

Operating Instructions  
**Firewood boiler S3 Turbo**



**Translation of the original German operating instructions for the operator**

Read and follow the instructions and safety information!

Technical changes, typographical errors and omissions reserved!

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## 1 General

Thank you for choosing a quality product from Froling. The product features a state-of-the-art design and conforms to all currently applicable standards and testing guidelines.

Please read and observe the documentation provided and always keep it close to the system for reference. Observing the requirements and safety information in the documentation makes a significant contribution to safe, appropriate, environmentally friendly and economical operation of the system.

The constant further development of our products means that there may be minor differences from the pictures and content. If you discover any errors, please let us know: [doku@froeling.com](mailto:doku@froeling.com).

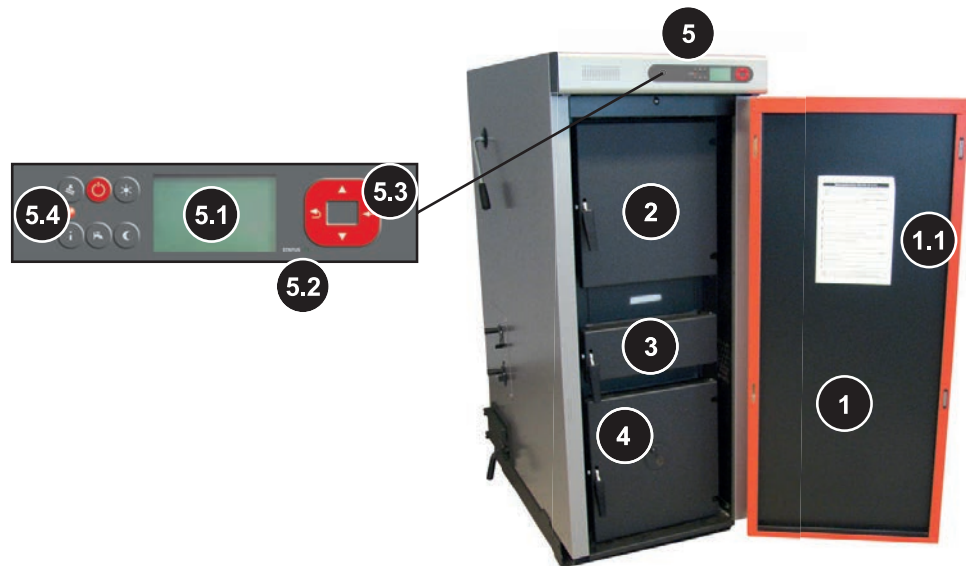
Subject to technical change.

### *Warranty and Guarantee Conditions*

Our sale and delivery conditions will be applicable. These conditions have been made available to customers, and customers have been made aware of them at the time of order completion.

You can also find the guarantee conditions on the enclosed guarantee certificate.

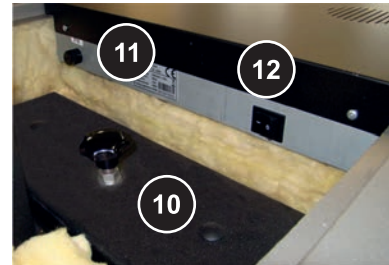
## 1.1 S3 Turbo Product Overview



1	Insulated door
1.1	Maintenance overview
2	Fuel loading door
3	Pre-heating chamber door
4	Combustion chamber door with inspection glass
5	S-Tronic Plus / S-Tronic Lambda controller
5.1	Visual display showing operating statuses and parameters
5.2	Status LED to display the operating status: - GREEN constant: BOILER ACTIVE (heating up/heating) - GREEN flashing (interval: 5 sec OFF, 1 sec ON): OFF - ORANGE flashing: WARNING - RED flashing: FAULT
5.3	Navigation keys to move around in the menus and to change the parameter values
5.4	Function keys to call up individual boiler functions directly <b>NOTICE! For key layout see operating instructions for boiler controller</b>



Underneath the back insulating cover (9):



6	Lever of the heat exchanger cleaner (WOS system)
7	<b>For S-Tronic Plus:</b> Manual adjusters for primary and secondary air <b>For S-Tronic Lambda:</b> Servo-motors for primary and secondary air (Air duct system set by qualified technician during initial start-up)
8	Cleaning door
9	Back insulating cover
10	Heat exchanger cover: Maintenance opening for cleaning the WOS system and heat exchanger
11	STL high-limit thermostat
12	Main switch

## 2 Safety

### 2.1 Hazard levels of warnings

This documentation uses warnings with the following hazard levels to indicate direct hazards and important safety instructions:

#### DANGER

*The dangerous situation is imminent and if measures are not observed it will lead to serious injury or death. You must follow the instructions!*

#### WARNING

*The dangerous situation may occur and if measures are not observed it will lead to serious injury or death. Work with extreme care.*

#### CAUTION

*The dangerous situation may occur and if measures are not observed it will lead to minor injuries.*

#### NOTICE

*The dangerous situation may occur and if measures are not observed it will lead to damage to property or pollution.*

## 2.2 General safety information



### DANGER

If the device is used incorrectly:

*Incorrect use of the system can cause severe injury and damage.*

When operating the system:

- Observe the instructions and information in the manuals.
- Observe the details on procedures for operation, maintenance and cleaning, as well as troubleshooting in the individual manuals.
- Any work above and beyond this should be carried out by authorised heating engineers or by Froling customer services.



### WARNING

External influences:

*Negative external influences, such as insufficient combustion air or non-standard fuel, can cause serious faults in combustion (e.g. spontaneous combustion of carbonisation gases or flash fires) which can in turn cause serious accidents!*

When operating the boiler, please note the following:

- Instructions and information regarding versions and minimum values, as well as standards and guidelines for heating components in the instructions must be observed.

### WARNING

Severe injuries and damage can be caused by an inadequate flue gas system.

*Problems with the flue gas system, such as poor cleaning of the flue pipe or insufficient chimney draught, can cause serious faults in combustion (such as spontaneous combustion of carbonisation gases or flash fires).*

Take the following precautions:

- Optimum boiler performance can only be guaranteed if the flue gas system is functioning correctly.



## 2.3 Permitted uses

The Froling Firewood boiler S3 Turbo is designed solely for heating domestic water. Only the fuels specified in the "Permitted fuels" section may be used.

⇒ See "Permitted fuels" [page 10]

The unit should only be operated when it is in full working order. It must be operated in accordance with the instructions, observing safety precautions, and you should ensure you are aware of the potential hazards. The inspection and cleaning intervals in the operating instructions must be observed. Ensure that any faults which might impair safety are rectified immediately.

The manufacturer or supplier is not liable for any damage resulting from non-permitted uses.

Only original spare parts or specific alternative spare parts authorised by the manufacturer may be used. Any kind of change or modification made to the product will invalidate the manufacturer's conformity with the applicable guideline(s). In such cases, the product will need to undergo new hazard evaluation procedures by the operator. The operator will then be fully responsible for the declaration of conformity according to the valid guideline(s) for the product and will need to issue a corresponding declaration for the device. This person will then assume all of the rights and responsibilities of a manufacturer.

### 2.3.1 The Clean Air Act 1993 and Smoke Control Areas

Under the Clean Air Act local authorities may declare the whole or part of the district of the authority to be a smoke control area. It is an offence to emit smoke from a chimney of a building, from a furnace or from any fixed boiler if located in a designated smoke control area. It is also an offence to acquire an „unauthorised fuel“ for use within a smoke control area unless it is used in an „exempt“ appliance („exempted“ from the controls which generally apply in the smoke control area). The Secretary of State for Environment, Food and Rural Affairs has powers under the Act to authorise smokeless fuels or exempt appliances for use in smoke control areas in England. In Scotland and Wales this power rests with Ministers in the devolved administrations for those countries. Separate legislation, the Clean Air (Northern Ireland) Order 1981, applies in Northern Ireland. Therefore it is a requirement that fuels burnt or obtained for use in smoke control areas have been „authorised“ in Regulations and that appliances used to burn solid fuel in those areas (other than „authorised“ fuels) have been exempted by an Order made and signed by the Secretary of State or Minister in the devolved administrations.

Further information on the requirements of the Clean Air Act can be found here: <http://smokecontrol.defra.gov.uk>

Your local authority is responsible for implementing the Clean Air Act 1993 including designation and supervision of smoke control areas and you can contact them for details of Clean Air Act requirements.

The Froling S1 Turbo 15 and S1 Turbo 20 have been recommended as suitable for use in smoke control areas when burning fuels as listed under "Permitted fuels".

The Froling S3 Turbo 18, S3 Turbo 28, S3 Turbo 36 and S3 Turbo 45 have been recommended as suitable for use in smoke control areas when burning fuels as listed under "Permitted fuels".

## 2.3.2 Permitted fuels

### *Firewood*

Firewood up to max. 55 cm long.

#### *Water content*

Water content (w) greater than 15% (equivalent to wood moisture  $u > 17\%$ )

Water content (w) less than 25% (equivalent to wood moisture  $u < 33\%$ )

#### *Note on standards*

EU: Fuel as per EN ISO 17225 – Part 5: Firewood class A2 / D15 L50

Additional for  
Germany:

Fuel class 4 (§3 of the First Federal Emissions Protection Ordinance (BimSchV) in the last amended version)

#### *Tips for storing wood*

- Use wind-exposed areas where possible for storage (e.g. store at edge of forest instead of in forest)
- Walls of buildings facing the sun are ideal
- Create a dry underlay, where possible with air access (line with round timber, pallets, etc.)
- stack split wood and store in such a way that it is protected from the elements
- If possible, stock fuel for the day in a warm place (e.g. in boiler room) (pre-heats the fuel!)

#### *Storage time dependent upon water content*

	Wood type	Water content	
		15 – 25%	less than 15 %
Storage in heated and ventilated room (approx. 20°C)	Soft wood (e.g. spruce)	approx. 6 months	from 1 year
	Hardwood (e.g. beech)	1 – 1.5 years	from 2 years
Outdoor storage (protected from elements, exposed to wind)	Soft wood (e.g. spruce)	2 summers	from 2 years
	Hardwood (e.g. beech)	3 summers	from 3 years

Freshly cut wood has an approximate water content of 50 to 60%. As the above table shows, the water content of the firewood decreases the longer the wood is stored depending on how dry and warm the storage location is. The ideal water content of firewood is between 15 and 25%. If the water content falls below 15%, we recommend you adjust the combustion control to the fuel.

### 2.3.3 Fuels permitted under certain conditions

#### *Wood briquettes*

Wood briquettes for non-industrial use with a diameter of 5-10 cm and 5-50 cm long.

