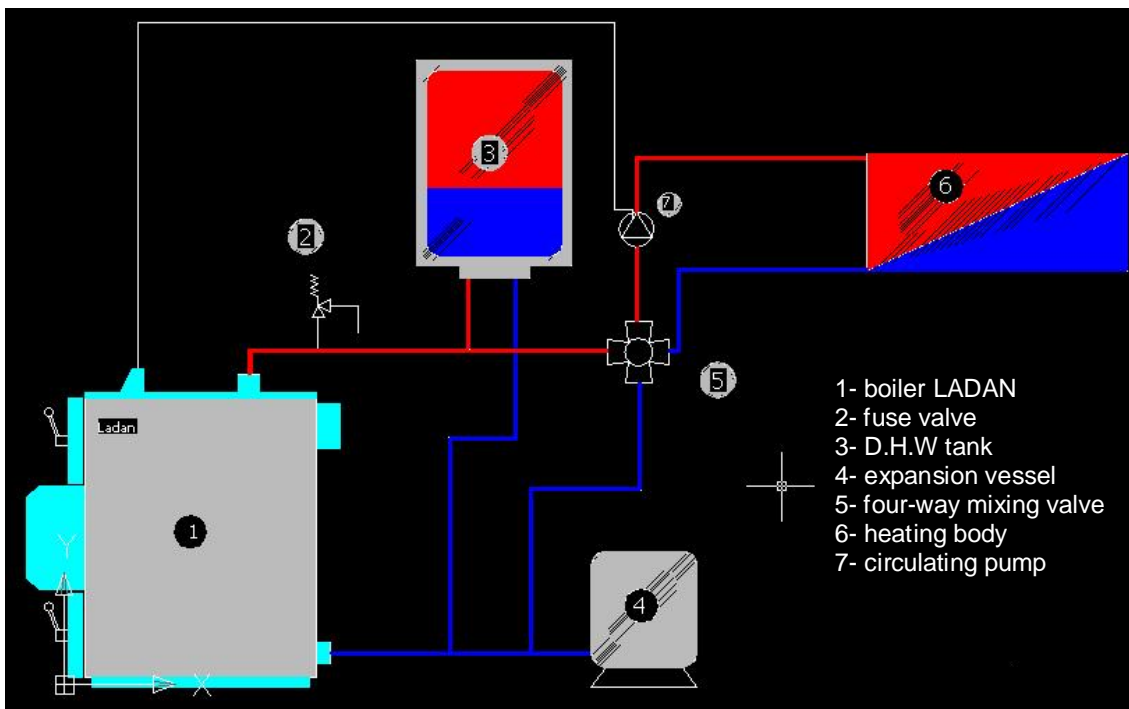
1. Upper metal sheet of the boiler
2. Socket of outlet water
3. Temperature sensor
4. Emergency thermostat /in case the temperature is higher than 110 °C the fan turns off /

Scheme of loading chamber:



## Assembly instructions:

Basic connection scheme of boiler Ladan into the central heating system



The boiler should be connected into the central heating system of which the capacity is appropriate to the boiler output.

The boiler must be connected to the flue by the shortest way. Other appliances must not be attached to the same flue. It is not recommended a permanent connection with water supply through the filling up valve so that in case of valve untightness the pressure might increase. Max. overpressure is 0,2 MPa.

Boiler room must have a good ventilation.

Assembly of boiler can be done by specialists in compliance with the valid local standards.

Minimum return water temperature at the inlet to the boiler is 60 °C.

It is recommended the boiler is fitted together with the accumulation tank which must correspond to the standard EN 303-5.

The boiler must be installed together with four-way valve /duomix/. The valve secures that return water temperature is not less than 60° and protect the boiler against the low temperature corrosion.

## **Installation rules:**

Place a boiler on the fireproof thermally isolated floor overhung boiler floor plan at least 500mm on the each side.

It is necessary to keep at least minimum specified safety distances of external boiler outlines and exhaust pipe from any combustible and medium combustible material in distance min. 800 mm.

Examles of combustibility:

Combustibility grade B: very hardly combustible materials / plasterboard .../

Combustibility grade C1: hardly combustible materials / lignit boards, sawdust boards .../

Combustibility grade C2: medium combustible materials / wood - oak, alder, larch, spruce, fiberboards .../

Combustibility grade C3: easily combustible materials/ wood- beech, ashen, poplar, fiberboards, cork, foils, polystyrene, polyethylene, asphald board, celulose materials .../

The boiler is necessary to install in accordance with standards valid in the country of installation.

## **Safety instructions:**

On the boiler and to his safety distance it is prohibited to put any combustible item and materials. Before you start to work with some changes related the boiler enviroments / manipulation with combustible materials, etc. / it is necessary to shutdown the boiler and wait till the boiler burns out. The boiler operation must be according his parameters and the boiler can not be overloaded. At the ash removing it is necessary to use safety tools /gloves., etc./ to take away and store the ash in the fireproof tanks.

