



Sunnytek Solar Sweden

BioGen Wood Log Power and Heat Solutions

The solution for staying powered and warm in remote places using locally available wood



Operation and Maintenance Manual

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1. Introduction

FOR YOU TO REMAIN SATISFIED WITH OUR PRODUCT, WE RECOMMEND THAT YOU FOLLOW THESE FUNDAMENTAL PRINCIPLES FOR LONG LIFESPAN AND SUSTAINABLE PROPER OPERATION OF THE BIOGEN WOOD LOG HEATER

- Use only dry wood fuel with max. 20 percent moisture content – (2 years old wood).
- During the process of gasification of solid wood some tar and other condensates (acids) may accumulate in the fuel bin. That is why a four-way mixing valve or a Laddomat needs to be installed right next to the heater. We adjust the mixing valve in such a way that the operating temperature of the water inside the heater is between 75 and 90 °C (167 – 194 °F). The prescribed minimum return water temperature is 60 °C (140 °F).
- When a circulating pump is used, the heating medium's temperature gradient must be ensured of at least 15 – 20 °C and a minimum return water temperature of 60 °C (140 °F). The pump must be connected to the thermostat switch in such a way that it only operates when the required minimum temperature is reached.
- The Stirling Engine is required to be cooled with water of a temperature between 6 and 70°C. The flow-rate of the cooling flow must be more than 8 litre/minute. This cooling flow must be implemented as a separate cooling circuit with its own pump.
- The heater must not be continually operated at an output capacity less than 60 % of its rated capacity.
- For correct and safe operation of the heater the following principles must always be observed:
 - Heater and Stirling Engine cleaning on a regular basis during a heating season; Note: be careful when cleaning the grey collar just below the engine-head, this material is fragile and must be cleaned with a soft brush, don't scrape the material.
 - Thoroughly cleaning of the heater and Stirling Engine after the end of a heating season;
 - Required chimney-draught (sufficient combustion products velocity)
 - Good thermal insulation of the chimney;
 - Regular inspections of chimney draft (chimney-sweep).
- It is recommended to install a heater in a system with a storage tank.

WARNING – If the above instructions are not followed the life of the heater's body and the ceramic fireproof insulation bricks may be substantially reduced as a result of low temperature corrosion. The heater body may become badly corroded as early as within two years.

2. Purpose of Use

The BioGen Wood Log Heater is intended for heating homes and other types of buildings. Additionally, the Stirling Engine will generate electrical energy of up to 1000W. The heater is designed exclusively to work on burning wood. Any dry wood such as chopped logs or wood chips with maximum length of 500 mm can be used as fuel for this heater. Recommended log diameter is 150 mm. Logs with larger diameters can be used as well (max. 200 mm). If so done, the heater's rated output capacity will decrease and the period of burning will be extended. Minimal diameter of wood chops is 60mm. In case these parameters are not met, extreme overheating of heater may occur in the burn-out chamber and ceramic parts will be damaged consequently due to excess heat.

3. Technical Parameters of the BioGen Wood log Heater

Parameter	Unit	Value
Output Capacity	kW	20
Maximum Output Capacity	kW	22
Fuel Bin Volume	cubic dm (dm ³)	110
Operating Draught	Pa	10-15
Maximum Operating Water Gauge Pressure	(MPa)	0,25
Heater Weight	kg	450
Exhaust Socket Diameter	mm	159
Heater Height	mm	1750
Heater Depth	mm	1140
Heater Width	mm	570
Water capacity	L	70
Heater Efficiency at Rated Capacity	%	85
Prescribed Type of Fuel		Dry wood calorific value of 15-17 MJ/kg, water content min. 12% - max. 20%, diameter 90-150 mm
Average Fuel Consumption	kg. h ⁻¹	5,8
Maximum length of wood logs/chips ø 60 – 200 mm	mm	500
IP rating	IP	20
Voltage options	V / Hz	230/50 or 230/60
Fan power input	W	77
Stirling Engine:		
Maximum electrical power generated	W	1000
Grid protection		G83/ENS
Cooling flow temperature	°C	6-70, 75 for 30 min. max.
Ambient temperature	°C	6-65

Note: If the maximum heater output capacity is required, any logs with larger diameters are necessary to be cut in half or, possibly, cut in quarters.

4. Technical Description

The BioGen Wood Log Heater is designed to work on wood combustion. The combustion process (which is based on power generating gasification) is obtained by passing ambient air into the firebox (furnace) with the use of an exhaust fan.

The heater shell is made from steel plates as a welded assembly. It consists of a fuel feed hopper, which at its bottom part is equipped with a fireproof insulation brick that comprises a longitudinal opening (nozzle) for exhausting the combustion products. There is an afterburning space with ceramic tile blocks located beneath the said fireproof insulation brick. In the rear part of the heater there is a vertical tube plate that, in its upper part, merges into a collecting duct where there is a firing valve. The collecting duct's rear part is equipped with an exhaust fan and socket for connecting the duct to the chimney.

The front face of the upper part comprises a re-fuelling door and the lower part comprises an ash door.

There is a fan located on the back side.

The outside surface of the heater body is thermally insulated with mineral wool inserted beneath sheet metal covers of the heater's outer shell.

The upper portion of the heater comprises a control panel.

The bottom section of the heater houses the Stirling engine. This Stirling engine is the power generating part of the BioGen heater. The engine is placed on a lift system which can remove the engine when necessary (an error occurs). By heating up the heater head (top part) of the Stirling engine it will generate power. The engine starts at 220 deg. C and produces its maximum power of 1000W at about 500 °C. When the engine is overheated or an error occurs the lift system will drop the engine out of the heater and a valve at the bottom of the heater will be closed. After this the heater continues normal operation without using the engine. To bring the engine back in the heater it should be cooled down first as described in section 11.2.

