

## Owner´s Manual



*S3 Turbo*



*Read and follow the operating instructions and safety information!*  
Subject to technical change!

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## Supplementary instructions

These instructions ensure safe and efficient use of the S3 Turbo Lambda (hereinafter referred to as the “system”). These instructions are a component part of the system and must be kept next to the system and within the immediate reach of staff at all times.

Staff must carefully read and understand these instructions before commencing all work. All the safety instructions and operating guidelines specified in this manual must be observed to ensure safety at work. In addition, the local accident prevention regulations and general safety regulations apply to the area of application of the system.

Images in these instructions are intended solely to aid understanding and may differ from the actual design.

### NOTICE

#### SAVE THESE INSTRUCTIONS!

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## 1 Overview

### 1.1 Front view



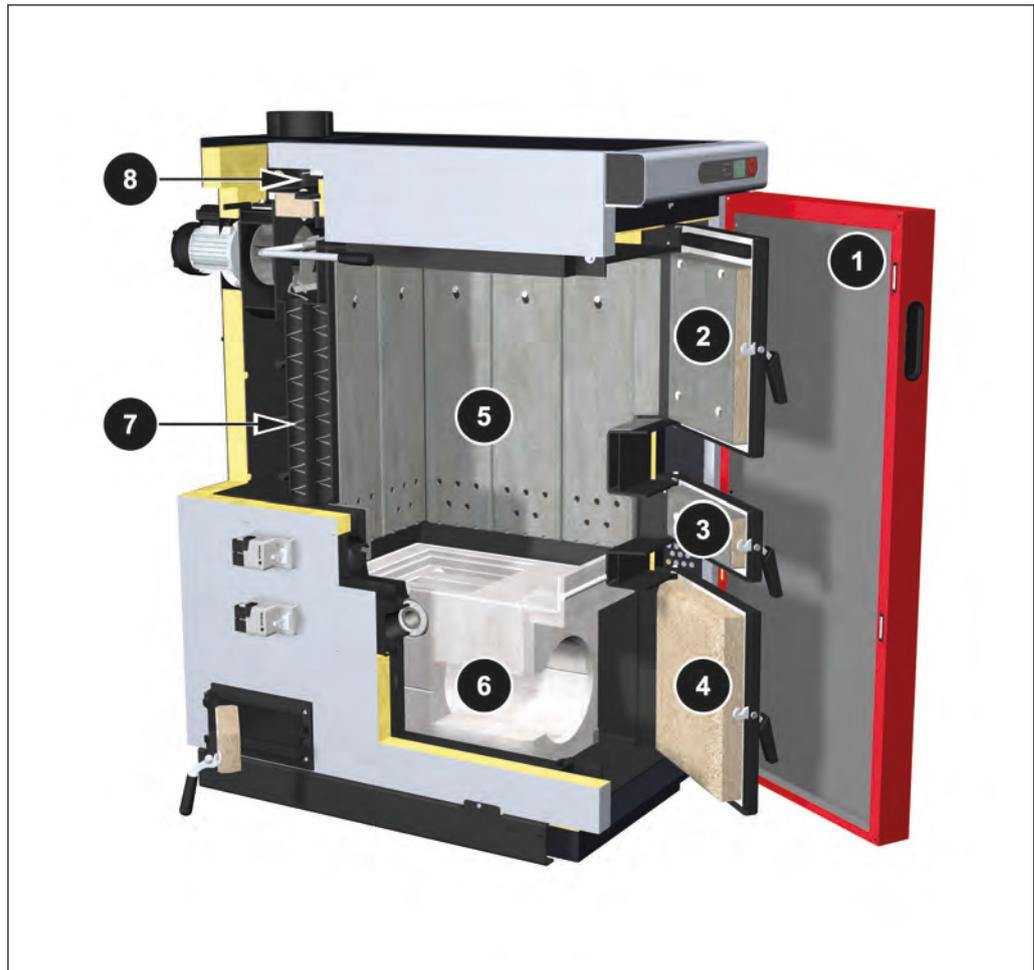
- |   |                                 |
|---|---------------------------------|
| 1 | Boiler S3 Turbo                 |
| 2 | Boiler controller control panel |
| 3 | WOS lever                       |
| 4 | Actuator of primary air flap    |
| 5 | Actuator of secondary air flap  |
| 6 | Heat exchanger cleaning door    |

### 1.2 Back view



- 1 Boiler flow connection
- 2 Induced draft fan
- 3 Thermal discharge safety device connection
- 4 Drainage
- 5 Boiler return connection

## 1.3 Cross-section



- |   |  |
|---|--|
| 1 | Insulated door   |
| 2 | Fuel-loading chamber door  |
| 3 | Pre-heating chamber door   |
| 4 | Combustion chamber door  |
| 5 | Fuel-loading chamber   |
| 6 | Combustion chamber   |
| 7 | Heat exchanger with spiral springs   |
| 8 | In flue gas nozzle: Flue gas temperature sensor and broadband lambda probe |

## 1.4 Boiler manufacture and testing

Your boiler was manufactured by Froling, a world leader on hot water (hydronic) heating for over 50 years. The S3 Turbo boiler confirms to traditional high standards for quality and reliability. It offers modern fire wood boiler technology with operating efficiencies of over 90% based on net calorific value of fuel. If treated properly and operated according to the guidelines in this manual, it will provide years of safe, dependable and cost-effective heating.

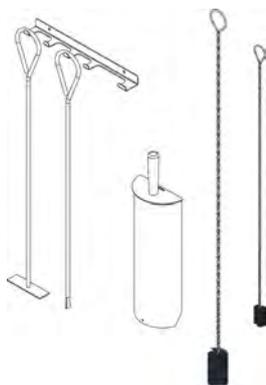
S3 Turbo boilers are designed and built in accordance with European standard EN 303-5. This unit was safety and performance tested and listed to ANSI/UL 2523-2013 and CAN/CSA B366.1-11 by OMNI Test Laboratories, Inc; Portland, Oregon. The installer should follow local or state installation requirements.

The S3 Turbo fire wood boiler is designed and constructed for the highly efficient combustion of fire wood. Do not burn other fuels in the fire wood boiler S3 Turbo. The S3 Turbo boiler is a not self-contained, weather-tight boiler. It should be installed within the heating building. S3 Turbo boilers should be installed with a thermal storage tank system.

## 1.5 Wood heater description and compliance status

The S3 Turbo wood boiler is a down-draft type wood gasification boiler with an output rating of between 51,250 btu/h and 102,500 (30 kW), or between 85,000 btu/h and 170,000 btu/h (50 kW). This appliance is not fitted with a catalytic combustor. This appliance meets the 2015 US Environmental Protection Agency's cord wood emissions limits for wood heaters sold after May 15, 2015.

## 1.6 Cleaning kit provided



The cleaning kit below is provided for cleaning the boiler:

- Furnace tool
- Ash shovel
- Cleaning brush (Ø 53 mm)
- Cleaning brush (30 x 20 mm)

## 2 Safety

### 2.1 Explanation of symbols

#### *Safety information*

Safety information in these instructions is indicated by symbols. The safety information is preceded by signal words which reflect the extent of the risk.

#### **DANGER**

This symbol and signal word combination indicates a hazardous situation which will lead to death or serious injury if it is not avoided.

#### **WARNING**

This symbol and signal word combination indicates a hazardous situation which could lead to death or serious injury if it is not avoided.

#### **CAUTION**

This symbol and signal word combination indicates a hazardous situation which could lead to slight or minor injuries if it is not avoided.

#### **NOTICE**

This signal word indicates important, but not safety-related information e.g. damage to property or pollution

#### *Safety information in operating instructions*

Safety information can refer to certain, individual operating instructions. To avoid disrupting the flow of the text when you are performing the action, this safety information is not incorporated in the operating instruction. The signal words set out above are used.

Example:

- Undo screw
- CAUTION! Pinching hazard at cover**  
Take care when closing the cover.
- Tighten the screw

#### *Special safety information*

The following symbols are used to draw your attention to particular hazards

#### *Tips and recommendations*

*Italics indicate useful tips and recommendations as well as information for efficient and smooth running.*

#### *Other markers*

The following markers are used in these instructions to highlight operating guidelines, results, lists, references, and other elements:

Marker	Explanation
□	Step-by-step operating instructions
↪	Results of actions
▪	Lists without a specified order
[Button]	Operating elements (e.g. button, switch), display elements (e.g. signal lights)
“Display“	Screen elements (e.g. buttons, assignment of function keys)

### ***Units used***

All units of measure are specified in these operating instructions in both SAE units and SI units. The SAE unit appears first, followed by the SI unit in brackets.

Example using information about heat output: 17 (5) BTU/h (kW) equals 17 BTU/h (SAE system) or 5 kW (SI system).

## 2.2 Permitted Uses

The S3 Turbo boiler is designed exclusively for heating domestic water. Only use those fuels specified in the “Permitted fuels” section.

Permitted use includes compliance with all the specifications in this instruction manual.

Any use other than or above and beyond the permitted use is considered misuse.

### WARNING

#### Danger of misuse

- Do not install the system in a mobile home.
  - Do not operate the system in an explosive atmosphere.
  - Keep the air inlet to the boiler room clear at all times.
  - Only use fuels permitted by the manufacturer.
  - Never store flammable materials close to the boiler.
  - Never set flammable objects on the boiler to dry (e.g. clothing).
  - Do not use any hydrogen halides or cleaning agents containing chlorine in the boiler installation room.
  - Keep covers and doors closed during operation.
  - The chimney is only to be used as an outlet for one heating system.
  - Do not use the hot water directly in swimming pools or thermal baths and do not use as drinking water.
  - Do not alter the boiler controller.
  - DO NOT BURN GARBAGE, GASOLINE, NAPHTA, ENGINE OIL OR OTHER INAPPROPRIATE MATERIALS.
  - DO NOT USE CHEMICALS OR FLUIDS TO START THE FIRE.
  - DO NOT OPERATE WITH FLUE DRAFT EXCEEDING 0.12 INCHES WATER COLUMN (30 Pa).
  - UNSAFE TO ADJUST FLUE DRAFT HIGHER THAN 0.12 INCHES WATER COLUMN (30 Pa).
  - THE HEAT EXCHANGER, DRAFT INDUCES, FLUE PIPE, AND CHIMNEY MUST BE CLEANED REGULARLY TO REMOVE ACCUMULATED CREOSOTE AND ASH. ENSURE THAT THE HEAT EXCHANGER, FLUE PIPE, AND CHIMNEY ARE CLEANED AT THE END OF HEATING SEASON TO MINIMIZE CORROSION DURING THE SUMMER MONTHS. THE APPLIANCE, FLUE PIPE, AND CHIMNEY MUST BE IN GOOD CONDITION. THESE INSTRUCTIONS ALSO APPLY TO A DRAFT INDUCER IF USED.
- Misuse of the boiler can create hazardous situations.

## 2.3 Requirements at the place of installation

### 2.3.1 Approval for the heating system

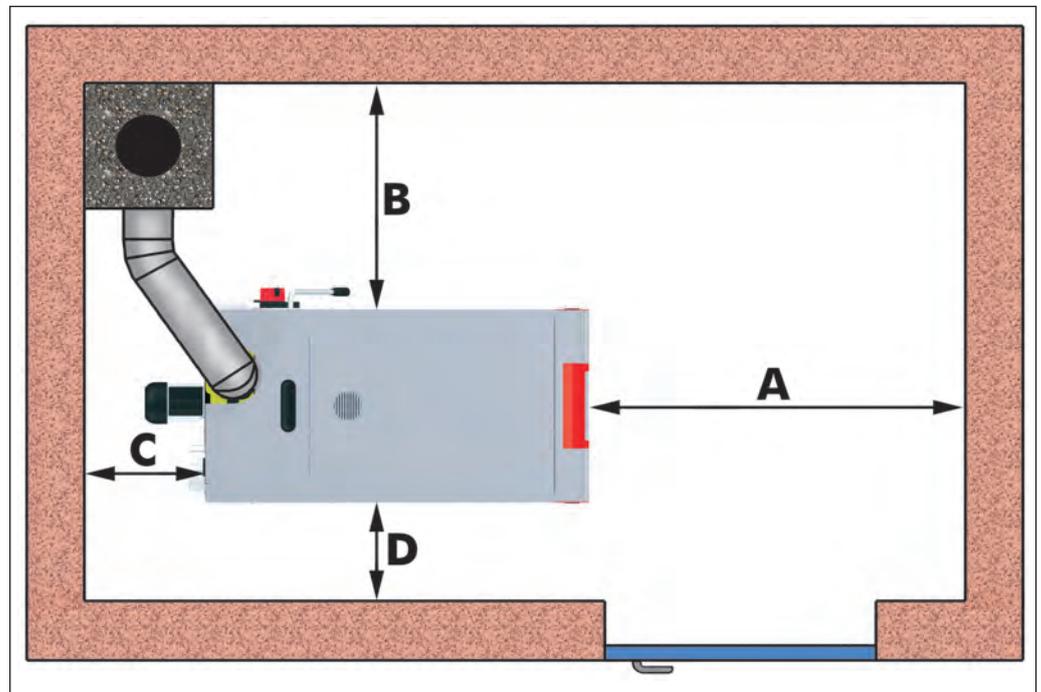
The appropriate supervisory authority (inspection agency) must always be informed when installing or modifying a heating system, and authorization must be obtained from the building authorities. Also observe ANSI/NFPA 211 and CAN/CSA B365 for the installation.

### 2.3.2 Space required

FOR SAFE INSTALLATION AND OPERATION CLEARANCES TO COMBUSTIBLES MUST BE MAINTAINED.

The diagram below shows how much space is required for the system in the boiler room.

The boiler may only be installed on non-combustible floors with these clearances.



Dimension	Name	S3 Turbo
A	Distance - front of boiler to wall	36" (900 mm)
B	Distance – side of boiler to wall	32" (800 mm)
C	Distance – back to wall	14" (350 mm)
D	Distance – side of boiler to wall	9" (250 mm)
Distance between ceiling and boiler		18" (460 mm)

### 2.3.3 Requirements for central heating water

#### *Water quality*

Water of the following quality is required for the first fill:

- The water must be clean, pure or purified as well as odorless and must not contain suspended matter.
- The water hardness must not exceed 190 grain/fl.oz. or 100 ppm CaCO<sub>3</sub> (100 mg/L), i.e. soft water is required.
- The chlorine concentration in the water must not exceed 58 grain/fl.oz. (30 mg/L).
- The pH value in the heating system must be between 8.0 and 8.6.
- If the water quality is too poor, use additives to prepare the water. If you are topping up with small amounts, always use clean water.

#### **NOTICE**

**The hot water must not be used directly in swimming pools or thermae. Use a heat consumer of the right size to consume the heat. Do not use the heating water as drinking water.**

To ensure good water quality during operation, avoid leaks and use a closed heating system. If necessary, use a return temperature control.

#### *First fill*

*To prevent air from getting into the heating system during the first fill, fill the filling hose with water.*

#### *Frost protection*

You can add anti-freeze to the heating water, however, this can reduce the heating efficiency. Always follow the manufacturer's dosing instructions when using anti-freeze, as using the incorrect amount can cause corrosion. Check the concentration of the anti-freeze at regular intervals.

### 2.3.4 Ventilation requirement for boiler room

#### *Introduction*

The external combustion air must meet certain requirements to ensure that adequate combustion air is supplied to the boiler and no by-products from the combustion get into the boiler room.

Ventilation air for the boiler room must be taken from and expelled directly outside, and the openings and air ducts must be designed to prevent weather conditions (e.g. from foliage or snowdrifts), plants or animals from obstructing the air flow. Permanent ventilation is required to ensure that the boiler runs smoothly.

In North America there are several regulations which govern the minimum requirements of combustion air for chimneys.

*The boiler must be installed in such a way that it receives adequate ventilation and combustion air and that the fuel in the boiler burns. The exhaust air must be expelled safely outside via the chimney and maintained within a safe temperature range.*

*Boiler rooms are usually so small that normal ventilation does not provide enough air and air must be brought in from outside. External air openings and air channels must be of an appropriate size to supply adequate combustion air. The design must comply with NFPA 211.*

*Consult your local chimney inspector for the installation and install the boiler in accordance with the applicable local regulations.*

Recommended size of air openings according to NFPA 54 and NFPA 211:

The boiler requires a fresh air supply of between 1 sq.in. per 2,500 BTU/h and 1 sq.in. per 4,000 BTU/h (550 mm<sup>2</sup>/kW and 880 mm<sup>2</sup>/kW), depending on local conditions and the climate zone. Local conditions may necessitate an additional air supply.

### 2.3.5 Requirements for the heating system

- The whole heating system must be designed in accordance with relevant national and local regulations.
- The boiler's nominal load must be adjusted to the calculated heating requirements of all the consumer loads connected in the heating circuit in summer and winter.
- The heating system must be big enough to transport the heat generated by the boiler and an additional heat source (if present). The pressure throughout the whole system including all heating zones must be even.
- Special equipment must be available for filling and ventilating the heating circuit. Flow valves and zone valves must be fitted to set the correct water flow volume.
- All fitted pipes must be water-tight and air-tight and safely insulated.
- If there is a risk of parts of the heating system freezing, add anti-freeze to the water in these heat zones.

### 2.3.6 Requirements for the boiler room

- 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.

- There is no lighting on the boiler. Therefore, the customer must provide sufficient lighting in the boiler room in accordance with national workplace design regulations.
- Always consult the manufacturer when using the boiler at more than 2000 meters above sea level.
- Always keep the air suction opening of the boiler free from dust.
- The boiler room must be at least (mm) high.

### 2.3.7 Combination with thermal storage

Your S3 Turbo boiler must be installed with a Thermal Storage System. The purpose of the thermal storage system is to absorb heat produced by the boiler if the building load cannot use all of the heat being produced. This means that the boiler will be batch fired. Batch firing requires that the boiler only be loaded with fuel and ignited when the thermal storage temperature is depleted adequately so that it can absorb the energy produced from the next fire. There may be some instances when the heating load will use all of the heat being produced by the boiler. In such cases, the boiler may be loaded continuously.

Your boiler is equipped with a timer that provides feedback about how many hours of run time (active burning) or slumber time (boiler is stopped because no heat is being taken from it) are accumulating. Slumber hours should be minimized as much as possible. If you find slumber hours increasing, it is likely that you are over-filling the boiler with wood and it is cycling on and off rather than having continuous run times.

Over filling the boiler may result in corrosion of the firebox wall, damage to the combustion chamber, damage to the firebox aprons, soot accumulation in the heat exchange and dirty emissions.

Your thermal storage system may require periodic maintenance. Please review the periodic maintenance requirements of your thermal storage system with your installer.

### 2.3.8 Return temperature control

It is recommended you fit a return temperature control when installing the heating system. If the hot water return is below the minimum return temperature, some of the hot water outflow will be mixed in via the return temperature control.

#### NOTICE

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

*The manufacturer stipulates using a return temperature control. The minimum return temperature is 140°F (60°C). It is recommended you fit some kind of control device (e.g. thermometer). The controller of the return temperature control can be integrated in the boiler controller.*

- ❑ Condensation water forms an aggressive condensate when combined with combustion residue, leading to damage to the boiler. If the outside temperature is low, condensation water can freeze at the chimney outlet, which can result in inadequate chimney escape, limited boiler output and a system breakdown.

### 2.3.9 Requirements for the chimney connection

The chimney connection must be big enough to channel flue gases from the building. The whole flue gas system must be designed to prevent possible seepage, insufficient feed pressure and condensation.

The manufacturer recommends fitting a draft regulator to limit the pressure to 0.12 inch WC (30 Pa). The draft regulator should be fitted directly on the chimney connection where the pressure is very low.

The boiler must be connected to a brick chimney or a shop-made chimney in accordance with UL 103 HT (ULC S629 in Canada). The chimney must be clean and in good condition at the time of installation.

The pipe unions within the chimney must be made of stainless special steel (with 304, 316 or 321 alloys). The flue gas connection pipe must be made of untreated steel or stainless steel with a thickness of 24 Gauge. The minimum rise of the pipe must be ¼" per foot for the progression towards the chimney. The chimney and the flue gas connection pipe must have a diameter of at least 6" (150 mm). The individual pipe sections must be joined together with at least three self-tapping screws and the joints sealed using high-temperature silicone. The flue gas pipe must not contain more than two 90° bends.

All connections must conform to NFPA 211. Consult your local chimney sweep for the installation and install the boiler in accordance with the applicable local regulations.

The chimney connection, ventilation ducts and fresh air openings must not be closed over or blocked.

The flue gas pipe must not be displaced by an attic, loft, fuel store or similar areas.

