



# Pellet burner PV 180a

User manual

## Table of content

|                                   |    |
|-----------------------------------|----|
| Table of content.....             | 2  |
| Description.....                  | 5  |
| Fuel.....                         | 7  |
| Installation.....                 | 7  |
| Boiler requirements.....          | 8  |
| Pellet container.....             | 11 |
| Burner.....                       | 12 |
| External auger.....               | 20 |
| Electrical connections.....       | 21 |
| Operation.....                    | 23 |
| Starting.....                     | 23 |
| Log.....                          | 24 |
| Settings.....                     | 25 |
| Refilling fuel.....               | 27 |
| Maintenance.....                  | 27 |
| Working principle.....            | 29 |
| Testing.....                      | 29 |
| Cleaning.....                     | 29 |
| Loading.....                      | 29 |
| Igniting.....                     | 30 |
| Preburn.....                      | 30 |
| Burning.....                      | 30 |
| Auger control.....                | 30 |
| Fuel level detection.....         | 30 |
| Output power levels .....         | 30 |
| Hold flame.....                   | 31 |
| End burn.....                     | 31 |
| End blow.....                     | 31 |
| Controller board description..... | 32 |
| Problems and solutions.....       | 34 |

## **Safety precautions**

Do not start the burner before it is connected to the boiler and the boiler is connected to the chimney.

It is recommended to wear a respirator while handling pellets.

The boiler room where the burner is installed must fulfill all rules and recommendations given by authorities.

All electrical connections must be done by trained professionals.

No flammable materials must be stored near the burner.

## **Warnings**

- Changing the construction of the burner without written permission from the manufacturer is forbidden.
- Use only spare parts provided or approved by the manufacturer in order to avoid any damage to the burner and dangers resulting from it
- Welding is allowed only after disconnecting the burner from electric supply. The circuit board must be removed from the burner.
- Do not open any boiler door while the burner is in operation.

### **The burner complies with following directives and standards**

Directive 2004/108/EC

Directive 2006/95/EC

Directive 2001/95/EC

Directive 2006/42/EC

EN 15270 2008

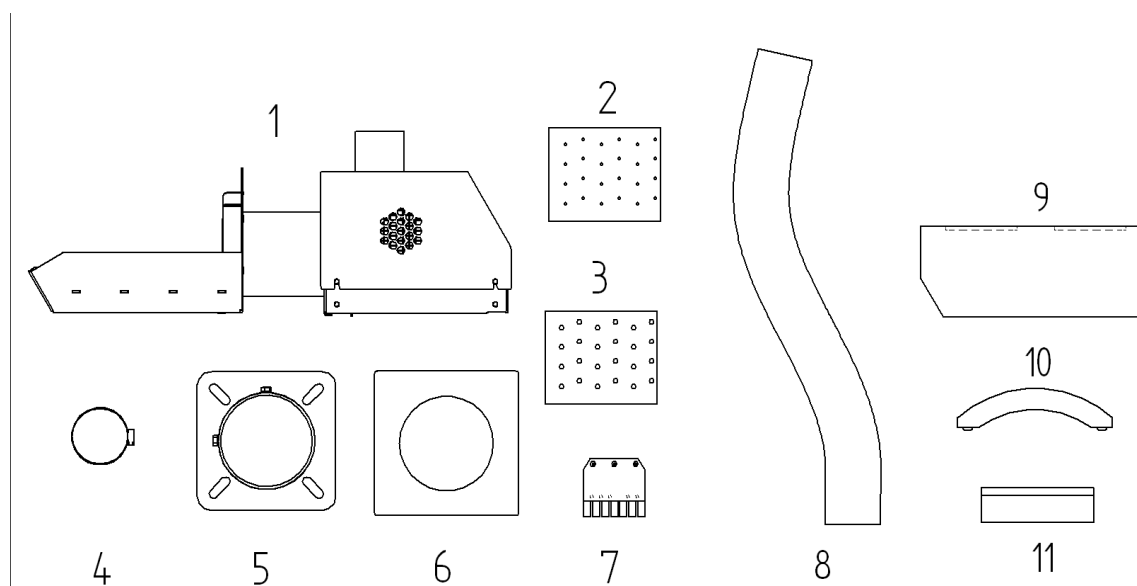
EN 230 2005

EN 60370-2-5 2002

## Package content

The burner is shipped with following components included:

1. **Burner**
2. **Bottom grate (smaller holes)**
3. **Upper grate (bigger holes)**
4. **Brackets for hose (2x)**
5. **Flange**
6. **Ceramic seal**
7. **7-pole boiler connector**
8. **Hose**
9. **Ceramic stones (side) – 2 pieces**
10. **Ceramic stone (cover) – 2 pieces**
11. **Ceramic stone (end)**



## Description

PV 180a is a pellet burner that is intended to be used with 6 or 8mm wooden pellets. You cannot use any other fuel to run this burner.

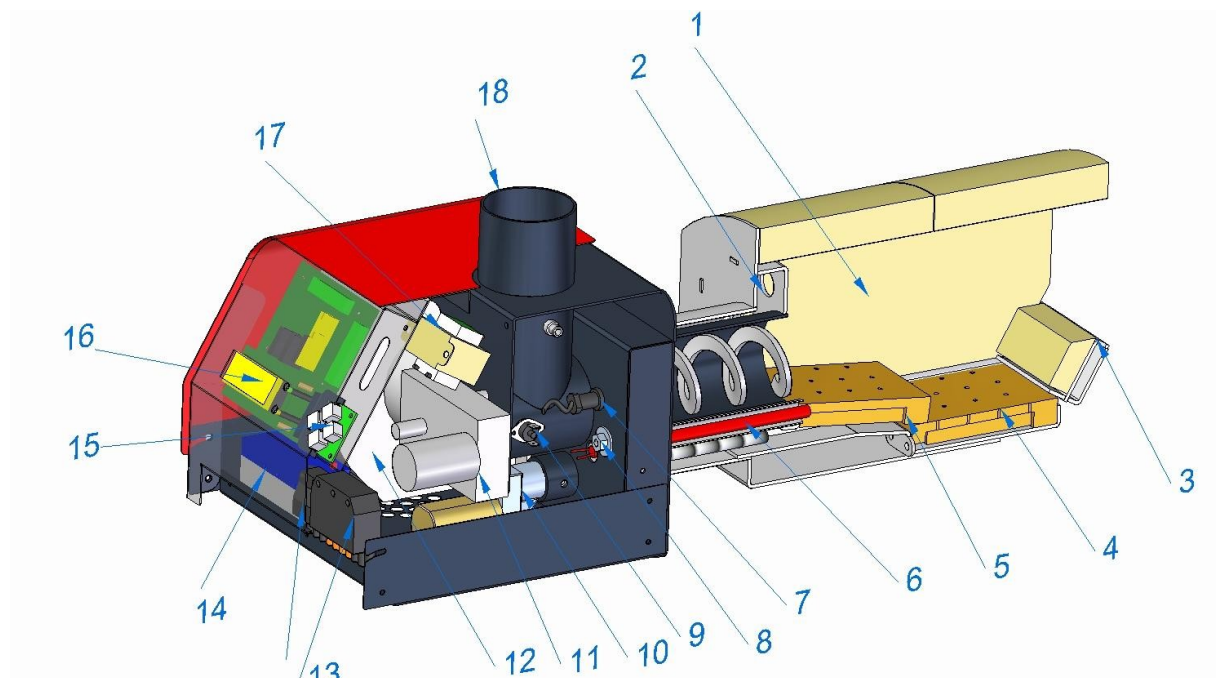
The unique construction of PV 180a allows it to be used with different boilers: liquid fuel, solid fuel and universal boilers. The PV 180a burner is connected to the boiler with a 129 mm flange (similar to oil burners).

The burner is equipped with a safety thermostat, a melting chute, temperature sensor and auxiliary battery for protection against back-burning.

Burner main components are shown on Figure 1

- |                            |                       |
|----------------------------|-----------------------|
| 1. Ceramic burning chamber | 11. Feed screw motor  |
| 2. Secondary air holes     | 12. Fan               |
| 3. Tertiary air holes      | 13. Plugs             |
| 4. Moving grate            | 14. Backup battery    |
| 5. Grate                   | 15. Keyboard          |
| 6. Ignitor                 | 16. Display           |
| 7. Flame sensor            | 17. Mains transformer |
| 8. Burner connecting nut   | 18. Fuel level sensor |
| 9. Safety thermostat       | 19. Fuel inlet        |
| 10. Grate motor            |                       |

Figure 1 Burner main components



## PV 180a

Figure 2 Dimensions

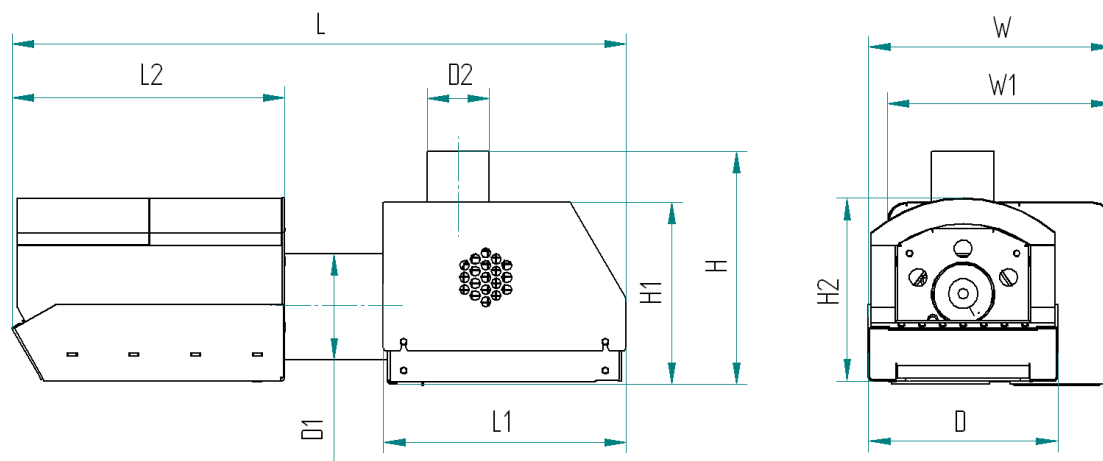


Table 1 Specification

|   | Unit | PV 180a  |
|---|------|----------|
| <b>L</b> total length                     | mm   | 746      |
| <b>L1</b> burner body length              | mm   | 295      |
| <b>L2</b> burning chamber length          | mm   | 331      |
| <b>D</b> burning chamber width            | mm   | 310      |
| <b>ØD1</b> burning chamber neck diameter  | mm   | 129      |
| <b>ØD2</b> internal feeder inlet diameter | mm   | 76       |
| <b>H</b> total height                     | mm   | 283      |
| <b>H1</b> burner housing height           | mm   | 221      |
| <b>H2</b> burning chamber height          | mm   | 241      |
| <b>W</b> total width                      | mm   | 297      |
| <b>W1</b> burner housing width            | mm   | 274      |
| <b>Mass</b>                               | kg   | 44       |
| <b>Supply voltage</b>                     | VAC  | 220-240  |
| <b>Power max</b>                          | W    | 620      |
| <b>Power average</b>                      | W    | 60 - 120 |
| <b>Power at standby</b>                   | W    | 7        |
| <b>Noise</b>                              | dB   | 58       |
| <b>Emission class<sup>1</sup></b>         | -    | 5        |
| <b>Operating temperature</b>              | C°   | 0-60     |
| <b>Nominal heat input</b>                 | kW   | 180      |
| <b>Min heat input</b>                     | kW   | 80       |