- The heater's construction gives the following advantages:
 - the combustion process takes place at a high temperature using the function of heat generating gasification;
 - the combustion air is supplied through an exhaust fan;
 - the combustion process is characterized by stable flame and a stable state and quality of combustion;
 - the large fuel feed hopper enables the burning of separate pieces of wood with maximum length of 500 mm;
 - enables the burning of wood waste.

5. BioGen Wood Log Heater Operating

5.1 Heater Preparation for Operation

Before the heater is put into operation, it is necessary to ensure that your heating system has been filled with water and de-aerated. The Ceramic "U" (see section 17, item 18) needs to be placed directly under the nozzle. There is also an electrical box at the back side of the heater, which has a terminal board for connection of the water pump (included socket). The pre-set value is 50°C.

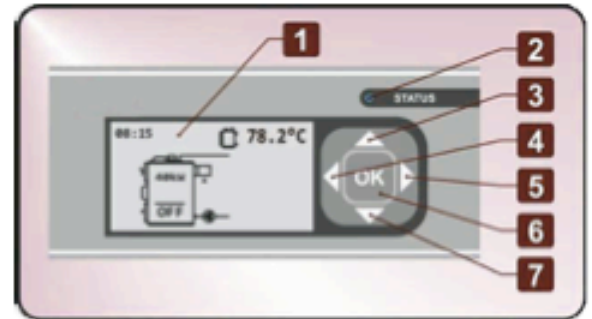
In order to ensure proper and safe operation, your wood-fired heater must be operated in accordance with the instructions contained in this operating and maintenance manual. The heater must be operated by adults only.

CAUTION

When you fire up a new heater for the first time, condensation and discharge of the condensate from the heater may occur - this is not because of any defect in the heater. After a longer duration of operation, the condensation will disappear.

5.2 BioGen Wood Log Heater display and control

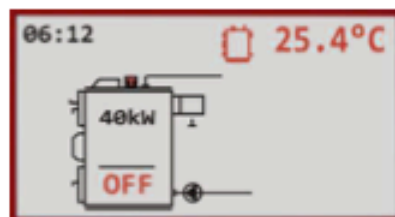
- 1) Graphics display, 128 x 64 pixels, LED backlight.
- 2) DuoLED – total status OK (green) / Err (red).
- 3) Button up - increase adjusted value or switch depiction of the displayed values.
- 4) Button left - auxiliary fan power down or move the selection left.
- 5) Button right - choice back (ESC) or move the selection right.
- 6) Button OK/ENTER.
 - Short pressing
 - power on the heater, five arrow button depiction and subsequently you can power off heater or supply fuel (suction fan goes to 100%)
 - fuel supply ending - after fuel supply is passed by
 - menu level or choice confirmation, data storage
 - long (2 sec) pressing – entrance to user operation settings
- 7) Button down - decreasing adjusted value or switching depiction of the measured values



For more information, please see the AK6000 manual.

5.3 Starting a fire

The state of the heater is off:



To start a fire:

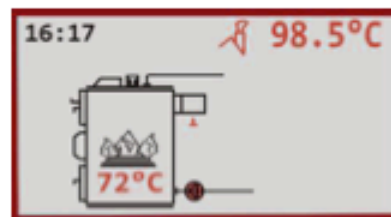
- Pull draw-rod (15) out and open the top door (2) and place a stack of small pieces of wood, paper, or other flammable material in the bottom of the top-chamber. Keep the draw-rod (15) pulled out.

- Press OK (short). The fan will start to run and the display updates to:



- Set fire to the stack of wood and other flammable material. The bottom-door (3) can be opened a little to let more air in, this will increase the success of starting the fire.
- After the small stack is burning well, place several small logs in the top chamber and let them catch fire. The door (2) can be closed during this process. After several minutes, fill up the top chamber with wood, $\frac{1}{2}$ to $\frac{3}{4}$ full. Close the bottom door (3). Be sure to keep the draw-rod (15) pulled out during this process.

5.4 Starting the gasification

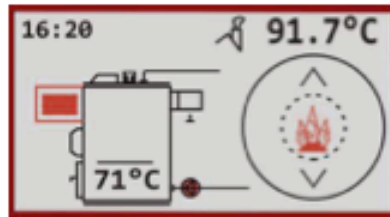


- While the fire grows stronger, keep an eye on the chimney temperature: When the chimney temperature has reached 150°C, push the draw-rod (15) fully in. This will start the gasification process. The generated gas is automatically ignited and burned in the bottom chamber where it heats up the head of the Stirling engine. Also, the water-body around the top and bottom chamber will heat up.
- After some time, the engine-head will become hot enough to start the engine. This will happen automatically. The start-moment and operation of the engine can be noticed by the particular sounds that can be heard when these processes take place.

5.5 Re-filling the heater

- When the chimney temperature drops below 180°C (correct?) or when the power of the Stirling Engine drops below 400W (correct?), the wood-mass in the top chamber needs to be compacted and/or to be added to.

- Press OK twice (short). The display will show an opening top door:



- Wait 10 seconds before opening the top door, the combustion products will be removed from the chamber
- Pull out the draw-rod (15) and open the door (2).
- Use the supplied rake (right name?) to compact the wood-mass and/ or add wood to the chamber.
- Press OK (short)
- Close the door (2) and push the draw-rod (15) fully back in.
- Repeat this process when required.