#### *Basic data for designing the chimney connection*

Description		S3 Turbo	
		30	50
Flue gas temperature at nominal load	°C	220	220
	°F	430	430
Flue gas temperature at partial load	°C	150	150
	°F	300	300
Flue gas mass flow at nominal load	kg/h	76	122
	lb/h	167	270
Flue gas mass flow at partial load	kg/h	43	65
	lb/h	95	143
Required feed pressure at nominal load	Pa	8	8
	in WC	0.03	0.03
Maximum permissible feed pressure	Pa	30	30
	in WC	0.12	0.12
Flue pipe diameter	mm	150	150
	inches	6	6

**⚠ CAUTION**

**ADJUSTMENT OF THE FLUE DRAFT HIGHER THAN 0.12 INCHES WATER COLUMN (30 Pa) COULD CAUSE A FIRE TO BURN OUT OF CONTROL AND AN UNSAFE CONDITION!**

- Maximum permitted setting: 0.12 inches WC (30 Pa)  
Ideal setting: 0.04 inches WC (10 Pa)

## 2.4 Safety markers

**⚠ WARNING**

**Danger if signage is illegible!**

- Ensure that all safety, warning and operating instructions are always in a clearly legible condition.
- Replace damaged stickers and signs immediately.
  - Over time stickers and signs can get dirty or otherwise unrecognizable which means that dangers cannot be identified and the necessary operating information cannot be observed. This poses a risk of injury.

The following stickers are located in the work area. They refer to the area immediately surrounding where they are affixed.

### 2.4.1 Mandatory signs



***Refer to the operating instructions***

Only use the indicated system once you have read the operating instructions.



***Wear hearing protection***

This sign indicates that hearing protection must be worn in the area concerned.



***Wear protective gloves***

This sign indicates that protective gloves must be worn in the area concerned.



***Wear safety shoes***

This sign indicates that safety shoes must be worn in the area concerned.



***Wear a dust mask***

This sign indicates that a dust mask must be worn in the area concerned.



***Keep the doors closed***

Keep the doors closed during operation.



***Turning off the main switch***

Switch off the main switch and take precautions to prevent accidental switching on before carrying out work to the system

Switch off the main switch for the fuel infeed and take precautions to prevent accidental switching on before entering the fuel storage room.



***Securing the main switch***

Switch off the main switch and secure with a padlock when carrying out maintenance work to the boiler.

### 2.4.2 Prohibitions



#### ***Unauthorized access prohibited***

Only persons authorized by the operator may enter the danger zone and fuel storage room. Keep children away! Keep the fuel storage room locked and keep the access key in a safe place. Protect the fuel from moisture.



#### ***No fire, open flames or smoking***

Areas marked with this are at risk of fire or explosion. Keep ignition sources away from these areas.

### 2.4.3 Warning signs



#### ***Automatic start-up***

This sign indicates that there is a risk of the system starting up automatically. Work may only be carried out in areas with this marking if the system has been secured.



#### ***Electric current***

Only licensed electricians may work in workspace with this marking. Unauthorized persons are not permitted to enter work areas with this marking or open the cabinet with this marking.



#### ***Harmful or irritant materials***

These materials can be irreparably harmful to health, trigger allergic reactions or irritate the mucous membranes.

Observe the information on the packaging and containers.



#### ***Danger from carbon monoxide***

There is a risk of poisoning from a possible concentration of carbon monoxide in the fuel storage room and boiler room. Ventilate the fuel storage room for at least 15 minutes before entering. Two people must always be present when working in the fuel storage room. The access door must be kept open at all times. Also wear a dust mask because of the high dust levels.



#### ***Hand injuries***

Keep hands away from areas bearing this warning.

There is a risk that your hands could get trapped, pulled in or otherwise injured.



#### ***Hot surfaces***

Hot surfaces, such as hot system parts, may not always be obvious. Do not touch these parts without protective gloves.



#### ***Risk of falling***

There is a risk of falling in the fuel store because of slippery surfaces or fuel lying about. Take extreme care and wear personal protective equipment.



#### ***Risk of injury at fans***

Keep hands away from areas bearing this warning.

There is a risk that your hands could get trapped, pulled into or otherwise injured in automatic fans.

## 2.4.4 Signage on the boiler

### *Notice of risks during installation*

#### S3 Turbo - WOOD FIRED GASIFICATION HYDRONIC FURNACE

##### INSTALLATION HAZARDS

Install, modify and use only in accordance with manufacturer's manuals. Refer to authorities having jurisdiction for proper installation. Contact local building and fire officials about restrictions and installation inspection in your area. If there are no applicable local codes, follow ANSI/NFPA 211 and CAN/CSA B365. Special precautions are required for passing the chimney through a combustible wall or ceiling.

Inspect and clean exhaust system, loading chamber, burning chamber, ash-pits, and heat exchanger frequently in accordance with owner's manual.

Basic boiler data for layout of chimney system

		S3 Turbo	
Quantity	Unit	30	50
Flue gas temperature	°C	220 / 150	220 / 150
Rated / partial load	°F	430 / 300	430 / 300
Flue gas mass flow	kg / h	76 / 43	122 / 65
Rated / partial load	lb / h	167 / 95	270 / 143
Minimum draft at boilers flue gas connection		8 Pa (0.03 inches water column)	
Maximum draft at boilers flue gas connection		30 Pa (0.12 inches water column)	
Flue gas connector Diameter		150 mm (6 inches)	
Maximum water temperature		88 °C (190 °F)	
Maximum allowable working pressure		2 bar (30 psi)	
Test Pressure		4.5 bar (67.27 psi)	
Minimum Pressure Relief Valve Capacity		155 kW (535,000 Btu/h)	

For detailed design information please refer to Installation Manual!

For unit specifications, see the plaque located directly on the boiler!

##### DANGER!

- ▲ Working on electrical components may cause severe injuries from electric shocks!

##### WARNING!

- ▲ The electrical system of the boiler shall be supplied from a double 115 V 60 Hz (nominal 230 V AC) 15 amp branch circuit including neutral and earth connection. For wiring instructions please refer to installation Manual!
- ▲ Chimney must be 6" (150 mm) diameter listed UL-103 HT or ULC-S629 residential all-fuel type or tile-lined masonry. Flue connector pipe must be 6" (150 mm) diameter made of a minimum 24 MSG black steel.
- ▲ Inadequate design, installation and maintenance of the flue gas system will lead to insufficient chimney draft and could result in Danger of Life or Severe Injury caused by serious faults in combustion, e.g. explosively combustion of carbonization gases and flash fires!
- ▲ This boiler requires fresh air for safe operation and must be installed so there are provision for adequate combustion and ventilation air!

##### CAUTION!

- ▲ DO NOT CONNECT THIS UNIT TO A CHIMNEY FLUE SERVING ANOTHER APPLIANCE!
- ▲ LOAD FUEL CAREFULLY OR DAMAGE WILL RESULT.
- ▲ REFER TO OWNER'S MANUAL. DO NOT ALTER THIS EQUIPMENT IN ANY WAY.
- ▲ UNSAFE TO ADJUST FLUE DRAFT HIGHER THAN 0.12 INCHES WATER COLUMN (30 Pa).
- ▲ MAY BE CONNECTED TO AN EXISTING BOILER SYSTEM.
- ▲ Flooring must be a minimum 3/8" (10 mm) non-combustible material covering the installation clearance area! The base shall be horizontally, planar and reinforced if required. For construction of base please mind the weight of boiler, water content and wood fuel according Installation Manual!
- ▲ This boiler is not for use with an automatic stoker
- ▲ Connection to an existing boiler system in combination with heat storage only!
- ▲ Use original spare parts only. Installation of non-licensed replacement parts will void the warranty!

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***Notice of risks during operation*****S3 Turbo - WOOD FIRED GASIFICATION HYDRONIC FURNACE****OPERATION HAZARDS**

**NOTICE!** Burn Wood only, max. length 21" (51cm)!

Load fuel carefully or damage will result!

Build the wood fire directly on the boiler Fuel Loading Chamber refractory floor!

Do not use small pieces or wood waste that could fall through the center slot in the refractory.

**DANGER!** Risk of Fire or Explosion!

- ▲ Do not burn garbage, gasoline, drain oil or other flammable liquids.
- ▲ DO NOT BURN GARBAGE, GASOLINE, NAPHTA, ENGINE OIL, OR OTHER INAPPROPRIATE MATERIALS!
- ▲ Do not use chemicals to start up unit firing.
- ▲ DO NOT USE CHEMICALS OR FLUIDS TO START THE FIRE.
- ▲ Use of inappropriate fuels can result in Danger of Life or Severe Injury caused by explosive combustion and flash fires!
- ▲ Burning fuels other than designated will void the warranty!

**DANGER!** Explosive Gases!

- ▲ Never open Combustion Chamber Door, Ash-Pit Door, Ash-Pit Cask Cover or Heat Exchanger Cask Cover during operation or refueling!
- ▲ Faulty operation of boiler system will cause Danger of Life or Severe Injury and Material Damage!
- ▲ Flue gases can cause fatal poisoning! In case of strong smell of flue gas:
  1. For safety keep all boiler doors and ash-pit doors tightly closed!
  2. Air the room where boiler is installed!
  3. Close the door of the boiler room and doors to living areas!

**WARNING!** Risk of Fire!

- ▲ KEEP ALL BOILER DOORS, FUEL STORAGE DOOR AND ALL COVERS TIGHTLY CLOSED DURING OPERATION!
- ▲ AFTER OPENING BOILER DOORS OR COVERS CLOSE ALL DOORS, COVERS AND CASING TIGHTLY!
- ▲ DO NOT OPERATE WITH FLUE DRAFT EXCEEDING 0.12 INCHES WATER COLUMN (30 Pa)!
- ▲ UNSAFE TO ADJUST FLUE DRAFT HIGHER THAN 0.12 INCHES WATER COLUMN (30 Pa)!
- ▲ THE HEAT EXCHANGER, DRAFT INDUCER, FLUE PIPE, AND CHIMNEY MUST BE CLEANED REGULARLY TO REMOVE ACCUMULATED CREOSOTE AND ASH. ENSURE THAT THE HEAT EXCHANGER, FLUE PIPE, AND CHIMNEY ARE CLEANED AT THE END OF HEATING SEASON TO MINIMIZE CORROSION DURING THE SUMMER MONTHS. THE APPLIANCE, FLUE PIPE, AND CHIMNEY MUST BE IN GOOD CONDITION. THESE INSTRUCTIONS ALSO APPLY TO A DRAFT INDUCER IF USED.
- ▲ Do not store fuel, clothing, furniture or other combustible material within marked installation clearances!
- ▲ Faulty operating conditions not complying with Owner's Manual, such as insufficient combustion air, incorrect or insufficient cleaning and maintenance or non-permitted fuel could result in Danger of Life or Severe Injury caused by serious faults in combustion (e.g. spontaneous combustion of carbonization gases or flash fires)!
- ▲ Inspect and clean appliance, flues and chimney regularly!
- ▲ First firing during start-up of boiler system shall be carried out in accordance to Instruction Label at Fuel Loading Chamber Door and in attendance of an authorized installer or manufacturer's representative only! Disregarding of warning may cause damage or explosion of combustion chamber and severe injuries unfavorably!
- ▲ Gas performed during solid-fuel combustion may cause a small explosion when the boiler is refueled!

**CAUTION!** Hot surfaces!

- ▲ Hot parts and the flue pipe can cause serious burns!
- ▲ Do not touch during operation!
- ▲ Maximum draft marked on nameplate!
- ▲ Unauthorized access to the boiler room could result in personal injury and damage to property!
- ▲ FOR SAFETY KEEP FIRING AND ASHPIT DOORS TIGHTLY CLOSED.
- ▲ Keep children away!
- ▲ Always use protective gloves while loading boiler or carry out other work on boiler! Also mind the risk of injuries by splinters of fire wood!
- ▲ Always use control handles when open boiler doors!
- ▲ Insulate flue pipe or do not touch during operation!
- ▲ Do not carry out maintenance when the boiler is hot!
- ▲ Do not touch hot surfaces behind Insulation Door!

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*Notice regarding procedures in an emergency***S3 Turbo - WOOD FIRED GASIFICATION HYDRONIC FURNACE****HAZARDS DURING REFUELING AND EMERGENCY PROCEDURES****▲ DANGER! In case of strong smell of flue gas!**

Flue gases can cause fatal poisoning!

1. For safety keep all boiler doors and ash-pit doors tightly closed!
2. Air the room where boiler is installed!
3. Close the door off the boiler room and doors to living areas!

**▲ DANGER! In the event of loss of electrical power!**

- Do not open any Boiler or Ash-pit Door!!
- Do not load fuel into the boiler!
- Boiler Control automatically restarts after power fail restart
- One hour after power has returned, check system for normal operation and compare manometer reading to initial settings. If system pressure is below, replenish water to the hydronic system according plumber's instructions.

**▲ DANGER! In the event of runaway fire!**

- Turn off Emergency Switch, if installed.
- Do not open any Boiler or Ash-pit Door!
- **DO NOT SWITCH OFF MAIN ISOLATOR AT CONTROL SYSTEM!**
- In case no Emergency Switch is installed:
  1. Open Insulation Door slightly and keep it opened
  2. Push Arrow-Down Key at Boiler Control to switch off ID-Fan
  3. Keep Insulation Door opened
  4. Do not open Ash-pit Door or any Boiler Door behind Insulation Door
- When there is no more risk of runaway fire, turn on Emergency Switch and close Insulation Door and resume to normal operation of the system.

**To cool overheated boiler (over 220°F / 105°C)!**

- Do not open any Boiler or Ash-pit Door!
- Turn all thermostats in your house to their highest temperature settings and open all windows.
- Open all hot water faucets.
- When boiler temperature has dropped below 180°F (82°C), reverse the above steps.
- In case Safety Temperature Limit Switch automatically has been activated please refer to Owner's Manual.

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## 2.5 Residual risks

### 2.5.1 Basic risks

#### *Incorrect operation*

#### WARNING

#### **Risk of injury from operating the system incorrectly!**

- Modifications to the boiler controller must only be undertaken in consultation with the manufacturer.
  - Modifying parameters on the boiler controller can cause malfunctions.

### 2.5.2 Risks from electricity

#### *Electric current*

#### DANGER

#### **Risk of death from electrocution!**

- Only allow licensed electricians to carry out electrical work to the electrical system.
- If the isolation gets damaged, switch off the power supply immediately and have it repaired.
- Prior to commencing work to active parts, shut off electrical systems and equipment so that they are no longer live and secure so that they remain off for the duration of the work. Follow the five safety rules:
  - Disconnect.
  - Secure against switching back on.
  - Check the system is no longer live.
  - Earth and short circuit.
  - Cover or shield any adjacent live parts.
- Never bypass or disable fuses. When replacing fuses, use the correct amperage.
- Always lay lines and cables far away from hot surfaces.
- Use shielded cables when using frequency converters.
- Ensure that the system is properly earthed with a protective earth system. Have all component assemblies checked at regular intervals to ensure the correct earthing.
- Keep moisture away from live parts. This can cause short circuits.
  - Touching live parts can cause immediate death by electrocution. Damage to the isolation or individual components can be perilous.

### 2.5.3 Danger from fire and explosion

#### *Risk of fire and explosion*

##### WARNING

#### **Risk of fire and explosion around the boiler!**

- DO NOT BURN GARBAGE, GASOLINE, NAPHTHA, ENGINE OIL OR OTHER INAPPROPRIATE MATERIALS.
- DO NOT USE CHEMICALS OR FLUIDS TO START THE FIRE.
- DO NOT OPERATE WITH FLUE DRAFT EXCEEDING 0.12 INCHES WATER COLUMN (30 Pa).
- UNSAFE TO ADJUST FLUE DRAFT HIGHER THAN 0.12 INCHES WATER COLUMN (30 Pa).
- THE HEAT EXCHANGER, DRAFT INDUCER, FLUE PIPE, AND CHIMNEY MUST BE CLEANED REGULARLY TO REMOVE ACCUMULATED CREOSOTE AND ASH.
- DO NOT INSTALL IN A MOBILE HOME.
- Keep covers on the boiler and the access door to the storeroom closed during operation.
- Smoking, fire and naked flames are not permitted in the store and boiler room.
- Do not store flammable materials in the boiler room.
- Do not set flammable objects on the boiler to dry (e.g. clothing).
- Always ensure that the boiler room is adequately ventilated.
- Maintain and inspect the heating system at the prescribed intervals. Ensure that the chimney vent is cleaned regularly.
- Do not use any hydrogen halides or cleaning agents containing chlorine in the boiler room.
- Observe the safety signs around the system.
  - Using the boiler incorrectly can cause fire or explosions.

#### *Fire protection*

##### WARNING

#### **Risk of injury from limited or incorrect firefighting!**

- Ensure that all fire extinguishers provided are suitable for the fire class.
- Test that the fire extinguishers are fit for use every two years or in accordance with the regulations set out by the fire authorities.
- Refill the fire extinguisher after each use.
- Only use approved extinguishing agents and spare parts that match the prototype on the fire extinguisher.
- When using the fire extinguisher, follow the safety and operating instructions on it.
- Note the operating temperature range when using the extinguisher.
  - If, in the event of a fire, the fire extinguisher is not fit for use or unsuitable for the specific fire class, this can result in serious injuries or even death and significant damage to property.

### *Flue gas system*

**⚠ WARNING****Risk of injury and damage to property from obstructing the flue gas system!**

- The chimney is only to be used as an outlet for one heating system.
- Optimum performance can only be guaranteed if the flue gas system is functioning correctly. It is, therefore, important to have the flue gas system cleaned regularly to ensure that the flue gas can escape properly.
- Arrange for the chimney sweep to check the chimney connection and chimney for tar oil deposits twice a month during the heating period.
  - Problems with the flue system, such as poor cleaning of the flue pipe or insufficient chimney escape can cause serious faults in combustion (such as spontaneous combustion of carbonization gases/explosion).

## 2.5.4 Danger from high temperatures

### *Hot surfaces*

**⚠ WARNING****Risk of injury from hot surfaces!**

- FOR SAFETY REASONS, KEEP ALL DOORS TIGHTLY CLOSED.
- Before all work on the boiler, burn out the fuel-loading chamber and let the boiler cool.
- Protective gloves must generally be worn for work on the boiler. Only touch the boiler using the handles provided.
- Insulate the flue gas pipes and do not touch them during operation.
- Keep children and unauthorized persons away from the boiler.
- Allow the boiler to cool before carrying out any maintenance work.
  - Touching hot surfaces on the boiler, on the flue gas pipe and on heating pipes can cause serious burns.

### *Hot media*

**⚠ WARNING****Risk of scalding from hot media!**

- Temperature adjustments on the boiler controller must only be undertaken in consultation with the manufacturer.
- Do not touch heating pipes and consumer loads in the heating circuit (radiator etc.) during operation.
- Allow the system to cool before carrying out any maintenance work. Always wear protective gloves when working on the system.
- Keep children and unauthorized persons away from the heating system.
  - Heating pipes and consumer loads in the heating circuit can heat up considerably from the hot water. An incorrect setting at the boiler controller means that the water obtained can be extremely hot. Contact with hot water or hot surfaces can cause scalding to skin.

*Hot ashes***⚠ WARNING****Risk of injury from hot ashes!**

- Always wear protective clothing and protective gloves when working on the system.
- Before handling ash, check whether or not it is still hot. Allow to cool if necessary.
  - Ash is extremely hot after the combustion process. Contact can cause serious burns.

**2.5.5 Risks from flue gases, lubricants and other equipment***Proposition 65***⚠ WARNING****CALIFORNIA Proposition 65**

*This product may contain chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.*

*Tar oil***⚠ WARNING****Health risk from tar oil!**

- Always proceed with caution and wear personal protective equipment (protective clothing, safety shoes, protective gloves) when cleaning the boiler.
- Have a chimney sweep regularly clean tar oil deposits from the chimney connection and chimney.
- Regularly check the air inlet to the boiler room to ensure a controlled combustion process in the boiler.
  - The combustion of firewood can cause tar oil deposits in the boiler and chimney. Skin contact can be seriously harmful to health.

*Leaking flue gas***⚠ WARNING****Risk of poisoning from flue gases in the boiler room!**

- If you smell flue gas keep all the doors on the boiler closed.
- Ventilate the boiler room.
- Close the fire door and doors to living areas.
  - Contact with flue gases can cause perilous situations.