#### *Note on standards*

EU:	Fuel as per EN ISO 17225 - Part 3: wood briquettes class B / D100 L500 Form 1 - 3
Additional for Germany:	Fuel class 5a (§3 of the First Federal Emissions Protection Ordinance (BImSchV) - applicable version)

#### *Notes on use*

- When burning wood briquettes use the settings for extremely dry fuel
- Wood briquettes must be heated up with firewood as per EN ISO 17225-5 (at least two layers of firewood under the wood briquettes)
- The fuel loading chamber must not be filled more than 3/4 full, as the wood briquettes expand during combustion
- Even when using the settings for dry fuel, burning wood briquettes can cause combustion problems. In such cases, repairs must be carried out by qualified staff. Please contact Froling customer services or your installer.

### 2.3.4 Non-permitted fuels

The use of fuels not defined in the "Permitted fuels" section, and particularly the burning of refuse, is not permitted.

#### CAUTION

In case of use of non-permitted fuels:

*Burning non-permitted fuels increases the cleaning requirements and leads to a build-up of aggressive sedimentation and condensation, which can damage the boiler and also invalidates the guarantee. Using non-standard fuels can also lead to serious problems with combustion.*

For this reason, when operating the boiler:

- Only use permitted fuels

### 2.4 Qualification of operating staff

#### CAUTION



If unauthorised persons enter the Installation room:

*Risk of personal injury and damage to property*

- The operator is responsible for keeping unauthorised persons, in particular children, away from the system.

Only trained operators are permitted to operate the unit. The operator must also have read and understood the instructions in the documentation.

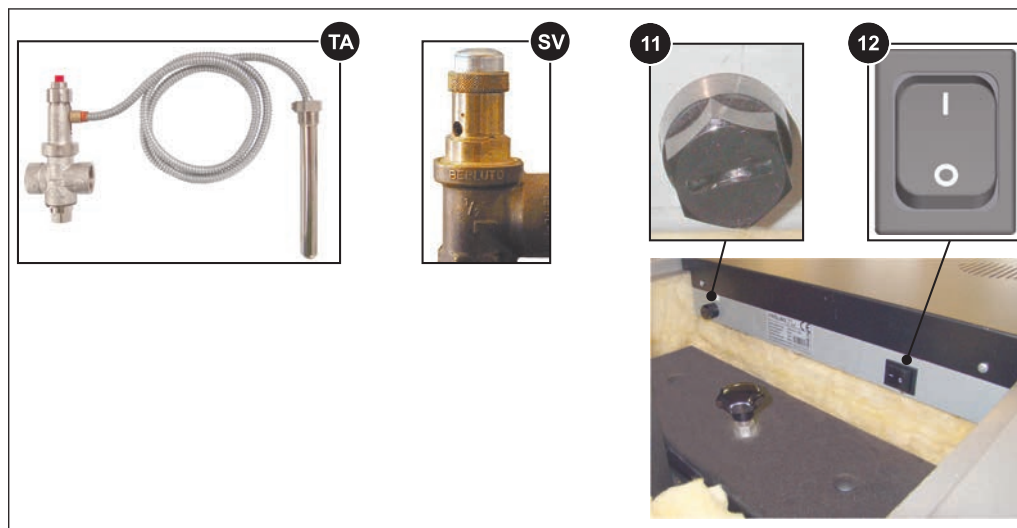
### 2.5 Protective equipment for operating staff

You must ensure that staff have the protective equipment specified by accident prevention regulations.



- For operation, inspection and cleaning:
  - suitable work wear
  - protective gloves
  - sturdy shoes

## 2.6 Safety devices



Underneath the back insulating cover:

**11 HIGH-LIMIT THERMOSTAT (STL)** (*protection against overheating*)

The STL switches off the combustion system when the boiler reaches 105°C. The pumps continue to run. Once the temperature falls below approx. 75°C, the STL can be reset mechanically.

**12 MAIN SWITCH** (*switches off the power supply*)

For shutting down the entire system

- The power to all components is switched off.

➔ **WARNING!** Only switch off the boiler when the fuel has burnt down and the boiler has cooled off.

**TA THERMAL DISCHARGE VALVE** (*protection against overheating*)

The thermal discharge valve opens at approx. 100°C and feeds cold water to the safety heat exchanger to lower the boiler temperature

**SV SAFETY VALVE** (*protection against overheating/excess pressure*)

When the boiler pressure reaches a maximum of 3 bar, the safety valve opens and the heated water is blown off in the form of steam.

## 2.7 Residual risks

 **WARNING**

When the main switch is switched off in heating mode:

*The boiler is not controlled. Any resulting boiler malfunctions can cause serious injury and damage.*

Take the following precautions:

- Allow the fire to burn out completely and let the boiler cool
  - ID fan switches off when "Off" status has been reached (flue gas temperature < 80°C, boiler temperature < 65°C)
- Only then is it safe to switch off the main switch

 **WARNING**

When touching hot surfaces:

*Severe burns are possible on hot surfaces and the flue gas pipe!*

When work is carried out on the boiler:

- Shut down the boiler according to procedure ("Off" operating status) and allow it to cool down
- Protective gloves must usually be worn for work on the boiler, and it should only be operated using the handles provided
- Insulate the flue gas pipes and do not touch them during operation

 **WARNING**

If you open the combustion chamber door, pre-heating door, fuel loading door during operation:

*This may result in injury, damage or flue gas generation!*

Therefore:

- Never open the combustion chamber door or pre-heating chamber door during operation
- The fuel loading door must be kept closed during operation and may only be opened briefly during reloading intervals

 **WARNING**

When inspecting and cleaning the boiler with the main switch on:

*Serious injuries possible due to boiler/individual components starting up automatically (induced draught)!*

Before inspection and cleaning work in/on the boiler:

- Allow the fuel in the boiler to burn off
- Allow boiler to cool off and switch off main switch



 **WARNING**

If non-permitted fuel types are used:

*Non-standard fuels can cause serious faults in combustion (e.g. spontaneous combustion of carbonisation gases / flash fires) which can lead to serious accidents!*

Take the following precautions:

- Only use fuels specified in the "Permitted fuels" section of these operating instructions.

## 2.8 Emergency procedure

### 2.8.1 Overheating of the system

If the system overheats and the safety devices fail to operate, proceed as follows:

**NOTICE! Do not under any circumstances switch off the main switch or disconnect the power supply!**

- Keep all the doors on the boiler closed
- Open all mixing valve taps, switch on all pumps.
  - ➔ The Froling heating circuit control takes on this function in automatic operation.
- Leave the boiler room and close the door
- Open any thermostatic valves on the radiator and ensure sufficient heat dissipation from the rooms

**If the temperature does not drop:**

- Contact the installer or Froling customer services
  - ⇒ See "Addresses" [page 49]

### 2.8.2 Smell of flue gas

 **DANGER**

If you smell flue gas in the boiler room:

*Inhaling toxic flue gas can potentially be fatal!*

If you smell flue gas in the room where the boiler is installed:

- Keep all the doors on the boiler closed
- Ventilate the room where the boiler is installed
- Close the fire door and doors to living areas
- Allow the fire to burn out completely and let the boiler cool

**Recommendation:** Do not install smoke alarms and carbon monoxide detectors near the system.



### 2.8.3 Power failure / induced draught fan failure

A power failure, among others, can be identified based on the following points:

- Display remains dark despite touching it
- LED status does not flash / light up
- No noise from the units (e.g. induced draught fan) can be heard

If the induced draught fan fails when there is power supply, the display shows the error message “ID fan does not rotate, in spite of full activation”.

#### DANGER



In the event of a power failure or induced draught fan failure during heating mode:

*The boiler is placed in an uncontrolled state. Life-threatening injury is possible when opening the doors.*

What to do in the event of a power failure / induced draught fan failure:

- Keep all the doors on the boiler closed
- Ventilate the room where the boiler is installed
- Close the fire door and doors to living areas
- Allow the fire to burn out completely and let the boiler cool

**Recommendation:** Equip the boiler with an uninterruptible power supply (USV, photovoltaic system, etc.). This ensures correct combustion of the firewood and prevents possible uncontrolled conditions (tarring of the heat exchanger, etc.).

**Recommendation:** Do not install smoke alarms and carbon monoxide detectors near the system.

### 2.8.4 Fire in the system

#### DANGER



In case of fire in the system:

*Risk of death by fire and poisonous gases*

Emergency procedure in case of fire:

- Leave the boiler room
- Close the doors
- Inform the fire department



## 3 Notes for operating a heating system

Carrying out modifications to the system and changing or disabling safety equipment is prohibited.

Always comply with all fire, building and electrical regulations when installing or operating the system, in addition to following the operating instructions and mandatory regulations that apply in the country in which the tank is operated.

### 3.1 Installation and approval of the heating system

The boiler should be operated in a closed heating system. The following standards govern the installation:

**Note on standards**

EN 12828 - Heating Systems in Buildings

**NOTICE! Each heating system must be officially approved.**

The appropriate supervisory authority (inspection agency) must always be informed when installing or modifying a heating system, and authorisation must be obtained from the building authorities:

**Austria:** report to the construction authorities of the community or magistrate

**Germany:** report new installations to an approved chimney sweep / the building authorities.

### 3.2 General information for installation room (boiler room)

#### Boiler room characteristics

- The floor must be even, clean and dry and have an adequate load-bearing capacity.
- There must not be a potentially explosive atmosphere in the boiler room as the boiler is not suitable for use in potentially explosive environments.
- The boiler room must be frost-free.
- The boiler does not provide any light, so the customer must ensure sufficient lighting in the boiler room in accordance with national workplace design regulations.
- When using the boiler above 2000 metres above sea level you should consult the manufacturer.
- Danger of fire due to flammable materials.  
The floor of the boiler room must not be flammable. No flammable materials should be stored near the boiler. Flammable objects (e.g. clothing) must not be put on the boiler to dry.
- Damage due to impurities in combustion air.  
Do not use any solvents or cleaning agents containing chlorine and hydrogen halides in the room where the boiler is installed (e.g. chlorination units for swimming pools).
- Keep the air suction opening of the boiler free of dust.

- The system must be protected against the chewing or nesting of animals (e.g. rodents etc.).

### Ventilation of the boiler room

Ventilation air for the boiler room should be taken from and expelled directly outside, and the openings and air ducts should be designed to prevent weather conditions (foliage, snowdrifts, etc.) from obstructing the air flow.