5.6 Stopping

When no more wood is added, the temperature of the fire, chimney, etc. will slowly drop. The controller of the heater will detect this and it will turn the heater off. When this has happened, the text "END" is shown on the display:



5.7 Heater Cleaning

When the gasification process has ended, and the heater has cooled down, it is recommended to clean the heater. This should be carried out as follows:

- Open the feeding door (2) and then sweep the ash through the slot (10) into the lower space. Small pieces of unburnt wood (i.e. wood coal) can be left in the charging hopper until the heater is fired up next time.
- Open the clean-out opening (13) and clean the tube plate by taking out of the tabulators (25) and cleaning by the tube cleaner. After you open the ashtray door you can rake the ash and soot out from the ashtray.
- Cleaning can normally take place with the Stirling engine inside, just scrape the ash around the Stirling head and make sure to remove all the ash also from the back of the heater. Once every month it's recommended to clean with the Stirling engine down. Push the emergency switch will make the engine goes down. After cleaning reset the emergency switch and reinstall the engine as described in 11.2.

The cleaning interval depends on the quality of fuel you use (moisture content), the intensity of heating, the chimney draught, and other specific circumstances. The heater should be cleaned at least once a month. The lower combustion space is necessary to be kept clean. You should clean it twice a week, at the least. Minimum once a year, we recommend to clean the wheel of the exhaust fan (4) and the air ways. We should turn off the control unit and unplug the heater from the electricity. We can demount the exhaust fan by unscrewing 4 screws under the chimney tube (14) and take out the exhaust fan with the sheet metal plate it is mounted on. Be careful and do not break the electrical cable it is connected to the heater. We can clean the wheel by a soft or medium brush. Then we mount the fan the same way we have demounted it. Electrical cables should hang from the bottom of the fan. To clean the air ways, we must demount the front panel (26), unscrew two screws under the upper door (2) and 2 screws on the panel's sides. Unscrew the air flap valve (7) and clean the air ways. Use a plug for the holes for air ways into the nozzle, to keep it clean from the ash from the cleaning. After cleaning, unblock the air way into the nozzle and mount the parts in the same order from the end to the beginning.

6. Heating System and Heater Maintenance

You should check the water level in the heating system at least once in every 14 days. Refill water if necessary. Refilling must be, at all times carried out with the heater out of operation. If, during winter season, your heater is out of operation, there is a danger that the water remaining in the system may freeze causing damage to the system. In this case we can use an anti-freeze mixture for the heating systems. Water should be pumped out of the system in exceptional cases only. If possible, drain the water from the system for a minimum necessary amount of time. After the end of a heating season a heater should be thoroughly cleaned, any damaged parts should be repaired or replaced with new parts.

7. Fuel

The appropriate type of fuel is dry wood with max. 20 percent moisture content. Logs should be with maximum length of 500 mm and calorific value of 15 – 17 MJ.kg⁻¹. Recommended log diameter is 150 mm. Logs with larger diameters can be used as well (max. 200 mm). If so done, the heater's rated output capacity will decrease and the period of burning will be extended. Minimal diameter of wood chops is 60mm. In case these parameters are not met, extreme overheating of heater may occur in the burn-out chamber and ceramic parts will be damaged consequently due to enormous heat. The required dimensions of wood pieces are stated in Chapter 2 - Technical Information.

8. Chimney

The chimney flue must at all times develop a sufficient draught to be able to reliably exhaust combustion products to the outside environment. A separate independent chimney flue of proper dimensions should be installed for the chimney to function properly. The proper function of a heater depends on the chimney draught. The chimney draught depends on the chimney's cross section, height and the roughness of the chimney's walls' internal surface. The BioGen Wood log Heater requires an operating chimney draught of 10-15 Pa.

No other appliance should be connected to the heater's chimney.

For the BioGen Wood log Heater, approximate dimensions of the heater's cross section are:

20 x 20 cm	Minimum height 7 m
ø 20 cm	Minimum height 8m

9. Accessories

Scraper for sweeping pipes	1 pc
Inlet valve	1 pc
Sweeping scraper	1 pc
Operation and maintenance manual	1 pc
Warranty certificate	1 pc
Female socket for pump	1 pc

10. Electrical Connection of the Heater to the Power Supply

The heater must be connected to the local electricity grid (230VAC/50Hz or 240VAC/60Hz) via a three-conductor cable (triplex) with a male plug with grounding contacts. The male electric plug is inserted into a fixed, grounded female electricity outlet. The power supply plugs must be easily accessible to personnel after the installation of a heater. Preferably the heater should be connected to a separate electricity group protected with an automatic 16A circuit breaker.

11. Possible Malfunctions and the Method of Correcting Malfunctions

<i>Malfunction</i>	<i>Cause</i>	<i>Method of Remedy</i>
The warning lamp ("Power") does not light	<ul style="list-style-type: none">- no voltage at power supply terminal- the plug is not properly inserted in the power socket (female terminal)- bad/blown fuse- bad mains switch- bad electric power cable	<ul style="list-style-type: none">- check- check- replace- replace- replace
Your heater is failing to give the required output capacity	<ul style="list-style-type: none">- too little water in the heating system- the heating system has not been deaerated- your heater is not of appropriate size/capacity for your hot water/heating system- fuel of low quality, high moisture content, too large logs- poor chimney draught- insufficiently clean heater	<ul style="list-style-type: none">- add water- deaerate- revise the project- burn dry wood and wood waste- clean your chimney, check the connection- clean the heater
Too noisy fan	<ul style="list-style-type: none">- the fan is clogged with dirt	<ul style="list-style-type: none">- clean the fan by blowing high pressure air through it or using a fine brush
The door is not tight fitting	<ul style="list-style-type: none">- defective caulking cord- blocked nozzle	<ul style="list-style-type: none">- replace- do not burn fine waste separately from larger pieces (sawdust, chips etc.) wood.