*Explosive dusts***⚠ WARNING****Risk of death from fire and explosion due to dispersed dust deposits!**

- Do not smoke within or close to the danger zone or boiler. Do not work with any kind of naked flame, fire or ignition sources.
- Keep the danger zone free from dust. Dust deposits over 5 mm thick are not permitted and must be removed.
- Stop work immediately in the event of a fire. Leave the danger zone until you get the all-clear and notify the fire brigade.
  - Dust deposits could catch fire or form an explosive compound if dispersed with the ambient air. This can result in serious and even fatal injuries.

***Incorrect fuel*****⚠ WARNING****Risk of injury and damage to the boiler if the incorrect fuel is added!**

- Only use fuels permitted by the manufacturer in the boiler.
- Never burn corn, cereal, coal, coke, garbage, painted or treated wood, bark, petrol, oil or other flammable liquids in the boiler.
- Never store fuel or other flammable materials in the boiler room.
- Never use chemicals, kerosene, charcoal, spirits or other flammable liquids to start or reignite the combustion process in the boiler.

**2.6 What to do in the case of danger*****What to do if the system overheats (at temperatures above 220°F (105°C))*****⚠ WARNING****Risk of injury from switching the system off prematurely at the main switch!**

- The system must only be switched off at the main switch once the boiler has cooled down sufficiently (operating status "Fire Off").
  - Switching off the main switch when the boiler is in heating mode can cause major combustion faults leading to serious accidents.

If the system overheats, proceed as follows:

- Keep all the doors on the boiler closed.
- Open all mixing valves; switch on all pumps. The Froling heating circuit control takes on this function in automatic operation.
- Leave the boiler room and close the access door.
- Ensure that heat is being consumed. To do this, activate all consumer loads.
- Once the boiler temperature has fallen to 185°F (85°C), return the heating circuit to normal status.
- If the temperature does not drop:
  - Inform the installer or Froling customer service.

In the event of a power failure proceed as follows:

- Keep all the doors on the boiler closed.
- The boiler controller will start again automatically after the restart.
  - Half an hour after the boiler restart, compare the values in the boiler controller and the values on the pressure gauges with the original values. If the pressure level is too low, add water to the heating system in accordance with the heating installer's instructions.

*In the event of excessive temperature the high-limit thermostat may have triggered. You may have to release this to allow the boiler to restart.*

***What to do if there is a smell of flue gas***

If you smell flue gas, proceed as follows:

- Keep all the doors on the boiler closed.
- Ventilate the boiler room where the boiler is located.
- Close the fire door and doors to living areas.

***What to do in the event of fire***

In the event of a fire proceed as follows:

- Keep all the doors on the boiler closed.

- Leave the main switch switched on.
- Close the fire door
- Leave the boiler room and the building.
- Inform the fire department.

## 2.7 Staff requirements

### *Risk of injury from inadequate qualification of staff!*

#### WARNING

### **Risk of injury from inadequate qualification of staff!**

*If unqualified staff work on the system, or are within the danger zone of the system, this creates hazards which could cause serious injuries and considerable damage to property.*

- All such activities should be carried out only by suitably qualified staff.
- Keep unqualified staff away from danger zones.

### **Definition of staff qualifications**

*The staff qualifications listed here for the United States are based on the descriptions of professional qualifications in the Occupational Outlook Handbook 2011-12 edition of the United States Department of Labor, Bureau of Labor Statistics.*

#### **Operator**

The operator is the person who operates the heating system for commercial or economic purposes by himself or cedes use/application to a third party and bears the legal responsibility concerning the product for the protection of the user or third parties during the operation.

He has been trained by the manufacturers and the suppliers in dealing with the system and its components and can independently detect potential hazards and avoid the associated risks.

#### ***Froling customer service or an authorized partner***

The Froling customer service or its authorized partner is able to perform the tasks assigned to it and recognize and avoid possible dangers thanks to its professional, product-related training, knowledge and experience as well as its knowledge of the relevant local regulations.

#### ***Heating system installer***

The heating system installer has demonstrably received specific instructions by the manufacturer regarding the tasks entrusted to him and potential dangers associated with improper conduct. The heating system installer must have read and understood these instructions. The heating system installer must have undertaken training and have professional experience of at least one year in his field of application.

The skills of the heating system installer include:

- Understanding technical contexts
- Reading and understanding technical drawings and diagrams
- Installing system components
- Installing and connecting of heating lines
- Performing maintenance work
- Dismantling and repairing or replacing system components, if a problem occurs

### *Licensed electrician*

Thanks to his training, knowledge, experiences and knowledge of relevant standards and provisions the licensed electrician is capable of performing the following tasks on electrical systems professionally and according to safety requirements:

- Planning and connecting electrical systems based on circuit and current flow diagrams
- Assembling pipes and connecting electric components
- Analyzing, measuring and testing electrical systems and functions
- Performing safety checks on electrical systems, components and devices
- Troubleshooting electrical systems

The licensed electrician is able to independently recognize and avoid hazards associated with these works.

### *Chimney sweep*

The chimney sweep is able to perform the tasks assigned to him and recognize and avoid possible dangers thanks to his professional training, knowledge and experience as well as his knowledge of the relevant standards and regulations.

The skills of the chimney sweep include:

- Understanding technical contexts
- Reading and understanding technical drawings and diagrams
- Checking heating, flue gas and ventilation systems as well as fuel stores for proper operation and fire safety
- Cleaning heating plants, smoke ducts and ventilation systems
- Knowledge of provisions under building law and environmental protection law, as well as knowledge in the field of energy efficiency, fire protection and climate protection
- Performing seal checks

### *Basic requirements*

Only persons expected to carry out their work reliably are admitted as staff. Persons, whose responsiveness is influenced e.g. by drugs, alcohol or medicine are not admitted.

When choosing staff, observe the applicable age and profession-specific regulations on site.

### *Unauthorized*



#### **Risk of death for unauthorized persons due to hazards in the danger zone and work area!**

- Keep unauthorized persons away from the danger zone and work area.
- In case of doubt, address the persons and direct them to leave the danger zone and work area.
- Suspend the work as long as there are unauthorized persons in the danger zone and work area.
  - Unauthorized persons that do not meet the requirements described here, do not know the dangers in the work area. Therefore, unauthorized persons are exposed to risk of serious injury and even death.

***Instruction***

The operator must regularly instruct the staff. For the purposes of traceability, you must create a training log containing the following at minimum:

- Date of training
- Name of the trainees
- Contents of the training
- Name of the instructor
- Signatures of the trainees and the instructor

## 2.8 Personal protective equipment

***Description of the personal protective equipment***

The personal protective equipment is as follows:

**Protective workwear:**

Protective workwear is tight-fitting work clothing with low tear resistance, narrow sleeves and without any protruding parts.

**Protective goggles**

Protective goggles are used to protect the eyes from flying parts when cleaning the system.

**Protective gloves**

Protective gloves are used to protect the hands against friction, abrasion, puncture, or deeper injuries and contact with hot surfaces.

**Safety shoes**

Safety shoes protect feet from crushing and falling parts as well as from sliding on slippery surfaces.

**Dust mask**

The dust mask is used for protection against dust when cleaning the system and when working in the fuel store.

## 2.9 Replacement parts

***Incorrect replacement parts***
**⚠ WARNING**
**Danger of injury when using incorrect replacement parts!**

- Use only original Froling replacement parts or spare parts approved by Froling.
- In case of doubt, always contact our customer service.
  - Hazards for the staff can arise through the use of incorrect or faulty spare parts and cause damage, malfunction or total failure.

*Spare parts can be obtained from the manufacturer or importer.*

## 2.10 Environmental protection

**NOTICE****Danger to the environment resulting from incorrect handling of environmentally hazardous substances!**

- Always follow the instructions below when handling hazardous substances and their disposal.
- If hazardous substances are accidentally released into the environment, take appropriate measures immediately. In case of doubt, inform the competent authority about the damage and request that proper measures be taken.
  - Incorrect handling of environmentally hazardous substances, in particular incorrect disposal, can cause significant damage to the environment.

The following hazardous substances are used:

***Ash***

Ashes should be placed in a steel container with a tight-fitting lid. The closed container of ashes should be placed on a non-combustible floor on the ground, well away from all combustible materials, pending final disposal. If the ashes are disposed of by burial in soil or otherwise locally dispersed, they should be retained in the closed container until all cinders have thoroughly cooled. For the disposal of ash from the heat exchanger, consult the local chimney sweep or waste disposal service of the municipality or province. Other waste should not be placed in this container.

***Firebricks***

The combustion chamber must be disposed of as construction waste.

## 2.11 The operator's responsibilities

### *Operator*

The operator is the person who operates the system for commercial or economic purposes by himself or cedes use to a third party and bears the legal responsibility concerning the product for the protection of the user, staff or third parties during the operation.

### *Operator duties*

The system operator is subject to the legal obligations for safety at work.

In addition to the safety instructions in this manual, the applicable regulations on safety, safety at work and environmental protection must be observed.

Therefore, in particular, the following applies:

- The "Occupational Safety and Health Act" of 1970 lays down that a safe workplace must be provided at all times during the execution of work.
- The operator must be aware of the applicable occupational safety regulations. Additionally, he must perform a risk assessment to determine hazards arising from special working conditions at the site where the system is used. He must implement these in the form of operating instructions for system operation.
- The operator must check throughout the entire period of use of the system whether the operating instructions created by him correspond to the current version of the regulations, and, if necessary, adjust them.
- The operator must clearly manage and determine the responsibilities for operation, troubleshooting, maintenance and cleaning.
- The operator must ensure that all persons who deal with the system have read and understood this manual. In addition, he must train the staff at regular intervals and inform them about possible dangers. Moreover, the operator must ensure that unauthorized persons do not get close to the system.
- The operator must provide the required protective equipment to staff and instruct them that it is obligatory to wear the necessary protective equipment.
- The operator must ensure that only fuels approved by the manufacturer are used.
- The operator must ensure that the prescribed safety tests are performed.
- The operator must ensure that the regulatory approval requirements are respected.
- The operator must ensure compliance with the requirements of the installation site and the safety measures when working in the storeroom.
- Furthermore, the operator is responsible for ensuring that the system is always in full working order. Therefore the following applies:
  - The operator must ensure that the maintenance intervals described in these instructions are respected.
  - The operator must ensure that the safety devices are regularly checked for proper functioning and completeness.

## 3 Description of the boiler

### 3.1 Front view



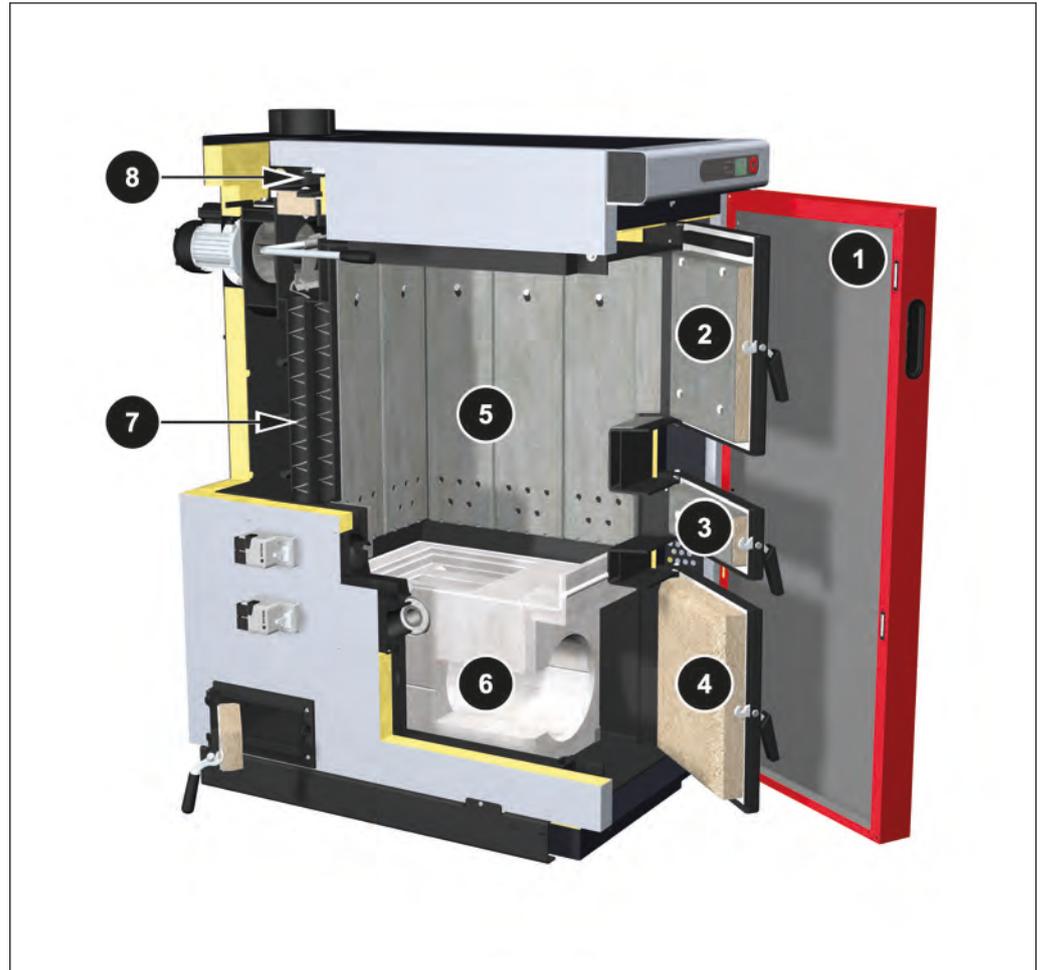
- |   |                                 |
|---|---------------------------------|
| 1 | Boiler S3 Turbo                 |
| 2 | Boiler controller control panel |
| 3 | WOS lever                       |
| 4 | Actuator of primary air flap    |
| 5 | Actuator of secondary air flap  |
| 6 | Heat exchanger cleaning door    |

## 3.2 Back view



- |   |  |
|---|--|
| 1 | Boiler flow connection                     |
| 2 | Induced draft fan                          |
| 3 | Thermal discharge safety device connection |
| 4 | Drainage                                   |
| 5 | Boiler return connection                   |

### 3.3 Cross-section



- |   |  |
|---|--|
| 1 | Insulated door   |
| 2 | Fuel-loading chamber door  |
| 3 | Pre-heating chamber door   |
| 4 | Combustion chamber door  |
| 5 | Fuel-loading chamber   |
| 6 | Combustion chamber   |
| 7 | Heat exchanger with spiral springs   |
| 8 | In flue gas nozzle: Flue gas temperature sensor and broadband lambda probe |

### 3.4 Functional description

The S3 Turbo wood boiler is a down-draft type wood gasification boiler with an output rating of between 51,250 btu/h and 102,500 (30 kW) or between 85,000 btu/h and 170,000 btu/h (50 kW). This appliance is not fitted with a catalytic combustor. This appliance meets the 2015 US Environmental Protection Agency's cord wood emissions limits for wood heaters sold after May 15, 2015.

This wood heater has a manufacturer set minimum low burn rate that must not be altered. It is against federal regulations to alter this setting or otherwise operate this wood heater in a manner inconsistent with operating instructions in this manual.

In order to maximize efficiency and minimize emissions it is important to light a new fire quickly. It is recommended that a 3" layer (7 cm) of ash is maintained on the floor of the upper firebox of the appliance. When starting a new fire the boiler should be off. Place approximately ten pieces of kindling with a cross-section of approximately 1" (2 – 3 cm) and a length of approximately 18" (46 cm) in the bottom of the primary (upper) firebox. This kindling should be placed on the left and right side of the firebox so that there is a slot of about 1" (2 – 3 cm) to the wood gas transfer slot. Place a layer of cardboard on top of the kindling and add start-up fuel on top of the cardboard. Start up fuel is smaller splits of wood with a cross-section of at least 2" (6 cm) and a length of approximately 18" (46 cm). Add enough start-up fuel so that the amount is approximately 10% of the weight of the expected firewood load; in other words, if you expect to load 100 pounds of firewood into the boiler, use ten pounds of start-up fuel. Once the kindling and start-up fuel is in place, add the amount of firewood required to recharge your thermal storage.

Once the firebox is loaded with kindling, cardboard, start-up fuel and firewood, place several sheets of crumpled newspaper inside the lighting door. With the fuel loading door and the lighting door open, turn on the boiler. As the draft induction fan comes on light the newspaper in several places using a match, lighter or small hand-held homeowner-type gas torch. Once the newspaper is ignited, close the fuel loading door securely and position the lighting door so that it is open approximately 1" (2 – 3 cm). Monitor the exhaust temperature on the boiler control panel. Once the exhaust temperature reaches 130 degrees C, typically in five to ten minutes, close the lighting door and the large outer door. Remain with the boiler during the entire lighting process. Refuel and re-start the boiler when your thermal storage is nearly depleted (storage temperature is approaching minimum usable temperature).

Because the primary and secondary air settings and the fan speed of the S3 Turbo are continuously and automatically adjusted, no manual adjustment of the boiler is required.

Removing ash from the boiler is a simple process. Use the supplied rounded ash scoop to remove ash from the secondary combustion tunnel as needed. A 3" layer (7cm) of ash should be maintained in the upper firebox. Ash may be pushed into the wood gas transition slot with the supplied ash tool so that it may be removed via the secondary combustion tunnel. Residual ash that accumulates in front of and around the sides of the secondary combustion tunnel should be removed as needed using the provided ash tool. Ash should be placed in a metal container with a tight fitting lid. The closed container of ashes should be placed on a noncombustible floor or on the ground, away from all combustible material pending final disposal. The ashes should be retained in the closed container until all cinders have thoroughly cooled.

The heat exchange tubes in the boiler will accumulate fly ash on their inner surface resulting in lowered boiler efficiency. These tubes should be cleaned daily by moving the tube cleaning lever on the side of the boiler back and forth several times. Ash should be removed as needed from the area below the heat exchange tubes via the small ash door. This ash door may be located either on the left or right side of the boiler and is down low on the boiler near the back. The turbulators should be removed from the boiler and the heat exchange tubes manually brushed with the provided wire brush on an annual basis. At the same time, the vanes of the draft induction fan should be cleaned with a stiff paint brush and a vacuum cleaner. The flue gas temperature sensor should be wiped clean with a clean dry cloth and the oxygen sensor inspected and cleaned if necessary also on an annual basis.

Gaskets on the fuel loading, lighting and ash removal doors should be checked for air tightness periodically.

While the S3 Turbo burns exceptionally cleanly and produces little or no visible smoke, it will, from time to time, produce small amounts of visible smoke and wood smoke odor. Because of this, the boiler and chimney should be located so as not to disturb building occupants or neighbors. Adequate chimney height is important and installation in small valleys and too close to neighbors should be avoided.

This appliance's rated efficiency was determined by an independent testing lab using the higher heating value of wood and the test protocol prescribed by the US Environmental Protection Agency. Because the S3 Turbo is a batch-fed boiler and is intended to burn at maximum output whenever it is operating, daily operating efficiency and Annual Fuel Utilization Efficiency are the same regardless of time of year or outdoor temperatures.

Because of the S3 Turbo's Lambdatronic control, this boiler is able to burn efficiently using firewood with a moisture content of up to 25%. That being said, higher moisture content fuel is inherently less efficient than drier fuel because more energy is used to dry the wood before it can be burned. We recommend firewood with a moisture content of between 15% and 20%.

The S3 Turbo is meant to be installed inside an insulated structure; preferable the dwelling that it is heating. While a boiler installed indoors has heat loss from the boiler jacket, that standby heat "loss" is recovered and contributes to the heating and so is not in fact, "lost". Thermal storage tanks will also have heat losses into the building. If you are planning to use the boiler to produce your domestic hot water during the warmer months, we recommend that you insulate the thermal storage tanks especially well so as to minimize these losses and the resulting warming of your home.

The combustion of any fuel produces potentially harmful emissions of smoke and Carbon Monoxide. The emissions data for this appliance may be found on the table listing all boiler specifications found in chapter „Technical specifications“ in this manual. As a batch-fed and Lambda controlled appliance, emissions are relatively consistent throughout the burn cycle.

We recommend the use of both smoke detectors and Carbon Monoxide detectors in buildings where this appliance is installed.

### 3.5 Permitted fuels

- Burn natural, seasoned, hard or soft firewood or wood-only manufactured wood bricks in this appliance only, length between 18" (46 cm) and maximum 21" (52 cm)

Chemically treated or painted wood is unsuitable as fuel. The S3 Turbo boiler is designed for burning fire wood only. Wood briquettes or manufactured pure wood logs can also be used as fuel provided they have a minimum cross section of 2.5 sq in (16 cm<sup>2</sup>). The fuel loading chamber can be filled to the top. Excessively small and compact pieces of wood or wood pellets are not suitable. Coal cannot be used as it destroys the combustion chamber!

