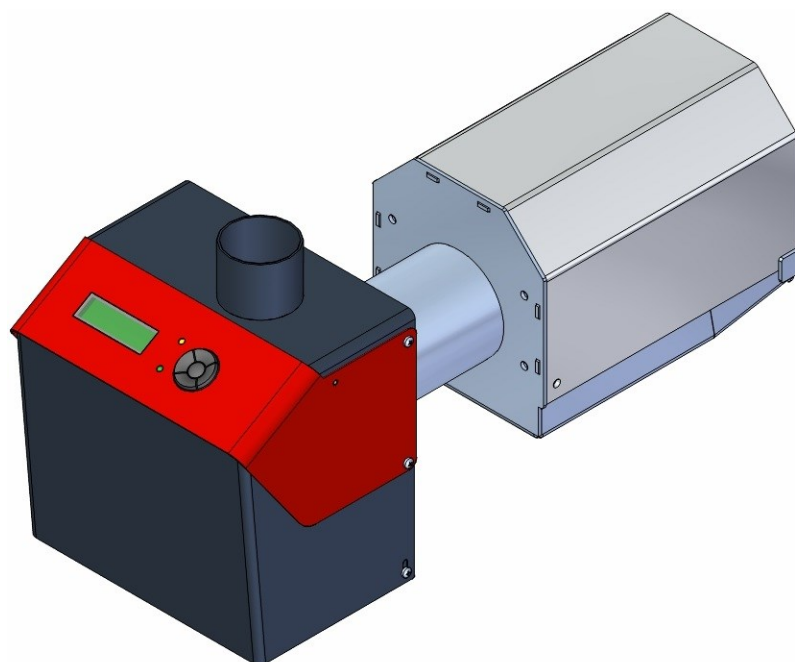




PV50b pellet burner

User manual

DK9802A2



1 Contents

2	Description	3
2.1	Specifications.....	3
3	Installation.....	7
3.1	Prerequisites.....	7
3.2	Installing burner to the boiler	10
3.2.1	Pellet storage.....	11
3.2.2	External auger	12
3.3	Electrical connections.....	13
3.4	Commissioning	13
4	Operation and maintenance	14
4.1	User interface	14
4.1.1	Status messages	16
4.1.2	Info menu	17
4.2	Starting and stopping	17
4.3	Description of a working cycle	17
4.4	Refilling fuel storage.....	19
4.5	Regular maintenance	19
4.6	Replacing components	19
5	Problem and solutions.....	22
6	Annex A – Electrical schematic.....	24

2 Description

PV50b is wood pellet burner for domestic and industrial use. Typical setup includes external pellet storage (1), external auger to transport pellets from storage to burner (2), boiler (3) and PV50b burner (4) mounted onto the boiler.

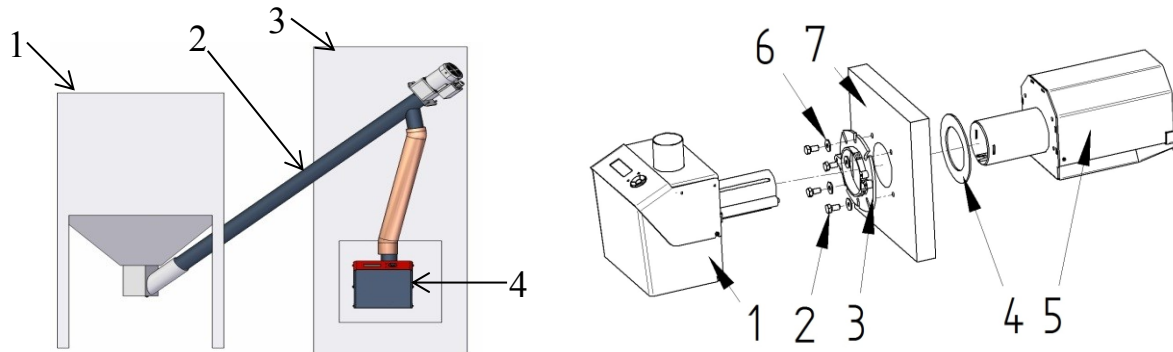


Figure 1 Typical installation

PV 50b 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 50b allows it to be used with different boilers: liquid fuel, solid fuel and universal boilers. The PV 50b burner is connected to the boiler with a 90 mm flange (similar to oil burners).

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

- Methods of control of pellet burner – modulating burner
- Means of ignition – Hot air element
- Without integral fuel hopper
- Automatic ash cleaning system
- “Hold flame” function
- Optional oxygen sensor interface
- Optional communications module interface

2.1 Specifications

Parameter	Unit	Value
L total length	mm	560
L1 burner body length	mm	175
L2 burner head length	mm	260
ØD burner head width	mm	180
ØD1 burner head neck diameter	mm	90
ØD2 internal feeder inlet diameter	mm	60

H total height	mm	275
H1 burner housing height	mm	230
W total width	mm	240
W1 burner head width	mm	168
Mass	kg	17
Supply voltage	VAC	220-240
Power max	W	570
Power average	W	25 - 40
Power at standby	W	7
Noise	dB	52
Emission class¹	-	5
Operating temperature	C°	0-60
Nominal heat input	kW	50
Min heat input	kW	20