Unless otherwise specified in the applicable building regulations for the boiler room, the following standards apply to the design and dimensions of the air ducts:

#### *Note on standards*

ÖNORM H 5170 - Construction and fire protection requirements

### 3.3 Requirements for central heating water

Unless contrary to other national regulations, the latest versions of the following standards and guidelines apply:

Austria:	ÖNORM H 5195	Switzerland:	SWKI BT 102-01
Germany:	VDI 2035	Italy:	UNI 8065

Observe the standards and also follow the recommendations below:

- Aim for a pH value of between 8.2 and 10.0. If the central heating water comes into contact with aluminium, the pH value must be between 8.0 and 8.5
- Use prepared water which complies with the standards cited above for filling and makeup water
- Avoid leaks and use a closed heating system to maintain water quality during operation
- When filling with make-up water, always bleed the filling hose before connecting, in order to prevent air from entering the system

#### **Advantages of prepared water:**

- Complies with the applicable standards
- Less of a drop in output due to reduced limescale build-up
- Less corrosion due to fewer aggressive substances
- Long-term cost savings thanks to improved energy efficiency

**Limit values for filling and make-up water:**

	Austria	Germany	Switzerland
Total hardness	≤ 1.0 mmol/L	≤ 2.0 mmol/L	< 0.1 mmol/L
Conductivity	-	< 100µS/cm	< 100 µS/cm
pH value	6.0 – 8.5	6.5 – 8.5	6.0 – 8.5
Chloride	< 30 mg/L	< 30 mg/L	< 30 mg/L

**Additional requirements for Switzerland:**

The filling and make-up water must be demineralised (fully purified)

- The water must not contain any ingredients that could settle and accumulate in the system
- This makes the water non-electroconductive, which prevents corrosion
- It also removes all the neutral salts such as chloride, sulphate and nitrate which can weaken corrosive materials in certain conditions

If some of the system water is lost, e.g. during repairs, the make-up water must also be demineralised. It is not enough to soften the water. The heating system must be professionally cleaned and rinsed before filling the units.

**Inspection:**

- After eight weeks, the pH value of the water must be between 8.2 and 10.0. If the central heating water comes into contact with aluminium, the pH value must be between 8.0 and 8.5
- Yearly. Values must be recorded by the owner

### 3.4 Notes for using pressure maintenance systems

Pressure maintenance systems in hot-water heating systems keep the required pressure within predefined limits and balance out volume variations caused by changes in the hot-water temperature. Two main systems are used:

***Compressor-controlled pressure maintenance***

In compressor-controlled pressure maintenance units, a variable air cushion in the expansion tank is responsible for volume compensation and pressure maintenance. If the pressure is too low, the compressor pumps air into the tank. If the pressure is too high, air is released by means of a solenoid valve. The systems are built solely with closed-diaphragm expansion tanks to prevent the damaging introduction of oxygen into the heating water.

***Pump-controlled pressure maintenance***

A pump-controlled pressure maintenance unit essentially consists of a pressure-maintenance pump, relief valve and an unpressurised receiving tank. The valve releases hot water into the receiving tank if the pressure is too high. If the pressure drops below a preset value, the pump draws water from the receiving tank and feeds it back into the heating system. Pump-controlled pressure maintenance systems with

**open expansion tanks** (e.g. without a diaphragm) introduce ambient oxygen via the surface of the water, exposing the connected system components to the risk of corrosion. These systems offer no oxygen removal for the purposes of corrosion control as required by VDI 2035 and **in the interests of corrosion protection should not be used.**

### 3.5 Return lift

If the hot water return is below the minimum return temperature, some of the hot water outfeed will be mixed in.

#### CAUTION

**Risk of dropping below dew point/condensation formation if operated without return temperature control.**

*Condensation water forms an aggressive condensate when combined with combustion residue, leading to damage to the boiler.*

Take the following precautions:

- Regulations stipulate the use of a return temperature control.
  - ➔ The minimum return temperature is 60 °C. We recommend fitting some sort of control device (e.g. thermometer).

### 3.6 Combination with storage tank

You can find more detailed information about storage tank design in the boiler assembly instructions.

**NOTICE! See "Design Information" section in the assembly instructions S3 Turbo**

### 3.7 Chimney connection/chimney system

EN 303-5 specifies that the entire flue gas system must be designed to prevent, wherever possible, damage caused by seepage, insufficient feed pressure and condensation. Please note in this respect that flue gas temperatures lower than 160K above room temperature can occur in the permitted operating range of the boiler.

**NOTICE! Please see the technical data contained in the assembly instructions for further information about standards and regulations as well as the flue gas temperatures when clean and the other flue gas values!**

## 4 Operating the system

### 4.1 Assembly and initial startup

Assembly, installation and initial startup of the boiler must only be carried out by qualified staff, and these procedures are described in the accompanying assembly instructions.

**NOTICE! See assembly instructions for the S3 Turbo**

#### NOTICE

**Optimum efficiency and efficient, low-emission operation can only be guaranteed if the system is set up by trained professionals and the standard factory settings are observed.**

Take the following precautions:

- Initial startup should be carried out with an authorised installer or with Froling customer services

The individual steps for initial start-up are explained in the operating instructions for the controller

**NOTICE! See operating instructions for boiler controller!**

The customer is responsible for ensuring the following prior to initial start-up of the system by Froling customer services:

- Electrical installation
- Installation of water pipes
- Connect flue gas including all insulation work
- Work must comply with local fire protection regulations
- Correct assembly / setting of the air duct according to firewood used, see boiler assembly instructions
  
- When heating up the boiler for the first time to dry out the fireclay concrete, the customer must provide approx. 0.5 m<sup>3</sup> of dry firewood.
- It is essential that the electrician who has carried out the installation work is available when starting up the system for the first time to make any changes to the wiring which may become necessary.
- During initial start-up, operating staff are shown how to use the boiler. It is imperative for proper handover of the product that those involved are present as this is a one-off opportunity.

#### NOTICE

**If condensation escapes during the initial heat-up phase, this does not indicate a fault.**

- Tip: If this occurs, clean up using a cleaning rag.

## 4.2 Heating up the boiler

### NOTICE

Do not modify the factory settings!

*Changing the system's factory settings can be detrimental to efficiency and emissions of the system.*

#### 4.2.1 Switching on the power supply



- Turn on the main switch
  - There is voltage at all of the boiler's components
  - When the control has completed the system start, the boiler is ready for operation

#### 4.2.2 Switching on the boiler

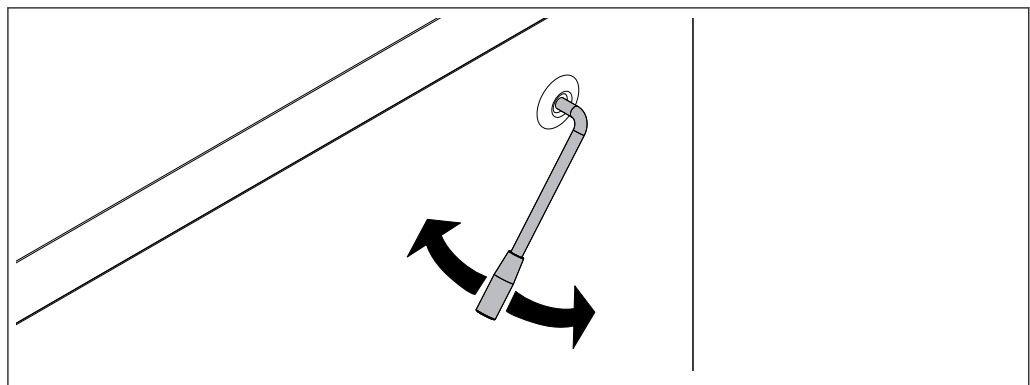


- For other modes press the relevant function key
  - Information on function keys in the relevant operating instructions of the boiler controller

**NOTICE!** The storage tank can be loaded in all operating modes to ensure constant heat consumption.

#### 4.2.3 Before heating up the boiler

##### *Operating the WOS lever*






- Pull the lever of the cleaning system several times before heating up (up and down 5 – 10 times)

**Reloading intervals when operating with storage tank**

Reloading intervals and amounts should be determined exclusively according to the storage tank for efficient and environmentally-friendly heating.

- Check the store load status on the display

Load status	Procedure
	<p>No bars or one bar in the store load status means that the storage tank needs to be heated up by approx. 35°C.                      ⇒ See "Determining the right amount of fuel" [page 24]</p>
	<p>Two bars in the store load status mean that the storage tank needs to be heated up by approx. 20°C.                      ⇒ See "Determining the right amount of fuel" [page 24]</p>
	<p>Three or four bars in the store load status mean that the storage tank cannot take any more heat, or only a small amount. In this case do not add fuel!</p>

### *Determining the right amount of fuel*

The amount of fuel added should allow the storage tank to be constantly heated to the max. storage tank temperature (= boiler target temperature). Please note that the amount to reload also depends on the type of fuel.

#### *Example: Heat a 2000 litre storage tank by 30°C*

The calculation below only takes into account the storage tank. It does not take into account the boiler efficiency, pipe losses and the energy required to heat the boiler and heating system.

Assumption: The storage tank currently has a temperature of 50°C and should be heated to 80°C. The calculation below shows how much fuel is required for heating. First we calculate the energy required:

As the medium to be heated is water and the mass is roughly the same as the volume (2000 litres = 2000 kg), we can use the simplified formula  $Q = m \times c \times \Delta t$ .

Q = energy required

m = mass of the medium to be heated

c = heat capacity of the medium to be heated (constant for water)

$\Delta t$  = temperature difference between start and end temperature<sup>1)</sup>

Mass (m) x heat capacity (c) x temperature difference ( $\Delta t$ ) = energy (Q)

2000 kg x 1.163 Wh/kgK x 30 K = 69 780 Wh

69 780 Wh = **69.8 kWh**

Heating a 2000 litre storage tank from 50°C to 80°C requires approx. 69.8 kWh of energy.

1. Temperature difference in Kelvins (K). As these are not absolute temperatures the value can be entered in degrees Celsius (°C). (30°C equals 30°K)

The amount of fuel can now be calculated from the energy required:

For our sample calculation we used beech with a water content w=20%. The energy content of the fuel varies according to the type of wood and the water content. (⇒ See "Fuel table" [page 25])

Energy required = 69.8 kWh (from calculation above)

Energy content of fuel = 3.8 kWh/kg (beech, w=20%)

Energy required / energy content of fuel = amount of fuel

69.8 kWh / 3.8 kWh/kg = **18.4 kg**

Approx. 18.4 kg beech wood (w=20%) is required to heat a 2000 litre storage tank from 50°C to 80°C.



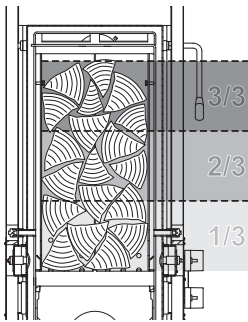
**Fuel table**

The table below shows a selection of wood types with the corresponding energy content depending on the water content:

Wood type	Energy content with water content [kWh/kg]		
	w = 15%	w = 20%	w = 25%
Spruce	4.3	4.0	3.7
Pine	4.3	4.0	3.7
Beech	4.1	3.8	3.5
Oak	4.1	3.8	3.5

**Fill level in boiler**

The table below shows the relationship between fill level and weight. It compares beech (example of hardwood) and spruce (example of soft wood) with a water content of approx. 20%. Using our example above with beech, the fill level of an S3 Turbo 40 would, therefore, be approx. one third.