The S3 Turbo is made to burn natural forest wood. Both hardwood and softwood are suitable, but oak should not be burned as the only source of wood for long periods because of its high acid content.

For effective gasification, the wood must be dry, i.e. moisture content 15-20%. Please follow the instructions included with the moisture meter provided to correctly determine wood moisture content. In addition to increasing the likelihood of generating creosote in the boiler, burning wet wood uses a substantial amount of the wood energy to evaporate the water present in the wood, reducing the available energy for heat. Using non-approved fuels will result in lower efficiency, higher emissions and may cause boiler components to fail prematurely and/or operate incorrectly.

The wood will dry out most quickly if it is cut into the appropriate length and split into pieces 4 – 5" (10 – 12 cm) thick. The best length is 21" (52 cm) for the S3 Turbo boiler. The wood is best stored in the open air under cover. Wood will dry most quickly if it is carefully stacked alternatively lengthwise and crosswise so that air can penetrate into the stack. Ideally the wood should be stored for at least one and a half years (two summer seasons). Do not burn small pieces of wood or wood chips in the boiler as they can block the combustion slot. Also, it can be difficult to control the combustion process with small wood pieces and chips.

### 3.6 Non-permitted fuels

#### DANGER

#### Non-permitted fuels

***Burning non-permitted fuels increases cleaning requirements and leads to a build-up of aggressive sedimentation and condensation, which can result in damage to the boiler and void the warranty! Using non-standard fuels can result in severe combustion malfunctions.***

Only use the fuels specified in the section "Permitted Uses" in these operating instructions!

- Do not burn corn, grain, coal, fuel coke, garbage or other residual materials, painted or treated wood, bark, gasoline, diesel, fuel oil, naphtha, engine oil, drain oil or other flammable liquids, or any other organic or inappropriate materials!
- Do not store fuel or other combustible material within marked installation clearances. Keep away from boiler while it is in operation!
- Do not use chemicals, gasoline, gasoline-type lantern fuel, kerosene, charcoal lighter fuel or similar liquids, or any other combustible fluids to start or rekindle the fire in this boiler.

## 4 Transport, Installation und Initial start-up

### 4.1 Safety

*Transport as well as installation and commissioning are carried out exclusively by the manufacturer's employees or staff authorized by the manufacturer.*

#### WARNING

##### **Risk of death from incorrect transport and faulty installation and commissioning!**

- Transport, installation and commissioning must be carried out exclusively by the manufacturer's employees or staff authorized by the manufacturer.
- Consult the manufacturer even in case of a subsequent change of location.
- Refrain from unauthorized transport, unauthorized installation and commissioning, as well as changes of location.
  - An error during transport and installation/commissioning can lead to perilous situations or cause substantial damage to property.

### 4.2 Conditions for initial start-up

#### 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 authorized installer or with Froling customer services.

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

- Electrical installation
- Installation of water pipes
- Connect flue gas including all insulation work
- Work must comply with local fire protection regulations
  
- 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

**Escaping condensation during the initial heat-up phase does not indicate a fault.**

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

## 5 Heating the boiler

### 5.1 Safety instructions for heating

#### *Incorrect operation*

#### WARNING

**Risk of injury due to incorrect operation!**

**Incorrect operation can cause serious injuries and considerable property damage.**

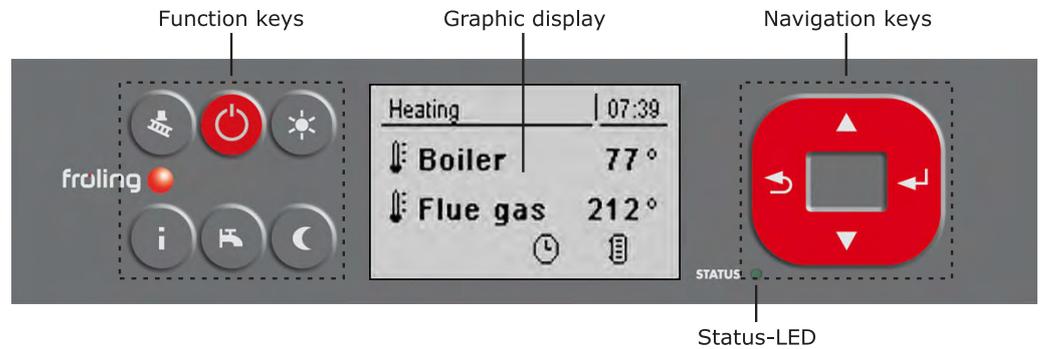
- Perform all operating steps according to the information and instructions in this manual.
- Only trained staff may carry out work to the system.
- Check the system externally for any visible damage or defects at least once a day.
- Before starting work, make sure that all covers and safety devices are installed and work properly.
- Never disable or bypass safety equipment during operation.
- Do not alter the boiler controller.

#### WARNING

**This wood heater has a manufacturer-set minimum low burn rate that must not be altered. It is against federal regulations to alter this setting or otherwise this wood heater in a manner inconsistent with operating instructions in this manual.**

## 5.2 Operation via the boiler controller

### 5.2.1 Control keys and display



#### Navigation keys

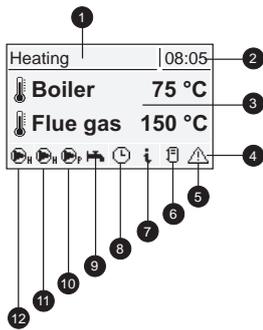
Navigation keys are used to move within the menu and to change parameter values.

Key	Function used for	
 UP arrow	Navigation: move up a menu level	
	Parameter change:	Depending on how long the key is pressed: <ul style="list-style-type: none"> <li>- Short: increases value</li> <li>- Long: increases value in increments of 10</li> <li>- Long (&gt;10 secs): increases value in increments of 100</li> </ul>
 DOWN arrow	Navigation: move down a menu level	
	Parameter change:	Depending on how long the key is pressed: <ul style="list-style-type: none"> <li>- Short: reduces value</li> <li>- Long: reduces value in increments of 10</li> <li>- Long (&gt;10 secs): reduces value in increments of 100</li> </ul>
 Enter key	Navigation: go to selected menu	
	Parameter change:	Releases the parameter for editing, or saves the parameter value after changing
 Back key	Navigation: go back up a menu level	
	Parameter change:	Depending on how long the key is pressed: <ul style="list-style-type: none"> <li>- Short: does not save parameter</li> <li>- Long: back to basic display without saving</li> </ul>

#### Status LED

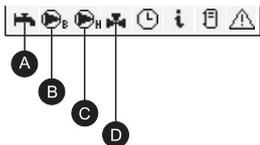
The status LED shows the operating status of the system:

- GREEN flashing (interval: 5 sec OFF, 1 sec ON): Off
- GREEN constant: **BOILER SWITCHED ON**
- ORANGE flashing: **WARNING**
- RED flashing: **FAULT**

*Graphic display*

Item	Description	
1	Shows operating status or menu name	
2	Shows the current time	
3	Displays the main values in the basic display (adjustable), menu contents, parameters and info texts	
4	Status toolbar	
5	Displayed when there is a fault/malfunction. Press the info key to display texts describing the fault and the solution.	
6	Shows the storage tank loading status (storage tank is optional)	
7	Indicates that an info text is displayed. Info texts are also identified by a frame	
8	Shows which function is active Function keys	
9	Shows that the DHW tank loading pump is active.	Only shown in the basic display!
10	Shows that the storage tank loading pump is active.	
11	Shows that the heating circuit pump of the second heating circuit is active.	
12	Shows that the heating circuit pump of the first heating circuit is active.	

At the service technician user level, the function of the respective components is also shown in the individual status menus by the corresponding status display:



Item	Description	
A	Shows whether the storage tank (or oil boiler) is hot enough for hot water preparation.	Only for service technicians in the status menus.
B	Shown when the DHW tank or return temperature control pump is active.	
C	Shown when the heating circuit or storage tank loading pump is active.	
D	Shows the status of the heating circuit mixer.	

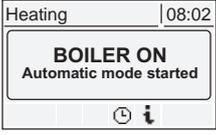
### Function keys

The function keys of the S-Tronic Lambda have dual assignments. Short or long pressing of the keys can access different functions (see below):

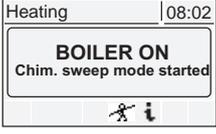
short keystroke ..... < 1 sec

long keystroke ..... > 4 sec

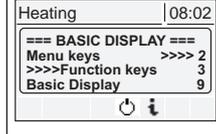
### Standby key

Keystroke		Function	
			Heating circuits and domestic hot water are controlled according to the programs and times set. Function remains active until another function key is pressed.

### Service program key

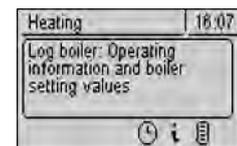
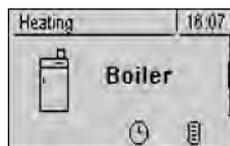
Keystroke		Function	
	short		The chimney sweep function is used for measuring boiler emissions using the chimney sweeper. For further information and the procedure for measuring emissions, see the operating instructions of the boiler and/or the "Instructions for the procedure for measuring emissions for the firewood boiler".
	long		Function not used

### Info key

Keystroke		Function	
	Short		Shows plain text information about the menu items or fault messages.
	Long		Choose language: Deutsch, Polski, Cesky, Slovenski, Italiano, Francais, English

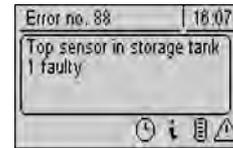
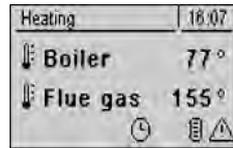
The info key can be pressed at any time to display information about the current menu item or the current fault message; fault messages have the highest priority.

### Info key in normal mode:



In normal operation (without pending fault messages) the info key can be pressed to display information or an explanation for every menu item or parameter.

The info text is also identified by the frame and the info symbol on the status line.

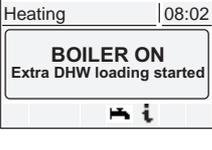
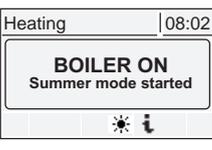
**Info key when there is a pending fault:**

If a fault has been acknowledged after it occurs but it has not resolved, a warning symbol is displayed at the bottom right on the status line.

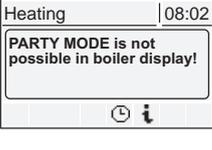
Pressing the info key calls up the information on the currently pending fault message again.

Procedure for troubleshooting:  
Troubleshooting

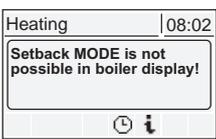
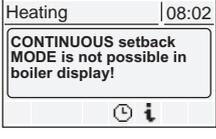
**Boiler program key**

Keystroke		Function	
	short		One-off manual loading of domestic hot water. The function is indicated during DHW tank loading by the tap symbol in the status line. After loading, the mode that was previously set becomes active again.
	long		To change to summer mode. The mode is indicated by the tap symbol on the status line. Domestic hot water loading is controlled according to the program that is set, the heating circuit controller is deactivated.

**Party program key**

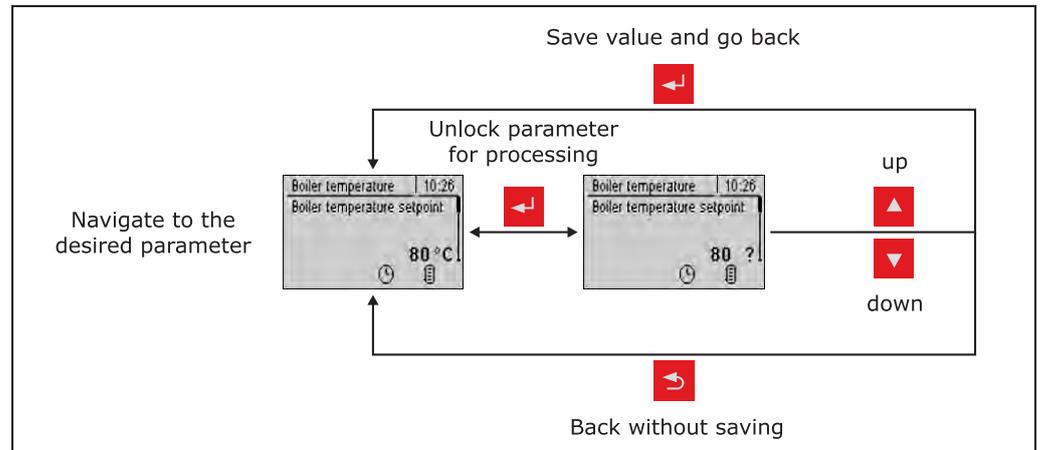
Keystroke		Function	
	short		To activate party mode on the room console. <b>Caution: Function only possible on the room console!</b> After an optional change to the room temperature setpoint, the heating circuit controller remains in heating mode until the end of the next heating period or another mode is activated. This function is not possible in summer mode! Observe the additional information in the operating instructions of the room console.
	long		During extra heating, heating and domestic hot water are heated for 6 hours. The mode setting is ignored. The function is indicated by the sun symbol in the status line. <b>Caution: The external temperature heating limit set in the "Heating" menu is active and can prevent release of the heating circuits.</b>

## Setback program key

Keystroke	Function
 short	 <p>To activate setback mode on the room console.  <b>Caution: Function only possible on the room console!</b>                      After an optional change to the setback temperature the heating circuit controller remains in setback mode until the start of the next heating time or until activation of another mode.                      Observe the additional information in the operating instructions of the room console.</p>
long	 <p>To activate continuous setback mode on the room console.  <b>Caution: Function only possible on the room console!</b>                      The room temperature is reduced to the preset setback temperature until automatic mode is activated.                      Observe the additional information in the operating instructions of the room console.</p>

## 5.2.2 Setting parameters

Values for all parameters are changed in the following way:

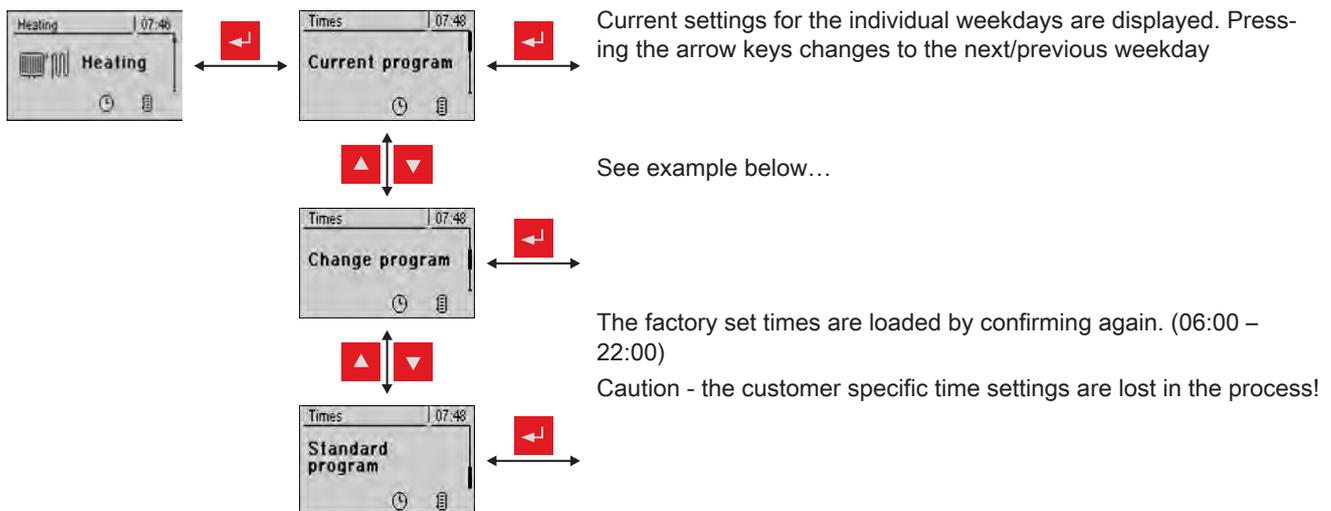


### 5.2.3 Setting times

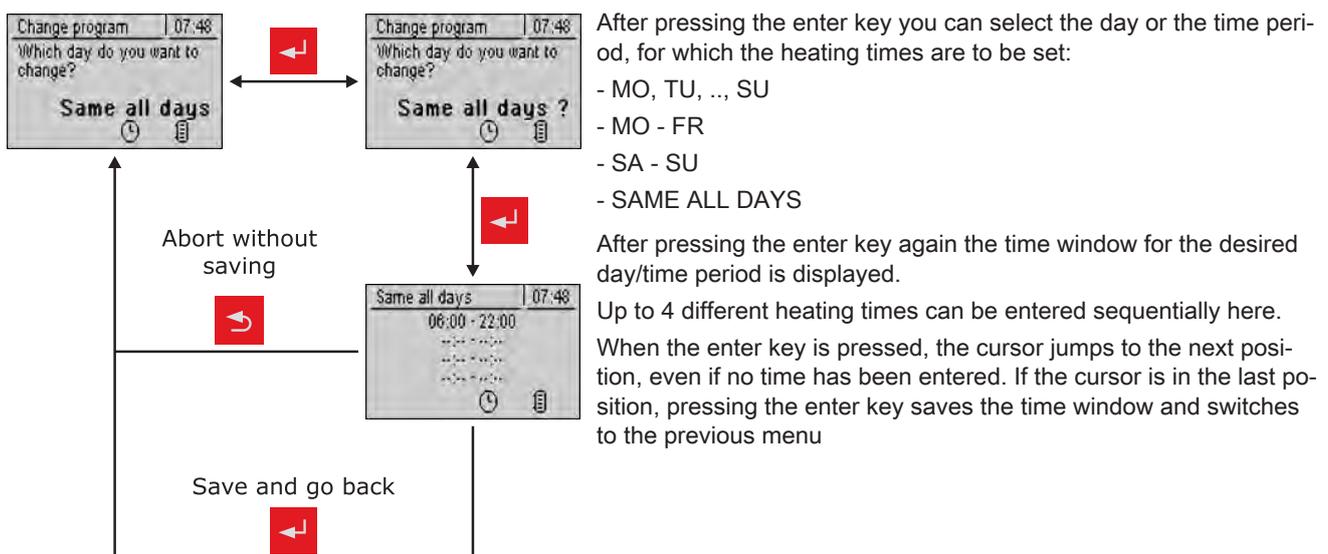
The desired time window for the components can be set in the "Times" submenu in the individual menus of the heating components (heating circuits, DHW tanks ...). The structure of the time menu and the procedure for changing the times are always the same.

Example - Setting times for heating circuit 01:

In the "Heating" menu -> "Times":



... In the "Change program" menu:



#### *Deleting a time window*

To delete a time window, the end time of the desired time window must be set to 24:00. If you press the up arrow key repeatedly the time disappears and is replaced by dashes. Then carry out the same process with the start time. After the enter key has been pressed repeatedly, the changes are adopted and the display returns to the previous menu.

## 5.3 Parameters overview

### 5.3.1 Heating

#### *Heating - Status*



<b>Heating circuit mode</b>
Display and setting the heating circuit mode: <ul style="list-style-type: none"> <li>▪ <b>Auto:</b> Automatic: heating phases according to the set heating times</li> <li>▪ <b>Extra heating:</b> heating circuit is activated for 6 hours.</li> <li>▪ <b>Setback:</b> Setback mode; the heating phases are ignored</li> <li>▪ <b>Continuous setback mode:</b> Heating circuit is reduced until activation of another mode.</li> <li>▪ <b>Party:</b> party mode; the current or next setback program is ignored</li> <li>▪ <b>OFF:</b> switched-off; heating circuit deactivated, only frost protection!</li> </ul>
<b>Actual flow temperature</b>
Display of the current flow temperature.
<b>Flow temperature setpoint</b>
Display of the calculated flow temperature setpoint.
<b>Room temperature</b>
<b>Prerequisite:</b> Heating circuit used in conjunction with remote control Display of the current room temperature.
<b>Outside air temperature</b>
Display of the current outside air temperature.

*Heating - Temperatures*

Basic display → Heating → Heating circuit 1 → Temperatures

**Desired room temperature during heating mode**

**Prerequisite:** Heating circuit used in conjunction with remote control  
Room temperature which is regulated during the set heating times

**Desired room temperature during setback mode**

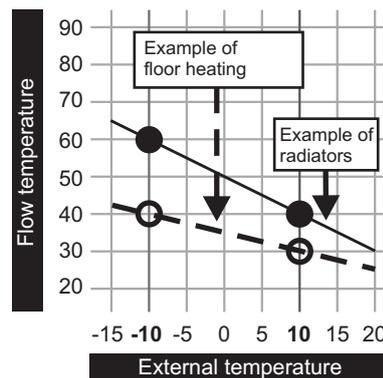
**Prerequisite:** Heating circuit used in conjunction with remote control  
Room temperature which is regulated outside of the set heating times

**Flow temperature SP at outside air temperature of +10°C**

First setting point for definition of heating curve

**Flow temperature SP at outside air temperature of -10°C**

Second setting point for definition of heating curve

**Reduction of flow temperature in setback mode**

The flow temperature is reduced by this value during setback mode.