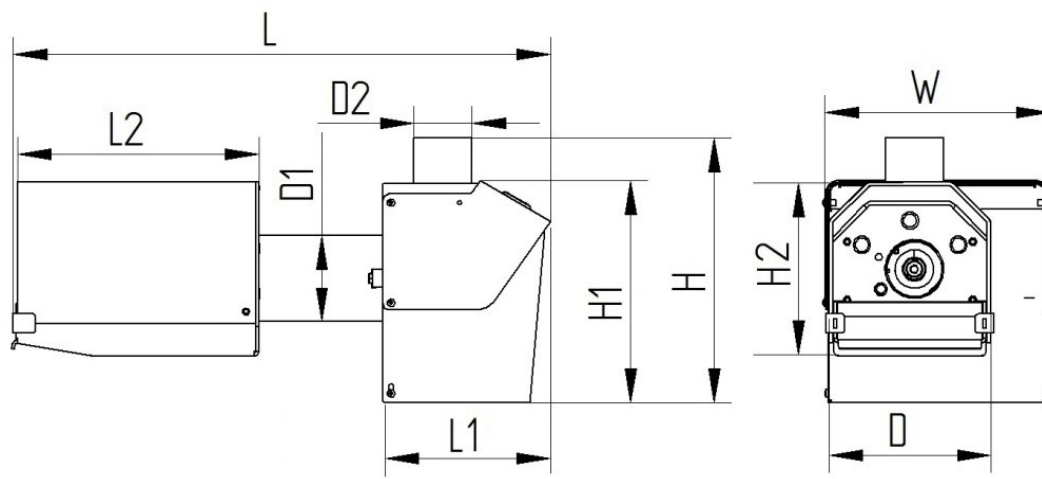


Figure 2 Dimensions

Main parts of the burner are shown on Figure 3 and listed below.

Table 1 Main components list

No	Spare part code	Short name	Description
1		Burning chamber	Pellets are burned inside the burning chamber on a grate.
2		Burner body	The half of the burner that is located outside the boiler. Incorporates feed screw (internal auger), fans, controller etc.
3		User interface	LCD screen, LED indicators and navigation buttons to show burner status and change settings.
4		Internal auger inlet	External fuel supply line (hose) is connected here.
5		Internal auger feed screw	Transports pellets from inlet to the burning chamber. Internal auger is switched by controller board.
6		Burning chamber back wall	Replaceable stainless steel wall that separates hot and cold surfaces and reduces heat transfer through boiler door.
7		Grates (set of two)	Moving grates, where burning takes place. Air is supplied through holes in grates
8		Igniter	Electric heating element to heat up air and ignite pellets in burning chamber.
9		Boiler connector	Connector for power supply, flue gas fan, thermostat
10		Power supply	AC-DC converter to supply internal controller board, feeder motor, fans and sensors.
11		Temperature sensor	Internal auger temperature sensor to detect back burning before safety thermostat cuts mains power.
12		Battery	Backup battery to enable safe shut down in case of mains power interruption.
13		Feeder motor	Internal auger motor with rotation feedback to transport controlled amount of pellets to burning chamber.
14		Primary fan	
15		External auger connector	Quick connector to connect external auger.
16		Secondary fan	
17		Controller board	Electronic control unit to turn on/off burner, switch external auger, regulate combustion air supply etc.
18		Fuel level sensor	Optical sensor to detect the presence of pellets in internal auger inlet. Normally, external auger is switched on, if no pellets detected.
19		Burning chamber cover	Replaceable cover to increase combustion quality