Fill level		Weight at fill level	
		S3 Turbo 20/30	S3 Turbo 40/45
3/3	Beech	approx. 40 kg	approx. 65 kg
	Spruce	approx. 24 kg	approx. 39 kg
2/3	Beech	approx. 27 kg	approx. 43 kg
	Spruce	approx. 16 kg	approx. 26 kg
1/3	Beech	approx. 13 kg	approx. 22 kg
	Spruce	approx. 8 kg	approx. 13 kg

**Reloading intervals when operating without storage tank or if the storage tank is too small**

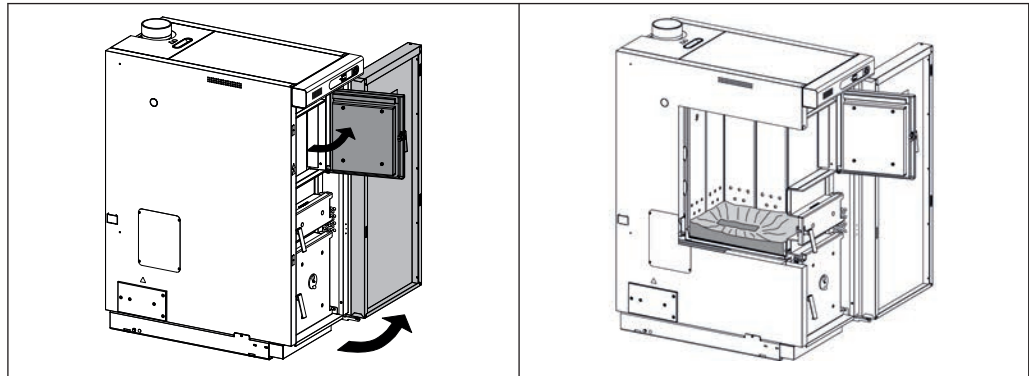
**NOTICE**

**Feed based on output:**

Only replenish the fuel if energy is needed!

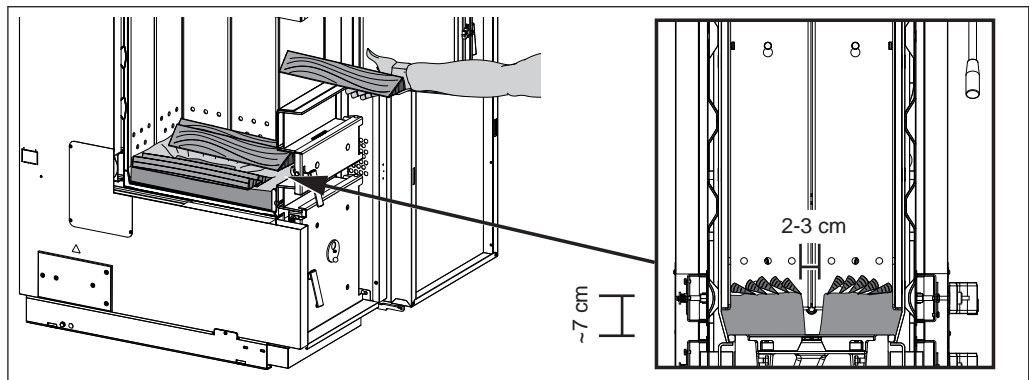
- If too much fuel is loaded, the boiler drops below its minimum output limit and goes over to "constant burn" operating status (blower fan switches off)
  - The level of efficiency drops in constant burn mode, the emissions increase and the boiler can tar up (pitch formation!)

## 4.2.4 Heating the boiler with firewood



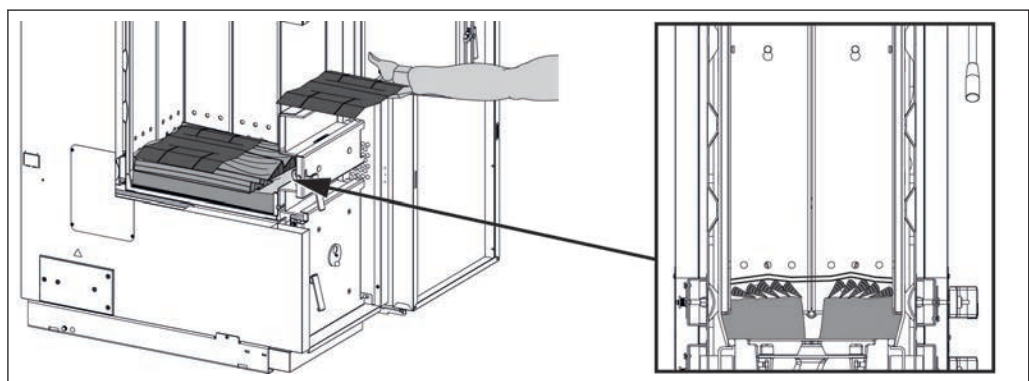
- Open the insulated door and the fuel loading door

- It is recommended that you do not remove the ash in the combustion chamber during each heating-up process, but rather only when the middle row of holes is no longer visible. This protects the combustion chamber.

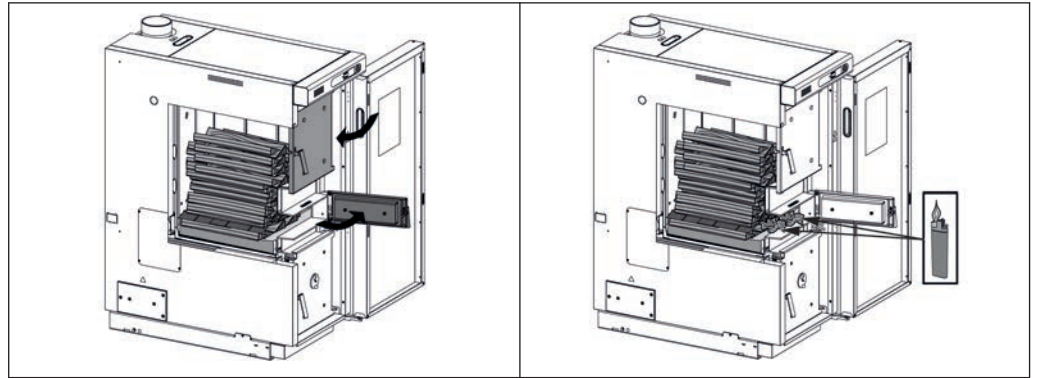


- Insert one layer of firewood

- Use firewood with a length of approximately 50 cm and arrange it lengthwise
  - Do not cover the flame slot entirely (2-3 cm)



- After the first layer of wood, lay cardboard across the whole area

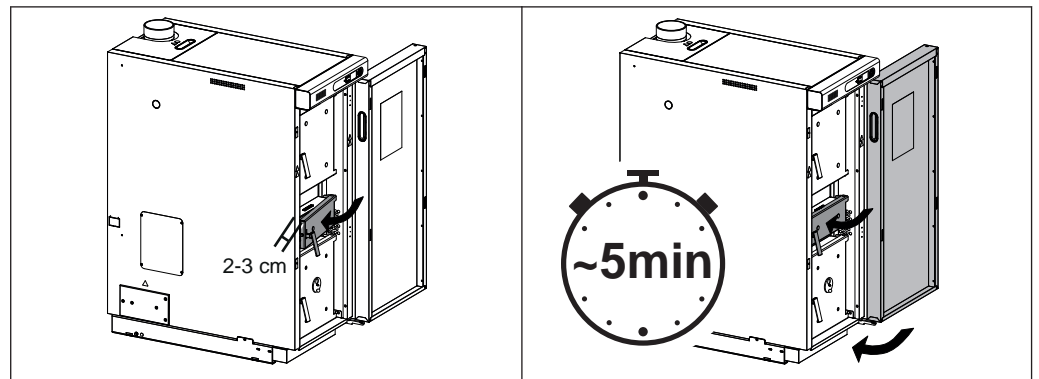


- Fill the fuel loading chamber according to the expected consumption and close the fuel loading chamber door
  - ⇒ See "Determining the right amount of fuel" [page 24]
- Open the pre-heating door, insert crumpled up paper and light



If the underpressure from the induced draught fan is too strong for the firing material to be ignited:

- Press the Down arrow in the navigation keys (5.3) briefly
  - ➔ The induced draught fan switches off
- Light the firing material
- Press the Up arrow in the navigation keys (5.3) briefly
  - ➔ The induced draught fan switches on



- Leave the pre-heating chamber door open for approximately 5 minutes
  - ➔ A bed of embers forms
- Close the pre-heating chamber door and the insulated door
  - ➔ The flue gas temperature must be  $> 130^{\circ}\text{C}$

### 4.2.5 Regulating the boiler

For the necessary steps, and how to display and alter parameters:

**NOTICE!** See operating instructions for boiler controller!

## 4.2.6 Reloading firewood


**! WARNING**

Touching hot surfaces behind the insulated door

*can cause burns!*

By the nature of its operation, the surfaces and operating elements in the area behind the insulated door get hot! When working with firewood, there is also a risk of injury from splinters.

- When working on the boiler during operation, particularly when reloading fuel, always wear protective gloves.

**! WARNING**


Opening the fuel loading door

*can cause injury, damage and smoke!*

- Open the fuel loading door slowly and with care
- Close the fuel loading door again immediately after checking/reloading

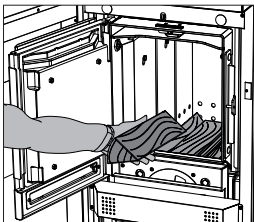
- Open the fuel loading door slowly and check the fuel

If the fuel in the boiler has burnt down:

- Refill with fuel
  - ⇒ See "Determining the right amount of fuel" [page 24]

If there is enough fuel in the boiler:

- Close the fuel loading door immediately



### 4.2.7 Switching off the power supply

#### WARNING

When the main switch is switched off in heating mode:

*The boiler is not controlled. Any resulting boiler malfunctions can cause serious injury and damage.*

Take the following precautions:

- Allow the fire to burn out completely and let the boiler cool
  - ID fan switches off when "Off" status has been reached (flue gas temperature < 80°C, boiler temperature < 65°C)
- Only then is it safe to switch off the main switch



- Turn off the main switch
  - Boiler controller is switched off
  - There is no power supply to any of the boiler components

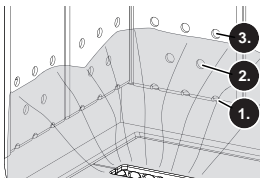
**NOTICE! Frost protection function is no longer active!**

### 4.3 Checking the ash level in the boiler

#### NOTICE

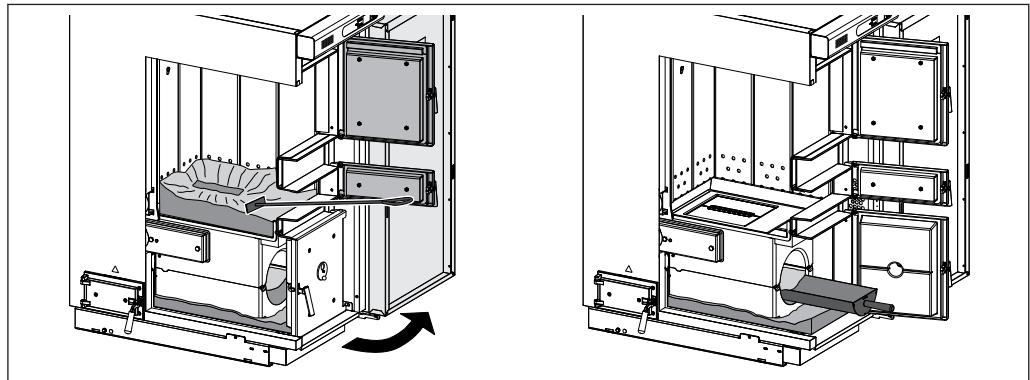
Cracks in the combustion chamber may occur during operation. If the fireclay elements and the surrounding seals remain in their original position, existing cracks do not represent a malfunction!