**External temperature, at which heating circuit pump switches off in heating mode**

If the outside air temperature exceeds this value during heating, the heating circuit pumps and mixing valve are deactivated.

**External temperature, at which heating circuit pump switches off in setback mode**

If the outside air temperature falls below this value in setback mode, the heating circuit pumps and mixing valve are activated.

**Frost protection temperature**

If the room temperature or the flow temperature is lower than the set value, the heating circuit pump will be switched on and the heating circuit mixer keeps to the maximum heating circuit flow temperature that is set.

**From which temperature at storage tank top should the overheating protection be activated**

If the temperature at top storage tank exceeds the set value, the heating circuit is activated regardless of mode (boiler, remote control) and set heating times. The flow temperature is controlled to the value set in the parameter "Flow temperature SP at outside air temperature of -10°C". The function will remain active until the value falls below 2°C.

**Recommendation:** The overheating protection should be assigned to a high temperature heating circuit (e.g. radiators).

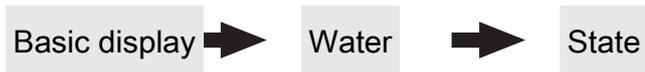
*Heating - Times*



⇒ See "Setting times" [page 46]

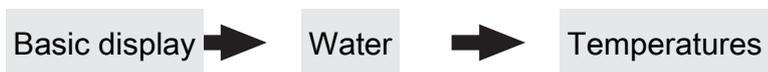
5.3.2 Water

*Water - Status*

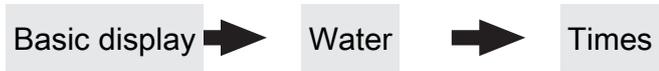


<b>DHW tank top temperature</b>
Current temperature of the DHW tank. The DHW tank is heated when the time window for the DHW tank loading is reached and the current temperature of the DHW tank has fallen below the value using the parameter "Reload if DHW tank temperature is below". A loading of the DHW tank takes place when either the time window has elapsed or the temperature value which is set under "Set DHW temperature" is reached.
<b>DHW tank bottom temperature</b>
<b>Prerequisite:</b> Solar panel system is regulated by Froling! Current temperature in the area of the reference sensor of the solar panel system.
<b>DHW tank pump control</b>
Specifies the speed of the DHW tank pump as a percentage of maximum speed.

*Water - Temperatures*



<b>Set DHW temperature</b>
When this DHW temperature is reached, DHW tank loading is stopped.
<b>Reload if DHW tank temperature is below</b>
If the DHW tank temperature falls below the value set here, the time window is active and the loading source (boiler or buffer tank) indicates the set loading increase, and the DHW tank loading is started.

*Water - Times*

⇒ See "Setting times" [page 46]

### 5.3.3 Solar

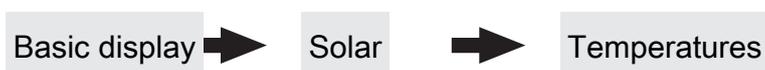
#### *Solar - Status*



<b>Collector temperature</b>
Display of the current temperature at the solar collector.
<b>Top storage tank solar sensor</b>
Display of the current temperature at the solar reference sensor in the top part of the buffer tank.
<b>Solar temperature buffer tank bottom</b>
Display of the current temperature at the solar reference sensor in the lower part of the buffer tank.
<b>Actual power from solar heat meter [kW]</b>
Display of the current output which is generated by the solar collector. The calculation of the output is only performed either when a per litre output of the collector pump has been set or an external volume pulse transmitter is used. In order to perform the calculation more precisely, the use of a collector return sensor is recommended.
<b>Flow through [l/h]</b>
<b>Prerequisite:</b> External volume pulse transmitter installed
Display of the water quantity currently being pumped through the solar collector.
<b>Todays yield [kWh]</b>
Display of the heat quantity that has been supplied by the solar panel system today.
<b>Daily yield 1 day ago [kWh]</b>
<b>Daily yield 2 days ago [kWh]</b>
<b>Daily yield 3 days ago [kWh]</b>
<b>Daily yield 4 days ago [kWh]</b>
<b>Daily yield 5 days ago [kWh]</b>
<b>Daily yield 6 days ago [kWh]</b>
<b>Total yield [kWh]</b>
Display of the heat quantity which has been supplied by the solar panel system since activation of the heat meter.
<b>DHW tank bottom temperature</b>
Current temperature in the area of the reference sensor of the solar panel system.

<b>Heat exchanger sec. return temperature (line to buffer tank)</b>
<b>Prerequisite:</b> Hydraulic system 12 or 13 Current temperature at heat exchanger flow on the secondary side.
<b>Collector pump runtime</b>
Display of the total runtime of the collector pump.
<b>Collector pump control</b>
Display of the current speed of the collector pump as a percentage of maximum speed.
<b>Pump between heat exchanger and buffer tank</b>
<b>Prerequisite:</b> Hydraulic system 12 or 13 Display of the current speed of the pump between heat exchanger and buffer tank.
<b>Pump between heat exchanger and DHW tank</b>
<b>Prerequisite:</b> Hydraulic system 12 Display of the current speed of the pump between heat exchanger and DHW tank.
<b>Diverter valve for top/bottom coils</b>
<b>Prerequisite:</b> Hydraulic system 12 or 13 Current control of the isolating valve on the solar side. <ul style="list-style-type: none"> <li>▪ 0% ... bottom buffer tank</li> <li>▪ 100% ... top buffer tank</li> </ul>
<b>Outfeed: 80°C / RL: 50°C</b> <b>P: 0.0 kW / DFL: 0</b> <b>Today: 0 kWh</b> <b>Total: 0 kWh</b>
<ul style="list-style-type: none"> <li>▪ <b>OUTFEED:</b> Current collector flow temperature</li> <li>▪ <b>Return:</b> Current collector return feed temperature</li> <li>▪ <b>P:</b> Current output which is generated by the solar collector</li> <li>▪ <b>DFL:</b> Current flow rate of solar collector</li> <li>▪ <b>Today:</b> Heat quantity that has been produced by the solar panel system today</li> <li>▪ <b>Total:</b> Heat quantity that has been produced since activation of the solar panel system</li> </ul>

### Solar - Temperatures



<b>Boiler target temperature during solar charging</b>
Up to this temperature the DHW tank is heated by the solar system. If the solar panel system is equipped with an isolating valve for switching between DHW tank and buffer solar coil, then this parameter is responsible for switching between both of these solar coils.
<b>Temp differential to start collector pump</b>
The collector pump activates when the collector temperature exceeds the reference temperature in the DHW tank or buffer tank by this value.
<b>Temp difference to stop collector pump</b>
The collector pump switches off when the difference between the collector temperature and reference temperature in the DHW tank or buffer tank is lower than this value.

### Maximum buffer tank bottom temperature during solar charging

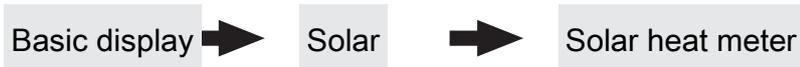
**Prerequisite:** Hydraulic system 12 or 13

If the sensor for the solar reference temperature in the buffer tank exceeds the specified value, the collector pump is switched off.

### Collector/pump protection from a collector temp.

If the measured value of the solar collector sensor exceeds the set value, then the solar collector must cool down by 20°C within 15 minutes, otherwise the solar collector pump stops in order to protect the pump.

## Solar - Heat meter



Outfeed: 80°C / RL: 50°C  
 P: 0.0 kW / DFL: 0  
 Today: 0 kWh  
 Total: 0 kWh

- **OUTFEED:** Current collector flow temperature
- **Return:** Current collector return feed temperature
- **P:** Current output which is generated by the solar collector
- **DFL:** Current flow rate of solar collector
- **Today:** Heat quantity that has been produced by the solar panel system today
- **Total:** Heat quantity that has been produced since activation of the solar panel system

### Collector temperature

Display of the current temperature at the solar collector.

### Actual power from solar heat meter [kW]

Display of the current output which is generated by the solar collector. The calculation of the output is only performed either when a per litre output of the collector pump has been set or an external volume pulse transmitter is used. In order to perform the calculation more precisely, the use of a collector return sensor is recommended.

### Flow through [l/h]

**Prerequisite:** External volume pulse transmitter installed

Display of the water quantity currently being pumped through the solar collector.

### Todays yield [kWh]

Display of the heat quantity that has been supplied by the solar panel system today.

### Daily yield 1 day ago [kWh]

### Daily yield 2 days ago [kWh]

### Daily yield 3 days ago [kWh]

### Daily yield 4 days ago [kWh]

Daily yield 5 days ago [kWh]
Daily yield 6 days ago [kWh]
Total yield [kWh]
Display of the heat quantity which has been supplied by the solar panel system since activation of the heat meter.

### 5.3.4 Buffer tank

#### *Buffer tank - Status*



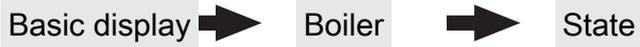
<b>Buffer tank top temperature</b>
Display of the current temperature in the top part of the buffer tank.
<b>Buffer tank temperature, sensor 2</b>
<b>Prerequisite:</b> Master boiler in the cascade or hydraulic system 4 or fuel amount calculation Display of the current temperature in the top part of the buffer tank.
<b>Buffer tank temperature, sensor 3</b>
<b>Prerequisite:</b> Master boiler in the cascade or hydraulic system 4 or fuel amount calculation Display of the current temperature in the lower part of the buffer tank.
<b>Buffer tank middle temperature</b>
<b>Prerequisite:</b> Middle buffer tank temperature sensor installed Display of the current temperature in the mid area of the buffer tank.
<b>Buffer tank bottom temperature</b>
Display of the current temperature in the lower part of the buffer tank.
<b>Buffer tank pump control</b>
Display of the current speed of the buffer loading pump.
<b>Buffer tank charge</b>
<b>Prerequisite:</b> Master boiler in the cascade or hydraulic system 4 or fuel amount calculation Display of the current buffer tank charge.

#### *Buffer tank - Temperatures*

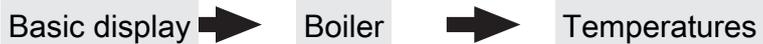


<b>Heating circuit release from following buffer tank temperature</b>
Temperature value which must be reached to release the heating circuit pumps in the top part of the buffer tank. <b>NOTICE! This parameter applies for all available heating circuits!</b>

## 5.3.5 Boiler

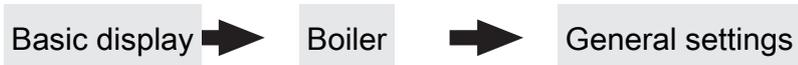
*Boiler - Status*

<b>Boiler temperature</b>
Display of the current boiler temperature.
<b>Flue gas temperature</b>
Display of the current flue gas temperature.
<b>ID fan control</b>
Display of the current ID fan control.
<b>Primary air</b>
Display of the current value of the primary air flap according to controller.
<b>Residual oxygen content</b>
Display of the current residual oxygen content.
<b>Return sensor</b>
<b>Prerequisite:</b> Return temperature control with mixing valve or bypass pump Display of the current temperature at the boiler return.

*Boiler - Temperatures*

<b>Boiler temperature setpoint</b>
The boiler temperature is regulated to this temperature. Setting range 70 – 90°C

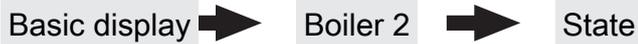
## Boiler - General settings



<b>Modem installed</b>
<ul style="list-style-type: none"> <li>▪ <b>NO:</b> The boiler does not have a modem for data transfer installed.</li> <li>▪ <b>YES:</b> The boiler has a modem for data transfer installed.</li> </ul>
<b>Display temperature in Fahrenheit</b>
<ul style="list-style-type: none"> <li>▪ <b>NO:</b> Displayed temperature values and settings are shown in °C.</li> <li>▪ <b>YES:</b> Displayed temperature values and settings are shown in °F.</li> </ul>
<b>Always log data in °C</b>
<ul style="list-style-type: none"> <li>▪ <b>YES:</b> In conjunction with a data logger, all temperature values are saved in °C.</li> <li>▪ <b>NO:</b> In conjunction with a data logger, all temperature values are saved in °F.</li> </ul>
<b>Source for ext. power demand (0 - off, 1 - 0-10V, 2 - Modbus)</b>
<b>Invert ext. power demand via analogue input</b>
<b>Input external power demand</b>
<b>Current external power demand</b>

### 5.3.6 Boiler 2

#### *Boiler 2 - Status*



<b>Temperature of secondary boiler</b>
Display of the current boiler temperature of the secondary boiler.
<b>Burner relay status</b>
Shows the current status of the burner relay: <ul style="list-style-type: none"> <li>▪ 0: Secondary boiler not active</li> <li>▪ 1: Secondary boiler active</li> </ul>
<b>Secondary boiler pump</b>
<b>Prerequisite:</b> "Isolating valve installed" parameter set to "NO" Display of the current pump control for the secondary boiler.
<b>Secondary boiler switching valve</b>
<b>Prerequisite:</b> "Isolating valve installed" parameter set to "YES" Display of the current isolating valve control of the secondary boiler.
<b>Manual start of secondary boiler (only when ID fan is switched off)</b>
<ul style="list-style-type: none"> <li>▪ OFF: Secondary boiler is controlled according to the program that is set</li> <li>▪ ON: Secondary boiler is activated immediately</li> </ul> <b>NOTICE!</b> Burner blockage noted.

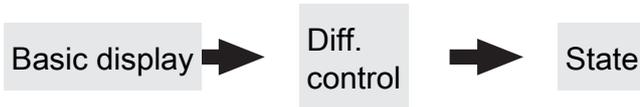
#### *Boiler 2 - Temperatures*



<b>Secondary boiler start delay</b>
If there is a requirement from the heating circuit or DHW tank and the buffer tank or boiler has insufficient temperature, the secondary boiler starts after the specified delay time set here.
<b>Secondary boiler minimum runtime</b>
If the secondary boiler is started, it will run for at least the length of time set here.
<b>Temperature difference between secondary boiler and buffer tank</b>
Temperature difference between secondary boiler and upper temperature in layered tank to activate the loading pump of the secondary boiler.

### 5.3.7 Difference regulator

#### *Difference regulator - Status*



<b>Heat source sensor</b>
Display of the current heat source temperature of the differential controller (e.g. tiled stove with water pocket, ...)
<b>Heat sink sensor</b>
Display of the current temperature of the heat sink for the differential controller (e.g. layered tank, ...)
<b>Pump speed</b>
Specifies the current speed of the differential controller pump.

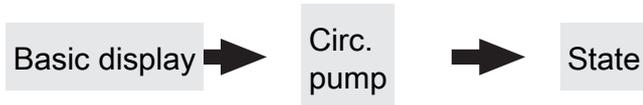
#### *Difference regulator - Times*



<b>Diff. control start time</b>
If after reaching the specified time, the criteria for starting the differential controller is permitted, then the pumps of the differential controller starts
<b>Diff. control stop time</b>
Also when the criteria for starting the differential controller is fulfilled, the differential controller is only active until the specified time.

### 5.3.8 Circulation pump

#### *Circulation pump - Status*



#### Return temperature in secondary circulation line

Display of the current temperature at the return feed sensor of the circulation line.

**NOTICE!** If the parameter "Return sensor present" is set to "NO", 0°C is permanently displayed.

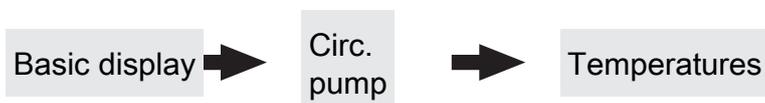
#### Flow switch on the domestic hot water line

- 0: Flow switch detects no flow rate.
- 1: Flow switch detects flow rate.

#### Speed of the circulation pump

Specifies the current speed of the circulation pump.

#### *Circulation pump - Temperatures*

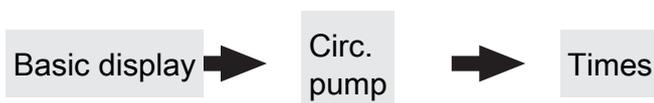


#### Switch off the pump at what return temperature in the circulation line

If the set temperature at the return circulation line is reached, the circulation pump will be deactivated.

**NOTICE!** Parameter only relevant when using a return feed sensor in the circulation line!

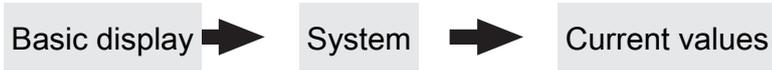
#### *Circulation pump - Times*



⇒ See "Setting times" [page 46]

### 5.3.9 System

#### *System - Current values*



Display of the current value for the relevant parameter. The parameters displayed depend on the boiler configuration!

Current status runtime
:
Software version
:

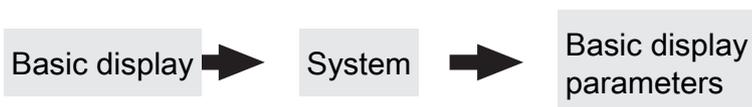
#### *System - Error*

##### Error - Error display

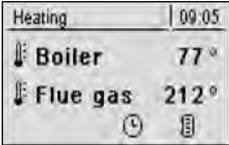
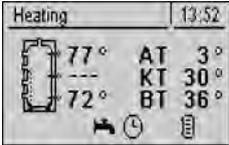


Display of the current fault messages. In addition, you can also invoke time information here, such as when the fault occurred, when the fault was acknowledged and when the fault was cleared.

#### *System - Basic display parameters*



You can individually adjust how the two items are shown in the basic display, and for each item you can choose from several parameters: e.g. boiler, flue gas, external, room, DHW tank, buffer tank top, buffer tank bottom, buffer tank graph, etc.

Position 1	Boiler	Selected
Position 2	Flue gas	Selected
		

If the “buffer tank graph” is selected, the temperatures of the top, middle (if available) and bottom buffer tank will be displayed next to the graph. In addition, further, fixed predefined values will be displayed:

OT ... Outside temperature

BT ... Boiler temperature

RT ... Room temperature (on room console BT is replaced by RT)

DT ... DHW tank temperature (if available)

### System - Boiler mode

Basic display → System → Boiler mode

#### Boiler mode

- **Automatic mode:** When “Automatic” is selected, the heating circuit as well as the domestic hot water tank are supplied with heat from the buffer tank according to the selected heating times.
- **Domestic hot water:** In “Domestic hot water” mode, the domestic hot water tank is supplied with heat from the buffer tank within the selected domestic hot water loading times. Heating circuits are not supplied with heat. Frost protection active.

### *System - Language*

Basic display → System → Language

#### Language - Sprache - Langue - Lingua - Jezik

- Deutsch, English, Francais, Italiano, Slovenski, Cesky, Polski, Svenska, Espanol, Magyar, Suomi, Dansk, Nederlands, Русский, Serbian

### *System - Current Date*

Basic display → System → Current Date

#### Current Date

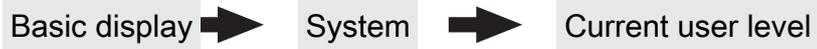
Display and setting of current date.

### *System - Current Time*

Basic display → System → Current Time

#### Current Time

Display and setting the current time.

*System - Current User Level*

<b>Child lock (Code "0")</b>
At "Child lock" level, only the "Status" menu appears. It is not possible to change parameters at this level.
<b>Customer (Code "1")</b>
Standard user level for normal operation of the display. All customer-specific parameters are displayed and can be changed.
<b>Installer / Service</b>
Releases parameters to adjust the controller to the system components (if configured).

## 5.4 Before heating up the boiler

### 5.4.1 Always move the WOS lever



- Move the lever of the cleaning system several times before the heating-up process
  - ↳ 5-10 times up and down!

### 5.4.2 Reloading intervals

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

### 5.4.3 Conversion tables and right amount of fuel

The amount of fuel added should allow the thermal storage to be heated to 100% charge status without on/off cycling of the boiler. 100% charge status means an average thermal storage temperature of boiler setpoint temperature (standard: 185 °F; 85 °C) minus a certain temperature which is set in the boiler controller (standard: 7 °F; 4 °C). Please note that the amount to reload also depends on the type of fuel.

$$100\% \text{ charge status} = 185 \text{ °F (85 °C)} - 7 \text{ °F (4 °C)} = 178 \text{ °F (81 °C)}$$

When the insulated door is opened the boiler display shows the required fuel quantity to load the thermal storage to 100%. Values are shown in SI units.

