

Operating Instructions
Firewood Boiler S4 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.

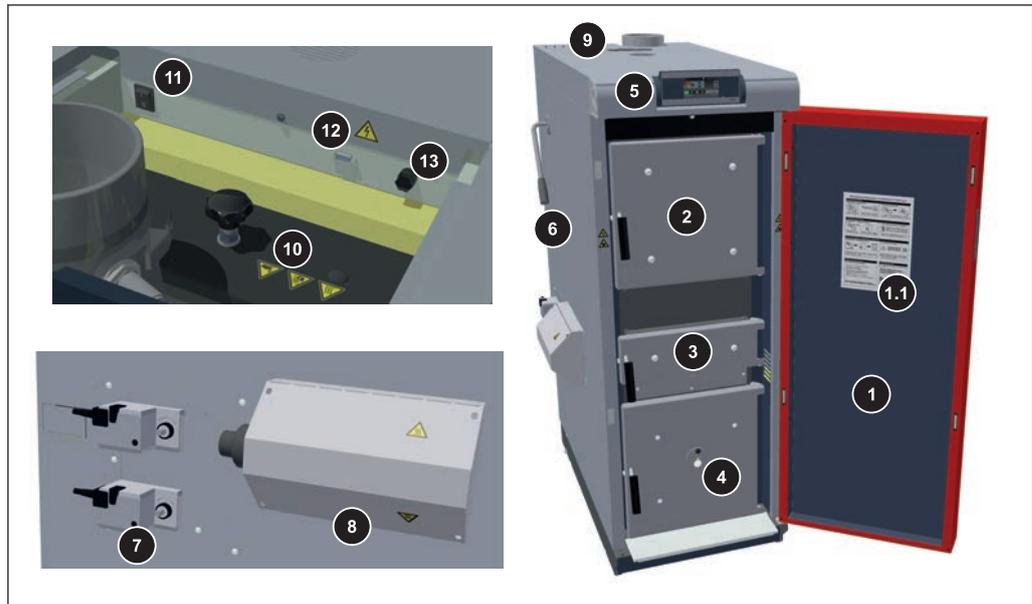
Subject to technical change.

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.

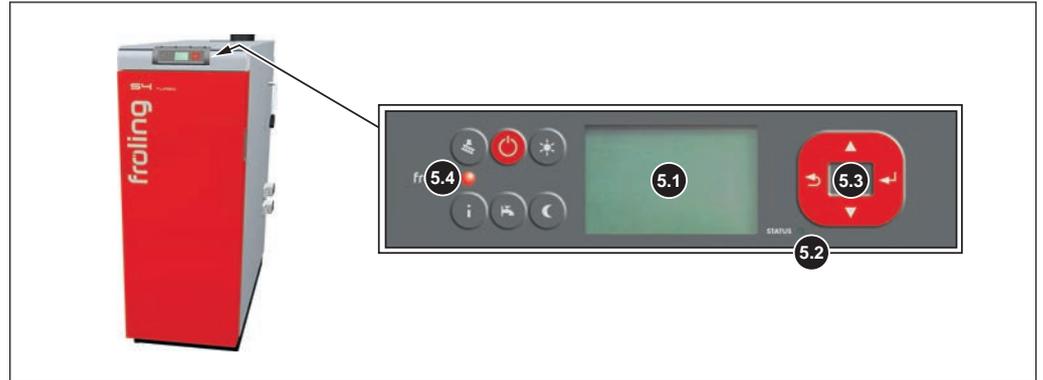
You can also find the guarantee conditions on the enclosed guarantee certificate.

1.1 S4 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	Control panel of the Lambdatronic S3200
6	Lever for heat exchanger cleaning system (WOS)
7	Actuators for automatic regulation of primary and secondary air
8	Automatic ignition (optional)
9	Back insulating cover
10	Heat exchanger cover: Maintenance opening for cleaning the WOS system and heat exchanger
11	Main switch
12	Service port
13	STL high-limit thermostat

Key control



5.1 Visual display showing operating statuses and parameters

5.2 Status LED (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
NOTICE! For key layout see control unit operating instructions

Touch control



5.1 Control panel of the Lambdatronic S 3200 - Touch

5.2 Large touch display for showing and changing operating statuses and parameters

5.3 Status LED (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

5.4 Brightness sensor for automatically adjusting the brightness of the display

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 or damage to property.

2.2 Pictograms used

The following symbols are used in the documentation and/or on the boiler to show what is required and forbidden and to give warnings.

In accordance with the Machinery Directive, signs fitted directly within the danger area of the boiler indicate immediate hazards or safety procedures. These stickers must not be removed or covered.

	Refer to the operating instructions		Wear safety shoes
	Wear protective gloves		Turn off the main switch
	Keep the doors closed		
	Unauthorised access prohibited		
	Warning - hot surface		Warning - hazardous electrical voltage
	Warning - hazardous or irritant materials		Warning - automatic boiler startup
	Warning of injury to fingers or hands, automatic fan		

2.3 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 Fröling 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.

2.4 Permitted uses

The Froling Firewood boiler S4 Turbo is designed solely for heating domestic water. Only use fuels specified in the "Permitted fuels" section.

⇒ See "Permitted fuels" [page 12]

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 its manufacturer's CE conformity. 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 attach the new CE label to the device. This person will then assume all of the rights and responsibilities of a manufacturer.

2.4.1 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 S4 Turbo 15, S4 Turbo 22, S4 Turbo 28, S4 Turbo 34, S4 Turbo 40, S4 Turbo 50 and S4 Turbo 60 have been recommended as suitable for use in smoke control areas when burning fuels as listed under "Permitted fuels".

2.4.2 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.

The air duct should be adjusted accordingly for optimal burning of these fuels ($w < 15\%$). ⇒ See "Extra cleaning of flue gas paths" [page 43]

2.4.3 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.

2.4.4 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

2.5 Qualification of operating staff

CAUTION



If unauthorised persons enter the installation room / boiler 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.

2.6 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

2.7 Design information

It is forbidden to carry out modifications to the boiler or to change or deactivate safety equipment.

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

2.7.1 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.

2.7.2 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

2.7.3 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

2.7.4 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.**

2.7.5 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).