#### 4.3.1 Removing ash

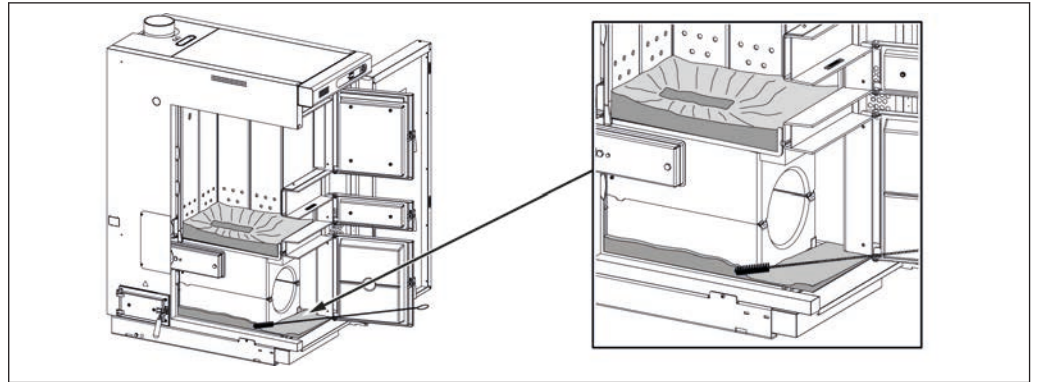


**Recommendation:** Do not remove the ash in the combustion chamber each time you heat up the boiler, only when the middle row of holes in the cladding plates is no longer visible. This protects the combustion chamber and makes the heating-up process more efficient.

Carry out all other cleaning work described in this section in the same way.

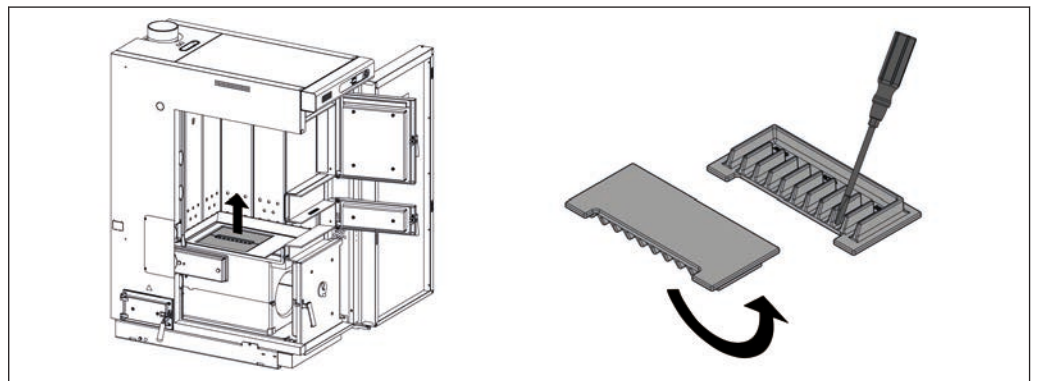


- Open the insulated door, pre-heating chamber door and the fuel loading chamber door
- Move the ash in the fuel loading chamber down into the combustion chamber below with the furnace tool
- Open the combustion chamber door and remove ash with a round ash shovel



- Clean the passage to the left and right of the combustion chamber with small brush and remove ash
- Empty the ash into the container provided
  - Use a fire-proof container with cover

### 4.3.2 Clean the grating



- Open the insulated door and the fuel loading chamber door
- Remove the two-part grating
- Remove ash deposits under the grating to ensure proper intake of secondary air.
  - Tip: use an ash vacuum!

## 5 Servicing the system

### 5.1 General information on servicing



#### DANGER

When working on electrical components:

*Risk of electrocution!*

When work is carried out on electrical components:

- Always have work carried out by a qualified electrician
- Observe the applicable standards and regulations
  - ➔ Work must not be carried out on electrical components by unauthorised persons



#### WARNING

During inspection and cleaning work on the hot boiler:

*Hot parts and the flue gas pipe can cause serious burns!*

Take the following precautions:

- It should be standard practice to wear protective gloves when working on the boiler.
- Only operate the boiler using the handles provided
- Before starting work, switch off the boiler and allow it to cool down for at least 1 hour



#### WARNING

When inspecting and cleaning the boiler with the main switch on:

*Serious injuries possible due to boiler/individual components starting up automatically (induced draught)!*

Before inspection and cleaning work in/on the boiler:

- Allow the fuel in the boiler to burn off
- Allow boiler to cool off and switch off main switch



#### WARNING

Incorrect inspection and cleaning:

*Incorrect or insufficient inspection and cleaning of the boiler can cause serious faults in combustion (e.g. spontaneous combustion of carbonisation gases / flash fires) and this can lead to serious accidents and damage!*

Take the following precautions:

- Clean the boiler following the instructions in the instruction manual. Follow the boiler operating instructions.

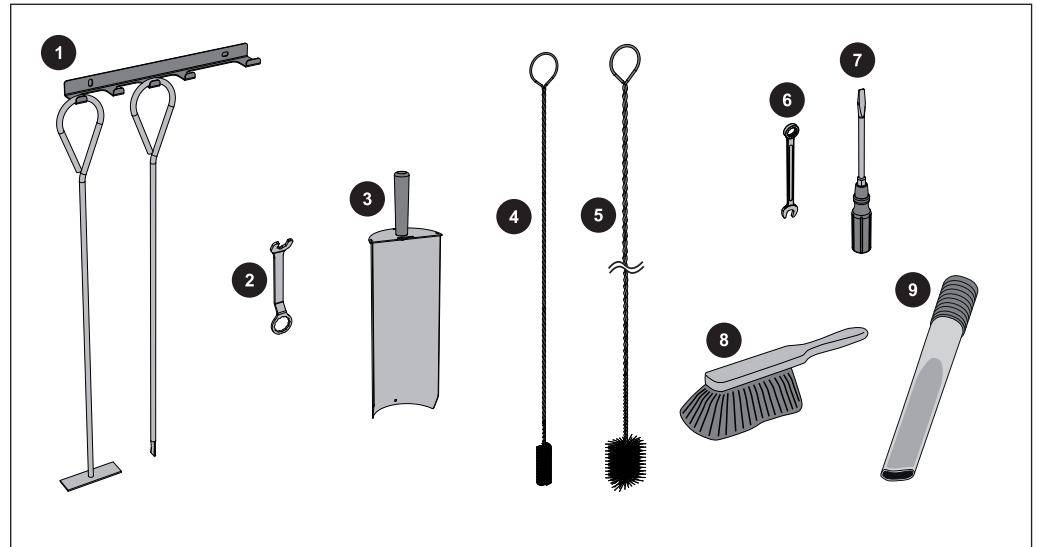


**NOTICE**

We recommend you keep a maintenance book in accordance with ÖNORM M7510.

**5.2 Required tools**

The following tools are required for carrying out cleaning and maintenance work:



**Included in delivery:**

1	Furnace tool with bracket
2	Spanner for door mountings
3	Ash shovel
4	Cleaning brush (30x20) for cleaning the carbonisation gas duct
5	Cleaning brush (Ø54) for cleaning the heat exchanger

**Not included:**

6	Spanner or box wrench AF 13
7	Screwdriver set (Philips, flat head, Torx T20)
8	Small brush or cleaning brush
9	Ash vacuum

## 5.3 Maintenance work by the operator

- Regular cleaning of the boiler extends its life and is a basic requirement for smooth running.
- Recommendation: use an ash vacuum for cleaning.

### 5.3.1 Inspection

#### *Checking the system pressure*



- Check the system pressure on the pressure gauge
    - The value must be 20% above the pre-stressed pressure of the expansion tank
- NOTICE! Check that the position of the pressure gauge and rated pressure of the expansion tank match your installer's specifications!**

If the system pressure decreases:

- Top up with water
  - NOTICE! If this happens frequently, the seal of the heating system is faulty! Inform your installer**

If large pressure fluctuations are observed:

- Ask an expert to inspect the expansion tank

#### *Checking the thermal discharge safety device*



- Check the seal of the discharge valve
    - The discharge pipe must not drip
- NOTICE! Exception: Boiler temperature > 100 °C**

If water is dripping from the discharge pipe:

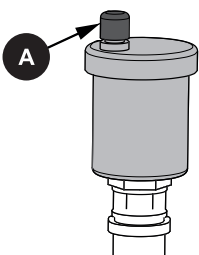
- Clean the discharge safety device in accordance with the manufacturer's instructions or have it checked/replaced by the installer if necessary

#### *Checking the safety valve*



- Check the seal of the safety valve regularly and ensure that the valve is not dirty
- NOTICE! Inspection work must be carried out in accordance with the manufacturer's instructions.**

#### *Checking the quick vent valve*



- Regularly check all the quick vent valves on the entire heating system for leaks
  - If any liquid is leaking, replace the quick vent valves

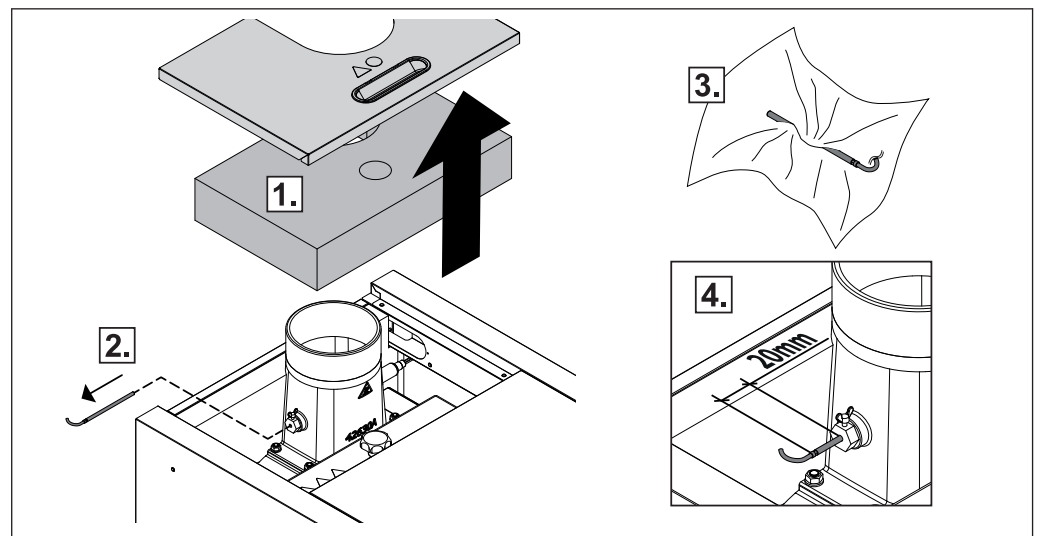
**NOTICE! The vent cap (A) must be loose (screw on approx. two revolutions) to ensure correct functioning.**

### 5.3.2 Periodic inspection and cleaning

The boiler must be inspected and cleaned at appropriate intervals depending on the operating hours and fuel quality.