11.1 Stirling Engine-related Errors

When a Stirling engine-related error occurs the status light on the BioGen Wood log Heater controls will start to slowly flash red/green. If the error causes the engine to stall (stops to operate) the engine will drop out of the heater and a cover will close the opening in the bottom of the heater. After this the heater continues to operate, only generating heat.

! Please be careful! When this happens, the engine head is very hot (up to 550 degrees) and will stay hot for a long time. Also, a few pieces of hot wood (charcoal) can leave the heater during the time the engine is dropping out and the cover is closing the opening in the bottom.

Before the engine can be re-installed, the engine head must have cooled (head temperature < 150°C) and the heating operation of the heater must have been stopped and the heater must have cooled down. When cooled down, clean the bottom part of the heater and the engine by removing ash and wood pieces. **(Be careful when cleaning the engine collar because the material can be easily damaged).**

11.2 Re-install the engine in the heater after an error

Make sure the bottom part of the heater is clean so no ash and charcoal parts fall on the engine when the bottom valve is opened.

Push the green button (see picture on next page) and hold until the engine is lifted up completely in the heater. This process stops when the engine is back in the right position. After this has happened the button can be released.



11.3 Error codes generated by Stirling engine

Code	Description	AR	UR	SR	NStop	EStop
10	Coolant inlet temperature sensor short-circuit	x			x	
11	Coolant inlet temperature sensor open-circuit	x			x	
12	Coolant outlet temperature sensor short-circuit	x				
13	Coolant outlet temperature sensor open-circuit	x				
14	Back end temperature sensor short-circuits	x				
15	Back end temperature sensor open-circuit	x				
16	Ambient temperature sensor short-circuits	x				
17	Ambient temperature sensor open-circuit	x				

301	Inner iron over-temperature	x				x
303	Dynamic absorber over-travel			x		x
304	Grid protection (G83/ENS)	x				x
306	Alternator overload			x		x
309	VI protection trip	x				x
310	Head over-temperature HW			x	x	
311	Head under-temperature HW	x				x
312	Remote emergency stop	x				x
404	Head under-temperature SW		x			x
405	Head over-temperature SW	x			x	
406	Head temperature measurement discrepancy		x		x	
407	Control thermocouple failure		x			x
408	Limit thermocouple failure		x			x
411	Under-current		x			x
414	Resistor integrity check failure			x		x
415	24 V d.c. power supply failure	x				x
420	Control thermocouple open-circuit	x				x
421	Limit thermocouple open-circuit	x				x
422	Control thermocouple integrity check failure	x				x
423	Limit thermocouple integrity check failure	x				x
424	Coolant over-temperature	x			x	
425	Coolant under-temperature	x			x	
501	Power meter communications checksum failure	x			x	
502	Power meter communications timeout	x			x	
504	VI protection reset	x				x
505	VI protection under-voltage trip	x				x
506	VI protection under-voltage trip	x				x
507	VI protection under-voltage trip	x				x
508	VI protection over-voltage trip	x				x
509	VI protection over-voltage trip	x				x
510	VI protection over-voltage trip	x				x
511	VI protection under-frequency trip	x				x
512	VI protection over-frequency trip	x				x
513	VI protection short-circuit trip	x				x
514	VI protection trip	x				x
603	Low coolant flow rate	x			x	
604	Ambient over-temperature	x			x	
605	Reset switch fault			x	x	

Key: AR = Automatic reset, UR = User reset, SR = service reset
 NStop = Normal shutdown (i.e. Heat source disabled)
 Estop = Emergency shutdown (i.e. Heat source disabled and engine stopped)

12. Fire Protection during the Use of Heating and Heat Consuming Devices and During the Installation of Such Devices

A heater must be installed in accordance with the STN 061008 standard – Fire Safety of Local Heating and Heat Consuming Devices. During the installation of a heater a safe distance between the heater and any building materials must be at least 200 mm. The same safe distance is also required for a smoke flue located near inflammable materials of the B, C1, and C2 Combustibility Classes (for Combustibility Classes please see Table 1).

If your heater and the smoke flue are located near any inflammable materials with C3 Combustibility Class, the safe distance of 200 mm must necessarily be doubled!

The safe distance of 200 mm must also be doubled if the Combustibility Class of any materials located near your heater and/or your smoke flue is unknown.

The safe distance may be reduced to half of the normal safe distance (100 mm) when using a thermally insulating shield of a minimum thickness of 5 mm. Such shield must be located 25 mm from the inflammable material it is intended to protect. The cover shield or a thermal barrier must extend at least 150 mm beyond either of the lateral edges of a heater (together with the smoke flue outlet) and at least 300 mm beyond the upper edge of a heater.

If your heater is placed on the floor that is made of inflammable material(s), such floor must be shielded with a thermally insulating fireproof board extending at least 300 mm beyond the ground plan on the fire tending side and at least 100 mm beyond the ground plan on all other sides. For this purpose, any incombustible, fireproof, thermally insulating materials can be used.

Combustibility Class of Building Materials and Products	Building Materials and Products Falling within the Combustibility Class
A – incombustible	granite, sandstone, concrete, bricks, ceramic tiles, mortar, fire retardant plasters etc.
B – not easily combustible	wood-wool slabs, clingstone, slabs of basalt wool, glass fibre slabs, etc.
C1 – hardly combustible	deciduous hard wood, laminated paper, laminated plastic sheets (Formica) etc.
C2 – medium combustible	coniferous wood, wood-chips, wood chipboards, particle boards etc.
C3 – easily combustible	Fibreboards (hardboard and the like), polyurethane, polystyrene, polyethylene

12.1 Smoke Flue

A smoke flue outlet must run into a chimney flue. A heater must not be connected to a chimney directly/immediately. A smoke flue should be as short as reasonably possible, but in no instance longer than 1 m, without any additional heating surface, and should ascend towards the chimney. It must be mechanically solid, fixed, thoroughly tight against leakage of combustion products, and should enable cleaning of its internal surfaces.