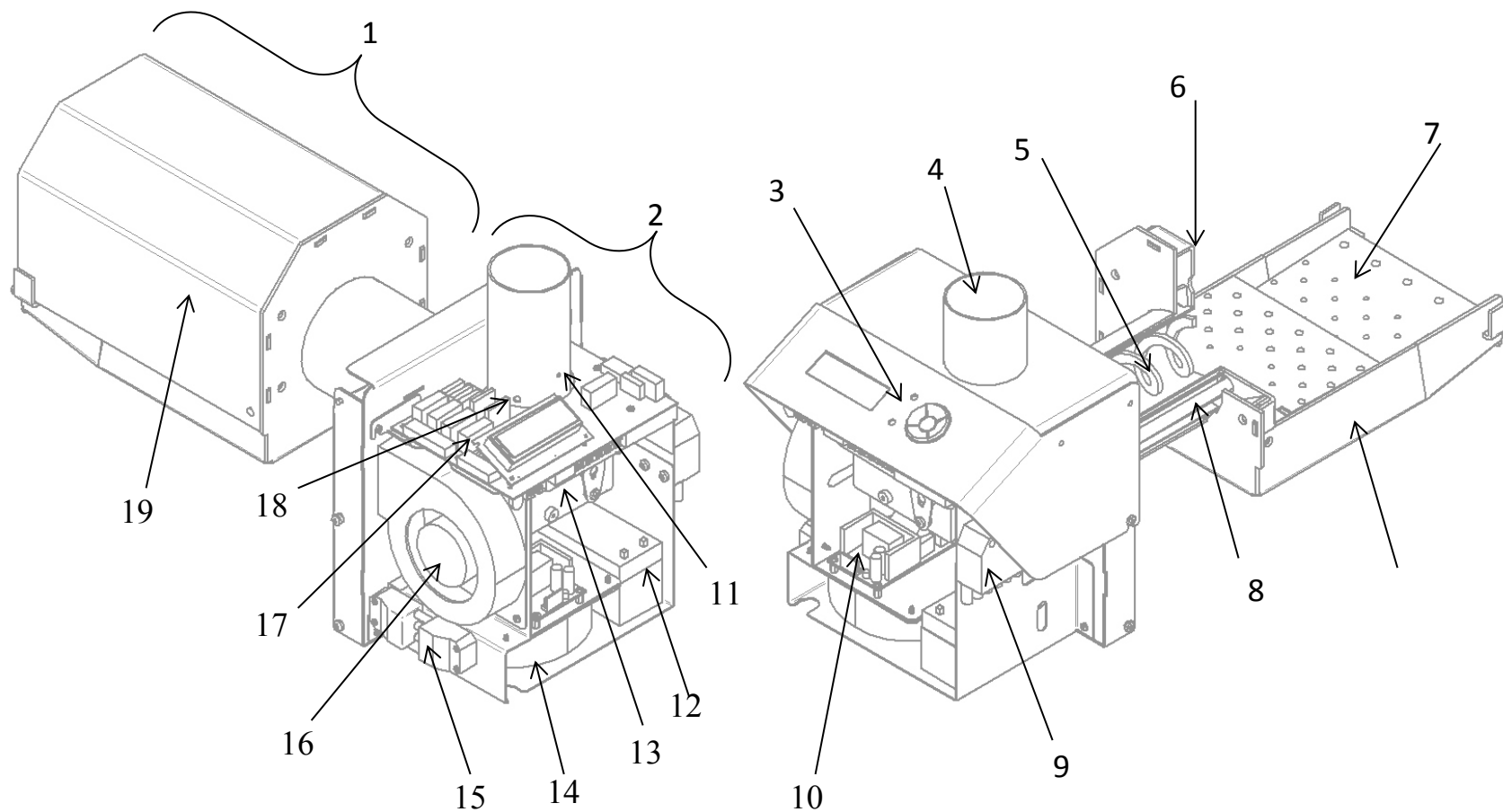


Figure 3 Burner main parts

3 Installation

3.1 Prerequisites

Following tools are needed 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
- Cross-head screwdriver for fixing the cover of the burner
- 4 mm hex wrench for fixing the boiler to the flange

Warning! 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

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

- The door of the boiler must have a 90 mm opening (placement opening for the oil burner).
- The thickness of the boiler door must be less than 100mm
- 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) draught 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.

Pellet burners need regular cleaning and therefore boiler construction must allow the door to be opened without removing the burner. The minimum boiler opening radius 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.

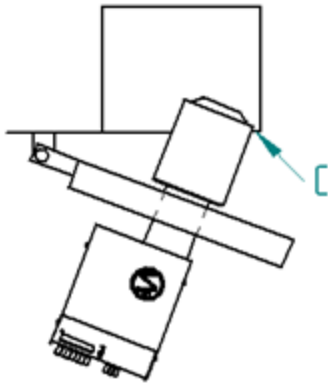


Figure 4 Hinge position and boiler opening size considerations

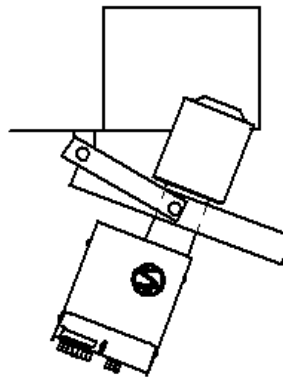


Figure 5 Double hinges

Boiler firebox length L (Figure 6) should be at least 2,5 x the length of the burning chamber. For PV 50b, minimum of 640mm is acceptable (leaving $L1$ approx. 380mm). The height under the burner ($H1$) should be enough for about 100mm of ash.

Minimum dimensions L and H for PV 50b: $L \geq 640\text{mm}$; $H \geq 400\text{mm}$.

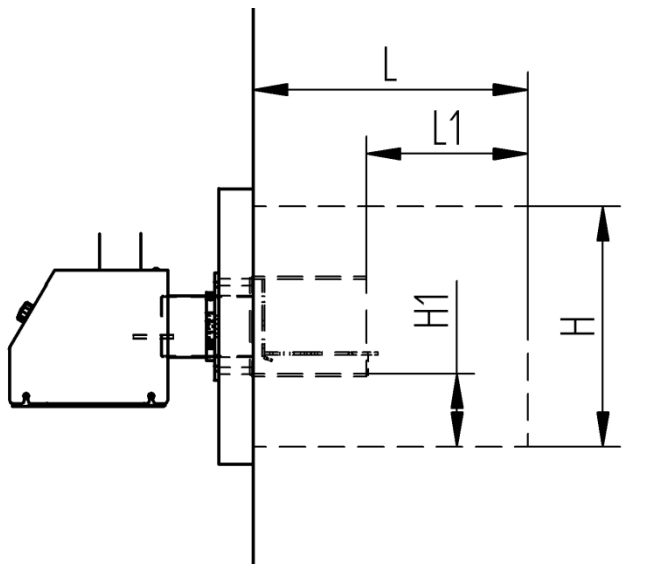


Figure 6 Boiler firebox requirements

Burners are 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 2 are only valid with supplied flanges.

Table 2 Mounting holes for boiler door

Dimension	Unit	Value
$\varnothing D$ hole for burning chamber neck	mm	90
$\varnothing D1$ flange bolt ring diameter	mm	130..150
$\varnothing D2$ bolt holes	mm	8..9