1. According to EN 15270

## Fuel

PV 180a uses premium wooden pellets as fuel. Wood pellets are concentrated and homogenized fuel made from sawdust and cutter shavings. Pellets are pressed with high temperature. No extra materials are added, pellets are held together by a natural ingredient found in wood – lignin. Pellets are CO<sub>2</sub>-neutral, renewable fuel. Pellets must be stored in a dry and ventilated room. It is recommended to wear a respirator when handling pellets.

Refilling must be carried out before the storage runs empty. In case it happened, burner has to be restarted and the loading time can be up to 20 minutes that external auger has enough time to refill itself.

Table 2 Pellet properties

|                                    |                               |
|------------------------------------|-------------------------------|
| <b>Raw material</b>                | sawdust and cutter shavings   |
| <b>Calorific value</b>             | 4700-5100 kWh/ton             |
| <b>Volume weight</b>               | ca 650-670 kg/m <sup>3</sup>  |
| <b>Volume of 1 ton</b>             | 1.5-1.6 m <sup>3</sup>        |
| <b>Diameter</b>                    | 6-10 mm                       |
| <b>Length</b>                      | 3-5 x diameter                |
| <b>Water content</b>               | 8-10 %                        |
| <b>Ash content</b>                 | Ca 0.5%                       |
| <b>To replace 1000 l light oil</b> | ca 2 tons or 3 m <sup>3</sup> |

## Installation

You will need the following tools in order to install the burner:

- Spanner no. 13 for fixing the flange of the burner to the boiler
- Spanner no. 10 for connecting the body of the burner with the burning camber and fix the bottom grate holder
- Cross-head screwdriver for fixing the cover of the burner
- 6 mm hex wrench for fixating the boiler to the flange

In order to install the burner, the boiler must correspond to the following requirements:

- The door of the boiler must have a 130 mm opening (placement opening for the oil burner).
- The thickness of the boiler door must be less than 90mm
- The construction of the boiler must make it possible to open the door of the boiler with the burner connected and removing ash from the furnace. If the door of the boiler is too narrow for opening it with the burner, then extra hinges must be installed.

- If there is not sufficient (less than 5Pa) negative pressure in the furnace, a draught fan should be installed for the exhaust gases.
- The boiler room where the burner is installed must fulfill all rules and recommendations given by authorities.
- The boiler must be positioned in a way that there is enough space for cleaning the burner, the boiler and the smoke pipe and removing the ash.

If flue gas temperature at the top of the chimney is less than 80C°, there is a risk of condensation. In this case a pipe should be installed throughout the length of the chimney.

**Note:** It is recommended to use a flue gas analyzer for adjusting the burner. The burner must be adjusted using the flue gas analyzer also when you change the size or the quality of the pellets.

## Boiler requirements

Pellet burners need regular cleaning and therefore boiler construction must allow the door to be opened without removing the burner. The minimum size of opening in boiler depends on the position of door hinges and vice versa. Figure 3 below illustrates the situation. Point C is critical.

In order to keep door width minimum and boiler opening small, a double hinge solution can be used. As double hinges add another degree of freedom, door must be fastened on both sides. Slide-out doors with guide rails is also an option.

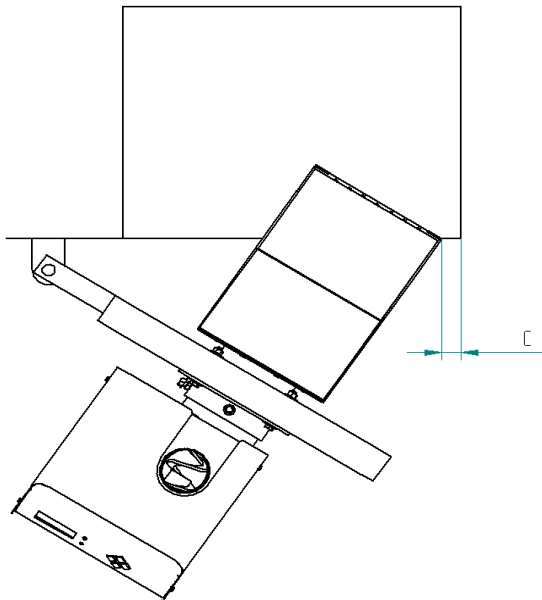
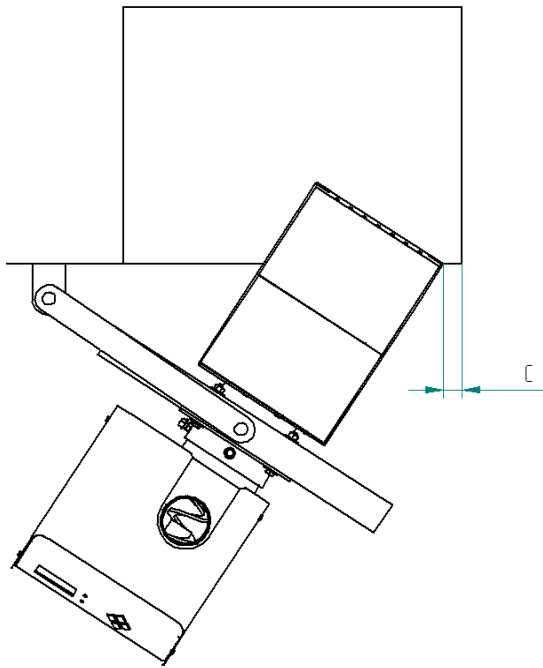


Figure 3 Hinge position and boiler opening size considerations





**Figure 4 Double hinges**

Boiler firebox length L (Figure 5) should be at least 2,5 x the length of the burning chamber. For PV 180a, minimum of 800 mm is acceptable (leaving L1 min. 480mm). The height should be enough to leave H1 below the burner min. 100mm for ash.

Minimum dimensions L and H for PV 180a:  $L \geq 800\text{mm}$ ;  $H \geq 470\text{mm}$ .

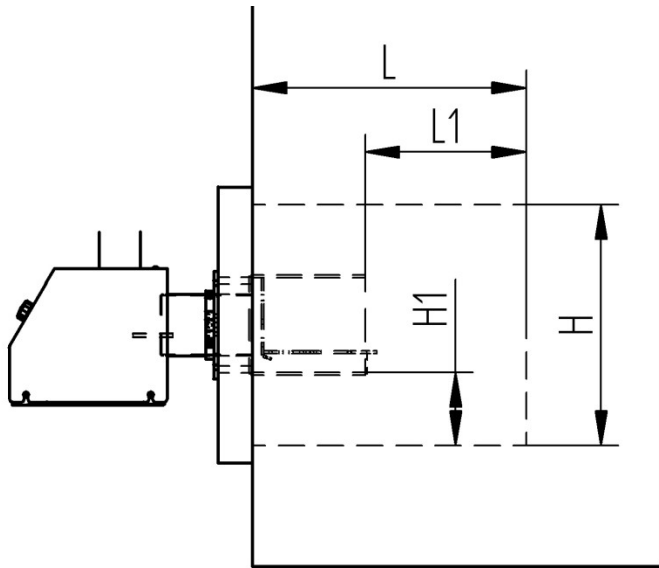


Figure 5 Boiler firebox requirements

Burner is mounted to door using supplied oil burner flange. Bolt hole circle diameter and bolt sizes can be customized by using custom flanges. D1 and D2 given in Table 3 are only valid with supplied flanges.

Table 3 Mounting holes for boiler door

|   | Unit |          |
|---|------|----------|
| $\varnothing D$ hole for burning chamber neck | mm   | 132      |
| $\varnothing D1$ flange bolt ring diameter    | mm   | 170..210 |
| $\varnothing D2$ bolt holes                   | mm   | 13       |

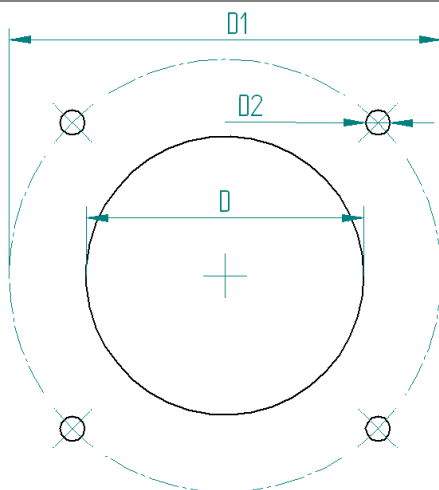
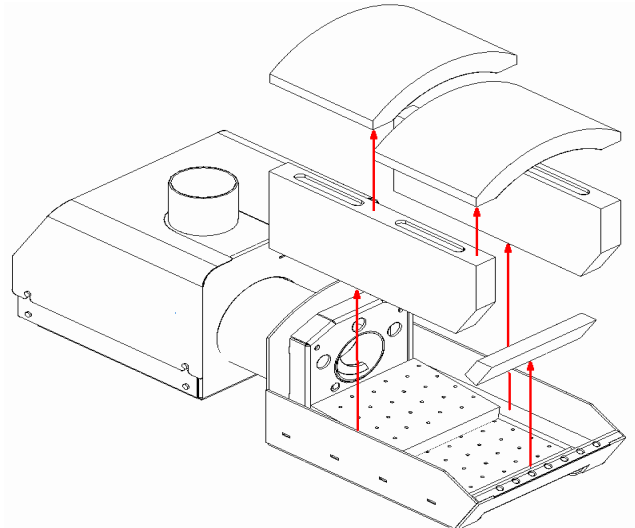