A smoke flue must not run through someone else's residential or non-residential units or facilities.

The internal cross section of a smoke flue must not be greater than that of the chimney and must not narrow towards the chimney. No bends should be included in a smoke flue.

13. Type of Environment

A heater can be safely operated in a "normal NM – 1 environment" that is specified in Slovak Technical Standard STN 332000-3.

CAUTION: A heater must be installed in a heater room where a suitable supply of combustion air is provided. A heater must under no circumstances be located within a residential space.

Under any circumstances which might possibly give rise to the danger of penetrating a residential space with inflammable gases or vapours or during the course of any works that may involve the danger of fire or explosion, a heater must be put out of operation in a timely manner, before any such danger occurs. (e.g. bonding of floor coverings, PVC and the like).

No objects consisting of inflammable materials must be put onto a heater or within a distance less than the safe distance.

14. Operation and Supervision

Any personnel operating a heater are required to follow this Operation and Maintenance Manual. No interventions in a heater which might endanger the health and/or safety of the operator(s) or any other persons sharing the given residential space/area are permitted.

A heater may only be operated by individuals over the age of 18 who are thoroughly familiar with this Operation and Maintenance Manual.

No children should be allowed to remain within a close distance to a heater that is currently under operation.

When operating a solid fuel fired heater no inflammable liquids are permitted to be used for firing up. Increasing in any manner a heater's output capacity during operation is prohibited as well.

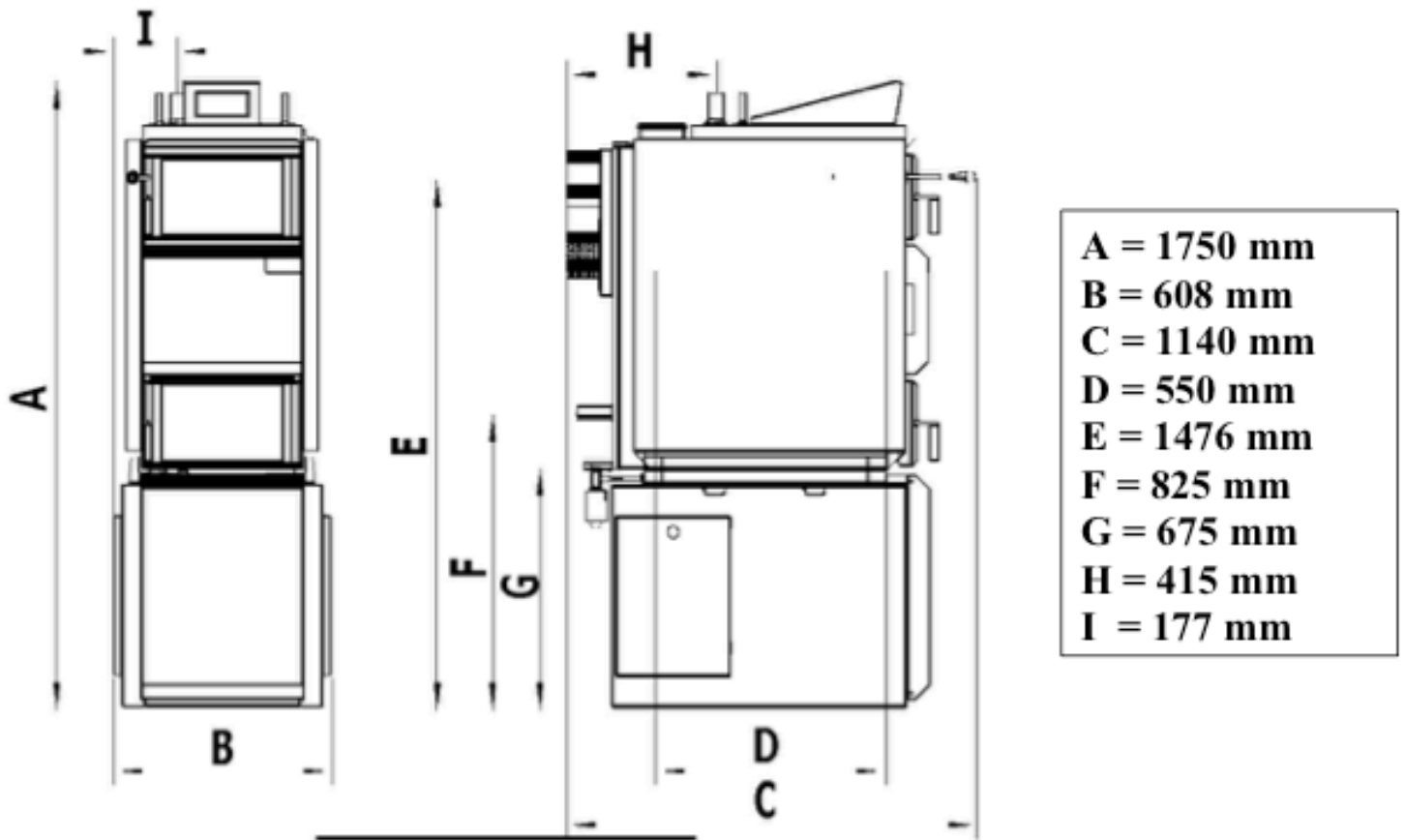
In the course of normal operation, a heater must be controlled by operating personnel.