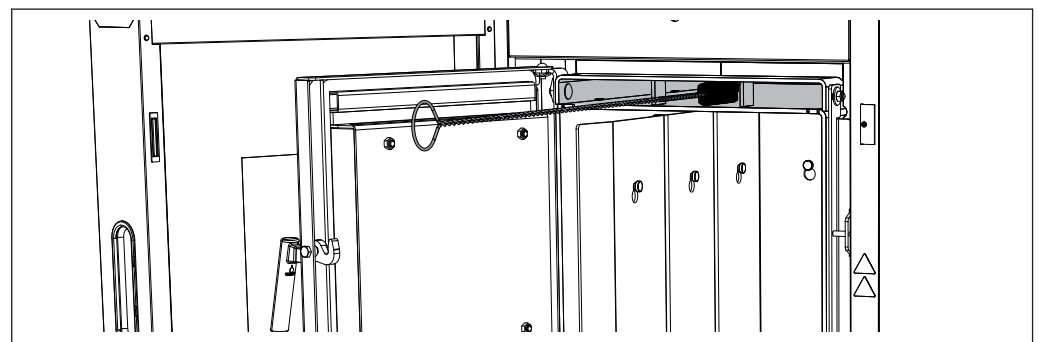
Inspection and cleaning must be repeated after not more than 1500 operating hours or at least once a year. For less efficient fuels (e.g. high ash content) this work needs to be carried out more frequently.

#### *Cleaning the flue gas temperature sensor*



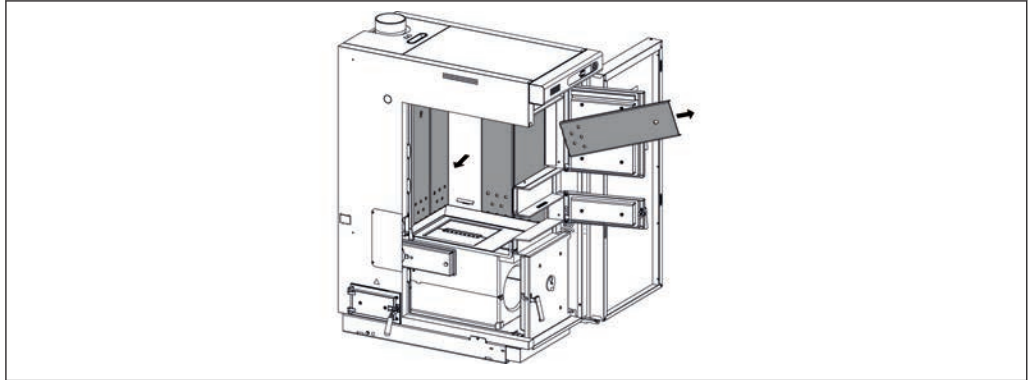
1. Remove the insulating cover and thermal insulation
2. Release the retaining screw and remove the flue gas temperature sensor from the flue gas pipe
3. Wipe the flue gas temperature sensor with a clean cloth
4. Push in the flue gas temperature sensor until about 20 mm of the sensor remains protruding from the bushing and secure with fixing screw

#### *Cleaning the carbonisation gas duct*

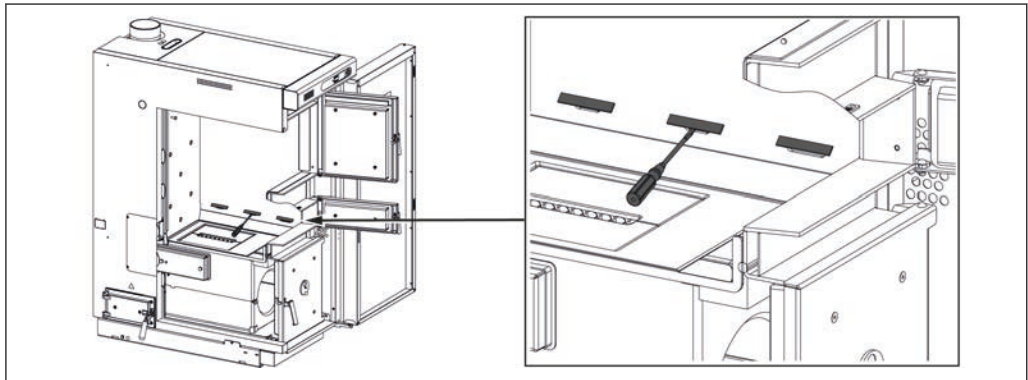


- Open the insulated door and the fuel loading chamber door
- Switch off the induced draught fan
  - This prevents damage to the fan from the cleaning brush
- Clean the carbonisation gas duct with a small brush

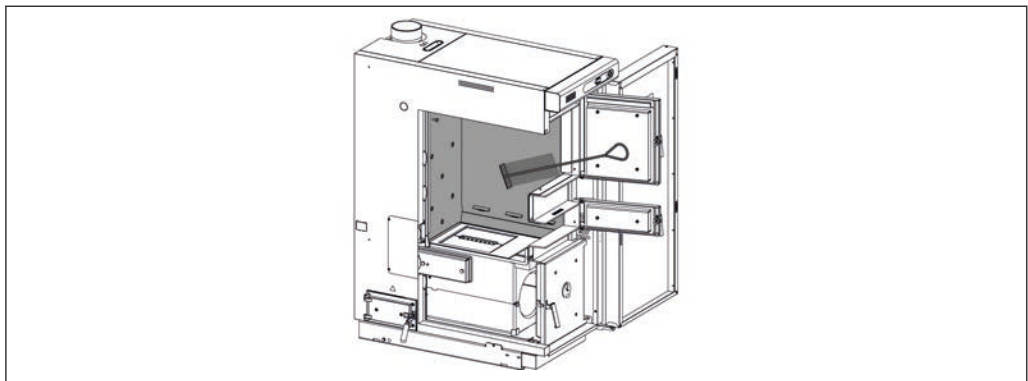
### Checking the primary air openings



- Open the insulated door and the fuel loading chamber door
- Hang out and remove the combustion chamber guards

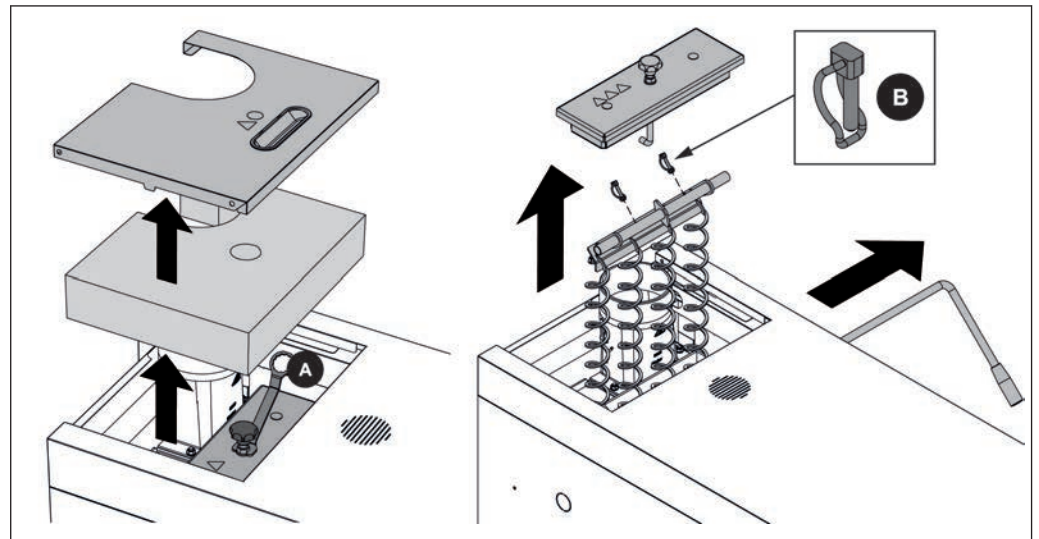


- Check the primary air openings for unobstructed air flow
- If necessary, clean the openings

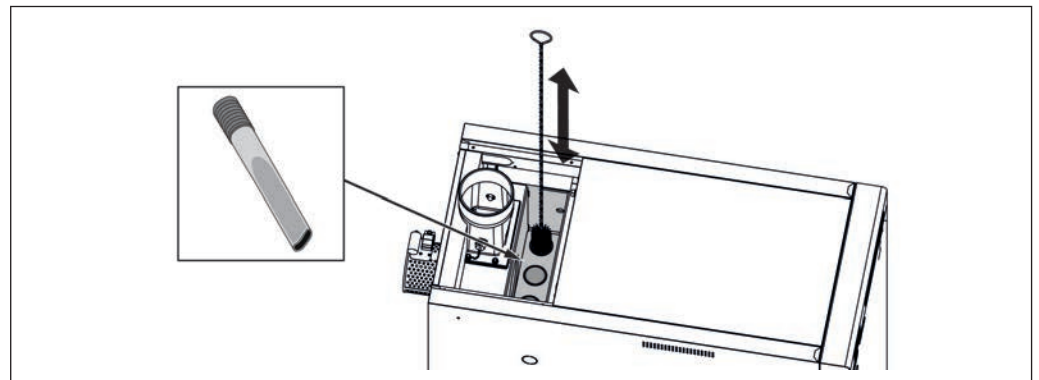


- Clean the boiler walls with the flat scraper
- Fit the combustion chamber guards in the original position and close all boiler doors