2.7.6 Combination with storage tank

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

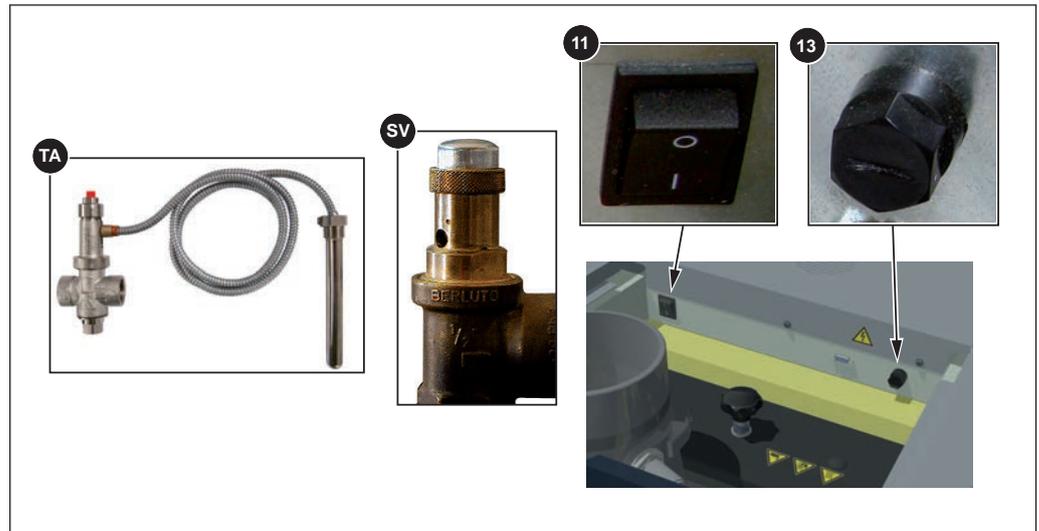
NOTICE! See "Design Information" section in the assembly instructions S4 Turbo

2.7.7 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!

2.8 Safety devices



Underneath the back insulating cover (9):

- | | |
|----|--|
| 11 | MAIN SWITCH (<i>switches off the power supply</i>)
For shutting down the entire system
<input type="checkbox"/> The power to all components is switched off.
→ WARNING! Only switch off the boiler when it has burnt down and cooled off. |
| 13 | HIGH-LIMIT THERMOSTAT (STL) (<i>protection against overheating</i>)
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. |
| TA | THERMAL DISCHARGE VALVE (<i>protection against overheating</i>)
The thermal discharge valve opens a valve at approx. 100°C and feeds cold water to the safety heat exchanger to lower the boiler temperature |
| SV | SAFETY VALVE (<i>protection against overheating/excessive pressure</i>)
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. |

2.9 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 in a controlled way (operating status "Off") and allow it to cool down
- Protective gloves must generally be worn for work on the boiler, and it should only be operated using the handles provided
- Insulate the flue pipes or simply avoid touching them during operation.

! 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.

! CAUTION

Automatic ignition attempt failed:

damage to equipment may occur

Damage to heating system (e.g. from frost) because automatic ignition was set incorrectly or not carried out.

- Before leaving the boiler check the start time that has been set for automatic ignition.
- Within an appropriate time ensure that automatic ignition has been carried out successfully.
 - Due to the different types of wood, Fröling cannot guarantee successful automatic ignition. The manufacturer/supplier is not responsible for resulting damage.

2.10 Emergency procedure

2.10.1 Overheating of the system

If the system overheats and the safety devices fail, 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 performs this function in automatic operation.
- Leave the boiler room and close the door
- Open any available radiator thermostat valves

If the temperature does not drop:

- Contact the installer or Froling customer services
 - ⇒ See "Addresses" [page 48]

2.10.2 Smell of flue gas

DANGER



If you smell flue gas in the boiler room:

Inhaling toxic flue gas can be fatal!

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

- Keep all the doors on the boiler closed
- Shut down the boiler according to procedure
- Ventilate the room where the boiler is installed
- Close the fire door and doors to living areas

2.10.3 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 Operating the System

3.1 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 S4 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 m³ 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.

3.2 Heating up the boiler

3.2.1 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

3.2.2 Switching on the boiler



- Press the standby key (key control)
- Switch the boiler on by tapping "Boiler ON" (touch control)
 - Automatic mode is active
 - The heating system is controlled via the controller according to the selected mode in automatic mode
- 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.

3.2.3 Before heating up the boiler

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
	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 23]
	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 23]
	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!

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)

Δt = temperature difference between start and end temperature¹⁾

Mass (m) x heat capacity (c) x temperature difference (Δt) = 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

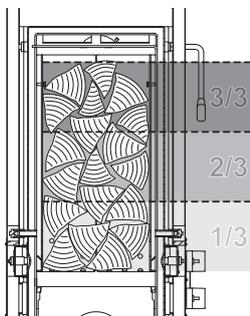
If fuels with a water content below 15% are used, adjust the air duct accordingly, ⇨
 See "Extra cleaning of flue gas paths" [page 43]

See also

📖 Extra cleaning of flue gas paths [→ 43]

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 S4 Turbo 34 would, therefore, be approx. one third.



Fill level		Weight at fill level	
		S4 Turbo 15-28	S4 Turbo 32-60
3/3	Beech	approx. 45 kg	approx. 55 kg
	Spruce	approx. 28 kg	approx. 33 kg
2/3	Beech	approx. 30 kg	approx. 37 kg
	Spruce	approx. 19 kg	approx. 22 kg
1/3	Beech	approx. 15 kg	approx. 18 kg
	Spruce	approx. 9 kg	approx. 11 kg

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

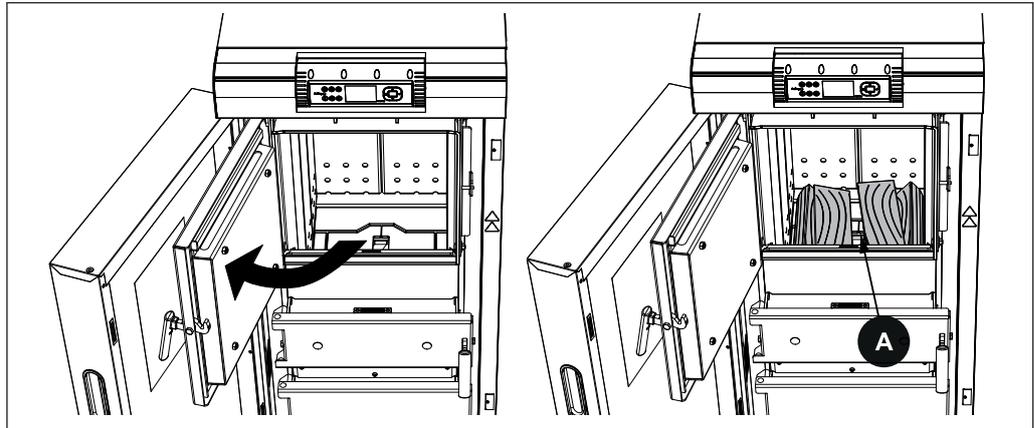
NOTICE

Feed based on output:

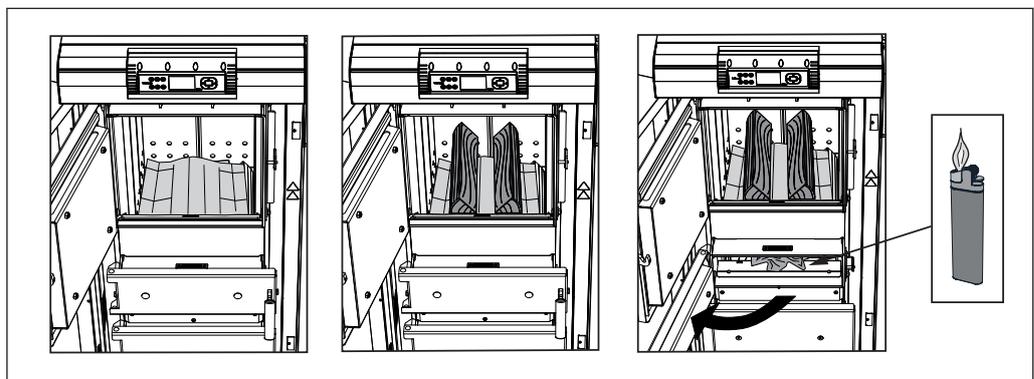
Only replenish the fuel if energy is needed!

- ❑ 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!)

3.2.4 Heating the boiler with firewood



- Open the insulated door and the fuel loading door
- Check the ash level in the combustion chamber and empty if necessary
 - It is recommended that you do not remove the ash in the combustion chamber during each heating-up process, but rather when the middle row of holes of the combustion chamber guards 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
 - Parts of the flame slot (A) must be kept clear!



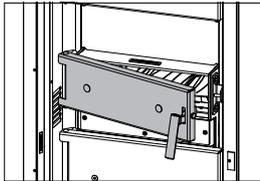
- After the first layer of wood, lay cardboard across the whole area
- Fill the fuel loading chamber according to the expected consumption and close the fuel loading chamber door
- See "[Determining the right amount of fuel](#)" [page 23]
- Open the pre-heating door, insert scrunched up paper and light

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

- Key control panel**
- Briefly press the DOWN arrow on the navigation keys
 - The induced draught fan switches off
 - Ignite the firing material
 - Briefly press the UP arrow on the navigation keys
 - The induced draught fan switches on

Touch control panel

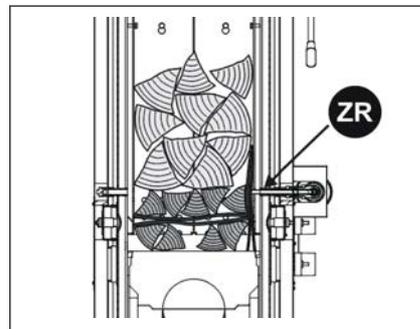
- Tap "ID fan off"
 - The induced draught fan switches off
- Light the firing material
- Tap "ID fan on"
 - The induced draught fan switches on



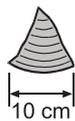
- Leave the pre-heating chamber door open for approximately 5 minutes
 - A bed of embers forms
- Close the pre-heating chamber door and the insulated door
 - The flue gas temperature must be > 130°C

3.2.5 Heating up the boiler with automatic ignition

- Open the insulated door and the fuel loading door
 - The induced draught fan switches on
- Check the combustion chamber for residual embers
 - Residual embers could ignite wood before the automatic start!
- If necessary remove all ash
 - ⇒ See "Cleaning" [page 33]
- Open the ignition pipe (IP) to check for dirt and clean if necessary
- Fill the fuel loading chamber in accordance with the output



- first layer of small pieces of wood
- second layer of cardboard and next to the ignition pipe
- third layer with more small pieces of wood
- fill the rest with firewood



Definition of small pieces of wood:

Firewood with a maximum length of 10 cm along the edge to the cut

- Use firewood with a length of approximately 50 cm and arrange it lengthwise
 - The burn-out opening in the grate must remain free!
 - Close the fuel loading door and insulated door
 - The boiler changes to "pre-ventilation" status. To guarantee a safe boiler operating status and to rule out possible ignition by residual embers due to incomplete cleaning of the combustion chamber, the boiler attempts to reach "Heating" status within a specified safety time without activating the ignition.
 - After this time has elapsed the boiler remains in "ignition wait" status until the time specified in the ignition menu for automatic ignition has been reached.
- NOTICE! See operating instructions for boiler controller!**

3.2.6 Regulating the boiler

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

NOTICE! See operating instructions for boiler controller!

3.2.7 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.

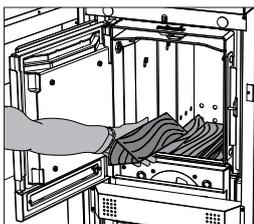


WARNING

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 23]

If there is enough fuel in the boiler:

- Close the fuel loading door immediately

3.2.8 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 Boiler Servicing

4.1 General information on servicing

DANGER



When working on electrical components:

Risk of electrocution!

When work is carried out on electrical components:

- Only 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 spigot can cause serious burns!

- Always wear protective gloves when working on the boiler
- Only operate the boiler using the handles provided
- 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



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

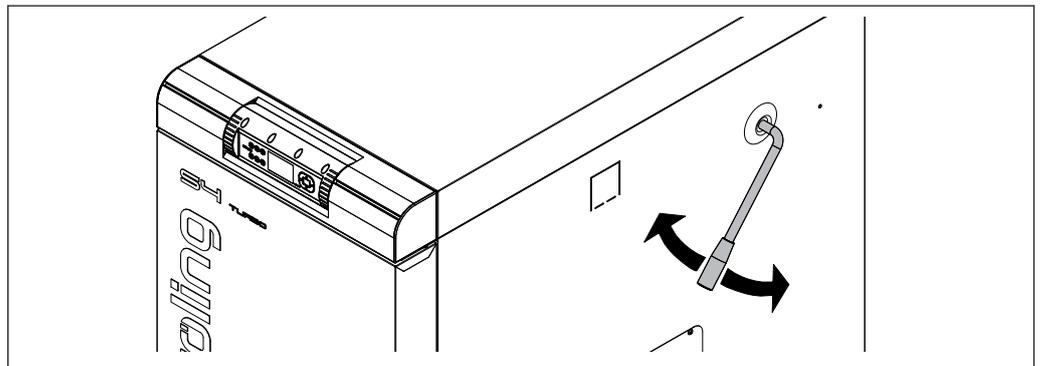
We recommend you keep a maintenance book in accordance with ÖNORM M7510.