A user is only allowed to perform such repairs that involve replacement of standard spare parts (such as fireproof concrete insulation bricks and the like). No user is allowed to interfere with the design and/or electric wiring of a heater.

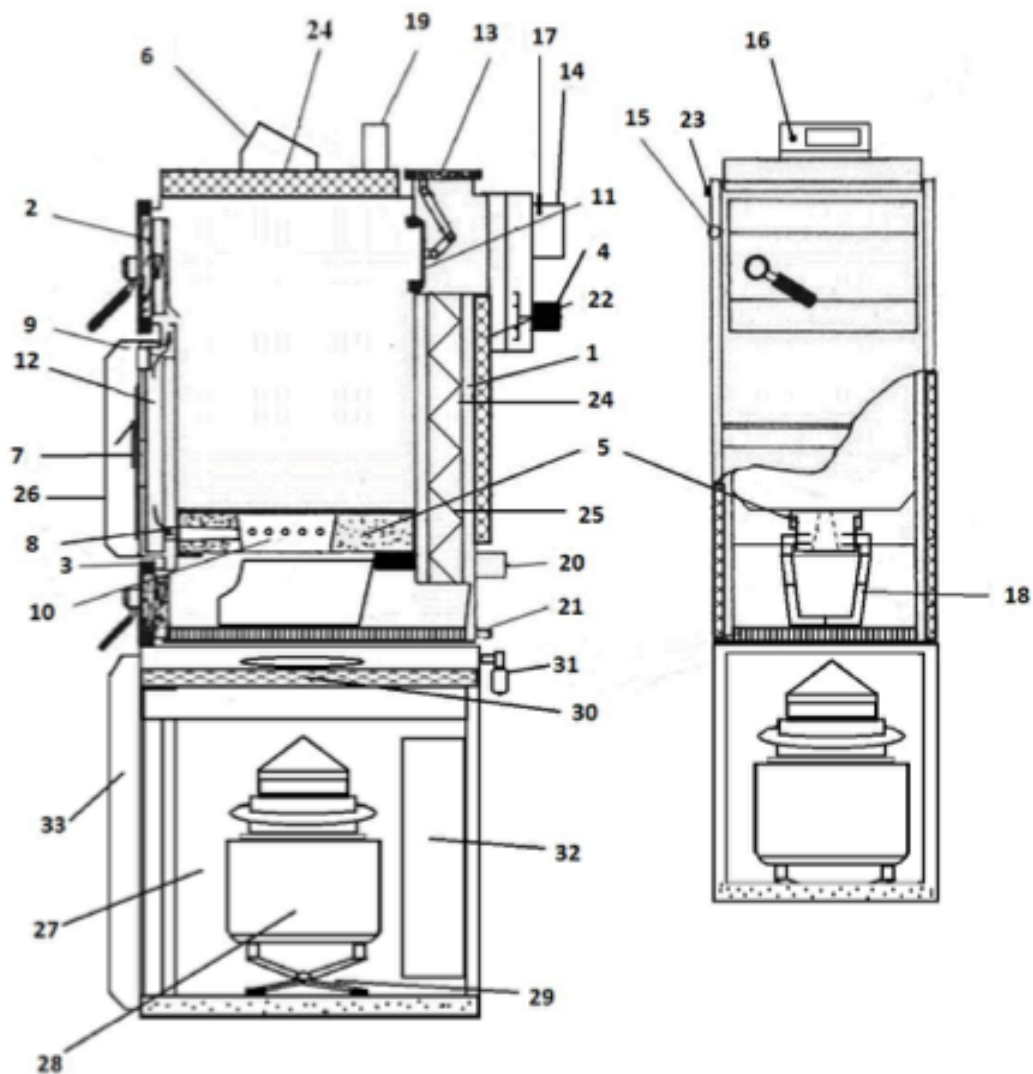
15. Recommended Accessories for BioGen Wood log heaters

- A. The DUOMIX mixing valve is an appropriate element to regulate a central heating system. It ensures that the heating water input temperature in a heater does not drop below 60 °C (140 °F). (Also other types of devices capable of ensuring that the return water temperature does not drop below 60 °C (140 °F) may be applied – e.g. a thermoregulation valve).
- B. Circulating pump with thermostat or
- C. Laddomat or similar system.

16. Heater dimensions



17. BioGen Wood Log Heater Basic Drawing



- | | | |
|---|--|----------------------------------|
| 1) Heater body (shell) | 12) Primary air inlet duct | 23) Cooling exchanger |
| 2) Door to add fuel (upper door) | 13) Clean-out cover | 24) Tube heat exchanger |
| 3) Door to remove ash (lower door) | 14) Smoke flue outlet | 25) Turbulator (air-brake valve) |
| 4) Exhaust fan | 15) Firing valve's draw rod | 26) Front cover panel |
| 5) Bottom of combustion space (refractory concrete) | 16) Fuse | 27) Stirling engine section |
| 6) Panel with controller display | 17) Chimney sensor (flue gas temperature sensor) | 28) Stirling engine |
| 7) Air flap valve | 18) Ceramic "U" tube | 29) Lift system |
| 8) Secondary air inlet | 19) Hot water outlet (DN 40, G1, 1/2") | 30) Bottom Valve |
| 9) Primary air inlet | 20) Cold water inlet (DN 40, G1, 1/2") | 31) Bottom Valve Motor |
| 10) Ceramics nozzle | 21) Inlet opening | 32) Stirling electronics |
| 11) Firing flap valve | 22) Thermal insulation | 33) Front cover bottom section |

18. BioGen Wood Log Heater Installation

Heaters are typically supplied to customers equipped with basic heater regulation. The regulation ensures the required heating water output temperature of 75 to 90° C. It does not cover the control of mixing valves and pumps. Each of the pumps within the system must be operated by a separate, independent thermostat in order that the reverse operation is not overcooled (i.e. the reverse temperature should not drop below 60°C). If a heater is installed without a heat storage unit or without an equalizing reservoir, any pump located within the heated spaces must be operated (switched on and off) by an independent thermostat or by means of electronic regulation so that such pump only runs when the heater circuit's pump is running. If you use two thermostats (each of them to operate a single pump), then you should set the heater pump's switch-on temperature to 75 °C and the switch-on temperature for the heating circuit's pump to 80 °C. At least one pump need to be equipped with filter.