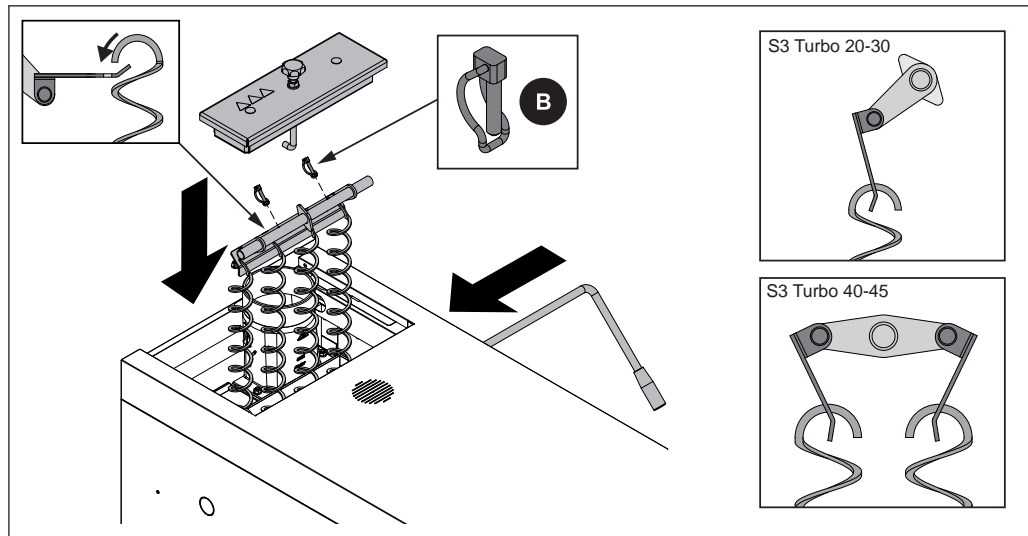
## Clean the heat exchanger pipes



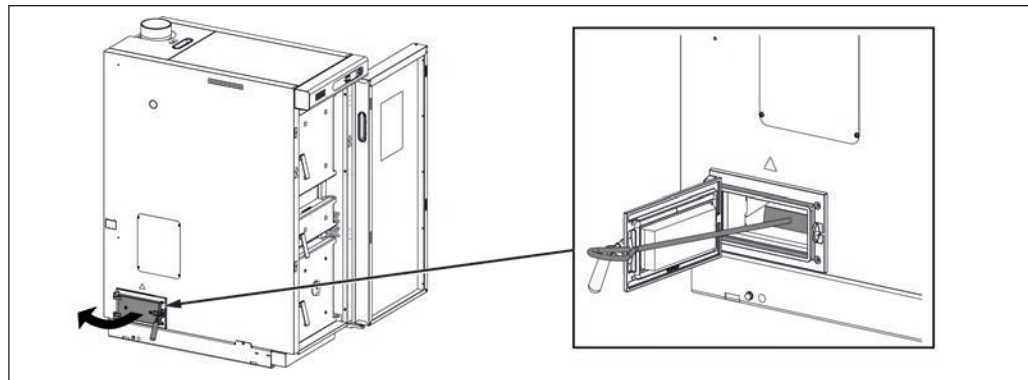
- Lift off the back insulating cover and remove the heat exchanger cover
  - Use spanner (A) provided
- Remove the pipe locking pin (B) and take out the WOS lever
- Lift out the turbulators together with the mounting bracket



- Remove the ash build-up in the pipes using the cleaning brush
  - The cleaning brush must be pushed all the way through before pulling it up.
  - The bristles cannot be turned in the pipe.



- Before fitting in the heat exchanger pipes, check that the WOS springs are correctly hooked into the linking plate
  - The protruding, canted sheet-metal strips must face upwards and the turbulators must be hooked in as shown
- Thread the turbulators into the heat exchanger pipes
- Insert the WOS lever and secure with pipe locking pin (B)
- Fit the heat exchanger cover and back insulating cover
  - Use spanner (A) provided



- Open the side cleaning door and remove the ash

### ***Cleaning the flue gas pipe***

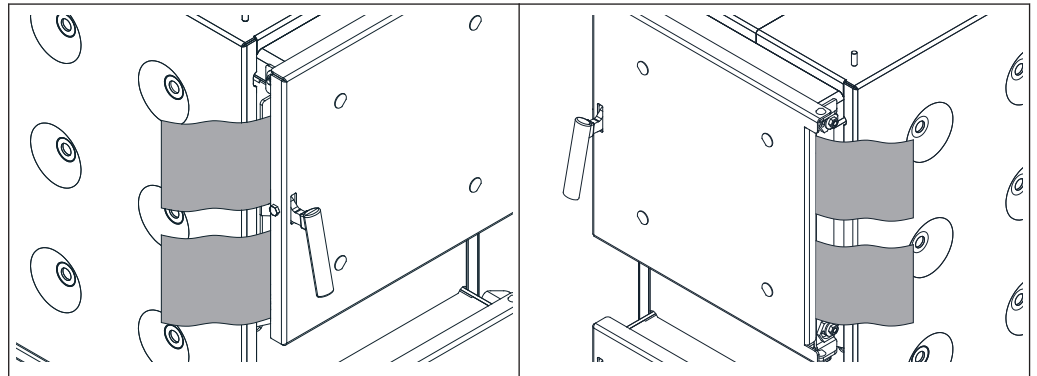
- Unplug the connection cable of the induced draught fan
  - This prevents damage to the fan from the cleaning brush
- Remove the inspection cover on the connecting pipe
- Clean the connecting pipe between the boiler and chimney with a chimney sweeping brush
  - Depending on the layout of the flue gas pipes and the chimney draught, cleaning once a year may not be enough!
- Plug in the connection cable of the induced draught fan

### ***Checking the draught controller flap***

- Check that the draught controller flap moves freely

## Checking the seal on the doors

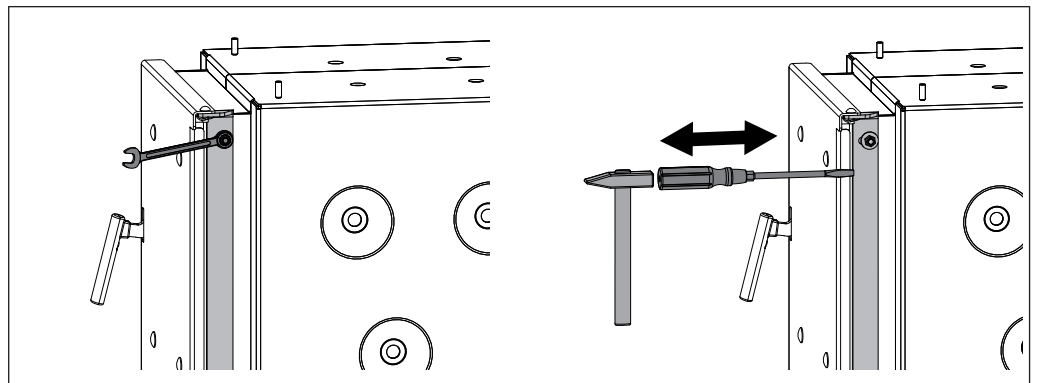
Checking the tightness is shown below using the example of the fuel loading door and is carried out in the same way for the other boiler doors.



On the door stop side and door handle side:

- Open the door and insert a sheet of paper at both the top and the bottom of the door stop between the door and the boiler
- Close the door and try to pull out the sheets of paper
  - If the paper can be removed:  
door is not sealed properly and must be adjusted!

## Positioning the doors

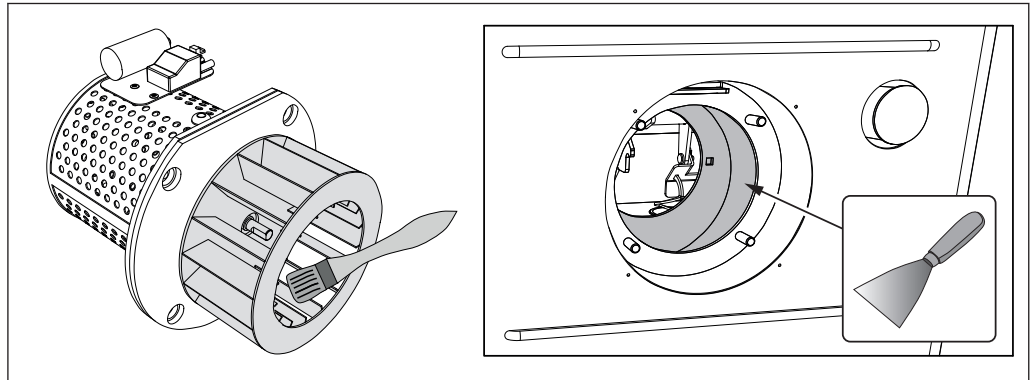


- Using an Allen key (SW 13 mm), loosen the nuts on the locking plate and/or hinge at the top and bottom
- Use suitable tools (e.g. screwdriver and hammer) to move the locking plate and/or hinge to the rear or the front as needed
  - Caution: the locking plate and/or hinge must be aligned in the same way at the top and bottom!
- Tighten the nuts at the top and bottom

***Cleaning the induced draught fan***

Check the induced draught fan for dirt and deposits and clean if necessary

**NOTICE!** Deposits on the running wheel can cause an imbalance in the ID fan, which can result in noise or, in the worst case, bearing damage.

***Cleaning (if required)***

- Unplug the connection cable of the induced draught fan
- Remove the induced draught fan from the back of the boiler
  - Take care not to damage the seal
- Check running wheel for damage
- Clean the fan wheel from the inside out using a soft brush or paint brush

**NOTICE! Do not move the balancing weights on the blower wheel!**

- Remove dirt and deposits from the induced draught housing using a scraper
- Remove any ash which has gathered using an ash vacuum
- Fit the induced draught fan
- Plug in the connection cable and secure with cable ties



## 5.4 Maintenance work by technicians

### CAUTION

If maintenance work is carried out by untrained personnel:

*Risk of personal injury and damage to property!*

The following applies for maintenance:

- Observe the instructions and information in the manuals
- Only allow appropriately qualified personnel to work on the system

Only qualified staff are permitted to carry out maintenance work in this chapter:

- Heating technicians / building technicians
- Electrical installation technicians
- Froling customer services

The maintenance staff must have read and understood the instructions in the documentation.

**NOTICE! We recommend a yearly inspection by Froling customer services or an authorised partner (third party maintenance).**

Regular maintenance and servicing by a heating specialist will ensure a long, trouble-free service life for your heating system. It will ensure that your system stays environmentally-friendly and operates efficiently and cost-effectively.

In the course of this maintenance the entire system is inspected and optimised, particularly regulation and control of the boiler. The emission measurement carried out can also be used to draw conclusions about the combustion performance of the boiler. For this reason, FROLING offers a service agreement, which optimises operating safety. Please see the details in the accompanying guarantee certificate.

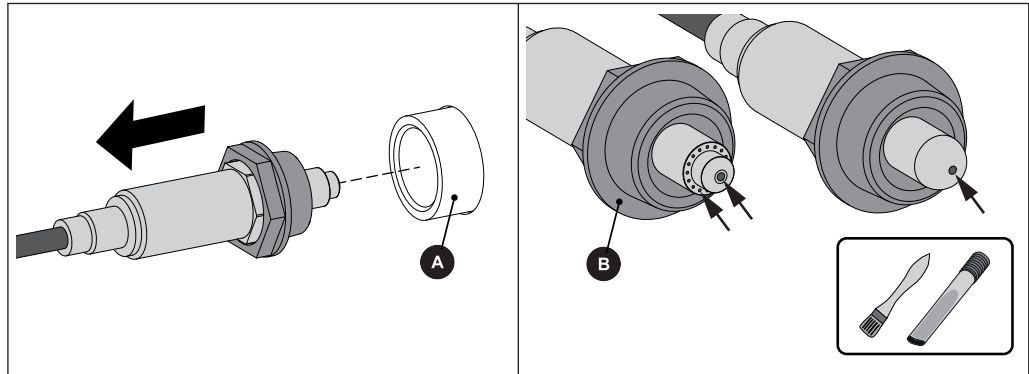
Your Froling customer service office will also be happy to advise you.