Figure 6 Mounting holes with supplied flanges for boiler door

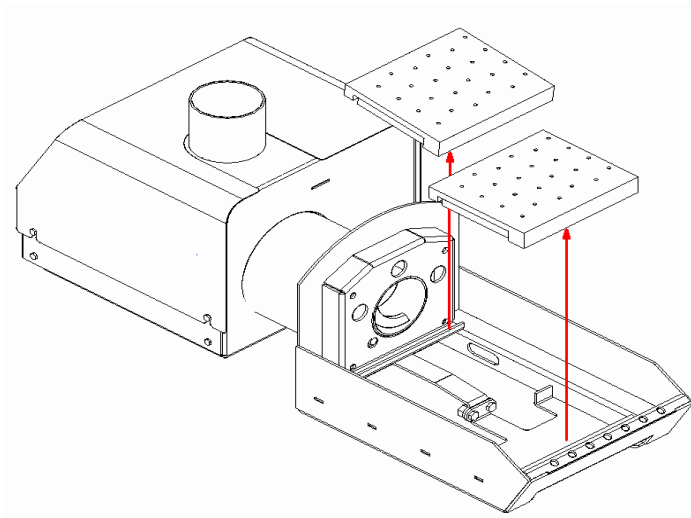
## Burner

In order to install the burner properly, you must go through the following steps:

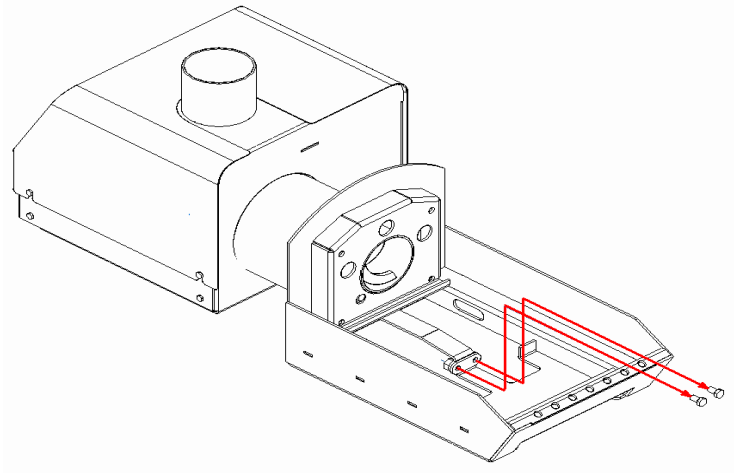
1. Remove carefully ceramic stones and the transparent joil from stones.



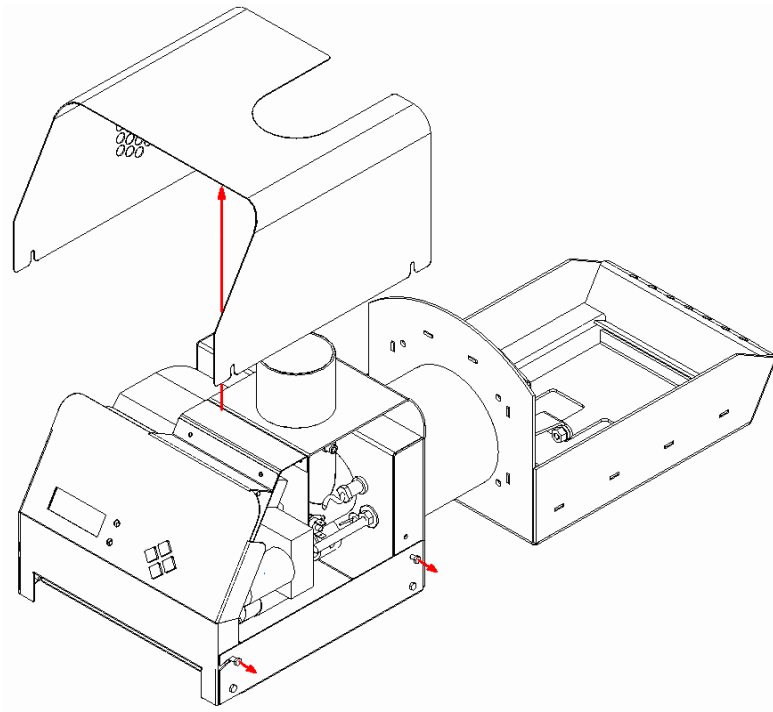
2. Remove upper and lower burning grates.



3. Remove the bolts from bottom grate holder

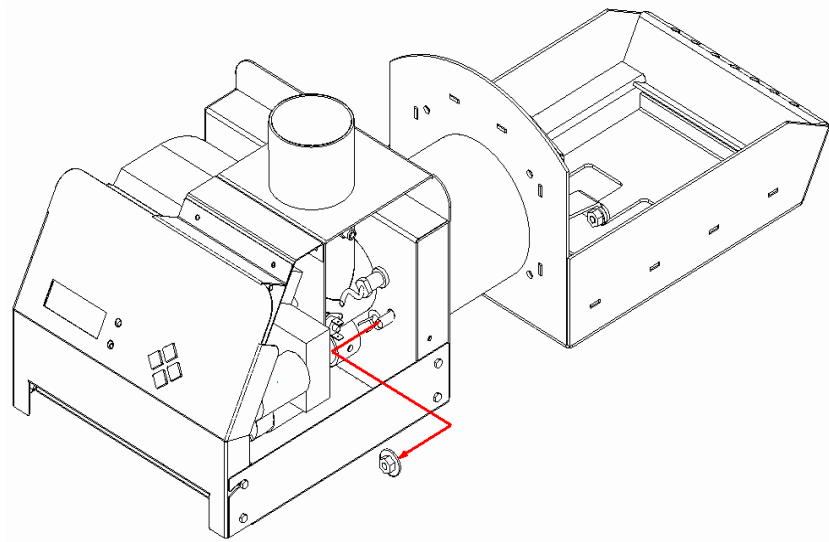


4. Remove the cover of the burner by loosening 4 screws of the cover. There is no need to remove the screws

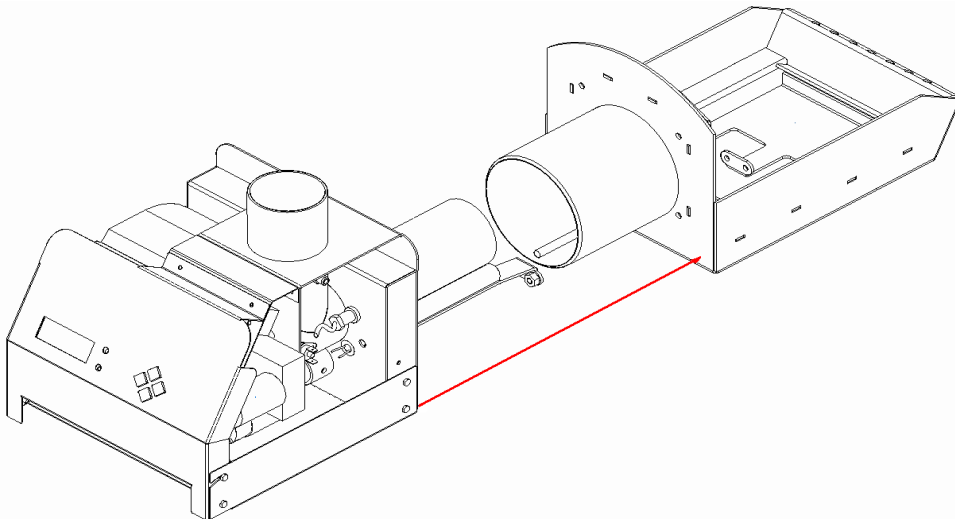


## PV 180a

5. Remove the M8 nut (13 mm wrench) that connects the halves of the burner.

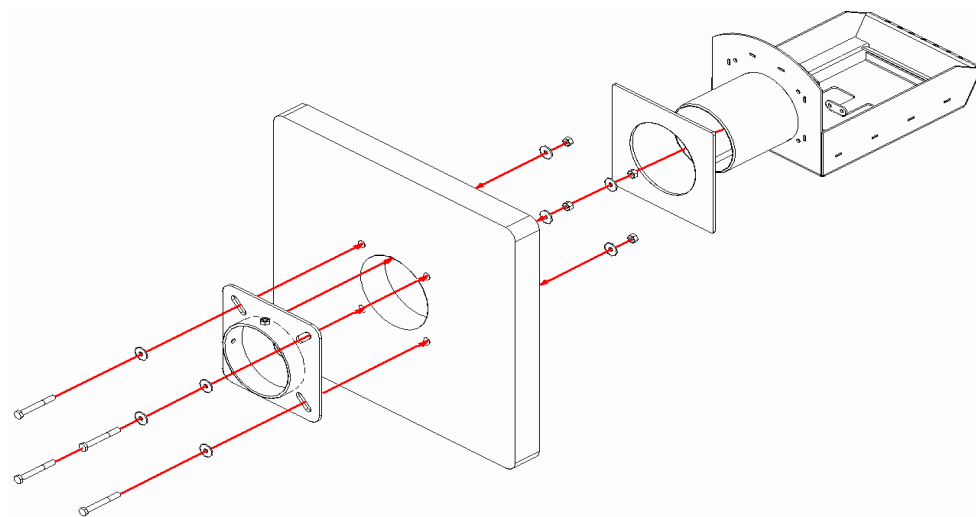


6. Separate the halves of the burner by pulling the burning chamber and slightly rotating it at the same time.

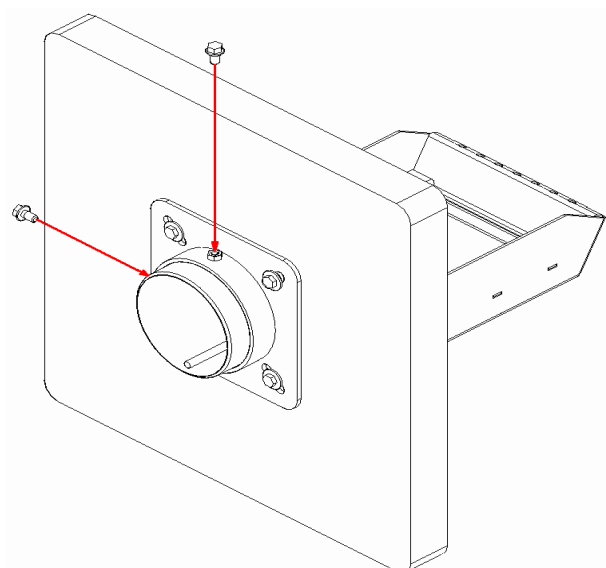


7. Fix the flange of the burner to the door of the boiler. Put a ceramic seal on the neck of the burning chamber. Put the chamber neck through the boiler door and flange. The rear wall of the burning chamber has to lean on the door of the boiler.