The selection of the required temperature for the water running into the heated building (spaces) is done using a 3-way or 4-way mixing valve. The 3-way valve itself does not provide heater's only-hot-water security. Such mixing valve can either be operated manually or through an electronic regulating device that will provide a more comfortable and more economic operation of the heater. Any related electrical wiring and devices must be done/installed by authorized professional personnel in accordance with the STN EN standard.

18.1 Protecting your BioGen Wood Log Heater from low-temperature corrosion.

The heater is required to be installed/connected with a Laddomat or thermoregulating valve. This way of connection provides the thermal separation of the heater and the heating circuits so that it can ensure a minimum temperature of 60 °C for the return water running back to the heater.

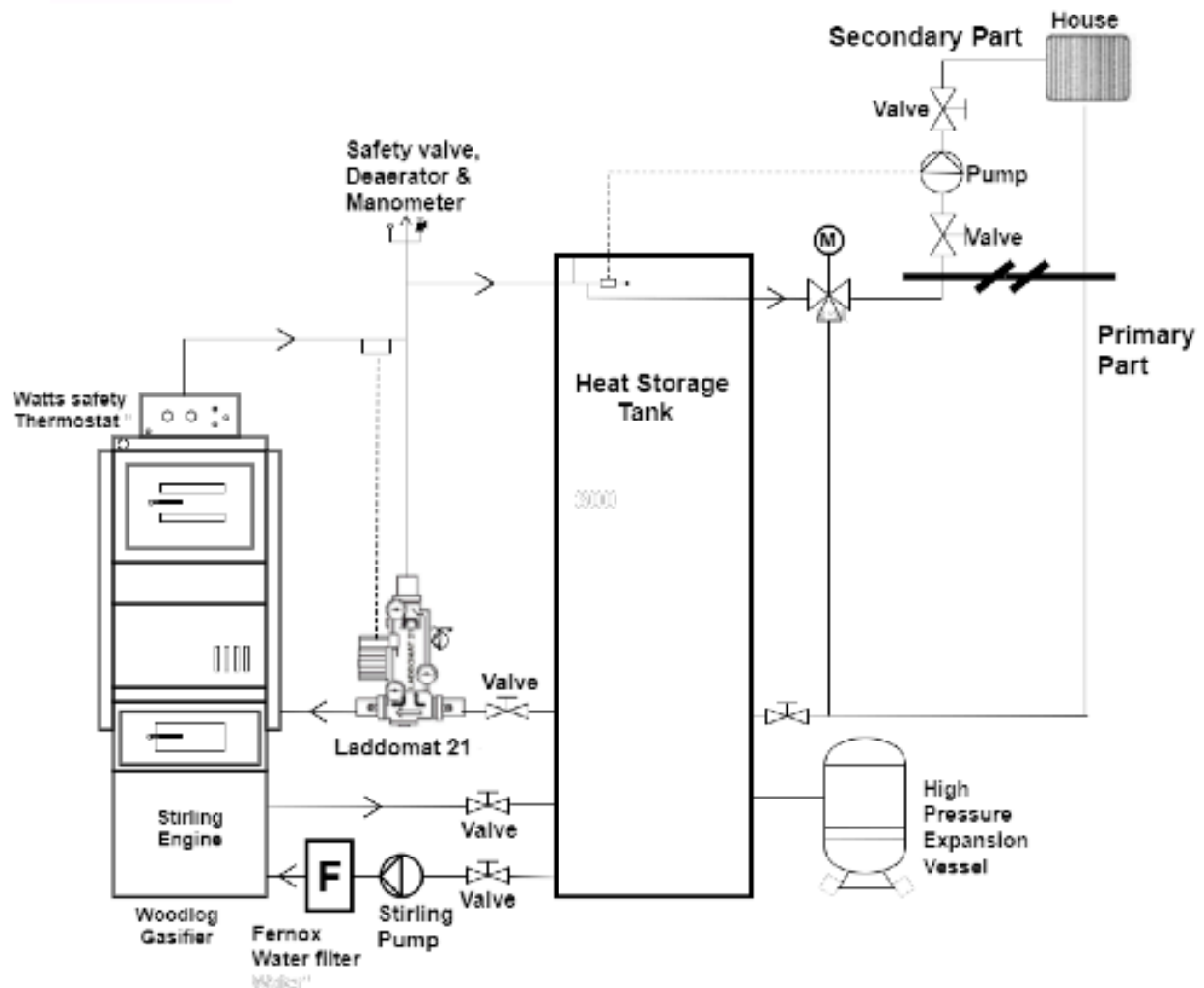
The output water temperature must be kept constant within the range from 75 to 90 °C. Under normal operating conditions, the temperature of the combustion products must never fall below the minimum of 110 °C. A low temperature of the combustion products results in the condensation of tars and acids although the output water temperature is kept within the range of 75 - 90 °C and the return water temperature is kept at 60 degrees centigrade. Such conditions may occur, for instance, during the heating of hot tap water in the summer seasons or when only a portion of a building is being heated. In such cases we recommend that the heater be connected with heat storage units (tanks) or lighting the heater on a daily basis. The heater must not be operating for a long time period below 60% of its maximum output capacity.