4.2 Inspection and cleaning

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

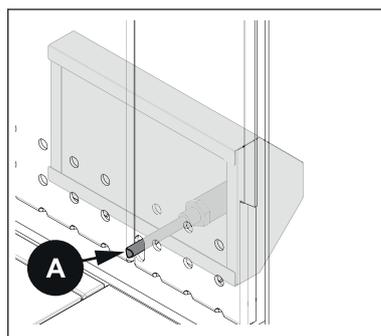
4.2.1 Prior to heating up

Always move the WOS lever



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

Check the ignition pipe (only with automatic ignition)



- Before filling the combustion chamber, check the ignition pipe (A) of the automatic ignition for dirt and clean if necessary.

4.2.2 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

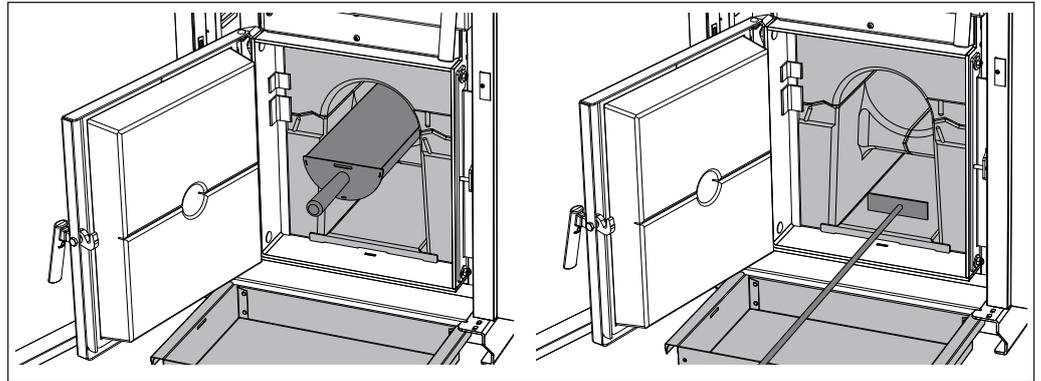


- Check the seal of the safety valve regularly and ensure that the valve is not dirty
- NOTICE! Inspection work must be carried out in accordance with the manufacturer's instructions.**

4.2.3 Cleaning

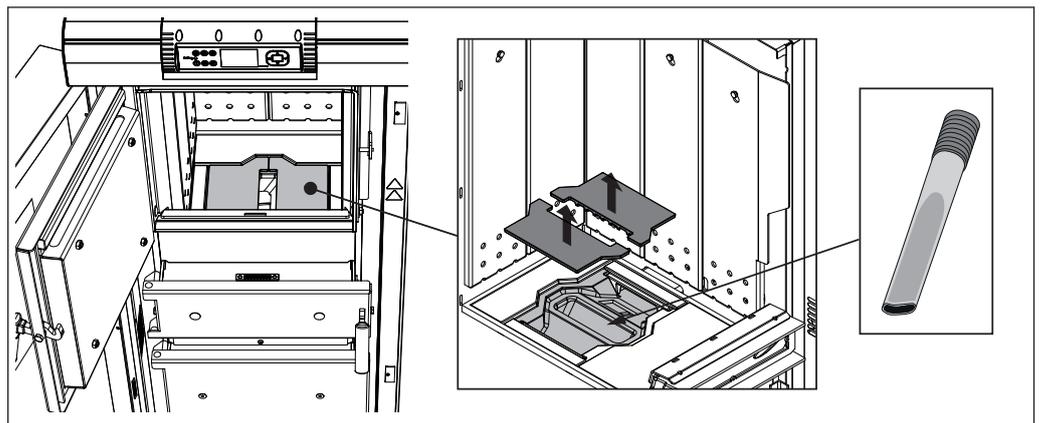
Empty the ash at appropriate intervals depending on energy requirements and the fuel quality. The ash needs to be emptied when the middle row of holes in the combustion chamber guards is no longer visible. Check that the grating is clean at the same time.

Emptying ash



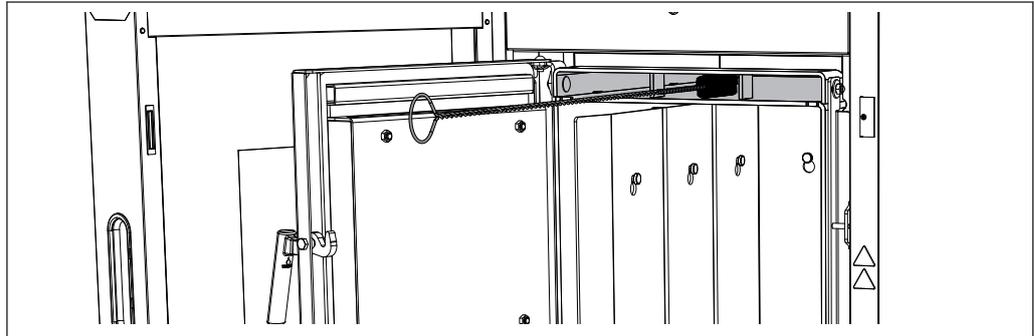
- Open the insulated door and the pre-heating chamber door
- Scrape the ash from the fuel loading chamber into the combustion chamber using the furnace tool
- Open the combustion chamber door
- Remove the ash using the rounded ash shovel
- Push the ash forwards out of the lower channel of the combustion chamber into the ash drawer provided using the furnace tool
- Shovel the ash into container provided
 - Fire-proof container with cover!

Cleaning the grating

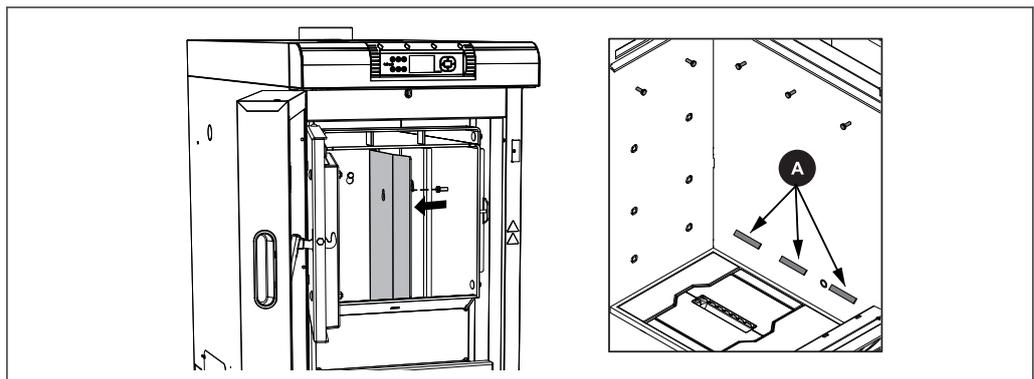


- Open the insulated door and the fuel loading chamber door
- Remove the two-part grating
- Remove ash deposits under the grating to ensure proper intake of secondary air.
 - Tip: use an ash vacuum!