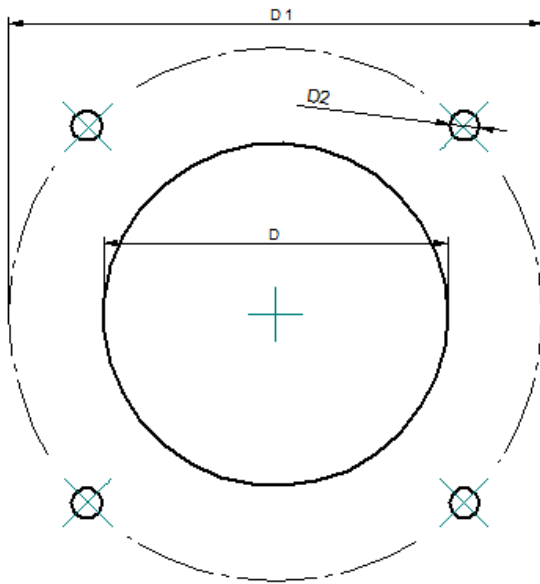


Figure 7 Mounting holes with supplied flanges for boiler door

3.2 Installing burner to the boiler

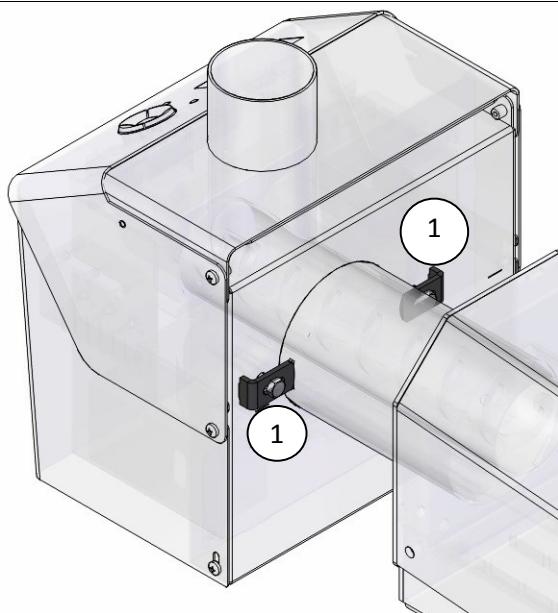


Figure 8

1) Remove burning chamber from the burner body by loosening burning chamber bracket bolts (1). There is no need to completely remove brackets or bolts.

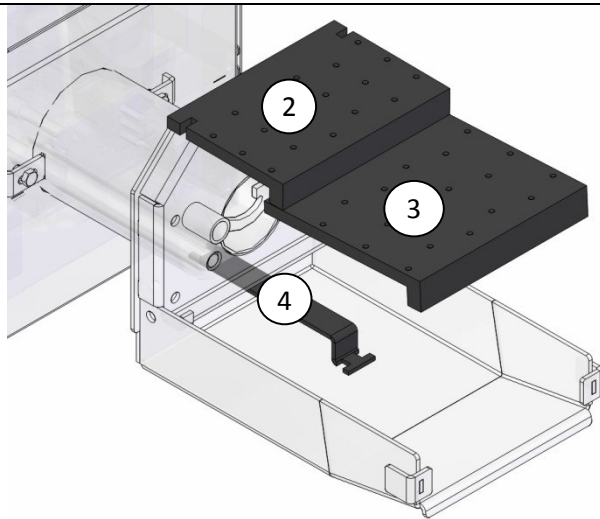
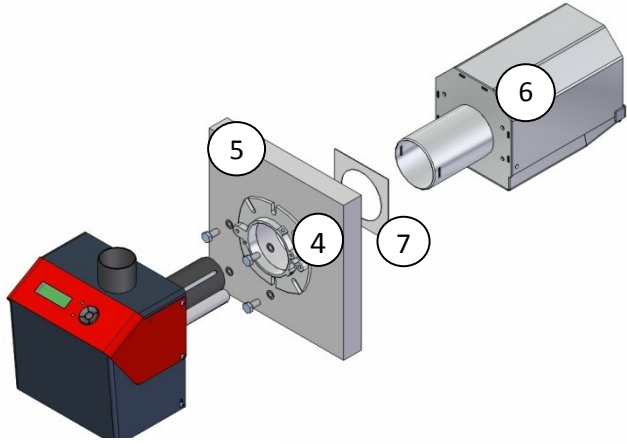
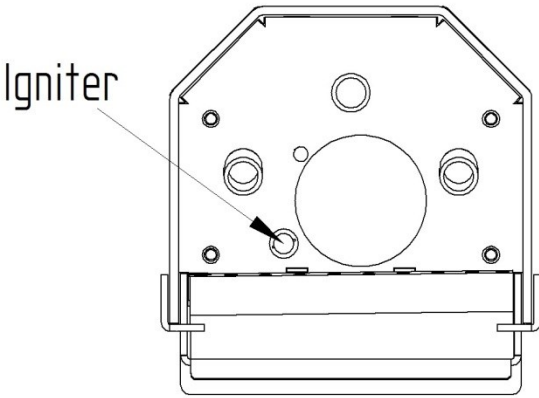


Figure 9

2) Remove upper grate (2) and then the lower grate (3) from the burning chamber.
3) Remove burning by pulling it, while pushing linear actuator rod (4) upwards through the burning chamber back wall.

 Figure 10	4) Fix the flange (4) of the burner to the door of the boiler (5). Make sure that the opening of the flange and the opening of the boiler door are aligned. 5) Fix the burning chamber (6). For that you need to put a ceramic seal (7) on the narrower side of the burning chamber and then put the chamber through the door of the boiler in a way that the rearward wall of the burning chamber would lean on the door of the boiler. Fixate the burning chamber with two grub screws to the flange. 6) Connect the body of the burner to the burning chamber like it was done before disassembling in step 1.
 Figure 11 Igniter correct position	7) Make sure, when looking through the burning chamber, the igniter end tip is at the same level with the back wall. The tube of the inner auger must reach through its opening. 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 back wall.

3.2.1 Pellet storage

The burner, the auger and the pellet container are a common system. The size and the location of the pellet container depend 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° (refer to Figure 12).
- It is advisable to use a container that can be closed with a cover.

3.2.2 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 to the storage or to some other object nearby (with delivered chain).

Figure 12 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 to 70 cm and horizontal displacement 10 to 20 cm (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.