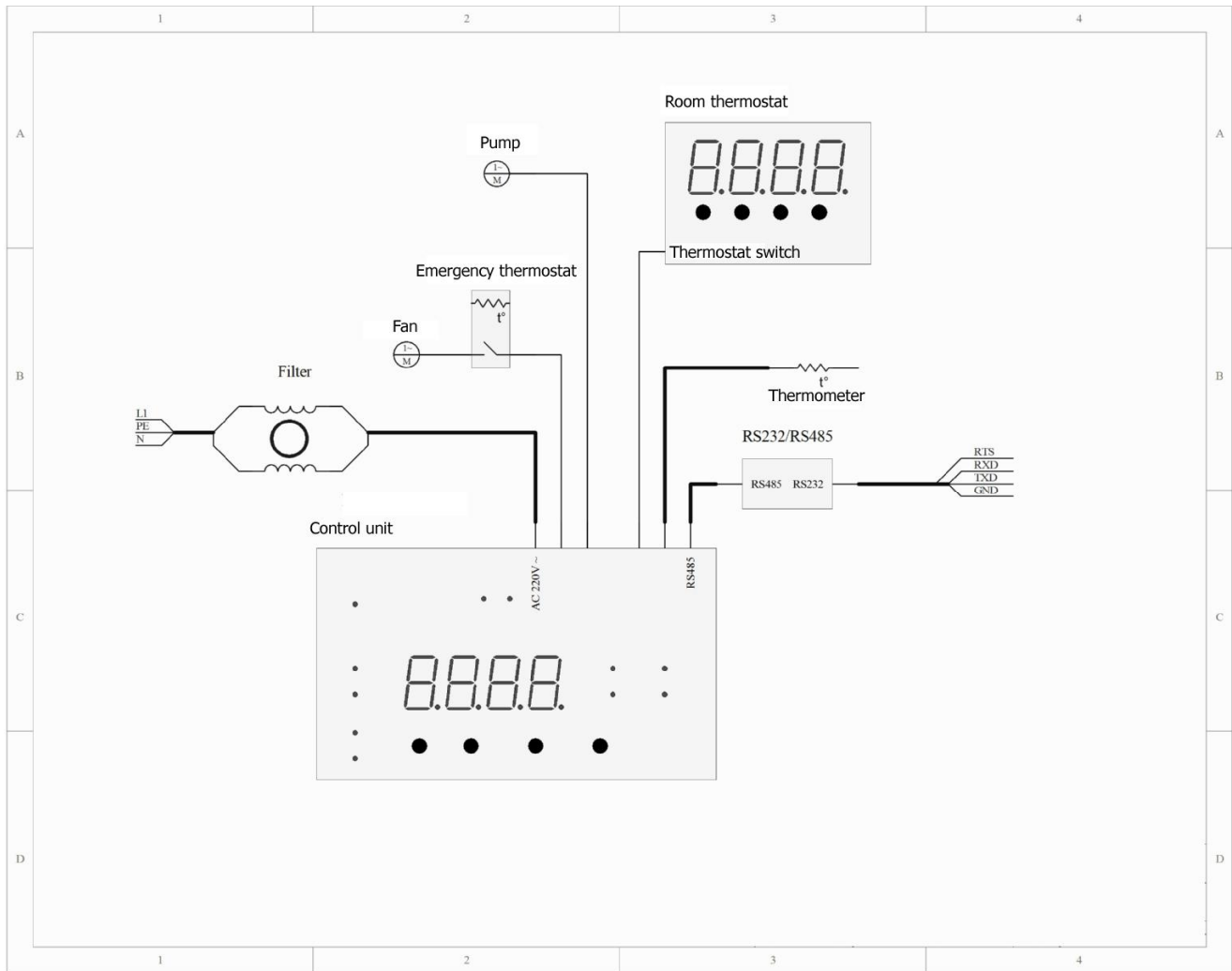
## **Attendance instructions:**

The boiler can be operated only by person who is older than 15 years old, mentally and healthy capable and familiarized with the Manual for operation. During boiler operation it is necessary to check impeccabile boiler state.

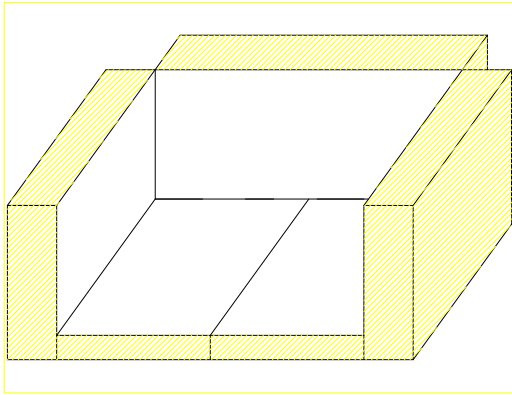
## Instructions for liquidation of the product after its lifetime:

The product should be liquidated by selling to a scrap-material dealer. The wrapping should be liquidated in the same way.

## Wiring diagram:



## Display of fireclay bricks lay out:



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Bricks are situated in the middle of the combustion chamber / lower door /. The edge of the rear brick must be behind the nozzle hole.

Certificate of warranty.

Type of boiler ..... LADAN

Production number .....

Checked by : .....

Sell-by-date: .....

.....  
Stamp and signature

**Instructions for customers and conditions of guarantee:**

- Producer is not responsible for damage during transportation of the product.
- Warranty period is 24 month from the date of ex-factory.
- Warranty is valid only if the boiler was installed into the heating system by specialized company.

- Warranty is valid only if body of the boiler was connected into the system together with four-way valve / duomix/ or other mixing valve.
- Producer is not responsible for incorrect boiler operation due to incorrect boiler connection into the system.

### **Guarantee:**

Guarantee does not include:

- consumable material like door seal, heat exchanger seal, fan seal, fireproof nozzle, fireproof brickwork and bricks.
- faults caused by the customer
- faults caused by an incorrect operation and maintenance, if boiler was used for other purpose than defined or unprofessional care.