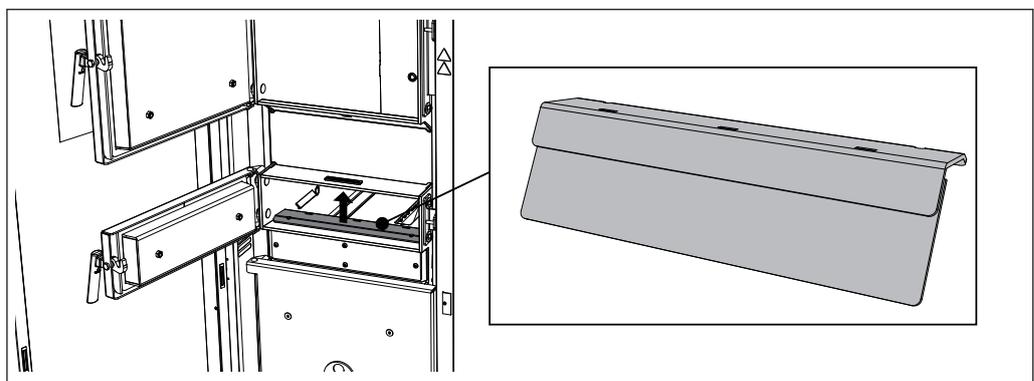
4.2.4 Annual inspection

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

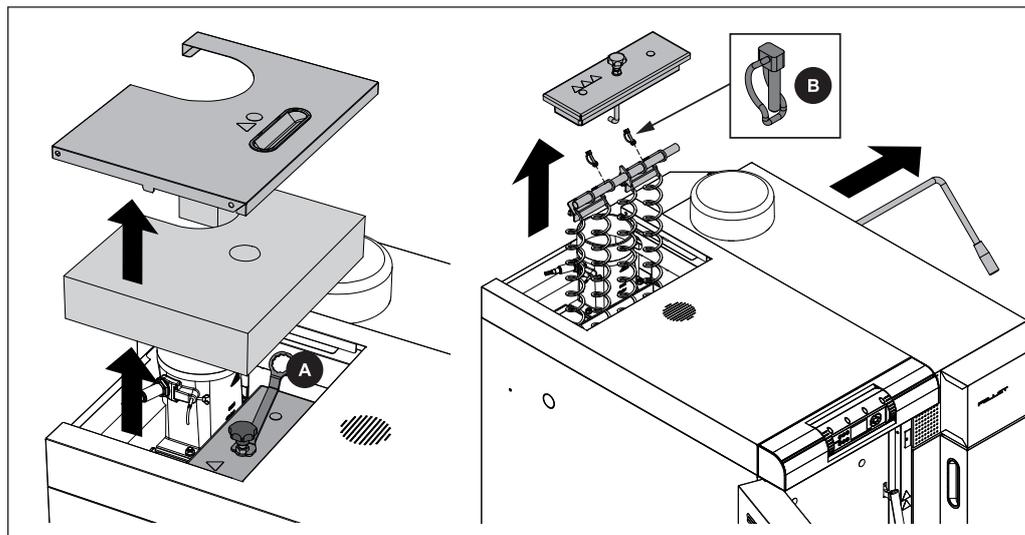
Checking the primary air openings

- Open the insulated door and the fuel loading chamber door
- Unhinge the cladding plates
- Check the primary air openings (A) for unobstructed air-flow
- If necessary, clean the openings

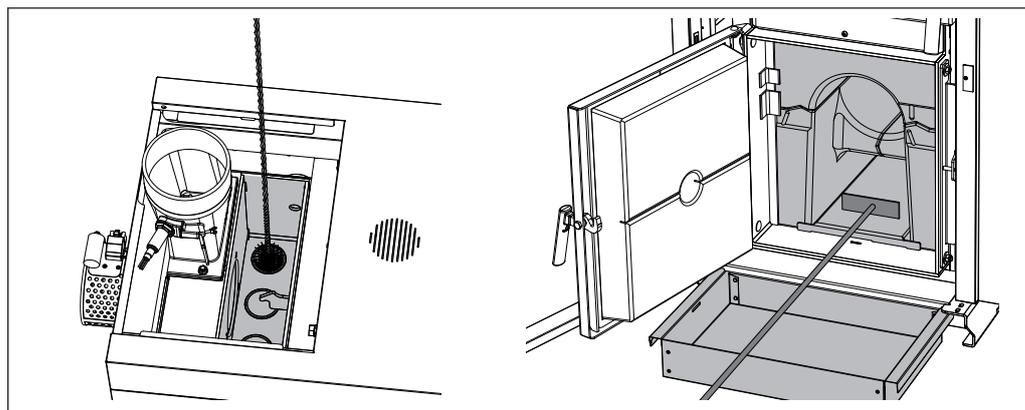


- Unhinge the front air guide plate and clean the slits
 - For cleaning use the door adjusting spanner provided if suitable