Caution! The connection between the burner and the boiler must be tight in order to avoid any leakage of smoke gases.

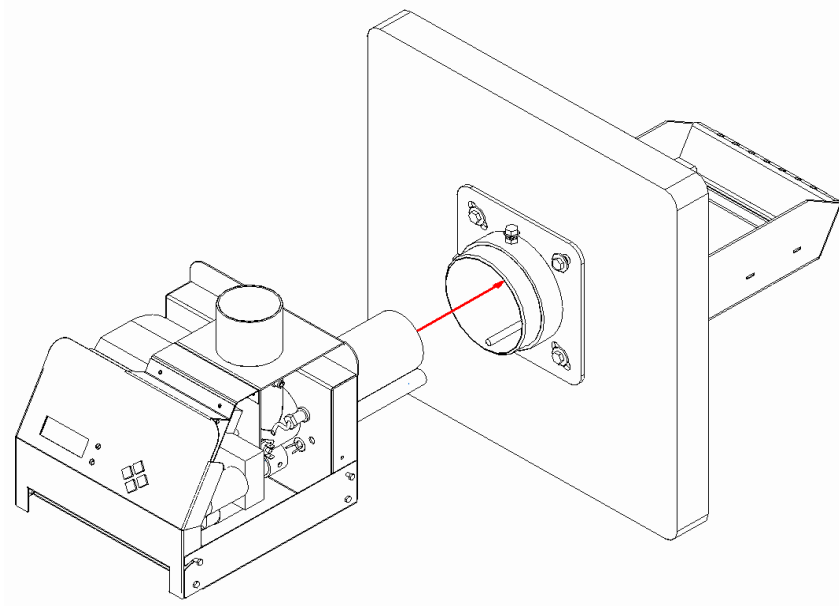


8. Fixate the burning chamber to the flange with two M8 bolt. Make sure the burning chamber is placed horizontal.

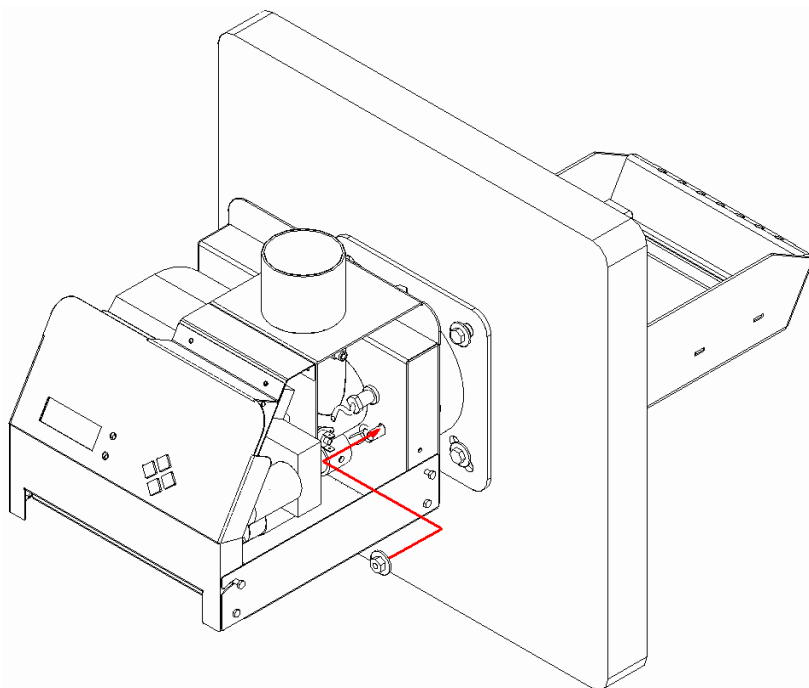


## PV 180a

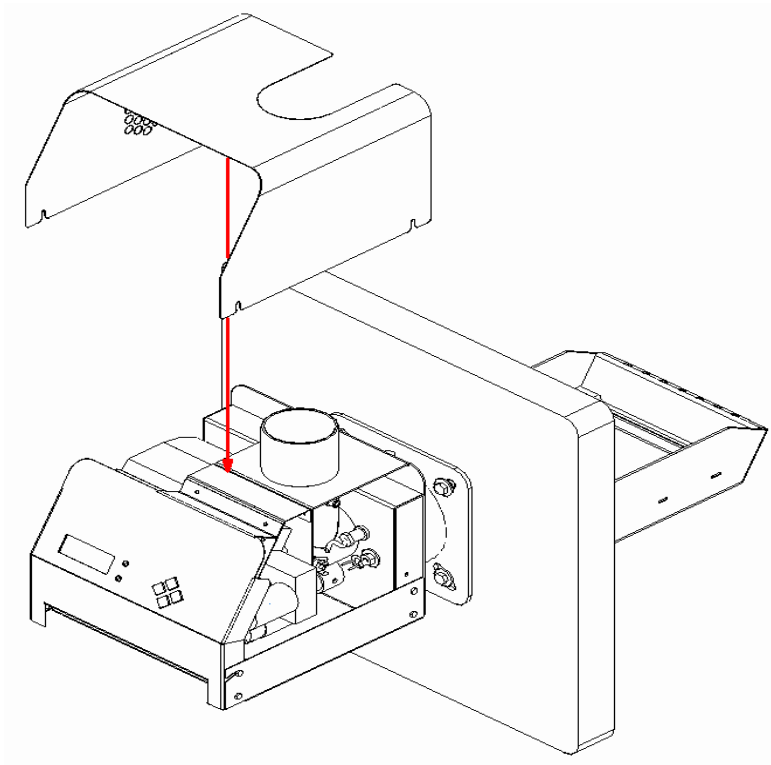
9. Connect the burner body to the burning chamber like it was before disassembling: push the burner body and slightly rotate it at the same time. Be sure that the burner halves are correctly connected.



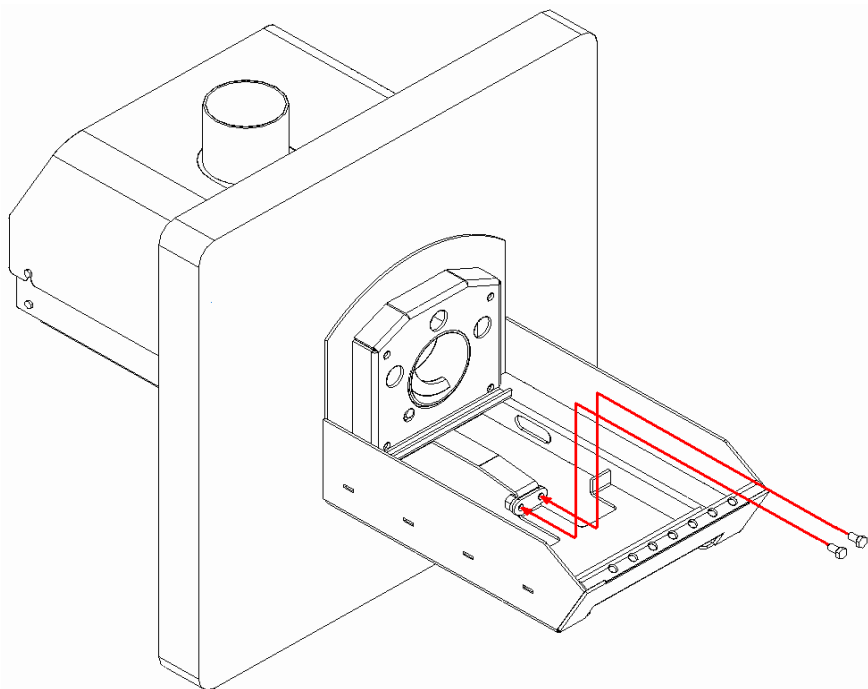
10. Fixate the halves of the burner with a M8 nut. The nut has to be rolled tight but not too hard.