The Stirling engine cannot handle water temperatures >70 degrees and always need a water flow. Therefore it has its own pump and is connected to the bottom part of the storage tank.

BioGen Wood log Heater Installation/Connection with Laddomat and Heat Storage tank



WoodLog Heater System Schematic



Laddomat 21: It ensures that the heating water input temperature in boiler does not drop below 60°C (140°F).

Safety Valve: It is important to keep the pressure of the system under 3.5 bars. When the pressure goes higher the valve opens to protect the system.

Stirling Pump: This pump is work to cool down the Stirling Engine. When the head temperature of the Stirling Engine is lower then 130°C, it does not work. The minimum flow rate should be 8 L/min

Watts Safety Thermostat: This thermostat is used to protect the boiler against too hot temperatures. When the Hot water temperature reaches the 90 °C, thanks to this thermostat, cold tap water comes into the system to cool down the water.

Fernox Water Filter: It is used to clean the water comes from the storage tank to the Stirling Engine.

18.2 Operation of the system with heat storage units (tanks)

After the heater is fired up and is operated at full capacity, it will heat the water in the storage tank to a temperature of about 80-90 °C (which may take from 2 to 4 fuel loads). Then the heater should be left to go out. Thereafter, heat is only taken from the storage tank using a 3-way valve, which will last for a period depending on the volume of the storage tank and the outdoor temperature.

Recommended heat storage unit sizes:

Heater Type	BioGen Wood log
Capacity (kW)	20
Volume (l)	3000

The above listed heat storage unit must be sufficiently thermally insulated.

Advantages of the heat storage unit use:

- up to 20 - 30 % lower fuel consumption – the heater operates at full output capacity giving an optimum heating coefficient of performance.
- high lifespan of both the heater and the chimney – minimum tar and acid production
- comfortable and convenient way of heating and an ideal fuel burning conditions.

19. Protecting the BioGen Wood Log Heater against Accidental Overheating

There are several methods that can be used to secure your heater against unwanted overheating. You can either connect a cooling heat exchanger protecting the system from overheating by using Danfoss BVTs, Honeywell TS 130 or WATTS STS 20 connected to water supply piping. In the event you use your own well, you can protect your heater using a backup electric power source to sustain the operation of at least one pump. Another option is to connect the heater together with a cooling tank and an inverse valve.

BioGen Wood log Heater:

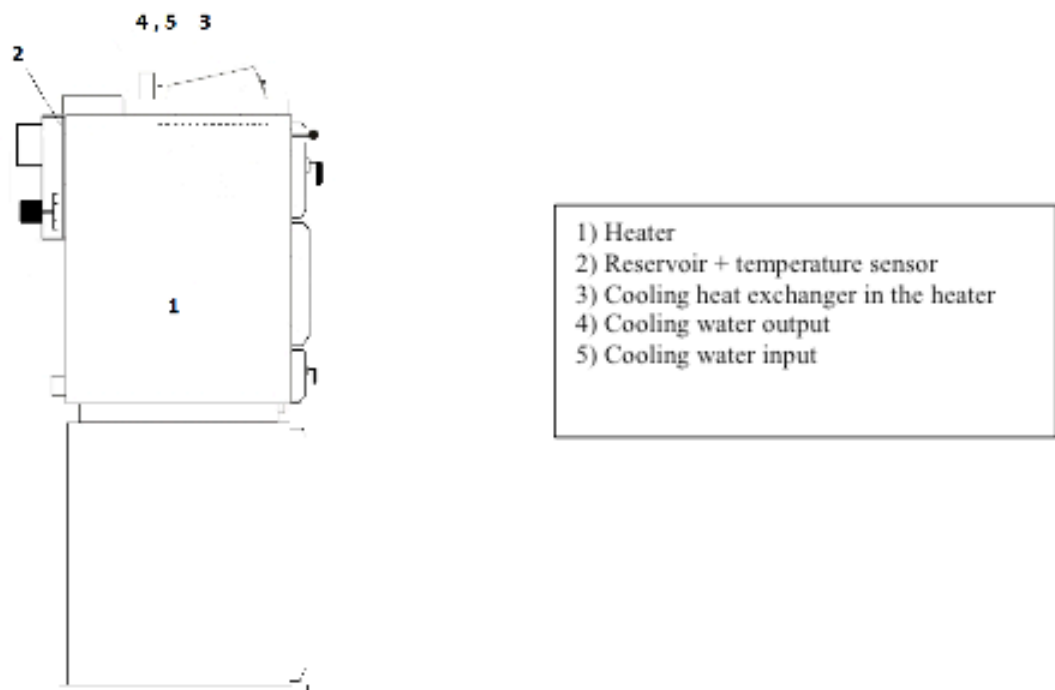


Figure: Cooling Pipes, Valves and Fittings Connection Scheme

CAUTION!

The cooling heat exchanger protecting the system from overheating must not be used for any other purposes except the protection of the heater from overheating.

Be sure to complete the installation of both the valve and the temperature sensor before you fill up the heater with heating water!!!

The Danfoss BVTs, Honeywell TS 130 or the WATTS STS 20 valve, the sensor of which is located in the lateral part of the heater, is intended to protect the heater from overheating by filling the cooler with cold tap water at any time when the temperature of the water inside the heater increases above 95 °C. The cooling water will subsequently be discharged into the drain. In the event that a reverse flap valve is placed in the cooler's inlet to prevent possible water backflow under reduced pressure conditions in water supply pipes, the connection to the cooling heat exchanger must be secured with a 6-10 bar safety valve or with an expansion vessel of at least 4 litres in volume.