Auger cable must be connected to the left of the burner. Make sure the connector is fully inserted into socket.

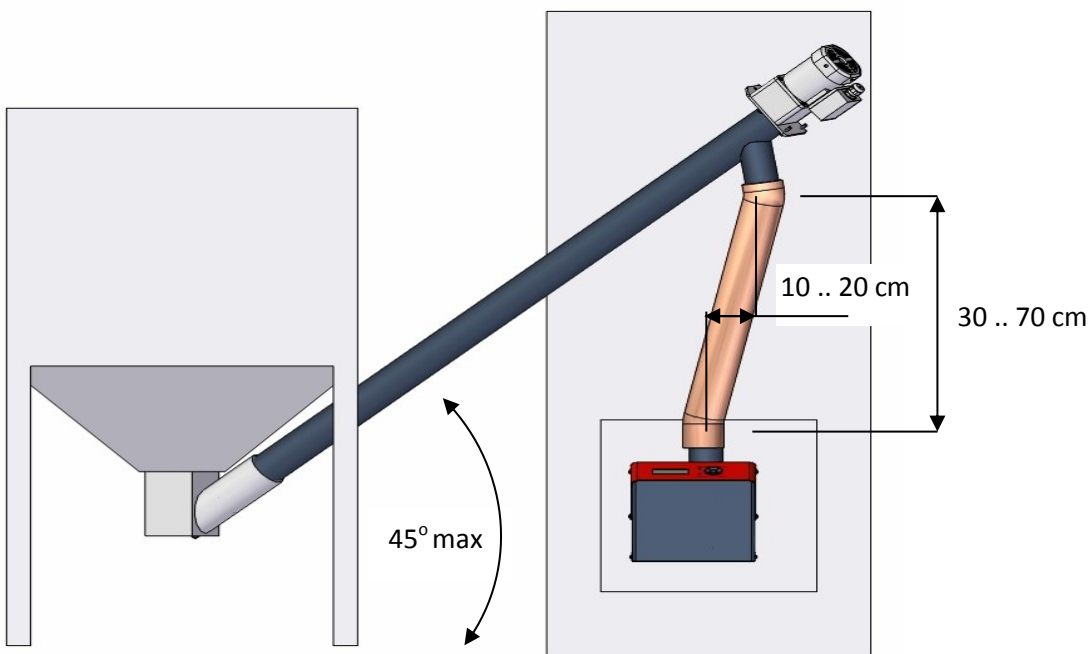


Figure 12 External auger installation

3.3 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.

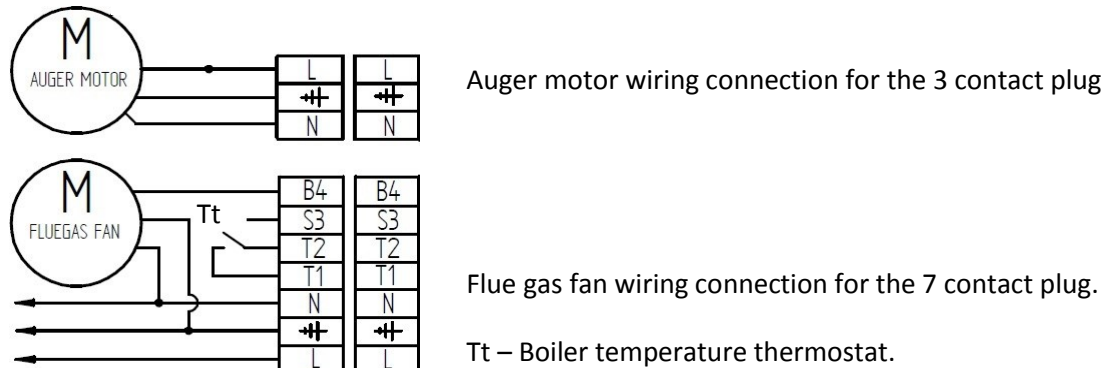


Figure 13 Electrical wiring

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

3.4 Commissioning

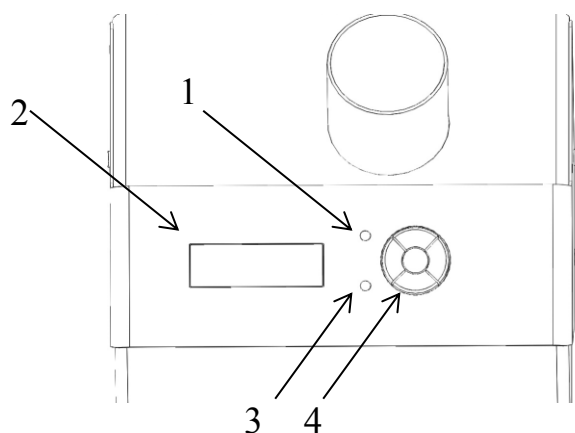
Before starting the burner for the first time, please check that:

- Burner body and burning chamber are securely connected by brackets
- The grates are installed in burning chamber
- Igniter can be seen from burning chamber and it is not stuck behind back wall of the burning chamber (Figure 11).
- Boiler thermostat is connected to the burner (Figure 13).
- External auger is connected to burner and auger position is according to requirements in Figure 12.
- Boiler is connected to chimney, dampers are opened and there is enough draught (4-6Pa minimum).
- No additional air valves are opened in boiler. All combustion air must come from the burner.