11. Place back the burner cover and fix the screws again.

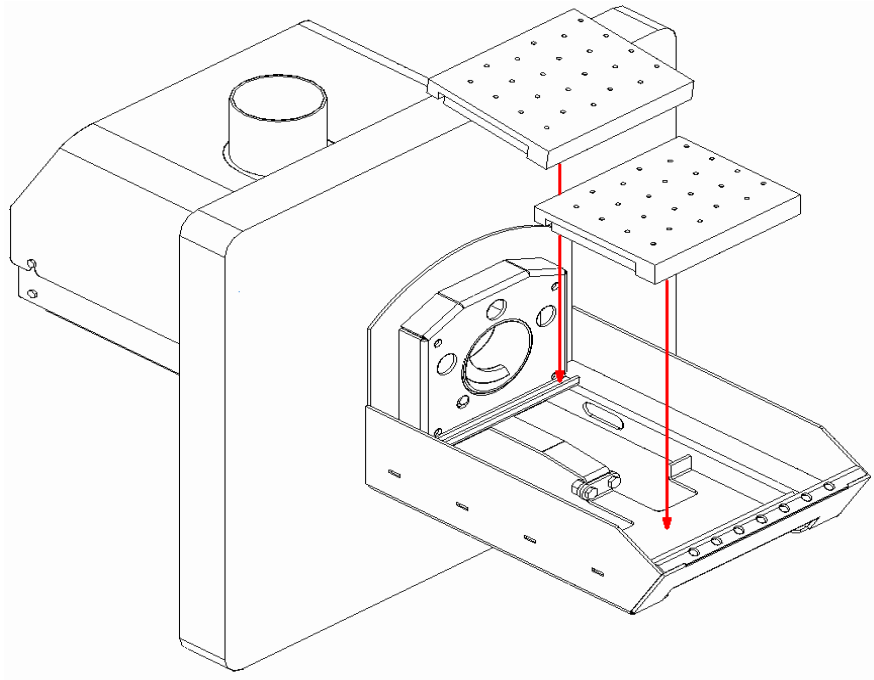


12. Place back the bolts and fix the bottom grate holder.

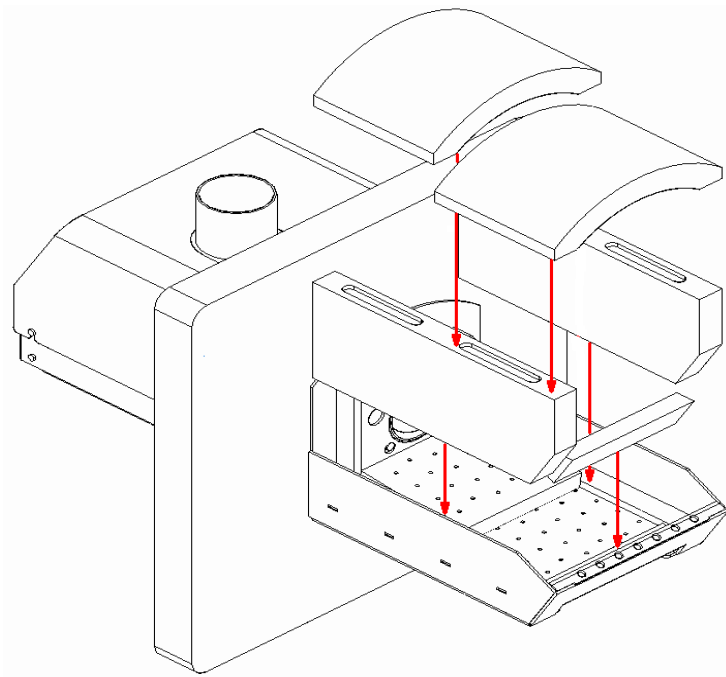


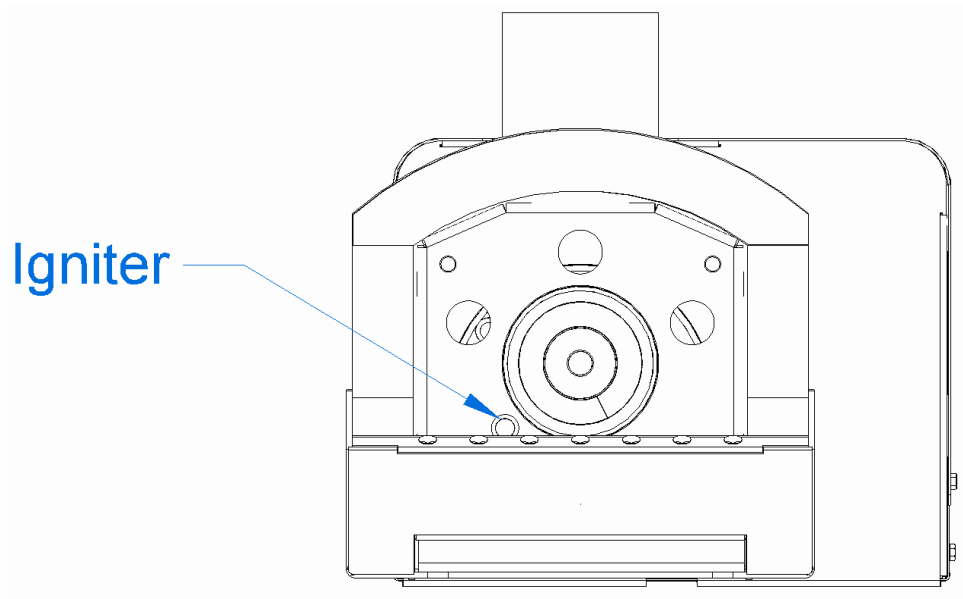


13. Place back the lower grate (smaller holes) and then the upper grate (bigger holes).



14. Place carefully back ceramic stones.





**Caution!** After the installation of the burner always make sure that the end of the igniter is positioned through its opening and not stuck behind the dividing wall.

## Pellet container

The burner, the auger and the pellet container are a common system. The size and the location of the pellet container depends on the needs and possibilities of the specific boiler room. While choosing the pellet container you must keep in mind that:

- If the pellet container is in the same room as the boiler, then the size of the pellet container must not exceed 500 liters (approx. 350kg).
- The container must be made of fireproof materials.
- The container must be positioned in a way that the raising angle of the feeding auger does not exceed 45°.

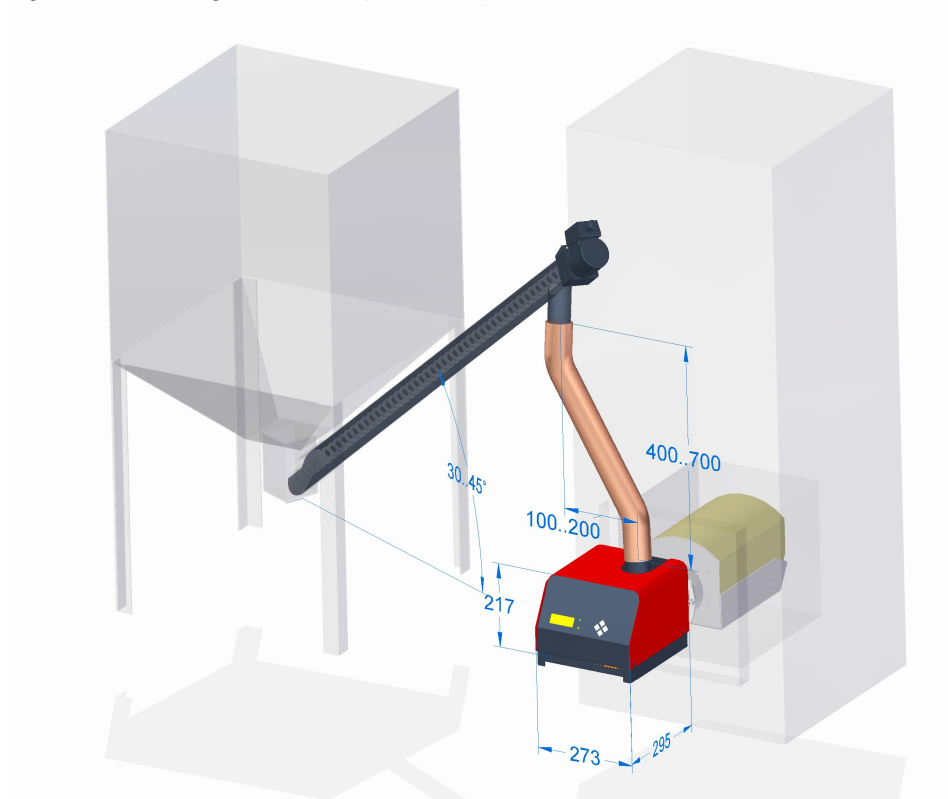
It is advisable to use a container that can be closed with a cover.

## External auger

A feeding auger transports pellets from the pellet container to the burner. The burner controls the work of the auger. The auger is connected to the burner with a special hose. The hose is made of melting material that acts as a safety measure against back-burning. The upper side of auger (with motor) must be fixed (with delivered chain) to a storage or to some other object nearby.

Figure 7 shows correct position for external auger. As the hose is a safety device, it must be placed strictly as described below. The vertical distance between auger outlet and burner inlet must be in range of 40..70cm and horizontal displacement 10..20cm (typical auger angle 30°..45°). External auger cannot be installed in position with angle greater than 45°. The hose must be in angle of 50° or more to ensure free falling of the fuel.

Figure 7 External auger installation (units in mm)



## Electrical connections

The burner is equipped with a standard oil burner plug that has 7 contacts. There will be different connection schemes used for different boilers. Usually the burner is connected to the boiler with a 5-wire cable. It is also possible to connect with a 4-wire cable.

**Caution!** All electrical connections of the burner must be made by a qualified professional.

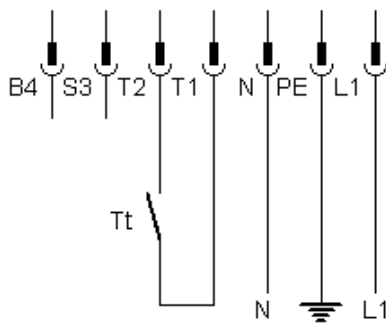


Figure 7 Burner 5-wire connection

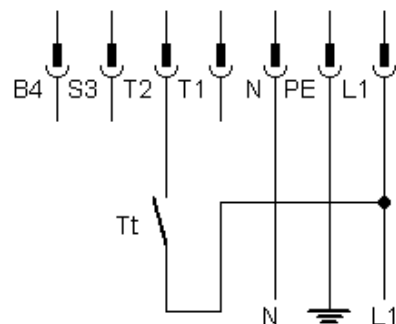
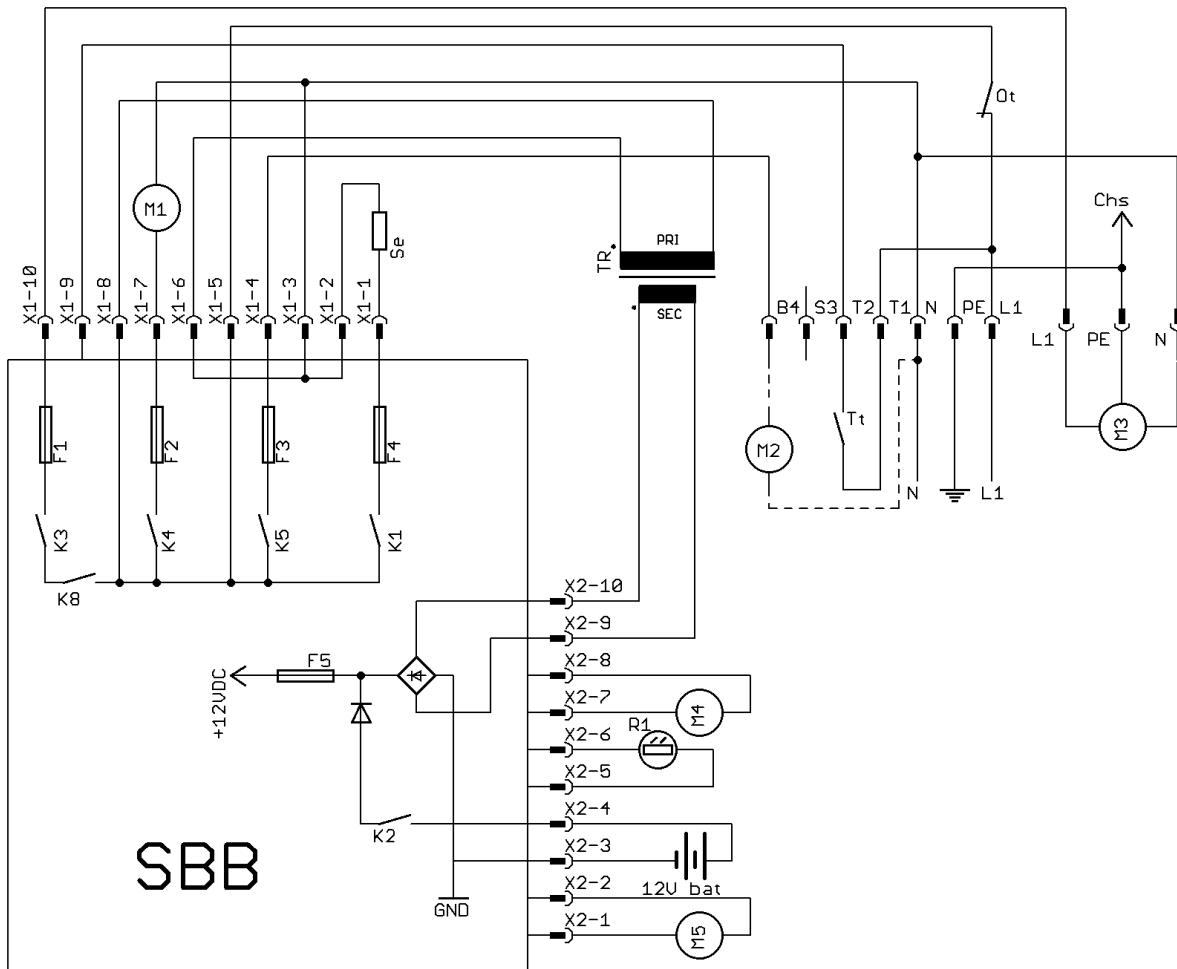