#### Conversion tables

conversion weight													
lbs	10	15	20	25	30	35	40	45	50	55	60	75	80
kg	5	7	9	11	14	16	18	20	23	25	27	34	36
lbs	85	90	95	100	105	110	115	120	125	130	135	140	145
kg	39	41	43	45	48	50	52	54	57	59	61	64	66

conversion thermal storage volume													
gal	400	450	500	550	600	650	700	750	800	850	900	950	1000
l	1514	1703	1893	2082	2271	2461	2650	2839	3028	3218	3407	3596	3785

**Calculation**

To calculate the energy required we use the 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

The amount of fuel can be calculated from the energy required and the energy content of the fuel. The energy content of the fuel varies according to the type of wood and the water content. (⇒ See "Fuel table" [page 67])

**Right amount of fuel**

The following tables give you an idea of the required amount to heat the thermal storage.

The calculation of the tables below is based on the formula above and as fuel hardwood with a water content of w=20% is in use. It does not take into account pipe losses and energy required to heat the boiler and heating system.

**Example:** Heat a 600 gal thermal storage from actual 130 °F average temperature to 100% charge.

**Answer:** 82 lbs

amount of fuel hardwood (w=20%) to heat a thermal storage to 100% [lbs]													
average temperature of thermal storage [°F]	effective thermal storage volume to be heated up [gal]												
	400	450	500	550	600	650	700	750	800	850	900	950	1000
165	15	17	18	20	22	24	26	28	30	31	33	35	37
160	20	23	26	28	31	33	36	38	41	43	46	49	51
155	26	29	33	36	39	42	46	49	52	55	59	62	65
150	32	36	40	44	48	52	56	60	64	68	72	75	79
145	37	42	47	52	56	61	66	70	75	80	84	89	94
140	43	49	54	59	65	70	75	81	86	92	97	102	108
135	49	55	61	67	73	79	85	92	98	104	110	116	122
130	54	61	68	75	82	89	95	102	109	116	123	129	136
125	60	68	75	83	90	98	105	113	120	128	135	143	150
120	66	74	82	91	99	107	115	123	132	140	148	156	165
115	72	80	89	98	107	116	125	134	143	152	161	170	179
110	77	87	96	106	116	125	135	145	154	164	174	183	193
105	83	93	104	114	124	135	145	155	166	176	186	197	207
100	89	100	111	122	133	144	155	166	177	188	199	210	221
95	94	106	118	130	141	153	165	177	188	200	212	224	236
90	100	112	125	137	150	162	175	187	200	212	225	237	250

**Example:** Heat a 600 gal thermal storage about 40 °F

**Answer:** 68 lbs

amount of fuel hardwood (w = 20%) [lbs]													
$\Delta T$ [°F]	effective thermal storage volume to be heated up [gal]												
	400	450	500	550	600	650	700	750	800	850	900	950	1000
20	23	26	28	31	34	37	40	43	45	48	51	54	57
25	28	32	35	39	43	46	50	53	57	60	64	67	71
30	34	38	43	47	51	55	60	64	68	72	77	81	85
35	40	45	50	55	60	65	70	74	79	84	89	94	99
40	45	51	57	62	68	74	79	85	91	96	102	108	114
45	51	57	64	70	77	83	89	96	102	109	115	121	128
50	57	64	71	78	85	92	99	106	114	121	128	135	142
55	62	70	78	86	94	101	109	117	125	133	140	148	156
60	68	77	85	94	102	111	119	128	136	145	153	162	170
65	74	83	92	101	111	120	129	138	148	157	166	175	184
70	79	89	99	109	119	129	139	149	159	169	179	189	199
75	85	96	106	117	128	138	149	160	170	181	192	202	213
80	91	102	114	125	136	148	159	170	182	193	204	216	227
85	96	109	121	133	145	157	169	181	193	205	217	229	241
90	102	115	128	140	153	166	179	192	204	217	230	243	255

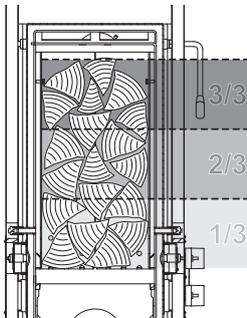
## 5.4.4 Fuel table

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 [Btuh/lbs (kWh/kg)]		
	w = 15%	w = 20%	w = 25%
Softwood	6560 (4.3)	6190 (4.0)	5730 (3.7)
Hartwood	6350 (4.1)	5880 (3.8)	5420 (3.5)

## 5.4.5 Fill level in boiler

The table below shows the relationship between fill level and weight. It compares spruce (example of soft wood) and beech (example of hardwood) 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 30	S3 Turbo 50
3/3	Soft wood	approx. 53 lbs (24 kg)	approx. 86 lbs (39 kg)
	Hardwood	approx. 88 lbs (40 kg)	approx. 143 lbs (65 kg)
2/3	Soft wood	approx. 35 lbs (16kg)	approx. 57 lbs (26 kg)
	Hardwood	approx. 60 lbs (27 kg)	approx. 95 lbs (43 kg)
1/3	Soft wood	approx. 18 lbs (8 kg)	approx. 29 lbs (13kg)
	Hardwood	approx. 29 lbs (13 kg)	approx. 49 lbs (22 kg)

## 5.4.6 Reloading intervals when operating without thermal storage or if the thermal storage is too small

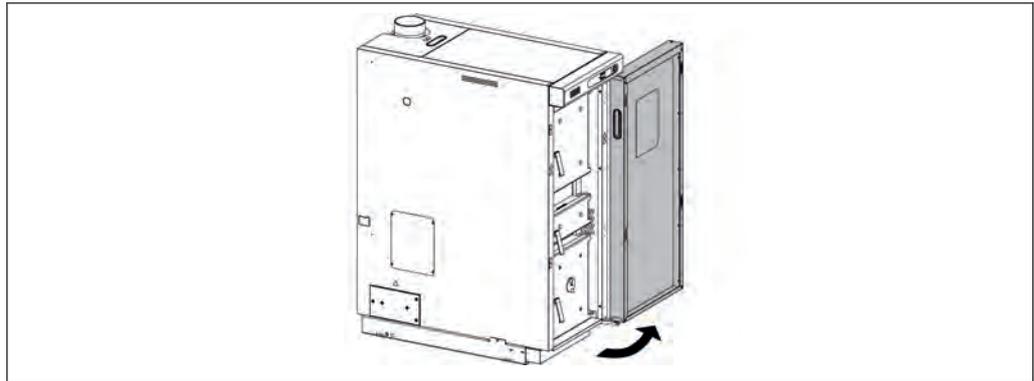
### NOTICE

#### Performance-related loading:

Only refuel if energy is required!

- If too much fuel is added, the boiler will drop below its minimum output limit and enter into the “Slumber” operating status (blower fan is switched off)
  - During “Slumber”, the efficiency drops, emissions increase and tar may form in the boiler.

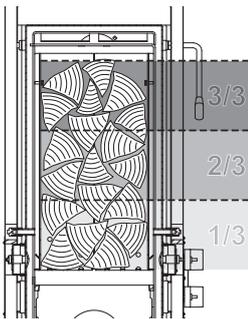
## 5.5 Heating up the boiler



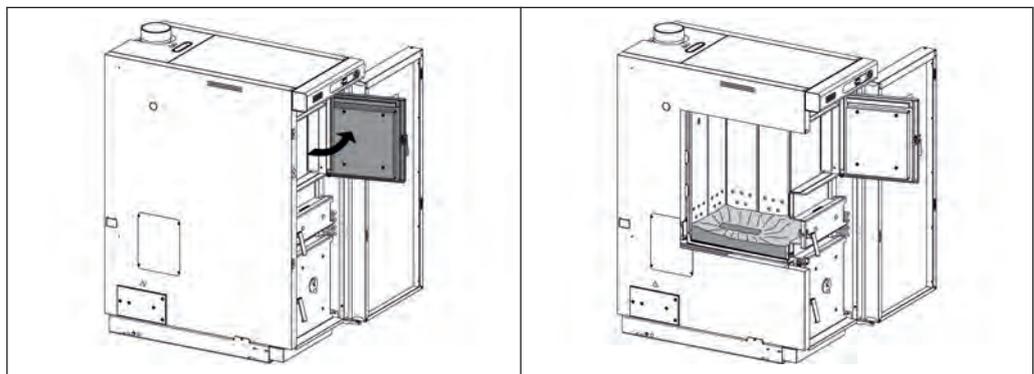
- Open the insulated door.
  - The induced draft fan starts running and the boiler display alternately shows the boiler's current values and the required fuel quantity to load the thermal storage.

**NOTICE!** When calculating the fuel quantity to load into the storage tank, the energy required for heating up the boiler (boiler water, combustion chamber) is not taken into consideration.

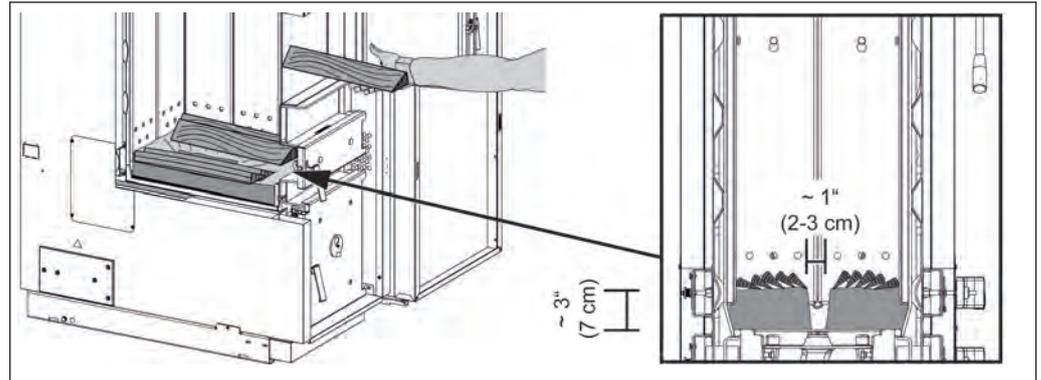
- Prepare the fuel quantity according to what is shown on the display.



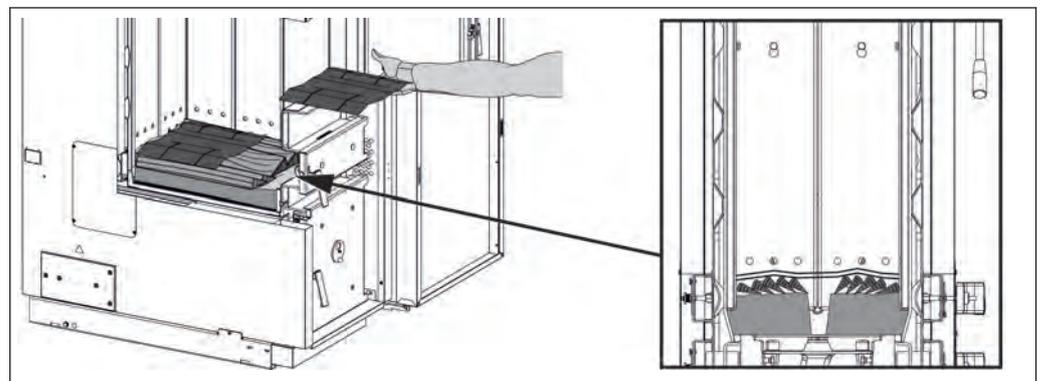
Fill level		Weight at fill level	
		S3 Turbo 30	S3 Turbo 50
3/3	Soft wood	approx. 53 lbs (24 kg)	approx. 86 lbs (39 kg)
	Hardwood	approx. 88 lbs (40 kg)	approx. 143 lbs (65 kg)
2/3	Soft wood	approx. 35 lbs (16 kg)	approx. 57 lbs (26 kg)
	Hardwood	approx. 60 lbs (27 kg)	approx. 95 lbs (43 kg)
1/3	Soft wood	approx. 18 lbs (8 kg)	approx. 29 lbs (13 kg)
	Hardwood	approx. 29 lbs (13 kg)	approx. 49 lbs (22 kg)



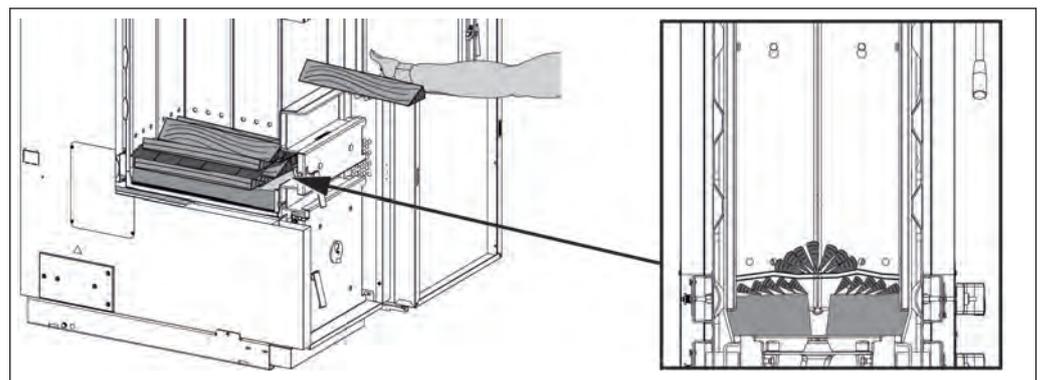
- Open the fuel loading door and check the ash level
  - Ash should remain in the boiler up to the height between the lowest and middle rows of holes, about 3" (7 cm) of the aprons. It is recommended that you do not remove the ash in the combustion chamber during each heating-up process, but rather only when the middle row of holes is no longer visible, until the remaining amount is about 3" (7 cm). This protects the combustion chamber and accelerates the heating-up process.



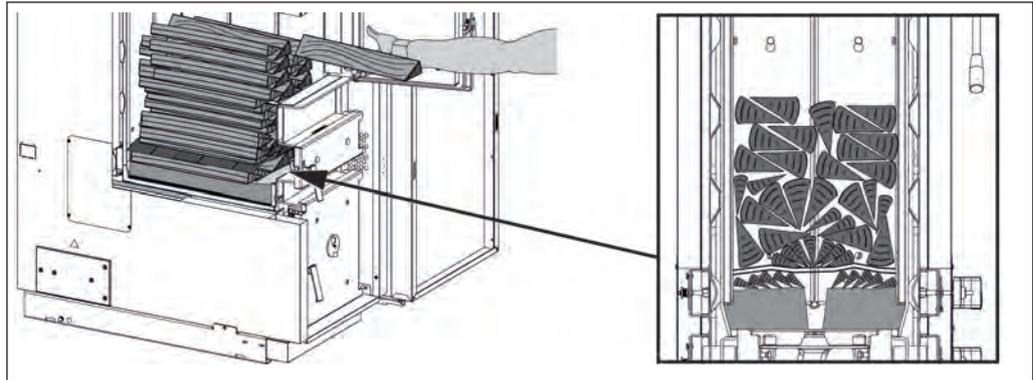
- Insert one layer of small-sized firewood.
  - Approximately ten pieces of kindling with a cross-section of approximately 1" (2-3 cm) and a length of approximately 18" (46 cm)
  - Do not cover the flame slot entirely (approx. 1", 2-3cm).



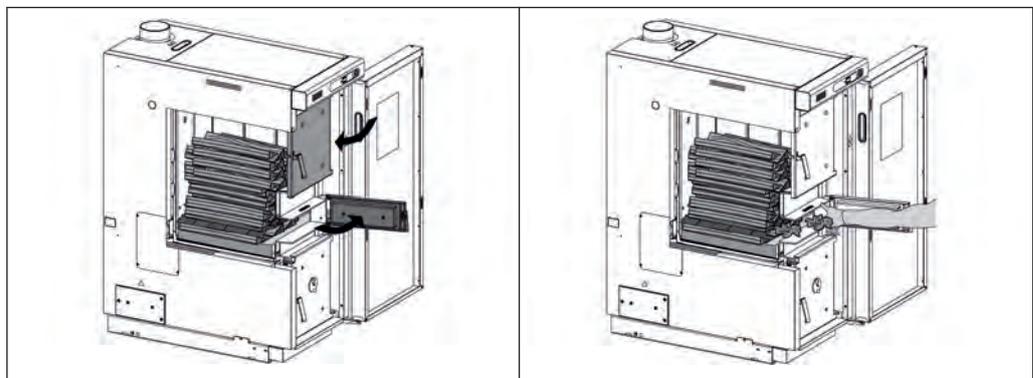
- After the first layer of wood, lay cardboard across the whole area.



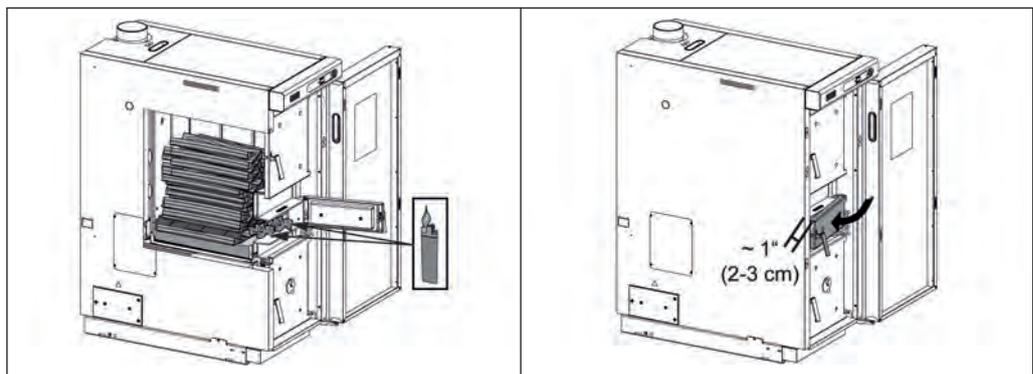
- Add start-up fuel so that the amount is approximately 10% of the weight of the expected firewood load; in other words, if you expect to load 100 pounds of firewood into the boiler, use ten pounds of start-up fuel.



- Once the kindling and start-up fuel is in place, add the amount of firewood required to recharge your thermal storage.

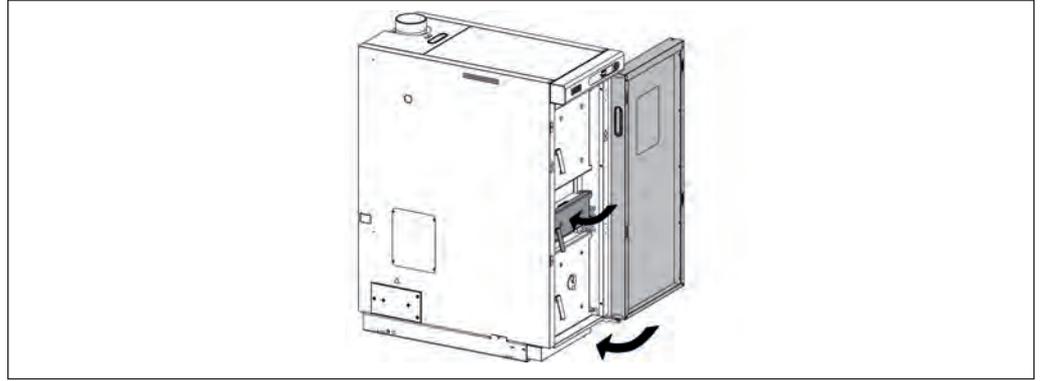


- Close the fuel loading door and open the pre-heating chamber door.
- Once the firebox is loaded with kindling, start-up fuel and firewood, place several sheets of crumpled newspaper inside the lighting door.



- Briefly press the DOWN arrow on the navigation keys.
  - The induced draft fan switches off.
- Ignite paper with a lighter at several positions.
- Press the UP arrow in the navigation keys.
  - The induced draft fan switches on.
- Leave the pre-heating chamber door open about 1" (2-3 cm) and watch the flue gas temperature.
  - A bed of embers forms.





- If the flue gas temperature has reached a value of  $> 130^{\circ}\text{C}$  ( $> 266^{\circ}\text{F}$ ), close the pre-heating chamber door and insulated door.