4 Operation and maintenance

4.1 User interface

User interface allows starting and stopping, changing parameters and view statistics about burning process. Main parts of the interface are listed below



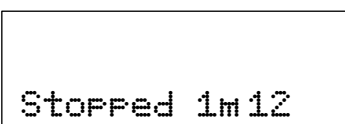
1. Flame indicator. Yellow LED to indicate if flame detector has detected flame in burning chamber.
2. LCD screen
3. Fuel indicator. Green LED to indicate if there are pellets in internal auger inlet.
4. Navigation buttons to change parameters and control the burner.

Figure 14 User interface

Up and down arrow keys enable to move up and down in menus, also change parameter value in editing mode. OK and back arrows have different actions depending on the context.

Table 3 Buttons

Button	Push time	Action
OK	less than 3s	Enter submenu Confirm settings (when blinking)
OK	more than 3s in INFO menu	Pellet counter reset
OK	more than 3s not in INFO menu	Error status reset
OK	more than 3s in NO POWER state	Switch off the burner (cut battery)
←	less than 3s	Move back from menu Discard changes in setting (when blinking)
OK + ←	more than 3s	Burner reset



By default, the status screen is displayed with time counter. **1m12** reads as 1 minute and 12 seconds and **3h24** means 3 hours and 24 minutes.

Main menu in Figure 1Figure 15 can be accessed by pressing OK button.

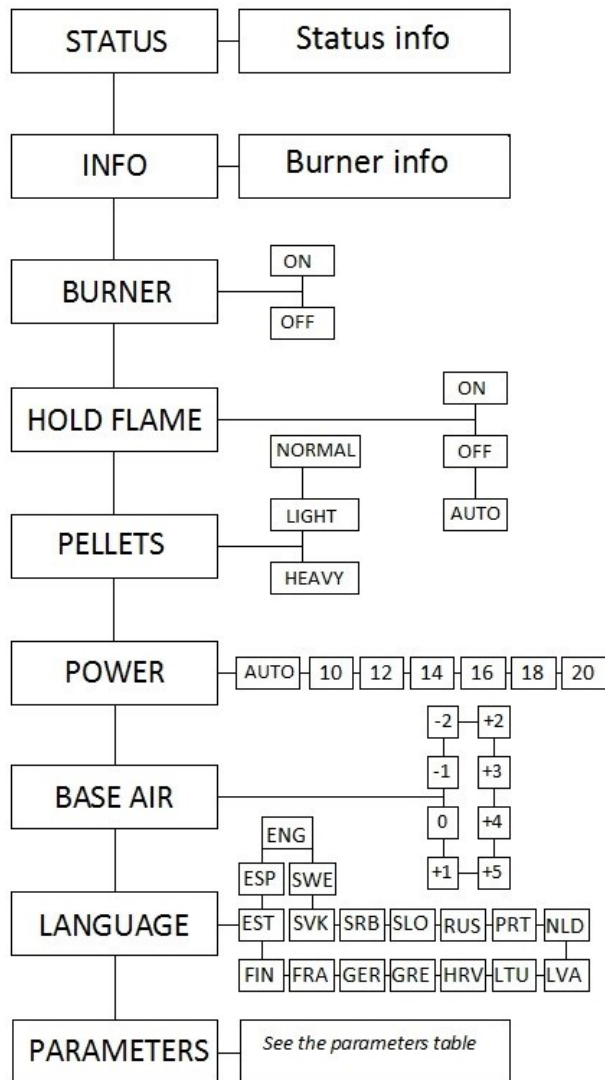


Figure 15 Menu layout

4.1.1 Status messages

During operation, the burner displays several status messages. Short explanation is given below.

Table 4 Burner status messages

Status Message	Description
STOPPED	The burner is not switched on.
WAITING	The burner is switched on and waiting for command from the thermostat of the boiler.
TESTING	Testing the fan, battery, and feeder.
LOADING	Loading pellets into burner for ignition after the command from boiler thermostat.
LOADING2	Second try if the first ignition was not successful.
IGNITION	Loaded amount of pellets are in the burning chamber, igniter and fan are working till photocell recognizes flame.
PREBURN	Only the fan is working, the igniter is off. Pellets start burning properly.
BURNING	Status of normal working: External auger works by level sensor, internal auger and fan are working by. Photocell must see the flame.
HOLD FLAME	Boiler has reached an estimated temperature and boiler thermostat switched off, pilot flame is held in the burning chamber.
BURN END	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.
END BLOW	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.
NO PELLETS	Level sensor does not detect pellets
NO FLAME	There is no flame in the burner more than 120 seconds during burning.
OVERHEAT	Temperature in the burner has reached preset temperature and burner turned off.
IGN.ERROR	Flame is not recognized after ignition
LEVEL ERR	Level dose not reached or level dose not disappear at burning time
FEEDER ERR	Jam in feeder or feeder rotation is not detected
FAN ERROR	Fan rotation problem
BATTERY LOW	Battery is not connected or empty
NO POWER	Supply power is not detected – burner works on battery

4.1.2 Info menu

Content of info menu is following:

TOTAL = total amount of pellets burned with this burner. Amount is updated after every 10 kg.

COUNT = amount of pellets burned since last zero. Amount is updated after every 0,1 kg. To zero the amount, be sure you are in this menu and hold down OK for 5 sec.

FAN = fan rotation speed as it is / fan rotation speed as it should be $\pm$ base air (selected base air in the main menu)

P = currently working power/ power as it should be

T = burner internal temperature

U = Battery voltage level

I = Feeder current

DRAUGHT = when pressure sensor is connected, draught is shown.

4.2 Starting and stopping

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 burner, there are two options:

- Turn boiler thermostat to lowest point.
- or-
- Go to menu and change 'Burner' from ON to OFF

In both cases, it takes some time before all pellets inside the burner are burnt. Status changes BURNING → BURN END → END BLOW → WAITING or STOPPED. It can take more than 20 minutes to complete.