Figure 8 Burner 4-wire connection

PV 180a



Chs – Chassis grounder

M1 – Fan

M2 – Flue gas fan\*

M3 – External auger

M4 – Internal feeder

M5 – Grate motor

Ot – Safety thermostat

R1 – Flame sensor

## SBB – Controller board

Se – Igniter

TR – Transformer

Tt – Boiler thermostat

\*Flue gas fan M2 is installed only if there is not enough draught. The flue gas fan is not included with burner.

## Operation

The burner is controlled via user interface on the front panel. LCD screen (1) displays settings menu, event log etc. Yellow light (2) shows the presence of flame in burning chamber. Or if blinking, the burner is out of normal operation. Status can be seen on log screen. Green light (3) indicates if there is fuel in the burner. To move in menus, use up and down buttons, to change parameter, press OK, to go back to LOG press “ESC” button.

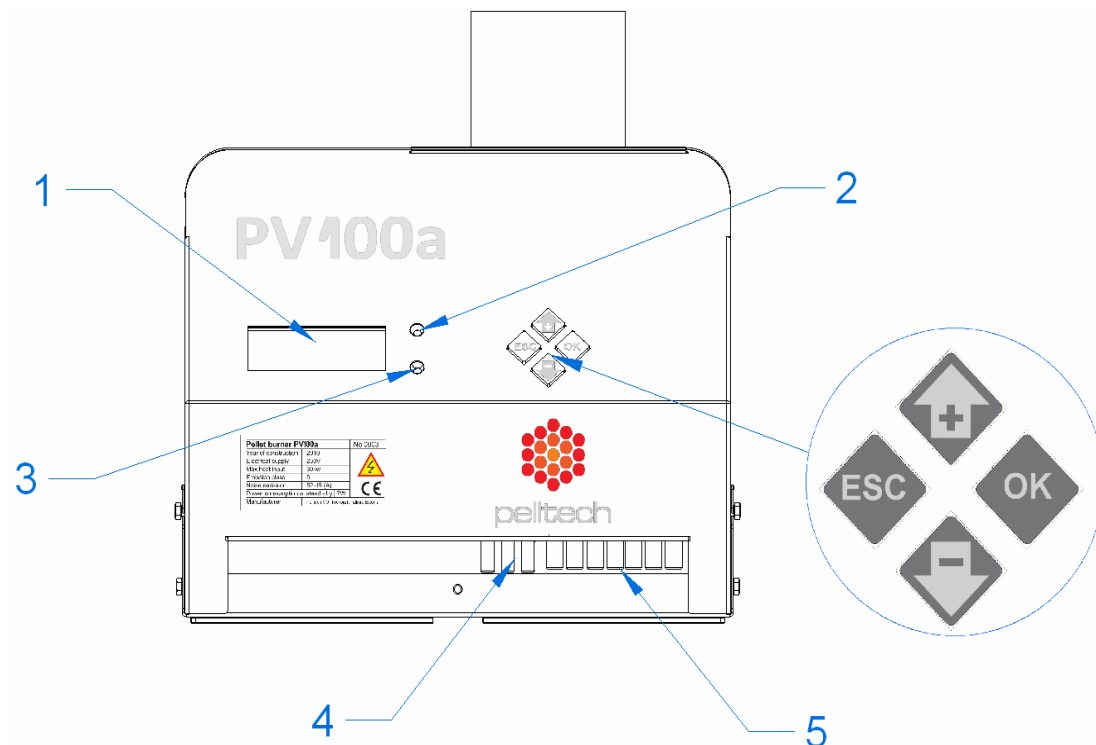


Figure 9 Front panel

- 1 – display
- 2 – yellow led, showing the flame in the burner
- 3 – green led, showing the fuel in the burner
- 4 – Plug for auger connection
- 5 – Plug for boiler connection

## Starting

Prior to the initial start-up of the burner make sure that:

- The burner is connected to the boiler
- The boiler thermostat is installed and is functioning properly
- The boiler thermostat is turned to lowest temperature
- The external auger is installed and connected to the burner

- The smoke duct is connected to the chimney, the dampers for smoke gases are open and there is sufficient draught. When the burner is operating, the negative pressure inside the boiler must stay between 4-6 Pa.

To turn on the burner, switch on boiler main switch. If burner displays 'Stopped', then go to settings menu and change parameter 'Burner' from OFF to ON. The display shows 'Waiting'. Now turn boiler thermostat to desired temperature. The burner will go to Loading-state. If this is the first run, external auger needs to be filled with pellets. It can take up to 20 minutes.

To stop the burning, turn boiler thermostat to lowest point. The burner will now finish the process after all fuel is burnt.

**Caution!** Never turn off a working burner from the main switch of the boiler. Use the thermostat switch for that purpose. In order to stop safely, let the burner burn empty. Do not leave the burner unattended when it has been necessary to use the emergency stop.

## Log

Log screen displays last events (burner states) and their duration. All states are described in Table 4. The duration is in form mm:ss ('m' in the middle) or hh:mm ('h' in the middle). For example "Igniting 01m25 means the burner ignition state lasted 1minute and 25 seconds.

Last row of the log shows current state. To reach the last row, press the "down" button, until you reach the current state. The duration of current state updates every second or minute.

Table 4 Burner states

| Status            | Description  |
|-------------------|--|
| <b>STOPPED</b>    | The burner is not switched on.   |
| <b>WAITING</b>    | The burner is switched on and waiting for command from the thermostat of the boiler.   |
| <b>TESTING</b>    | Testing the fan, battery, feeder.  |
| <b>CLEANING</b>   | Removing ash from burning chamber  |
| <b>LOADING</b>    | Loading pellets into burner for ignition after the command from boiler thermostat.   |
| <b>LOADING2</b>   | Second try if the first ignition was not successful.   |
| <b>IGNITING</b>   | Loaded amount of pellets are in the burning chamber, igniter and fan are working till photocell recognizes flame.                    |
| <b>PREBURN</b>    | Only the fan is working, the igniter is off. Pellets start burning properly.   |
| <b>BURNING</b>    | Status of normal working: External auger works by level sensor, internal auger and fan are working by. Photocell must see the flame. |
| <b>HOLD FLAME</b> | Boiler has reached an estimated temperature and boiler thermostat switched off, pilot flame is held in the burning chamber.          |
| <b>BURN END</b>   | Boiler has reached an estimated temperature and boiler thermostat switched off   |

|                    |   |
|--------------------|---|
|                    | the burner. The external auger has stopped, the internal feeder and fan are still working until all fuel is burned.                     |
| <b>END BLOW</b>    | When photocell doesn't see any flame only the fan keeps on working with minimum speed in order to make sure there is no fuel in burner. |
| <b>NO PELLETS</b>  | Level sensor does not detect pellets  |
| <b>NO FLAME</b>    | There is no flame in the burner more than 120 seconds during burning.   |
| <b>OVERHEAT</b>    | Temperature in the burner has reached preset temperature and burner turned off.   |
| <b>IGN.ERROR</b>   | Flame is not recognized after ignition  |
| <b>LEVEL ERR</b>   | Level dose not reached or level dose not disappear at burning time  |
| <b>FEEDER ERR</b>  | Jam in feeder or feeder rotation is not detected  |
| <b>FAN ERROR</b>   | Fan rotation problem  |
| <b>GRATE ERROR</b> | Grate is stucked.   |
| <b>BATTERY LOW</b> | Battery is not connected or empty   |
| <b>NO POWER</b>    | Supply power is not detected – burner works on battery  |

## Settings

To enter settings menu, press OK. To go back to log screen, press “ESC”.