**NOTICE! Remain with the boiler during the entire lighting process!**

## 5.6 Add more firewood during the operation

### ⚠ WARNING

When touching hot surfaces behind the insulated door:

*Hot surfaces can cause serious burns!*

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

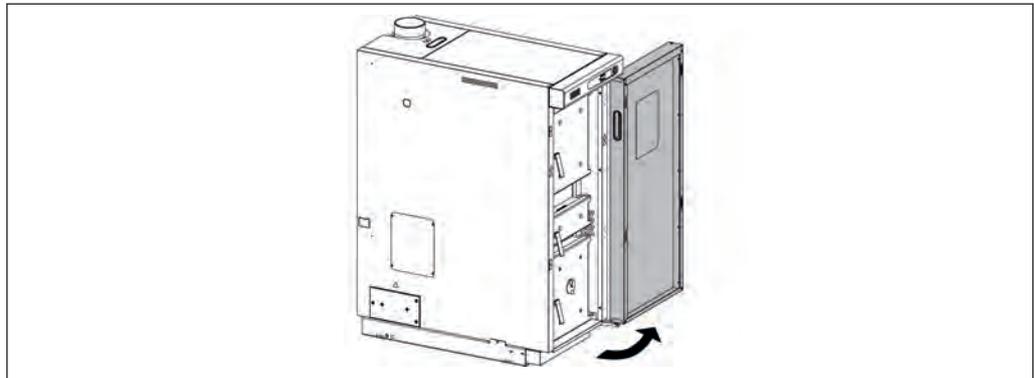
- When working on the boiler during operation, particularly when reloading fuel, always wear protective gloves

### ⚠ WARNING

When opening the fuel loading door:

*May result in injury or damage or flue gas generation!*

- Open the fuel loading door slowly and carefully
- Close the fuel loading door immediately after checking or adding more firewood



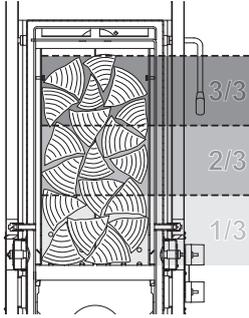
- Open the insulated door and observe the boiler's basic display parameter
  - The induced draft fan starts running and the boiler display now alternately shows the boiler's current values and the required fuel quantity to load the thermal storage.
  - When a fuel quantity below 20 lbs (9 kg) is displayed, we recommend that you do not add any more firewood and instead wait until a later time.

*Display under 20 lbs  
(9 kg):*

- Close the fuel loading door and insulated door again.

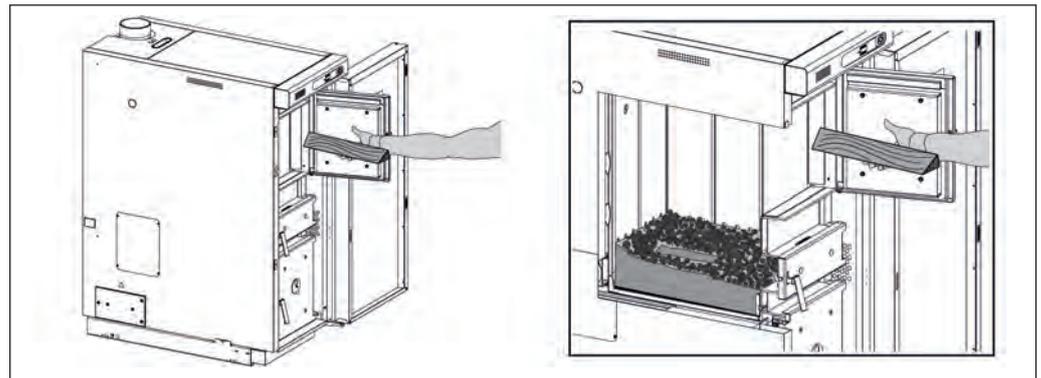
**Display above 20 lbs  
(9 kg):**

- Assess the remaining fuel in the fuel-loading chamber.



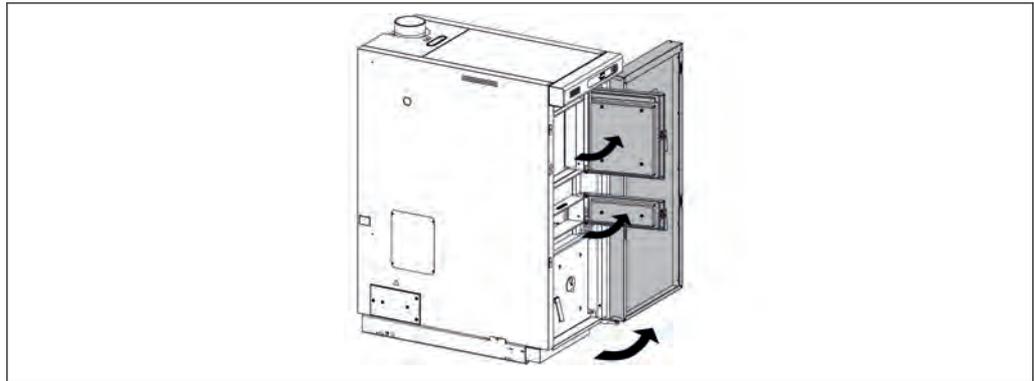
Fill level		Weight at fill level	
		S3 Turbo 30	S3 Turbo 50
3/3	Soft wood	approx. 53 lbs (24 kg)	approx. 86 lbs (39 kg)
	Hardwood	approx. 88 lbs (40 kg)	approx. 143 lbs (65 kg)
2/3	Soft wood	approx. 35 lbs (16 kg)	approx. 57 lbs (26 kg)
	Hardwood	approx. 60 lbs (27 kg)	approx. 95 lbs (43 kg)
1/3	Soft wood	approx. 18 lbs (8 kg)	approx. 29 lbs (13 kg)
	Hardwood	approx. 29 lbs (13 kg)	approx. 49 lbs (22 kg)

- Prepare the fuel quantity actually needed to load the thermal storage.
  - The fuel quantity actually required is determined by the difference of the fuel quantity shown on the display and the current remaining fuel in the fuel-loading chamber.
- The optimal time for adding fuel is when the basic firebed is achieved.
  - A firebed is “basic” when it reaches the top row of holes in the cladding.

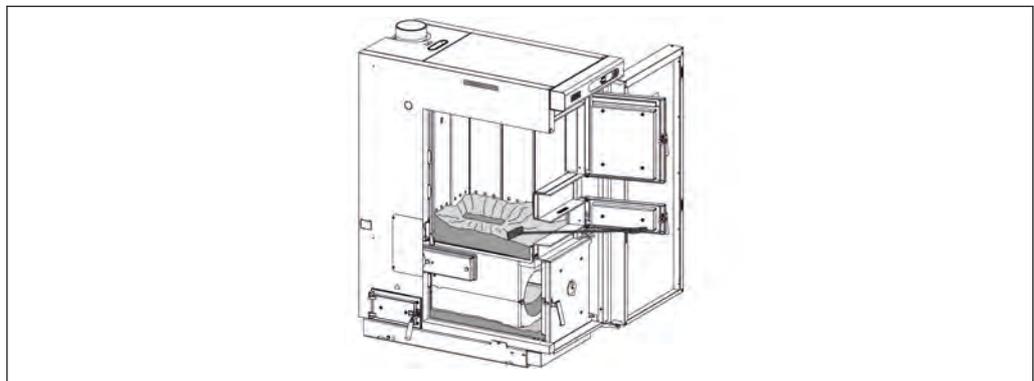


- Open the fuel loading door, add the prepared fuel quantity, then close the fuel loading door and insulated door again.

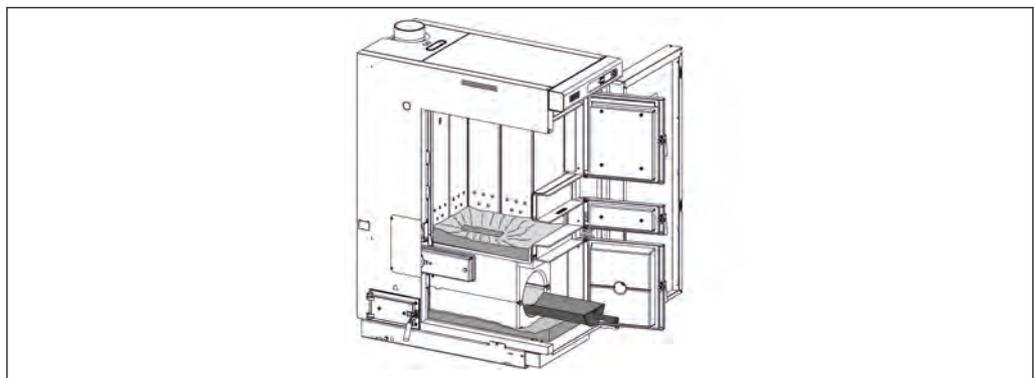
## 5.7 Remove ash



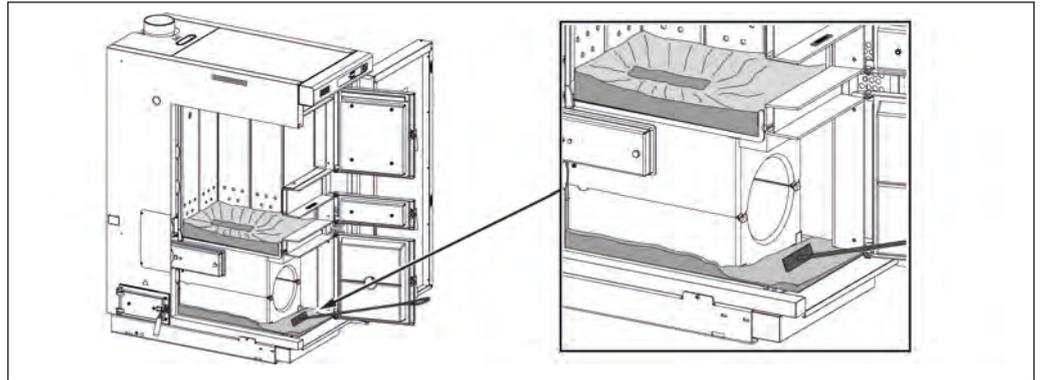
- Open the insulated door, pre-heating chamber door and the fuel loading chamber door



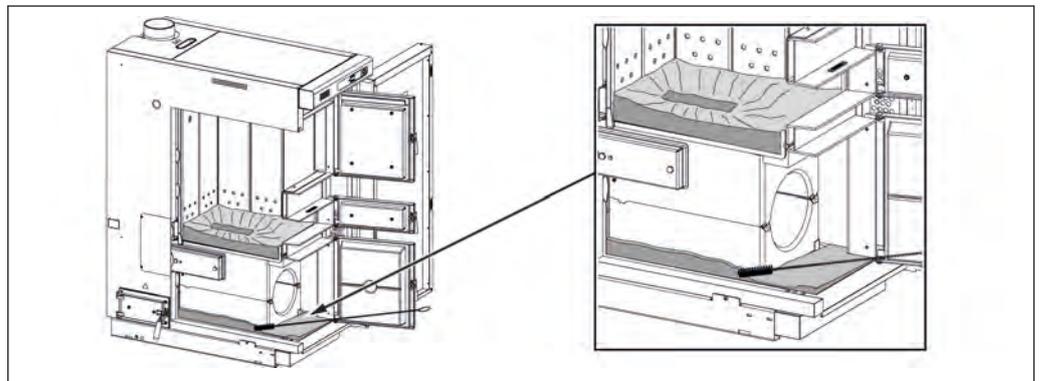
- Scrape the ash from the fuel loading chamber into the combustion chamber using the furnace tool.
  - Ash should remain in the boiler up to the height between the lowest and middle rows of holes, about 3" (7 cm) of the aprons. It is recommended that you do not remove the ash in the combustion chamber during each heating-up process, but rather only when the middle row of holes in the combustion chamber guards is no longer visible, until the remaining amount is about 3" (7 cm). This protects the combustion chamber and accelerates the heating-up process.



- Open the combustion chamber door and remove ash with a round ash shovel
  - Fire-proof container with cover!



- Remove ash in the area in front of the combustion chamber with the furnace tool.
  - Fire-proof container with cover!



- Clean the passage to the left and right of the combustion chamber with small brush and remove ash
- Shovel the ash into the container provided
  - Fire-proof container with cover!
  
- Close all boiler doors again after removing the ash.

## 6 Maintaining the boiler

### 6.1 Safety instructions for maintenance

#### *Improper maintenance work*

#### WARNING

##### **Risk of injury due to improperly performed maintenance work!**

- Before starting any work, the boiler must be in the “Fire Off” operating condition. Allow the boiler to cool sufficiently. Once the boiler has cooled down, switch off the emergency switch and take precautions to prevent it being accidentally switched on.
- Only operate the boiler using the handles provided.
- Perform all inspection and cleaning work to the boiler in the proper way.
- Pay attention to order and cleanliness in the boiler room.
- Any maintenance work not permitted for the operator must be carried out exclusively by Froling customer service or an authorized partner.
- Always wear personal protective equipment for work (protective clothing, safety shoes, protective gloves).
- Before starting up again, make sure that there is no-one in the danger zone and that all covers and safety devices are installed and work properly.
- THE HEAT EXCHANGER, DRAFT INDUCES, FLUE PIPE, AND CHIMNEY MUST BE CLEANED REGULARLY TO REMOVE ACCUMULATED CREOSOTE AND ASH. ENSURE THAT THE HEAT EXCHANGER, FLUE PIPE, AND CHIMNEY ARE CLEANED AT THE END OF THE HEATING SEASON TO MINIMIZE CORROSION DURING THE SUMMER MONTHS. THE APPLIANCE, FLUE PIPE, AND CHIMNEY MUST BE IN GOOD CONDITION. THESE INSTRUCTIONS ALSO APPLY TO A DRAFT INDUCER IF USED.
  - Incorrect or insufficient inspection and cleaning of the boiler can cause serious faults in combustion (e.g. spontaneous combustion of carbonization gases or explosion) and this can lead to serious accidents and damage.

#### *Automatic start-up*

#### WARNING

##### **Risk of injury from automatic start-up!**

- Before starting any work, the boiler must be in the “Fire Off” operating condition.
- Switch off the emergency switch and take precautions to prevent accidental switching on.
  - There is a risk of serious injury from the system starting up automatically if it is switched on during inspection and cleaning.

## 6.2 Securing the system so that it cannot be switched on again



**WARNING**

**Risk to life from unauthorized or uncontrolled switching on!**

- Before switching on again, ensure that all safety equipment has been fitted and is functioning correctly and that there is no risk to persons.
  - Always follow the procedure set out below to secure the system against being switched back on:
    - Disconnect.
    - Secure against switching back on.
    - Check the system is no longer live.
    - Earth and short circuit.
    - Cover or shield any adjacent live parts.
- ➔ **Unauthorized or uncontrolled switching on of the boiler can cause serious injury or death.**

## 6.3 Maintenance schedule

Interval	Maintenance work	Staff
Heating up each time	Always move the WOS lever	Operator
Every 100 operating hours	Visually inspect the system	Operator
	Check that safety equipment is functioning properly	Operator
	Remove ash and clean the grating	Operator
twice a month during the heating period	Remove soot, tar oil and ash deposits from the chimney connection and chimney	Chimney sweep
Annually or every 3000 operating hours	Clean the flue gas temperature sensor	Operator
	Clean the broadband probe	Froling customer service or an authorized partner
	Cleaning the low-temperature carbonization gas duct	Operator
	Cleaning the primary air openings	Operator
	Check the setting and seal on the doors	Operator
	Cleaning the heat exchanger pipes	Froling customer service or an authorized partner
	Cleaning the induced draft fan	Froling customer service or an authorized partner
	Clean the flue gas pipe and check the chimney draft	Chimney sweep
	Checking the draft controller flap	Chimney sweep

## 6.4 Maintenance work

### 6.4.1 Checking the safety equipment

#### *Checking the system pressure*



- Check the system pressure on the pressure gauge.
  - The value must be 20% greater than the preload 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:

- Add 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.

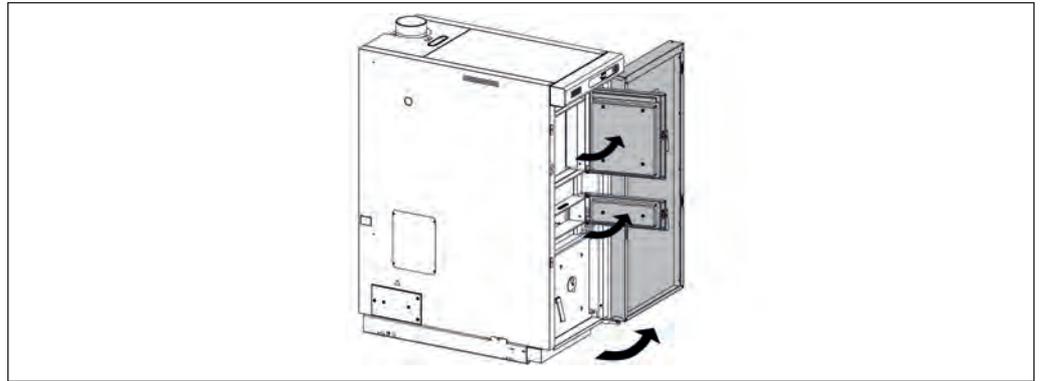
#### *Checking the safety valve*



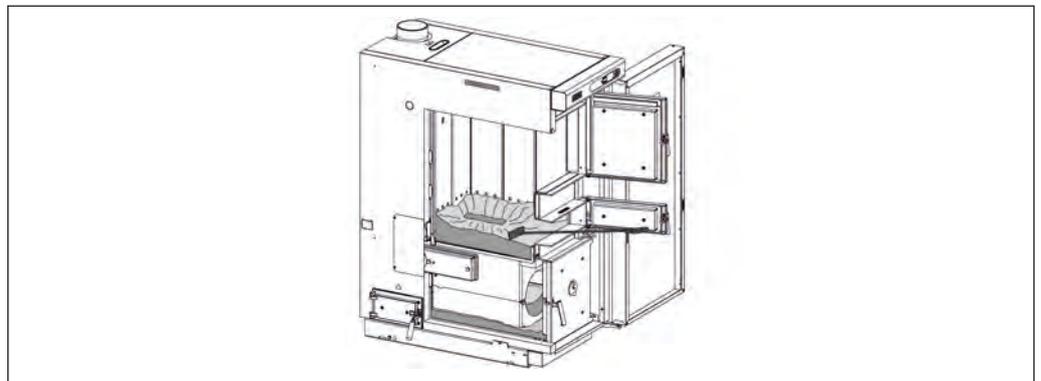
- Check the seal of the safety valve regularly and ensure that the valve is not dirty.

**NOTICE!** Inspection work must be carried out in accordance with the manufacturer's instructions.

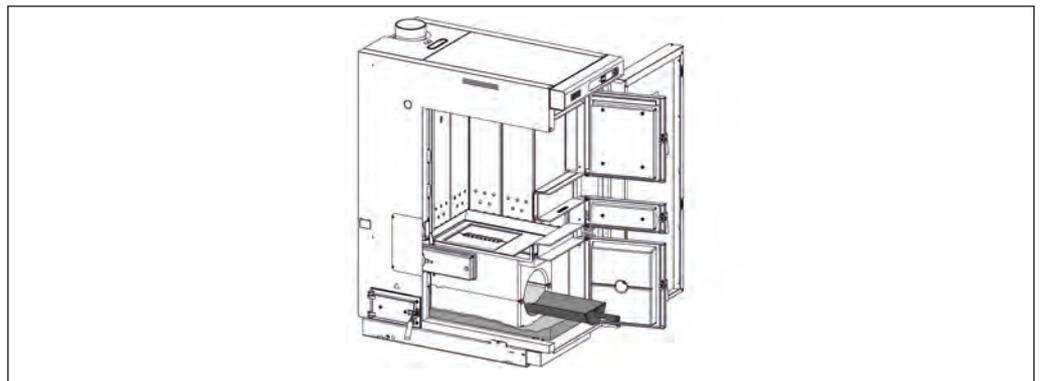
### 6.4.2 Remove ash



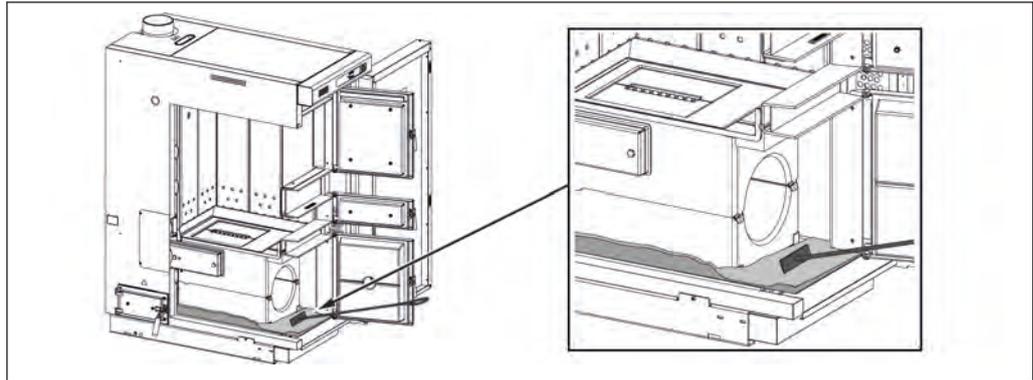
- Open the insulated door, pre-heating chamber door and the fuel loading chamber door



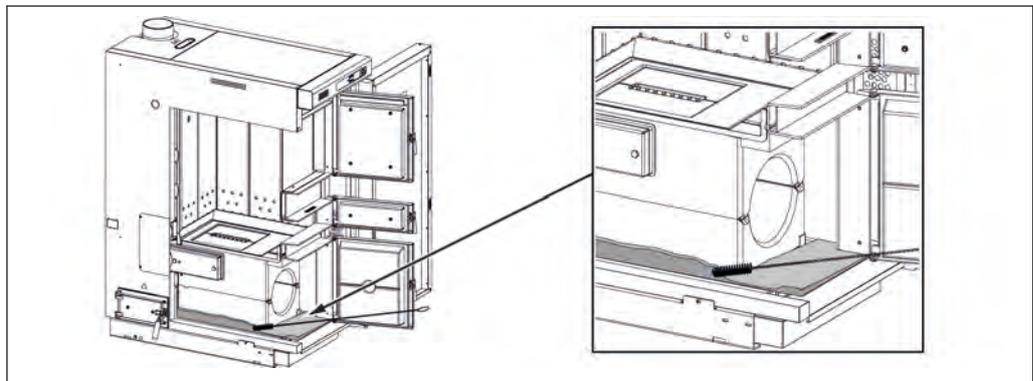
- Scrape the ash from the fuel loading chamber into the combustion chamber using the furnace tool.