Warning! Never turn off a working burner from the main switch of the boiler (i.e. by cutting the mains supply). Use the thermostat switch for that purpose. In order to stop safely, let the burner burn empty.

4.3 Description of a working cycle

When the burner is switched on for the first time, it displays **STOPPED**.

After turning on the burner (chapter 4.2), the burner enters into **WAITING** status. Now the burner is ready to start if boiler thermostat signal is received (electrical connections chapter 3.3).

Burner starts **TESTING** if boiler thermostat signal is received. Combustion air fans, battery voltage is tested and measured.

Upon completion of testing, the burner starts **CLEANING**, during which grates are moved back and forth to remove the ash.

After cleaning, the burner is ready to load pellets into burning chamber. In **LOADING** status, external auger starts to transport pellets into burner. Internal feeder loads pellets into burning chamber. Internal feeder starts only when there is a signal from level sensor. The signal is needed to ensure that the internal tube is filled with pellets. This way the amount of pellets entering into burning chamber is roughly proportional to the number of rotations that internal feeder makes.

IGNITING starts when predetermined amount of pellets is loaded to burning chamber. The amount of pellets is adjustable in parameters menu. Igniters are switched on first time in loading status to preheat the ignition system. Igniters are periodically switched on and off to keep them from overheating. It can take several minutes for the hot air to ignite pellets.

Signal from flame sensor marks the end on igniting and burner enters into **PRE-BURN** status. The purpose of this status is to allow build up flame before starting to add more fuel.

Next status, **BURNING**, is the normal operating state of the burner. Here fuel is periodically added according to current power level. If enabled from menu, burner can make cleaning cycle after fixed time intervals. Cleaning during burning is preceded by short **HOLD FLAME** status to burn the pellets before dumping ash to boiler.

Burning can be ended by turning burner off from menu or button on user interface, but normally the burning status ends by receiving boiler thermostat signal. In all three cases, the next status is **END BURN**. No more pellets are added anymore, but the combustion air is still kept as in burning status. It allows remaining pellets to burn. End burn lasts until no flame is detected by flame sensor.

The burning cycle ends by **END BLOW** status. Here only small amount of air is supplied to completely burn all embers.

Next status can be waiting again or **HOLD FLAME**, if it is enabled from menu. Hold flame reduces the number of ignitions and allows the burner to operate smoothly. Here only minimal pellets and air is supplied to keep the flame alive.

4.4 Refilling fuel storage

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 by switching burner OFF and back ON from menu. Failing to do so will result 'Fuel error' due to fuel loading timeout.