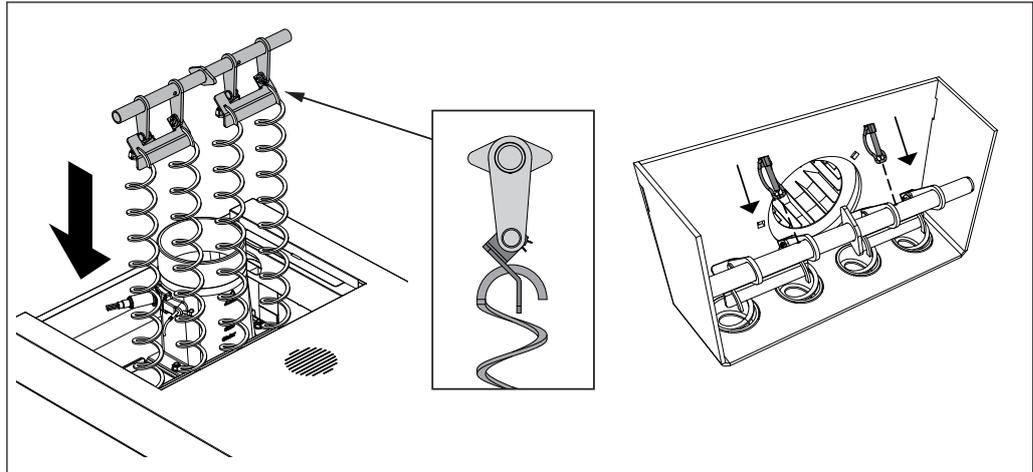
Cleaning the heat exchanger pipes



- 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

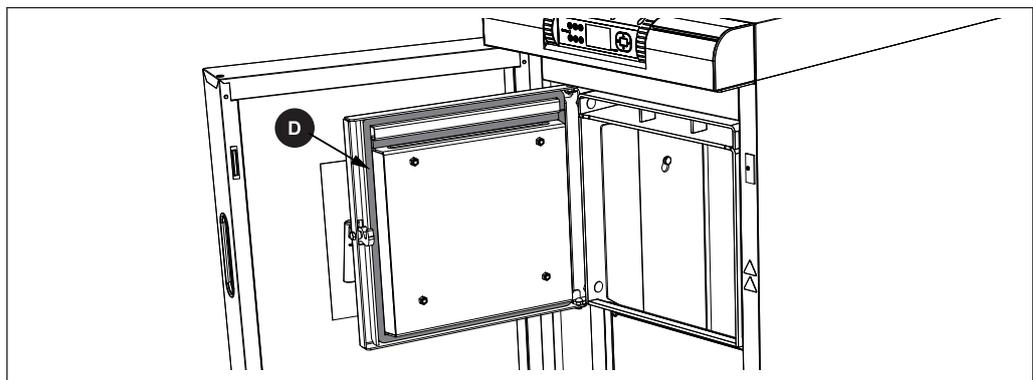


- Remove the ash build-up in the pipes using the cleaning brush
 - The cleaning brush must be pushed all the way through before pulling it up.
 - The bristles cannot be turned in the pipe.
- Push the ash forwards out of the lower channel of the combustion chamber into the ash drawer provided using the furnace tool



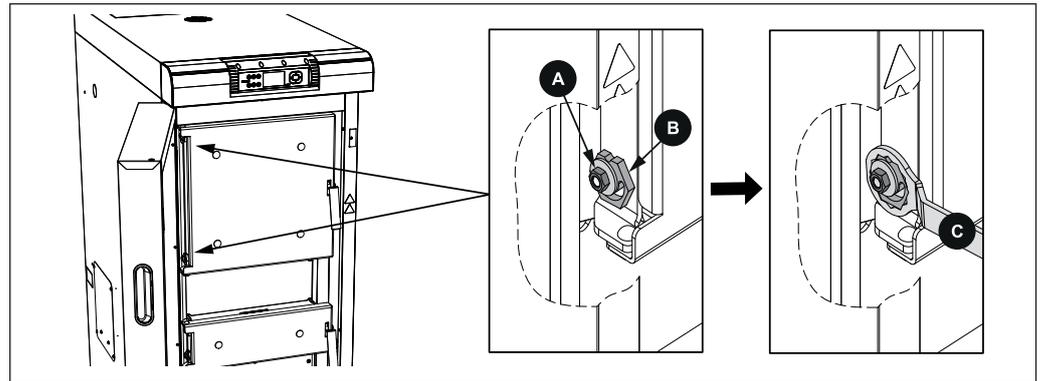
- Before fitting in the heat exchanger pipes, check that the WOS springs are correctly hooked into the linking plate
 - The protruding, canted sheet-metal strips must face upwards and the turbulators must be hooked in as shown
- Thread the turbulators into the heat exchanger pipes
- Insert the WOS lever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

Checking the seal on the doors

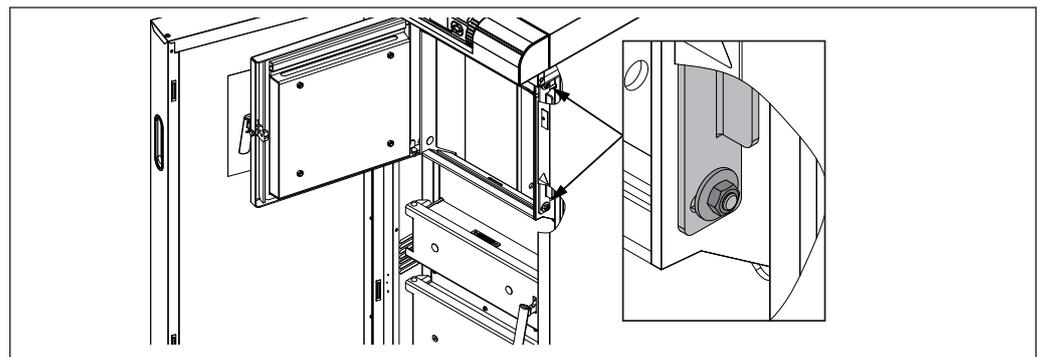


- Close the relevant door and check its seal
- Check the seal (D) for perfect alignment on the door frame
 - Imprint in the seal
- If the seal is black or the imprint is broken:
 - The seal is no longer guaranteed. Tighten the door latches or replace the seal

Positioning the doors

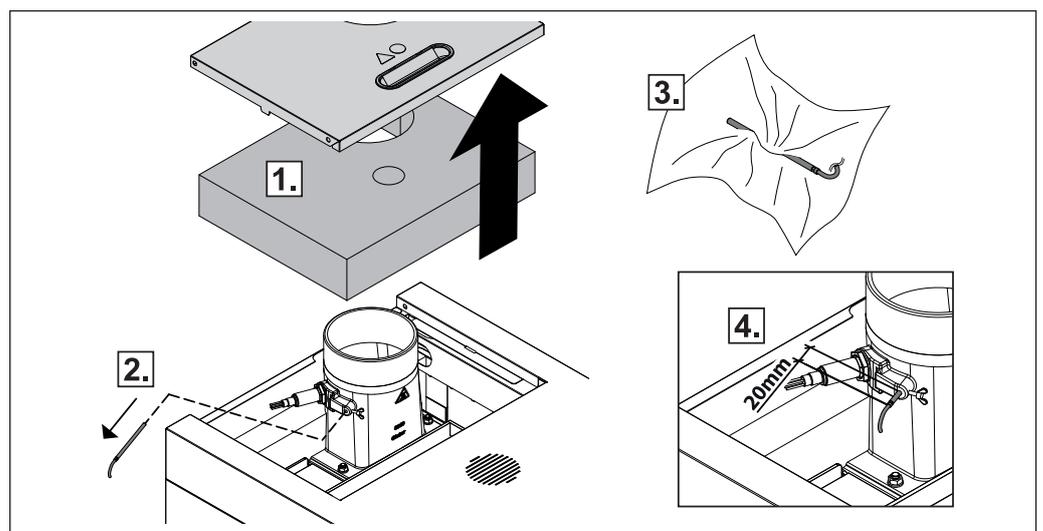


- Loosen the locknuts (A – AF 13) on the locking cams
- Press door onto door frame and adjust the contact pressure using the locking cam (B)
 - ➔ Adjusting spanner (C) included!
- Secure the adjustments by tightening the lock nuts (A)



- Adjust the contact pressure on the door handle side on the locking plate

Cleaning the flue gas temperature sensor



1. Remove the insulating cover
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

Clean the flue gas pipe

- Switch off 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 sweep's brush
 - Depending on the layout of the flue pipes and the chimney draught, annual cleaning may not be enough. The cleaning interval should be adjusted accordingly.