Table 5 Main menu

| Menu nr | Menu parameter ENG | Description                                    | Default value | Selection list              |
|---------|--------------------|--|---------------|-----------------------------|
| 1       | STATUS->           | Submenu for status information * <sup>1</sup>  |               |                             |
| 2       | INFO->             | Information from burner devices * <sup>2</sup> |               |                             |
| 3       | BURNER             | Turn burner ON/OFF                             | OFF           | ON/OFF                      |
| 4       | HOLD FLAME         | Flame holding allowed * <sup>3</sup>           | OFF           | ON/OFF/AUTO                 |
| 5       | PELLETS            | Select fuel quality                            | NORMAL        | NORMAL/LIGHT/HEAVY          |
| 6       | POWER              | Actual power level                             | AUTO          | AUTO/80/100/120/140/160/180 |
| 7       | BASE AIR           | Fan speed correction for all fan speeds        | 0             | -2/-1/0/+1/+2/+3/+4/+5      |
| 8       | LANGUAGE           | Language selection * <sup>4</sup>              | ENG           | See language list           |
| 9       | PARAMETERS ->      | Parameter setup menu                           |               |                             |

\*1 – see “Status menu description”

\*2 – see “Info menu description”

\*3 – see “HOLD FLAME” status description

\*4 – see “Languages” chapter



Table 6 Parameters menu

| Parameter |                 | Description   | Unit  | Value   |        |      |
|-----------|-----------------|---|-------|---------|--------|------|
| Nr        | Name            |   |       | Default | Min.   | Max. |
| 1         | BURN AIR @80kW  | Fan speed at power level 1  | rps   | 30      | 15     | 50   |
| 2         | BURN AIR @100kW | Fan speed at power level 2  | rps   | 33      | 15     | 50   |
| 3         | BURN AIR @120kW | Fan speed at power level 3  | rps   | 36      | 15     | 50   |
| 4         | BURN AIR @140kW | Fan speed at power level 4  | rps   | 39      | 15     | 50   |
| 5         | BURN AIR @160kW | Fan speed at power level 5  | rps   | 42      | 15     | 50   |
| 6         | BURN AIR @180kW | Fan speed at power level 6  | rps   | 45      | 15     | 50   |
| 7         | TESTING AIR     | Fan speed for testing   | rps   | 42      | 38     | 50   |
| 8         | IGNITION AIR    | Fan speed during ignition cycle   | rps   | 45      | 20     | 35   |
| 9         | BURN END AIR    | Fan speed during end blow cycle   | rps   | 20      | 10     | 30   |
| 10        | HOLD FLAME AIR  | Fan speed during hold flame cycle   | rps   | 10      | 7      | 14   |
| 11        | HOLD FLAME ON   | In case of Hold flame is set on AUTO, flame holding activated after 2 waiting session, both less then 15 min. | min   | 15      | 5      | 30   |
| 12        | HOLD FLAME OFF  | In case of Hold flame is set on AUTO, there is maximum time for flame holding cycle.                          | min   | 60      | 30     | 90   |
| 13        | MIN POWER       | Minimum power level   | kW    | 70      | 50     | 100  |
| 14        | MAX POWER       | Maximum power level   | kW    | 90      | 50     | 100  |
| 15        | AUTO POWER UP   |   | min   | 60      | 30     | 120  |
| 16        | AUTO POWER DOWN |   | min   | 30      | 15     | 45   |
| 21        | PELLET NORMAL   | Internal feeder production  | g/rot | 70      | 60     | 100  |
| 22        | PELLET LIGHT    | Internal feeder production  | g/rot | 65      | 60     | 100  |
| 23        | PELLET HEAVY    | Internal feeder production  | g/rot | 75      | 60     | 100  |
| 24        | LOADING FEED    | Feeder turns during loading cycle   | rot   | 20      | 10     | 24   |
| 25        | LOADING 2 FEED  | Feeder turns during second loading cycle  | rot   | 3       | 1      | 8    |
| 26        | BURN END FEED   |   | rot   | 18      | 10     | 25   |
| 30        | SMOKEFAN ON     | Smokefan is turned ON or OFF  |       | OFF     | ON/OFF |      |
| 31        | SMOKEFAN 1      | Smokegas fan speed for ignition, end blow, burn at power level 1 and 2  | %     | 40      | 0      | 100  |
| 32        | SMOKEFAN 2      | Smokegas fan speed for burn at power level 3 and 4  | %     | 60      | 0      | 100  |
| 33        | SMOKEFAN 3      | Smokegas fan speed for burn at power level 5 and 6  | %     | 80      | 0      | 100  |
| 40        | PHOTOCELL       | Photocell sensitivity   | %     | 84      | 50     | 100  |
| 41        | PREBURN TIME    | Preburn cycle lenght  | s     | 25      | 15     | 80   |

## PV 180a

|           |                |  |     |      |                  |     |
|-----------|----------------|--|-----|------|------------------|-----|
| <b>42</b> | PREBURN CYCLES |  | n   | 6    | 2                | 10  |
| <b>43</b> | OVERHEAT TEMP  | Maximum allowed burner temperature                                 | °C  | 50   | 20               | 70  |
| <b>46</b> | MAX.CURR x10mA | Feeder max current   |     | 160  | 72               | 216 |
| <b>48</b> | CLEANING CYCL. | Counted burning time between cleanings (0=Cleaning OFF)            | min | 180  | 0                | 250 |
| <b>50</b> | ON ERROR RELAY | Error output relay contacts (ON - NO or OFF -NC)                   |     | ON   | ON/OFF           |     |
| <b>99</b> | MODEL VERSION  | Load default settings for chosen burner model or change model type | 0   | 100a | 20a/30a/50a/100a |     |

### Refilling fuel

The fuel storage must be refilled before it runs empty. Fuel can be added at any time during the operation. To add fuel, simply pour a new bag of pellets into your fuel storage.

If the storage runs empty before new fuel is added, the external auger must be loaded again as described in chapter Starting. Failing to do so will result 'Fuel error' due to fuel loading timeout.

### Maintenance

**Pellet burner PV 180a requires systematic maintenance.** The maintenance period depends on the quality of the pellets and heating intensity. The average maintenance period is between 1 to 2 months. Although the burner has an automatic cleaning system, some ash collects on the grates and under the grates. Depending on the quality of the pellets, the maintenance period may vary.

To clean the burner:

1. Turn off the burner by turning the thermostat to 0.
2. Let the burner cool down for at least 1 hour.
3. Open the boiler's door to gain access to burning chamber
4. Remove carefully the cover stones from burning chamber.
5. Remove ash from the grates.
6. Remove the grates, make sure that all holes on the plate are clean.
7. Remove all residues collected under the grates.
8. Place back all removed burner parts.
9. Close the boiler's door to finish the maintenance and turn the thermostat to desired temperature.

NB! Check the boiler manual for boiler cleaning.

#### Feed screw motor

The condition of the feeding screw motor is crucial for safety. Therefore the motor must be replaced after every 2000 working hours or after 120-150 tons of pellets are burned or when the burner gives warning. Burnered pellets amount (in kg) is accessible from info-menu.

#### Battery

Battery must be replaced when the burner gives warning message or after 5 years. As the battery is also safety device, burner monitors the state of battery and blocks next work cycle if battery voltage is not within limits.

#### Fan

The air in boiler room contains dust that can deposit on fan bearings. The best cure is to keep boiler room as clean as possible. Otherwise the fan bearings can get stuck after several years of working and must be replaced.

#### Resetting safety thermostat

In case of overheating the burner flashes yellow indicator and displays message OVERHEAT. The safety thermostat must be reset manually. Thermostat is located on the horizontal tube of inner auger.

1. Make sure the burner has cooled down and disconnected from power supply.
2. Remove the cover by loosening 4 screws (2 on both sides)
3. Press small button on thermostat.
4. Connect power supply
5. Press OK for 5s
6. If indicator keeps flashing, you need to replace the thermostat.

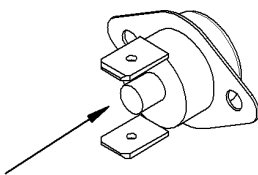


Figure 11: Resetting the safety thermostat

## Working principle

### Testing

Before every startup the burner tests itself. At testing time fan is turned on at maximum power. If its speed doesn't reach 30 rps, "fan error" will occur on display. Battery loading is turned off and feeder is turned on. If battery voltage is lower than 12V, "Battery low" error will occur. By testing the feeder has to make 1 full turn in 8 seconds, if it fails to do it, "feeder error" will occur.

### Cleaning

To clean the burner, parameter 48 has to be turned ON. Before every working cycle, burner grate will be cleaned by pulling the lower grate under the upper grate and pushing away the ash by moving back. If the grate is stuck, it will move back and try again. After 1 minute trying and failing to move back to its right position, "grate error" will occur.

### Loading

In the loading cycle, internal feeder loads correct amount of fuel into burning chamber needed for ignition. Loaded fuel amount is measured by counting internal feeder rotations. Loading is correctly ended when feeder has made 20 half-rotations (or as set in the par24). Internal feeder working depends on fuel level sensor:

- The feeder is started when level sensor recognizes fuel in burner for more than 1s,
- The feeder stops when feeder makes 1.5 rotations without fuel in burner.

External auger is holding permanent fuel level in the feeder tube all loading time depending on level sensor:

- The auger is started when level sensor does not recognize fuel in burner more than 1s.
- The auger is stopped when level sensor recognizes fuel in burner more than 5s.

Maximum loading time is limited with 5 minutes in normal working conditions and 20 minutes after manual start.

- Igniter is preheated in the end of loading cycle. When internal auger has made 10 half-rotations (par24 - 12 ) the igniter is turned on for preheating. If the igniter is turned on more than 1 minute at loading time, the igniter will be turned off.

## Igniting

In ignition state the igniter is heated up and fan blows hot air through loaded pellets and ignites them.

Igniter is turned off after every 50 seconds to avoid overheating it, and turned on again after 20s .

## Preburn

The purpose of preburn state is to fully ignite the pellets. No fuel is added at preburn. Fan works at the same speed as in ignition.

## Burning

The running position of the burner. Fuel is periodically added and fan is keeping speed according to air table. Burning state lasts until boiler thermostat is switched off.

## Auger control

External auger is holding permanent fuel level in the feeder tube during Burning state. The auger is controlled by fuel level sensor in following manner:

- Auger is started after level sensor does not recognize fuel in burner and internal feeder has done 2 half-rotations.
- Auger is stopped when level sensor recognize fuel in burner for more than 1s.

## Fuel level detection

Pellet level in vertical feeder tube is detected by fuel level sensor (optical). Fuel is detected when pellets interrupt optical link between sensor pair.

Burner will enter level detection fault condition in following cases:

1. Fuel loading timeout (no signal for specified period of time)
2. Fuel unloading timeout (signal lasts longer than specified period of time)

## Output power levels

Burner has 6 preset output power levels. For every level, program calculates correct fuel amount depending of fuel calorific value and burner internal feeder productivity. The feeder productivity for normal, light and heavy pellets can be changed from setup menu (par21, par22, par23). For most pellets it is 70g per rotation. Calculated amount of fuel is divided into periodic feeding cycles. In every cycle internal feeder makes half rotation. If the calculated cycle comes to short (less than 11s) then the cycle length is doubled and fuel is fed with by full rotation of feeder. For every power level there is different preset fan rotation speed (air table).