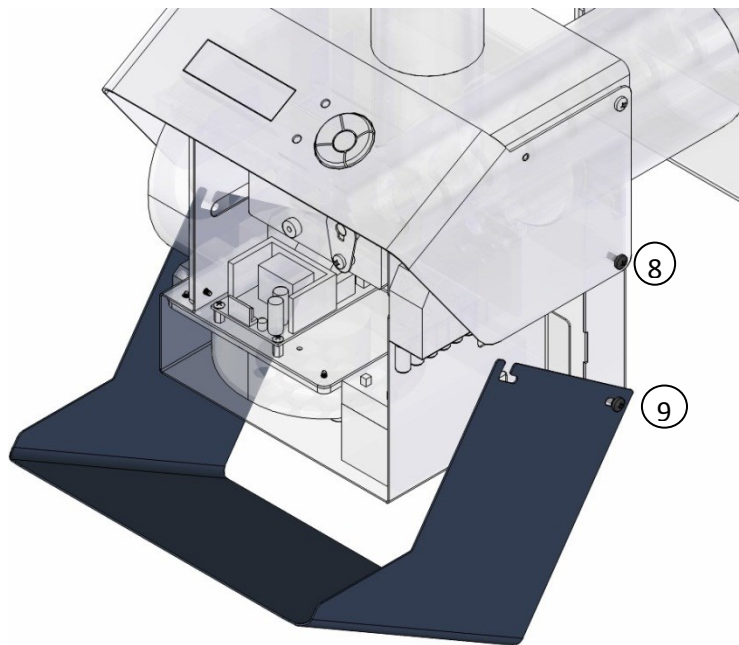
4.5 Regular maintenance

Following maintenance procedures must be carried out on regular basis

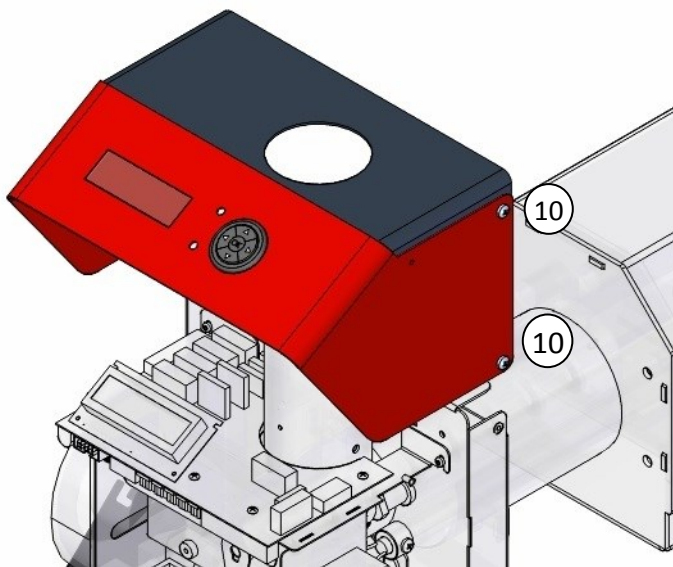
Once a week – ash removal from boiler

Once a year – cleaning of grate power screw

4.6 Replacing components

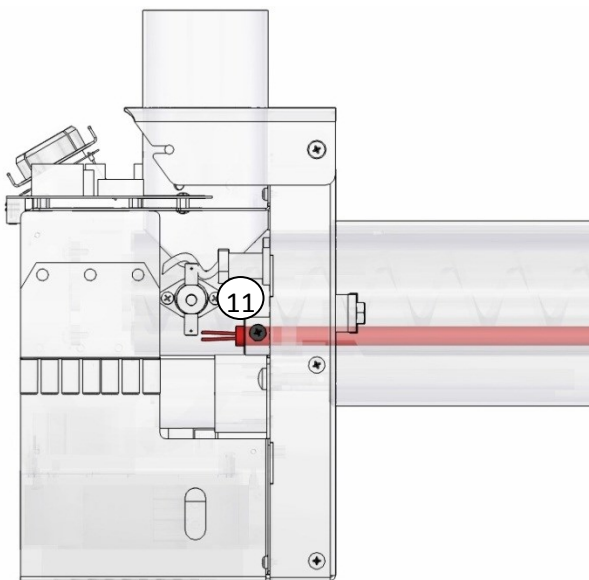


To open burner lower cover, loosen burner cover's middle (8) and bottom (9) screw. Then pull the cover towards direction shown in picture. There is no need to remove screws.



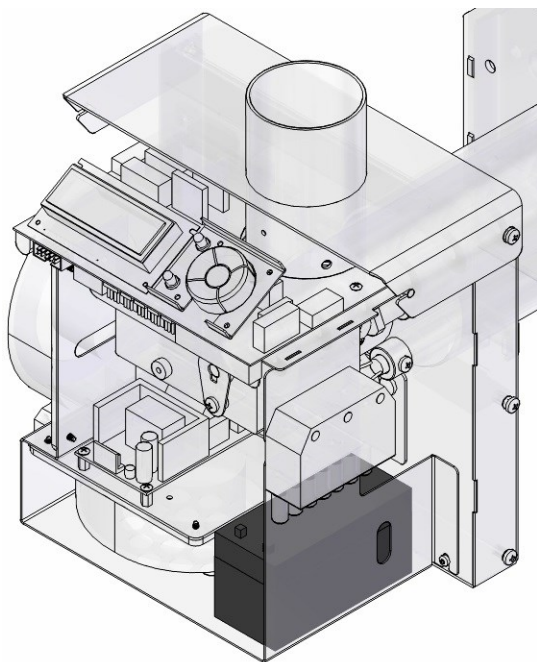
In order to remove burner upper cover, first open burner lower cover. Then remove upper cover's screws (10). Pull the cover upwards direction shown in the picture.

NOTE: it may be necessary to remove user interface buttons from the controller board to completely remove upper cover from the burner.



Igniter

- 1) Disconnect burner from the power network.
- 2) Open burner body.
- 3) Disconnect igniter wiring from the control board X1, connector 1 and 2.
- 4) Loosen igniter fixation screw (11) using cross-head screwdriver.
- 5) Remove igniter from the burner body.
- 6) Install and connect new igniter vice versa from removing.



Battery

- 1) Disconnect burner from the power network
- 2) Open burner body
- 3) Disconnect battery wiring
- 4) Install new battery, redo wiring, redo burner cover and connect burner to the network.

Note: It is recommended to use two sided tape to secure battery in place.

5 Problem and solutions

Error status	Cause	Action
Stopped	This is actually not an error condition. Burner is turned OFF from menu.	To turn burner on: - hold down OK at least 3 sec. -or- - change BURNER from OFF to ON in setup menu
No pellets	Maximum loading time is reached (5 or 20 minutes) and not enough fuel from external auger for ignition is loaded Fuel level is not detected in 4 minutes at burning time	- check fuel in storage - check auger and auger connection to burner - check the level sensors, clean them
No flame	Flame disappeared at preburning time Flame is disappeared at burning time Flame dose not disappeared in end blow cycle	- check the level sensors, clean them - check photocell, clean it
Overheat	Burner internal temperature is reached over set-point as fixed in setup menu. Possibly back-burning is happened	- check burner temp. from INFO menu - check temp sensor connection - check burning chamber and clean it - check the chimney and pressure in the boiler - check the internal feeder screw connection and rotation
Ignition error	Flame is not detected at ignition time	- check igniter and igniter fuse - check photocell
Level error	Fuel level in the burner dose not disappeared at burning time	- Check the level sensors, clean them
Feeder error	Feeder did not make any rotations in 8 seconds at its running time Feeder motor current reached 0.75A permanently in 0.2 second time	- check feeder sensor connection - check magnet on the feeder shaft - check feeder screw connection - feeder can be stuck.
Fan error	Fan did not reach 40 rps in 7 seconds at testing time with full power Fan did not reach to needed speed at burning time in 20 sec.	- check fan sensor connection - check fan power connections - check magnet on the fan shaft - check fan bearings and rotation
Battery low	Battery voltage is less than 12V with load (working feeder)	- If there was power failure then just wait when it is loaded - check battery, maybe too old

No power	No mains power Safety thermostat is turned off the power - backburn	- check power connector, cables - check safety thermostat - check burner for backburn
----------	---	---

6 Annex A – Electrical schematic

Fuse	Rating	Description
F1	3A	Ignitor
F2	2A	Error/pump
F3	1A	Auger
F4	2A	Fluegas fan
F6	6A	Fans and grate
F8	1A	Feeder
F10	6A	Battery

Main wiring diagram on the next page.