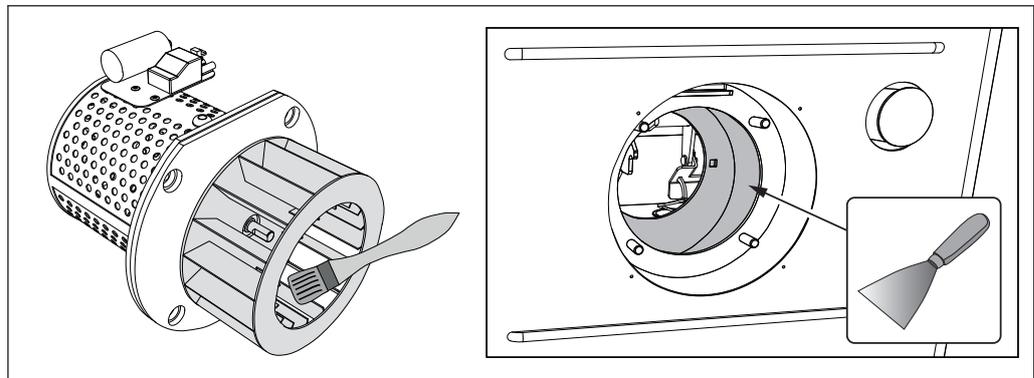
Checking the draught controller flap

- Check that the draught controller flap moves freely

Cleaning the induced draught fan

Saugzuggebläse auf Verunreinigungen kontrollieren und gegebenenfalls reinigen.

Reinigung (falls erforderlich):



- Anschlusskabel des Saugzuggebläses ausstecken
- Saugzuggebläse an der Rückseite des Kessels demontieren
 - Darauf achten, dass die Dichtung nicht beschädigt wird!
- Laufrad auf Beschädigung prüfen
- Ventilatorrad mit einer weichen Bürste oder Pinsel von innen nach außen reinigen

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

- Verunreinigungen und Ablagerungen im Saugzuggehäuse mit Spachtel beseitigen
- Angefallene Asche mit Aschesauger entfernen
- Saugzuggebläse montieren
- Anschlusskabel anstecken und mit Kabelbindern fixieren

4.3 Emissions measurement by chimney sweep or regulatory body

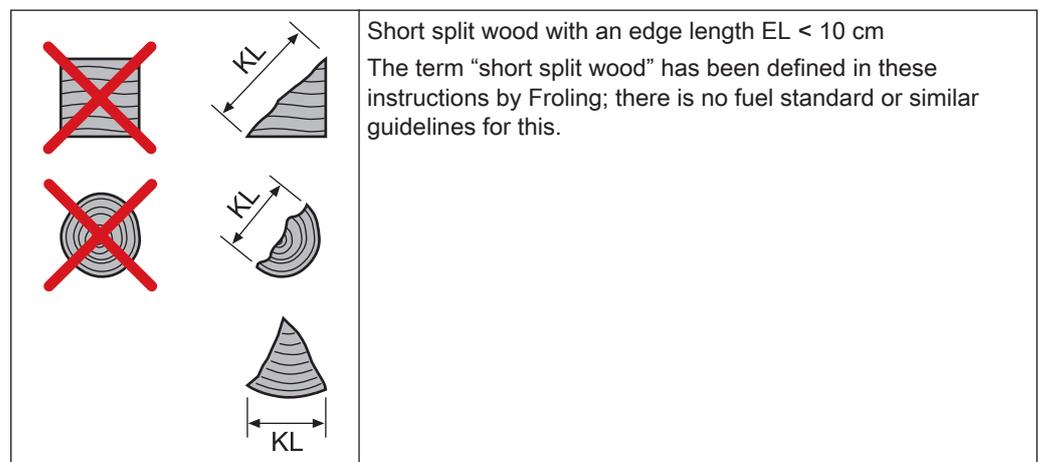
4.3.1 Preparing for the measurement

- 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
- Ensure that there is enough combustion air
- Prepare adequate fuel
- Ensure that there is adequate heat dissipation
- Clean the boiler thoroughly for the emissions measurement

4.3.2 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



- 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)

4.3.3 Performing the emissions measurement

Preparing for the measurement

- Clean boiler 2 heating days (1 heating day = 1 day during which the boiler to be measured is in operation) before 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
- Ensure that there is enough combustion air
- Prepare adequate fuel
- Ensure that there is adequate heat dissipation

Create the measurement conditions and perform the measurement

- Fill the boiler approx. 1/4 full with short split wood () in accordance with the operating instructions and heat up

Ensure that the operating conditions are fulfilled:

- Return temperature min. 60 °C

NOTICE! Exception: boiler with Thermovar valve and valve core 55 °C (boiler manufactured before 2010)

- Boiler temperature min. 70 °C
- Chimney draught ranging from 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 is visible
- Close the fuel loading door

Once the basic firebed has been achieved (top row of holes visible in the combustion chamber guards):

- With the doors closed, press the chimney sweep button (boiler with button display) or activate chimney sweep function in the quick menu (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

- Regularly check the that the conditions are stable:
- Boiler temperature > 70 °C
 - Flue gas temperature around 170 °C

4.4 Maintenance agreement / Customer service

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).

4.5 Replacement parts

With Fröling 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

4.6 Disposal information

4.6.1 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

4.6.2 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.

5 Troubleshooting

5.1 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)

5.1.1 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.

5.2 Extra cleaning of flue gas paths

Error characteristics	Possible cause	Elimination of error
Extra cleaning required due to very sticky, black deposits in the flue gas paths Noticeably shorter cleaning intervals	Using fuels with a water content less than 15%	Optimise air duct by adjusting the boiler controller

- Navigate to the “General Settings” menu
 - Activate the parameter “FW w<15%” in the “Fuel selection” menu

NOTICE! See operating instructions for boiler controller!

NOTICE! If you have any questions, please contact Froling customer services or your installer!