### NOTICE

All national and regional regulations relating to regular testing of the system must be observed. Please be advised that, in Austria, commercial systems with a rated heat output of 50 kW or more must be regularly tested at yearly intervals in accordance with the Heating Plant Regulations (Feuerungsanlagen-Verordnung).

### 5.4.1 Cleaning the Lambda probe

**NOTICE!** Lambda probe only installed on S3 Turbo with S-Tronic Lambda!



- Carefully remove Lambda probe with plastic bushing
  - Pay attention to the cables of the Lambda probe!
- Carefully remove impurities from the measuring ports with a fine brush and ash vacuum
  - Hold the Lambda probe with the tip downwards so that deposits can fall out of the measuring ports
- Check the plastic bushing for dirt and cracks, replace if necessary
  - **IMPORTANT:** The seal surface of the bushing (B) must lie flat on the sleeve (A) after assembly

**CAUTION:**

- Do not clean the Lambda probe with compressed air
- Do not use chemical cleaning agents (brake cleaner, etc.)
- Careful handling of the Lambda probe, no “tapping” or cleaning with a wire brush

### 5.5 Emissions measurement by chimney sweep or regulatory body

Various legal regulations stipulate that heating systems must be inspected periodically. In Germany this is regulated by the First Federal Emissions Protection Ordinance (BimSchV) in the last amended version, and in Austria by various state laws.

The following minimum requirements must be met by the operator of the system for a successful measurement:

- Thoroughly clean the boiler 2 heating days (1 heating day = 1 day during which the boiler to be measured is in operation) before the measurement
- Ensure there is adequate fuel
  - Only use fuels of high quality which meet the requirements as stipulated in the boiler operating instructions (“Permitted fuels” chapter)
- Ensure that there is adequate heat consumption on the day of the measurement (e.g. storage tank must be able to take heat for the duration of the measurement)
- There must be a suitable measuring port in the straight flue gas pipe for the measurement. The measuring port must be twice the flue gas pipe diameter away from the last upstream bend.
  - If the measuring port is not correctly positioned, the measuring result will be distorted

#### 5.5.1 General information on measurement

Observe the following basic conditions:

- Only use fuel permitted according to the operating instructions
  - Ensure that the water content (w) is greater than 15% and less than 25%
- Use short split wood (edge length EL < 10 cm) to create the measuring conditions and for the measurement itself

	<p>Short split wood with an edge length EL &lt; 10 cm</p> <p>The term “short split wood” has been defined in these instructions by Froling; there is no fuel standard or similar guidelines for this.</p>
--	-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

- The fuel must be dry, clean and uncontaminated (not painted, glued, etc.)
- The combustion process must not be interrupted during the measurement
 Interruptions to the combustion process include:
  - Opening the boiler doors
  - Stoking the burning material
  - Switching off the ID fan (e.g. because of inadequate heat consumption)

## 5.5.2 Performing the emissions measurement

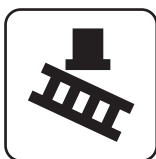
### *Create the measurement conditions and perform the measurement*

- Fill the boiler approx. 1/4 full with small pieces of split wood in accordance with the operating instructions and heat up
  - TIP: The smaller the wood is split, the better and faster the bed of embers forms
- Ensure that the operating conditions are fulfilled
  - Return temperature min. 60 °C, boiler temperature min. 70 °C, chimney draught in the range of 8-10 Pa
- Allow the fuel to burn off until a basic firebed is achieved
  - This will take at least one hour depending on the fuel used and the power consumption
- Open the fuel loading door, distribute the embers evenly with the furnace tool and gauge the height of the embers
  - The top row of holes in the combustion chamber guards must be visible
- Close the fuel loading door

Once the basic firebed has been achieved (top row of holes visible in the combustion chamber guards, the two lower rows of holes of the combustion chamber guards are covered with embers):

- With the doors closed, press the chimney sweep button (boiler with button display) or activate chimney sweep function (boiler with touchscreen)
  - The boiler temperature setpoint will be automatically set to 85°C for 45 minutes
  - All of the configured heating circuits will be activated at maximum flow temperature for 45 minutes
- Open the fuel loading door and fill the boiler with the maximum permitted amount of fuel
  - If the boiler has activated reload calculation, the amount of fuel required will be shown on the screen
- Close the doors and wait approx. 10 minutes until the combustion process is under way
- Take the measurement at the designated measuring port
  - The ready-to-measure state is shown on the display
  - Regularly check that the conditions are stable:
    - Boiler temperature > 70 °C
    - Flue gas temperature around 170 °C

### *Start emissions measurement*



- Activate the “Chimney-sweep mode” icon
- Select the sub-item “FW nominal load” from the menu
  - The display will indicate that the boiler is ready for measurement as soon as all the conditions for the measurement are fulfilled

## 5.6 Replacement parts

With Froling original replacement parts in your boiler, you are using parts that match perfectly. As the parts fit together so well, installation times are shortened and a long service life is maintained.

### NOTICE

**Installing non-original parts will invalidate the guarantee.**

- Only replace components or parts with original replacement parts

## 5.7 Disposal information

### 5.7.1 Disposal of the ash

- Austria:**  dispose of ash in accordance with the Waste Management Act (AWG)
- Other countries:**  dispose of ash in accordance with local regulations

### 5.7.2 Disposal of system components

- Ensure that they are disposed of in an environmentally friendly way in accordance with waste management regulations in the country (e.g. AWG in Austria)
- You can separate and clean recyclable materials and send them to a recycling centre.
- The combustion chamber must be disposed of as builders' waste.

## 6 Troubleshooting

### 6.1 General fault with power supply

Error characteristics	Cause of error	Elimination of error
Nothing is shown on the display No power to the controller	General power failure Main switch is turned off FI circuit breaker or line protection is switched off Faulty fuse in the controller	Turn on the main switch Switch on the FI circuit breaker or line protection Replace the fuse – note the amperage (6.3AT)

#### 6.1.1 Behaviour of system after a power failure

When the power supply has been restored, the boiler returns to the previous mode and is controlled according to the specified program.

- After a power failure, check whether the STL (high-limit thermostat) has tripped.
- Keep the doors of the boiler closed during and after the power failure, at least until the induced draught fan automatically starts up again.

### 6.2 Excessive temperature

The high-limit thermostat (STL) switches off the blower fan at a maximum boiler temperature of 105 °C. The pumps continue to run.



Once the temperature falls below approx. 75°C, the STL can be unlocked mechanically:

- Unscrew the cap on the STL (high-limit thermostat)
- Unlock the STL by pressing with a screwdriver

### 6.3 Faults with fault message - Key control

#### 6.3.1 Troubleshooting

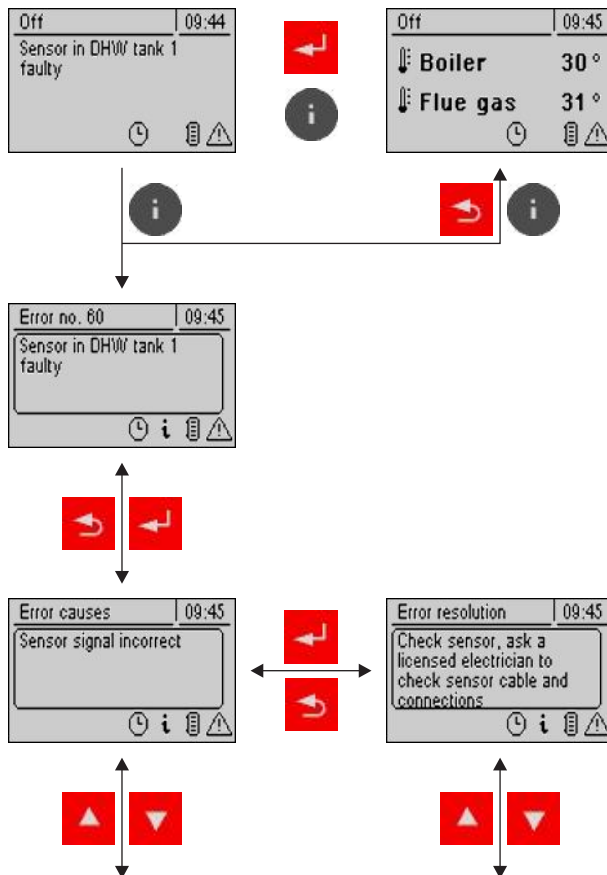
The term "fault" is a collective term for warnings, errors and alarms. The boiler reacts differently to the three types of message:

<b>WARNING</b>	In case of warnings the status LED flashes orange and the boiler initially continues controlled operation.
<b>ERROR</b>	In case of errors, the status LED flashes red, the boiler follows shutdown procedure and remains in operating status "Off", until the error is resolved. After troubleshooting, the boiler switches back to the operating status "Off".
<b>ALARM</b>	An alarm triggers a system emergency stop. The status LED flashes red, the boiler switches off immediately and the heating circuit controller and pumps remain active.

#### Procedure for fault messages

When a fault occurs:

- The status LED flashes with a red or orange light
- The display shows the current fault messages and the warning symbol in the status line



After pressing the enter key the fault is acknowledged.

The warning symbol in the status line shows that the fault is still pending.

Pressing the info key displays the fault as info text with the related fault number. The warning symbol only switches off when the fault has been resolved!

After pressing the enter key an info text on the cause of the fault is displayed. Pressing the enter key again displays instructions for resolving the fault.

If a fault has various causes or the cause can be resolved in various ways, you can scroll through with the navigation keys.

## 6.4 Acknowledging a fault message

Trace and remove the fault and then:

- Press the Enter key
  - Status LED constant or flashing green light (depending on operating status)
    - Green constant: Heating up/Heating
    - Green flashing: Off



## 7 Appendix

### 7.1 Addresses

#### 7.1.1 Address of manufacturer

**FRÖLING**  
Heizkessel- und Behälterbau GesmbH

Industriestraße 12  
A-4710 Grieskirchen  
AUSTRIA

TEL 0043 (0)7248 606 0  
FAX 0043 (0)7248 606 600  
EMAIL [info@froeling.com](mailto:info@froeling.com)  
INTERNET [www.froeling.com](http://www.froeling.com)

#### *Customer service*

Austria	0043 (0)7248 606 7000
Germany	0049 (0)89 927 926 400
Worldwide	0043 (0)7248 606 0

#### 7.1.2 Address of the installer

Stamp