Burner chooses the output level between preset min and max powers. When burning time has been more then 60 min (par 15), next time burner takes one level up, when burning time has been less then 30 min (par 16), next time burner takes one level down.

### Hold flame

The main idea of this state is to reduce the number of igniting cycles. This state can be turned on automatically or manually in "hold flame" menu (ON/OFF/AUTO). If set to AUTO, burner goes to "hold flame" when the time between two startups is less then 10 minutes for 2 times. When "hold flame" lasts more then one hour, automatic mode is turned off and burner goes to "burn end" state. In "hold flame" state new fuel is fed after every 127s and fan is working by speed given by par10.

### End burn

In the end burn state all fuel inside the burning chamber and feeder tube must be burned - no more fuel added from external auger. Internal feeder and fan keep on working as in previous states ("hold flame" or "burning"). After the feeder has made periodically 15 half-rotations (par26), the feeder starts working continously until 32 half-rotations is made.

### End blow

Only the fan keeps on working with speed shown in par9 to burn out all coals. Feeder is turned off. This state lasts until no flame is recognized plus one minute.

Table 7 Air table for PV 180a

| Power [kW] | Fan [rps] | Cycle [s]* | Feeder [rot]* |
|------------|-----------|------------|---------------|
| <b>80</b>  | 30        | 30,5       | 2             |
| <b>100</b> | 33        | 24,5       | 2             |
| <b>120</b> | 36        | 20         | 2             |
| <b>140</b> | 39        | 17,5       | 2             |
| <b>160</b> | 42        | 15         | 2             |
| <b>180</b> | 45        | 13,5       | 2             |

\* - cycle length and feeder rotations are different if feeder production changed in parameters setup

## Controller board description

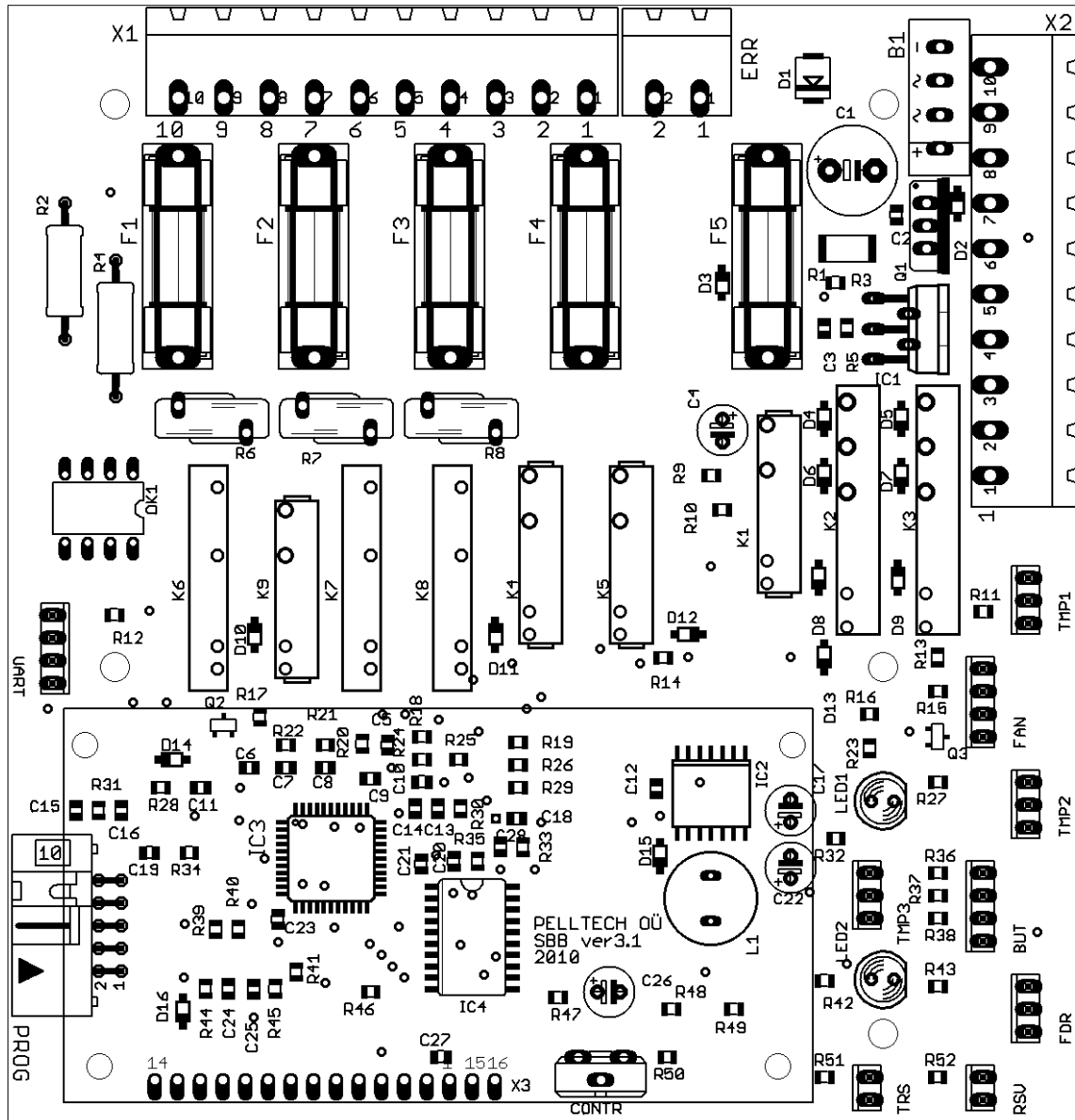


Figure 10 Controller board

Table 8 X1 and X2 connectors

| X1 | Description       | X2 | Description               |
|----|-------------------|----|---------------------------|
| 1  | Igniter           | 1  | Grate motor+              |
| 2  | Igniter           | 2  | Grate motor-              |
| 3  | N                 | 3  | Battery positive terminal |
| 4  | Flue gas fan      | 4  | Battery negative terminal |
| 5  | Mains transformer | 5  | Flame sensor              |
| 6  | Mains transformer | 6  | Flame sensor              |
| 7  | Fan               | 7  | Feed screw - (black)      |
| 8  | L                 | 8  | Feed screw + (red)        |
| 9  | Thermostat        | 9  | Mains transformer         |
| 10 | External auger    | 10 | Mains transformer         |

BUT – User interface buttons

CONTR – LCD contrast and viewing angle adjustment

FAN – Internal air fan speed feedback sensor

FDR – Feed screw motor speed feedback sensor

TRS – Fuel level sensor transmitter (black marking)

RSV – Fuel level sensor receiver (white marking)

TEMP1 – Feed screw tube temperature sensor

TEMP2 – Ambient temperature sensor

TEMP3

UART – RS232 interface for external modem (5V TTL).

#### Fuses:

| Fuse | Rating     | Function                    |
|------|------------|-----------------------------|
| F1   | 0.5A quick | External auger              |
| F2   | 1A quick   | Fan                         |
| F3   | 0.5A quick | Flue gas fan                |
| F4   | 3A quick   | Igniter                     |
| F5   | 2A quick   | Controller and feeder motor |



## Problems and solutions

| Error states          | Cause  | Action   |
|-----------------------|--|--|
| <b>Stopped</b>        | This is actually not an error condition.<br>Burner is turned OFF from menu.                                      | To turn burner on:<br>- hold down OK button at least 3s<br>OR<br>- change row BURNER from OFF to ON in setup menu  |
| <b>No pellets</b>     | Maximum loading time is reached (5 or 20 minutes) and not enough fuel from external auger for ignition is loaded | - check fuel in storage<br>- check auger and auger connection to burner  |
|                       | Fuel level is not detected in 4 minutes at burning time  | - check the level sensors, clean them  |
| <b>No flame</b>       | Flame is disappeared at preburning time  | - check the level sensors, clean them  |
|                       | Flame is disappeared at burning time   | - check the level sensors, clean them  |
|                       | Flame is not disappeared in end blow state   | - check photocell, clean it  |
| <b>Overheat</b>       | Burner internal temperature is reached over set-point as fixed in setup menu. Possibly back-burning is happened  | - check burner temp. from INFO menu<br>- check temp sensor connection<br>- check burning chamber and clean it<br>- check the chimney and under pressure (draught) in the boiler<br>- check the internal feeder screw connection and rotation |
| <b>Ignition error</b> | Flame is not detected at ignition time   | - check igniter and igniter fuse<br>- check photocell  |
| <b>Level error</b>    | Fuel level in the burner has not disappeared at burning time   | - Check the level sensors, clean them  |
| <b>Feeder error</b>   | Feeder has not made any rotations in 8 seconds at its running time   | - check feeder sensor connection<br>- check magnet on the feeder shaft   |
|                       | Feeder motor current is reached 0,75A permanently in 0,2 second time   | - check feeder screw connection<br>- feeder can be blocked   |
| <b>Fan error</b>      | Fan has not reached 40 rps in 7 seconds at testing time with full power  | - check fan sensor connection<br>- check fan power connections   |
|                       | Fan has not reached needed speed at burning time in 20 sec.  | - check magnet on the fan shaft<br>- check fan bearings and rotation   |
| <b>Grate error</b>    | Grate is stucked during the burner cleaning  | - Clean the burning chamber manually as described in the "maintenance" chapter   |
| <b>Battery low</b>    | Battery voltage is less than 12V with load (working feeder)  | - If there was a power failure then just wait when it is charged<br>- replace the battery  |
| <b>No power</b>       | No network power   | - check power connector, cables<br>- check safety thermostat<br>- check burner for backburn  |
|                       | Safety thermostat has turned off the power - backburn  |  |

## Warranty

Warranty object is pellet burner PV 180a and auger PA1500+B or PA 2000+B.

Producer gives 2 years warranty from the date of sale for the burner and auger. Exemption is ignition element, for this item warranty is 1 year.

Warranty does not cover defects caused by an accident, misuse, abuse, improper installation or operation, lack of reasonable care, unauthorized medication, loss of parts, tampering, attempted repair by a not authorized person, power supply errors or using poor quality fuel.

WARRANTY SHEET

Burner type

**PV 180a**

Serial number

.....

Date of sale

.... / ..... / .....

Customers contact details

.....

.....

.....

Installators name and signature

.....

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WARRANTY SHEET

Burner type

**PV 180a**

Serial number

.....

Date of sale

.../ ...../ .....

Customers contact details

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Installators name and signature

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