5.3 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 reset mechanically:

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



5.4 Faults with fault message - Key control

5.4.1 Troubleshooting

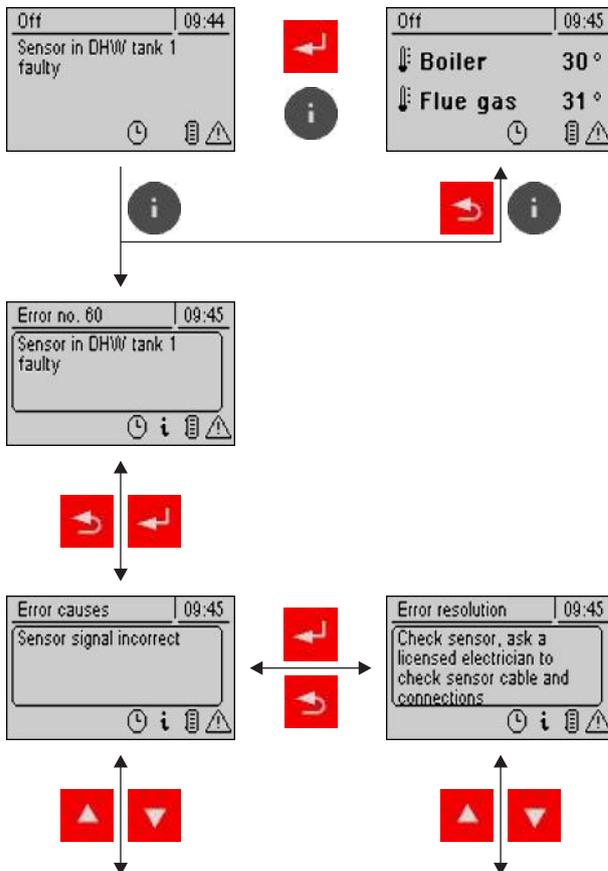
The term "fault" is a collective term for warnings, errors and alarms. The boiler reacts differently to the three types of message:

WARNING	In case of warnings the status LED flashes orange and the boiler initially continues controlled operation.
ERROR	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".
ALARM	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.

5.5 Faults with fault message - Touch control

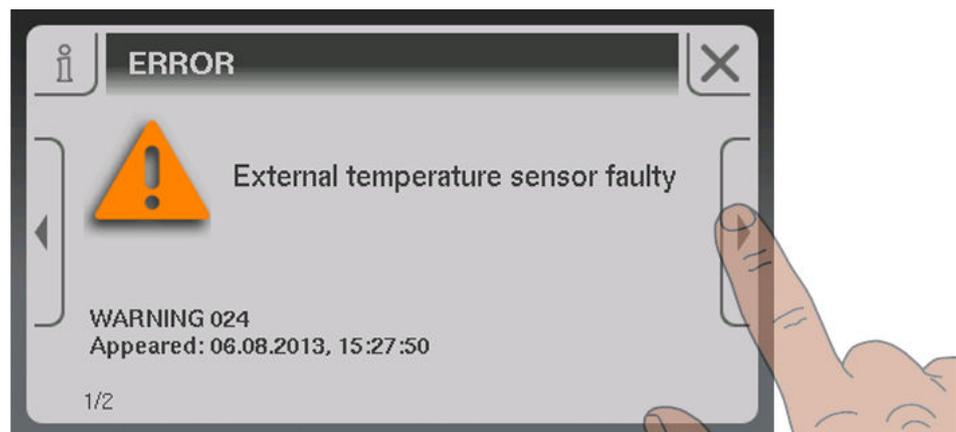
5.5.1 Troubleshooting

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

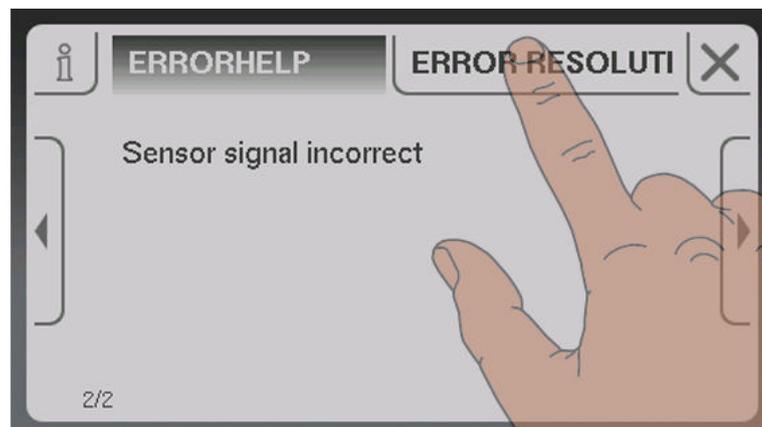
WARNING	In case of warnings the status LED flashes orange and the boiler initially continues controlled operation.
ERROR	When there is an error, the status LED flashes red, the boiler follows the shutdown procedure and remains in "Off" status until the problem is resolved.
ALARM	An alarm triggers a system emergency stop. The status LED flashes red, the boiler switches off immediately and the heating circuit controller and pumps remain active.

A window with the corresponding fault text will also appear. Pressing the Cancel icon takes you back to the basic display. If the quick select icon and the warning triangle flash alternately, there is still a fault. The "Error display" button will now appear in the quick menu.

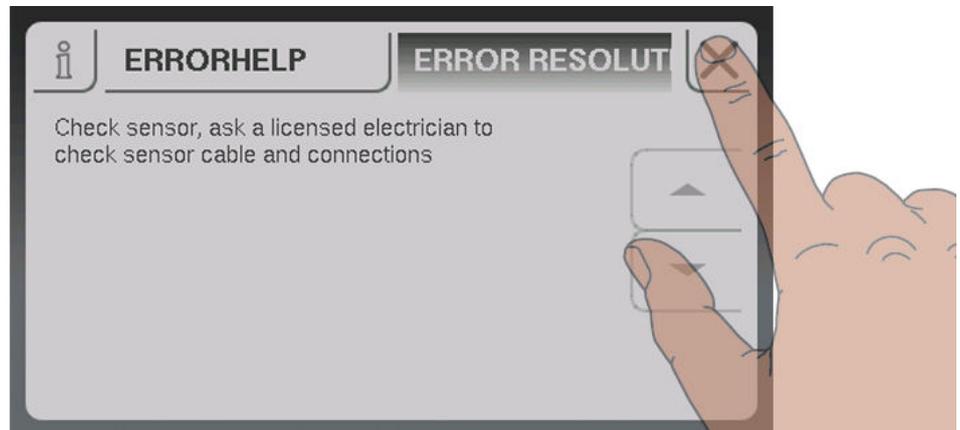
Procedure for fault messages



If you open the window with the respective fault text, the right arrow will take you to possible causes of the fault.



Tapping “Solution” will also display action to be taken to resolve the problem. If there are several options available, these will be listed one below the other.



Once the fault has been resolved, tap the Cancel icon to return to the basic display.

5.6 Acknowledging a fault message

key control Nach dem Beheben der Störung:

- Press the Enter key
 - Status LED constant or flashing green (depending on operating status)
 - Green constant: Automatic mode active / On
 - Green flashing: Automatic mode deactivated / Off

touch control Trace and remove the fault and then:

- Tap the “Cancel” symbol
 - Status LED constant or flashing green light (depending on operating status)
 - Green constant: automatic mode active / on
 - Green flashing: Automatic mode deactivated / Off

6 Appendix

6.1 Addresses

6.1.1 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
INTERNET www.froeling.com

Customer service

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

6.1.2 Address of the installer

Stamp