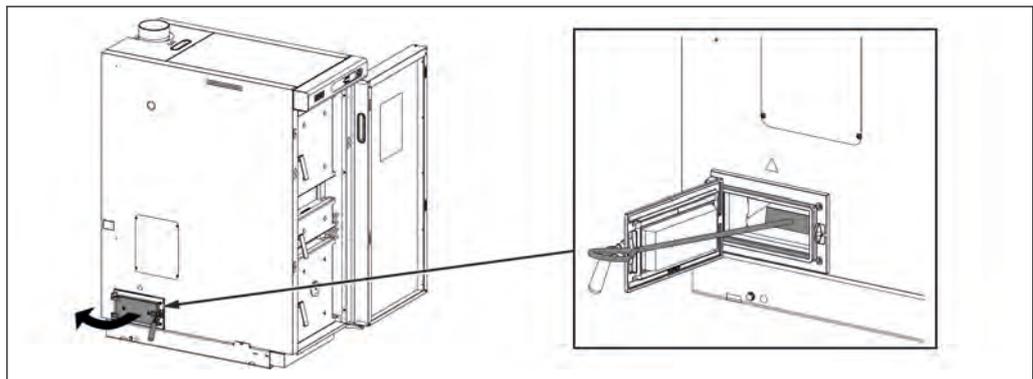
- Open the combustion chamber door and remove ash with a round ash shovel
  - Fire-proof container with cover.



- Remove ash in the area in front of the combustion chamber with the furnace tool.
- ↳ Fire-proof container with cover.

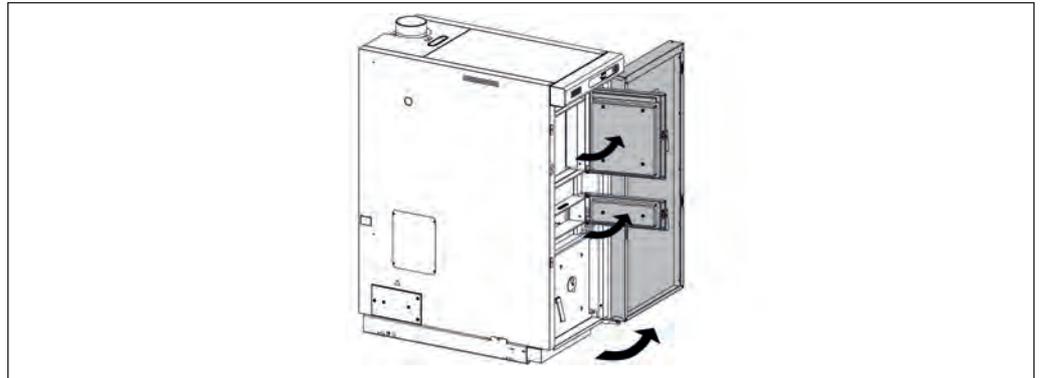


- Clean the passage to the left and right of the combustion chamber with small brush and remove ash
- Shovel the ash into a container
- ↳ Fire-proof container with cover

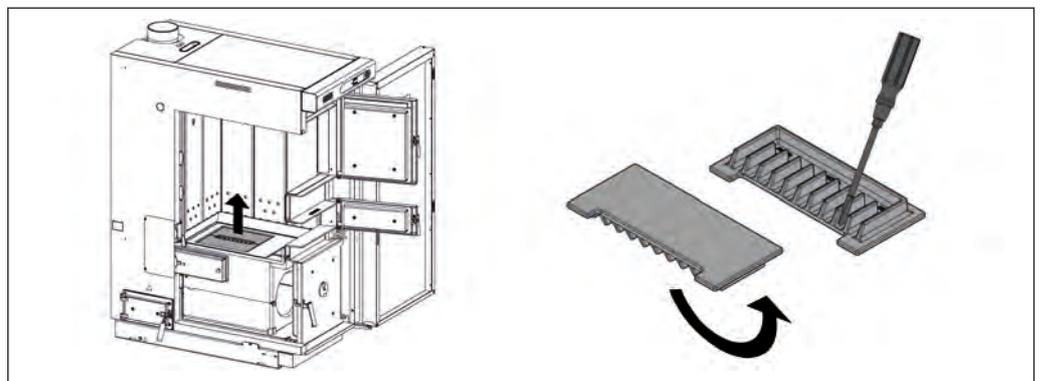


- Open the heat exchanger cleaning door and remove the ash with the furnace tool
- ↳ Fire-proof container with cover
  
- Close all boiler doors again after removing the ash.

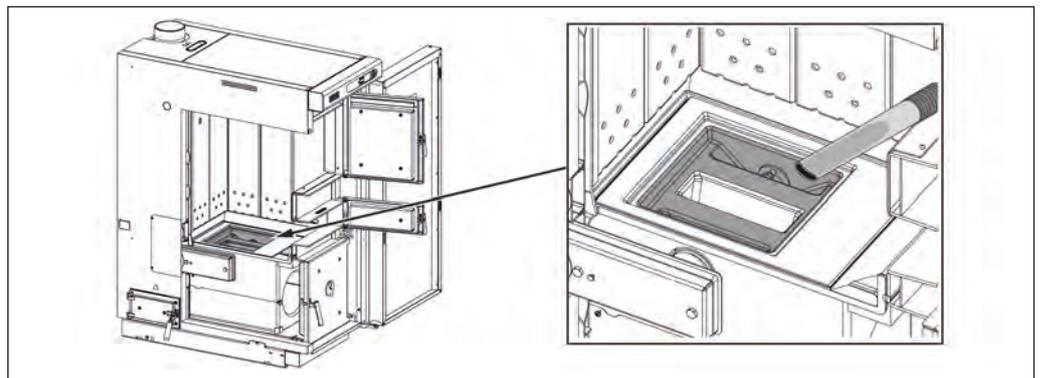
### 6.4.3 Cleaning the grate



- Open the insulated door, pre-heating chamber door and the fuel loading chamber door.

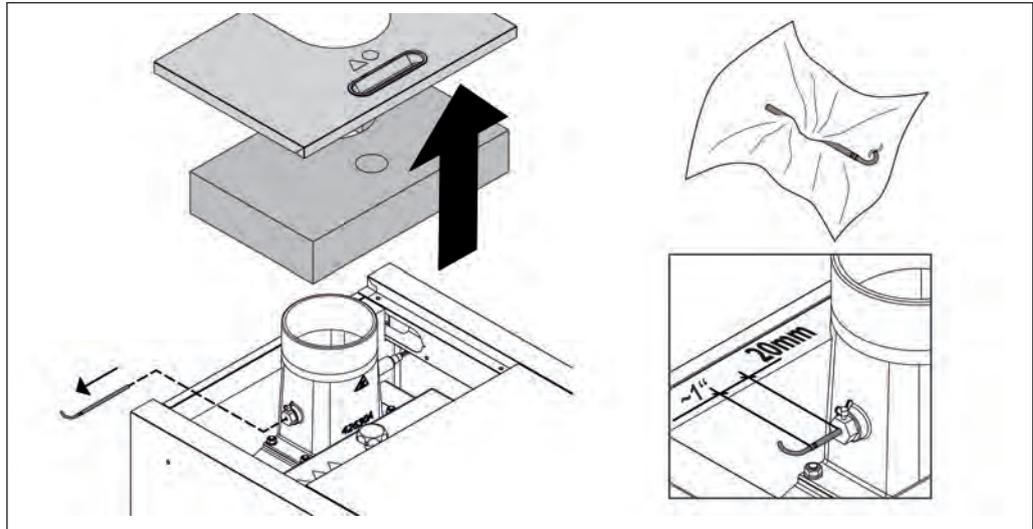


- Remove both halves of the grating from the fuel-loading chamber.
- Turn them over and scrape the ribs with a screwdriver.



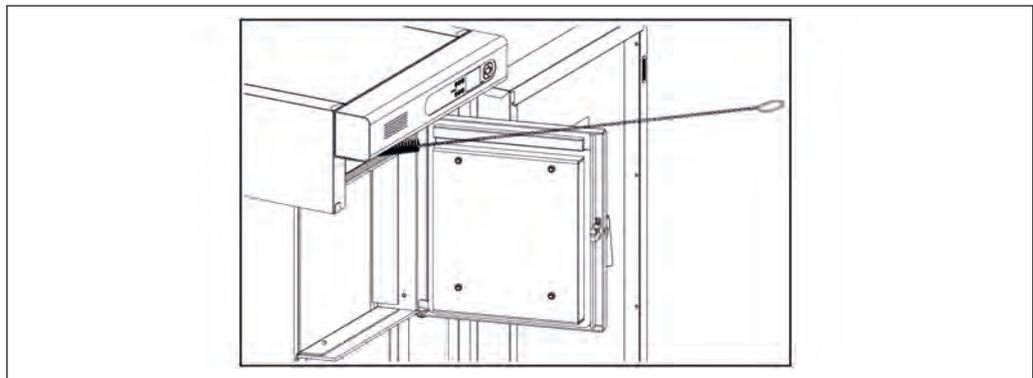
- Check the secondary air inlets and clean with an ash vacuum if necessary.
- Place the two halves of the grating back on the combustion chamber.
  - Ensure that they are positioned correctly.
- Close all boiler doors after positioning the grating halves.

#### 6.4.4 Cleaning the flue gas temperature sensor



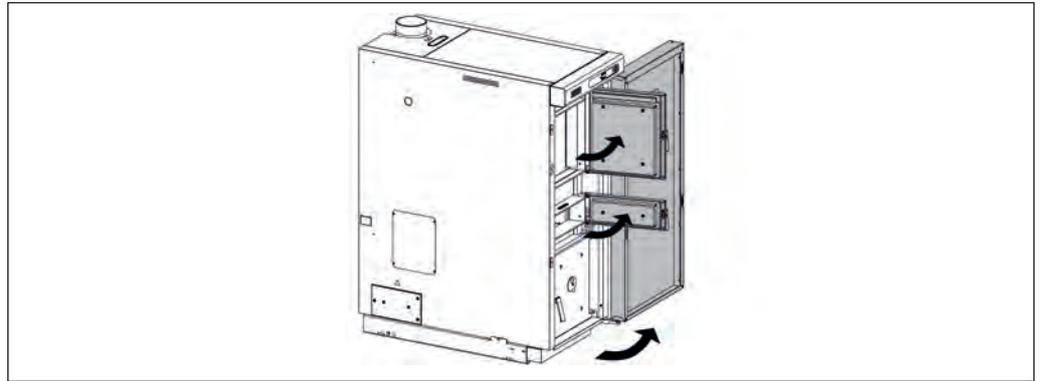
- Remove the back insulating cover and thermal insulation.
- Release the retaining screw and remove the flue gas temperature sensor from the flue gas pipe.
- Wipe the flue gas temperature sensor with a clean cloth.
- Push in the flue gas temperature sensor until about 1" (20 mm) of the sensor remains protruding from the bushing and secure with fixing screw.
- Put the thermal insulation and rear insulating cover back in place.

#### 6.4.5 Cleaning the low-temperature carbonization gas duct

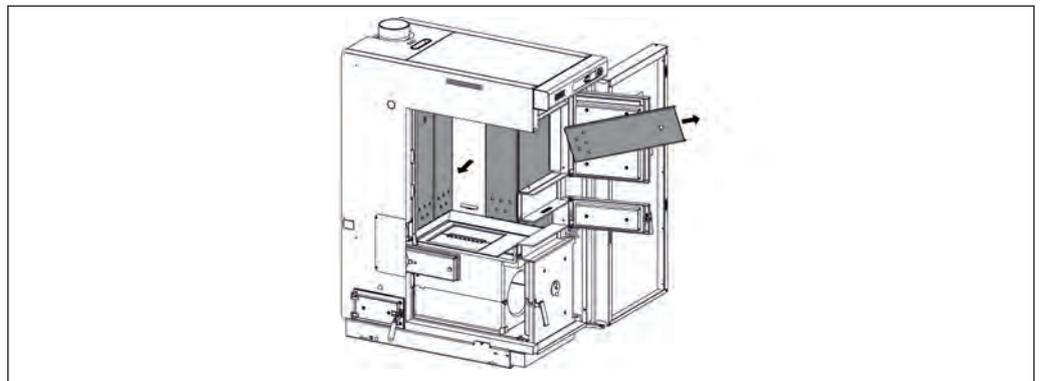


- Open the insulated door and the fuel loading chamber door
- Clean the low-temperature carbonization gas duct with a small brush
- Close all boiler doors after cleaning the low-temperature carbonization gas duct!

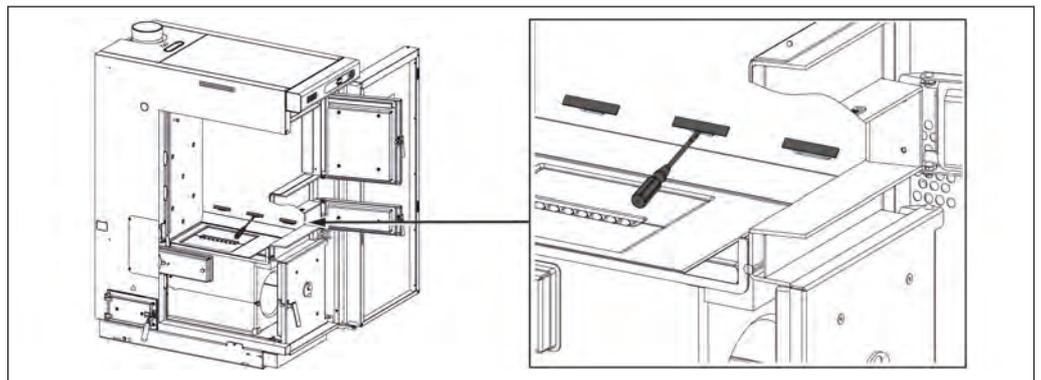
### 6.4.6 Cleaning the primary air openings



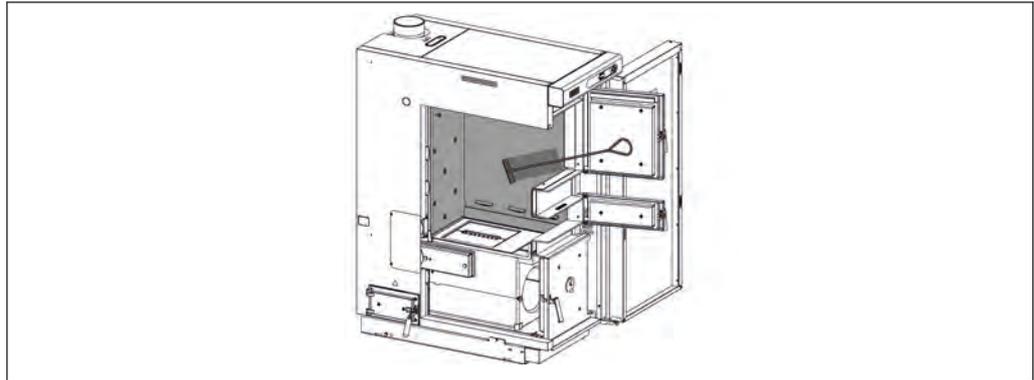
- Open the insulated door, pre-heating chamber door and the fuel loading chamber door.



- Unhinge all aprons and remove from the fuel-loading chamber.



- Check the primary air openings (left and right) for unobstructed air flow and clean with a screwdriver if necessary.



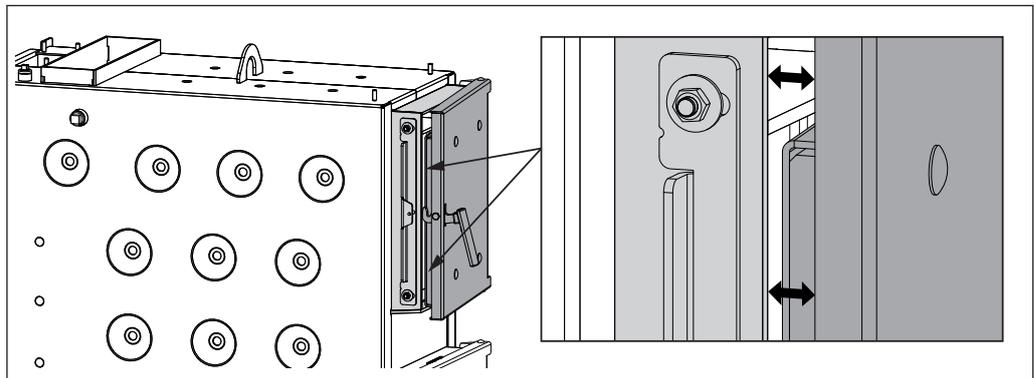
- ❑ Scrape off all the boiler walls behind the aprons with the furnace tool.
- ❑ After the primary air openings have been cleaned and the boiler walls scraped off, mount all aprons back in their previous position and close all the boiler doors.

#### 6.4.7 Set and check the seal on the doors

The example below shows how to set and check the seals on the fuel loading doors. The procedure is the same for the combustion chamber door and the pre-heating chamber door!

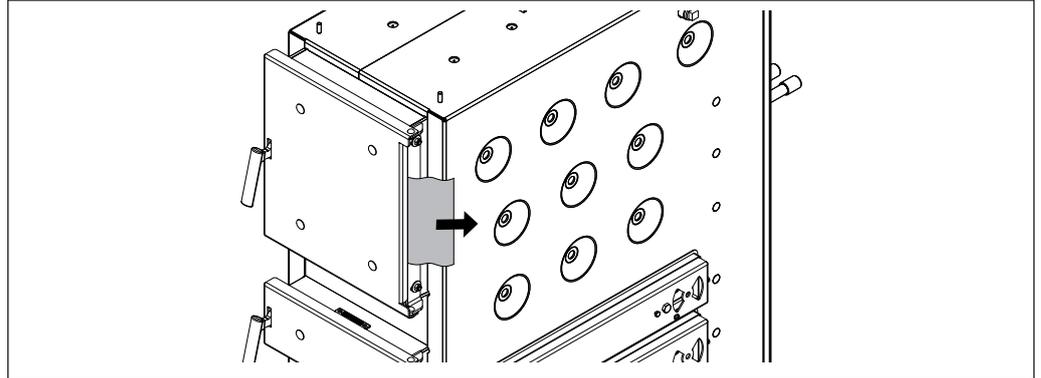
*On the side with the door stop*

*Checking the setting:*



- ❑ Close the door
  - A slight resistance must be felt when there is a gap of 1" (2- 3 cm):  
Setting OK
  - No resistance or only very slight resistance felt:  
Setting must be corrected - push the hinge toward the back  
⇒ See "Adjusting the doors" [page 86]
  - Resistance noticeable at a gap of >1" (> 3 cm):  
Setting must be corrected - push the hinge toward the front  
⇒ See "Adjusting the doors" [page 86]

**Checking the seal:**

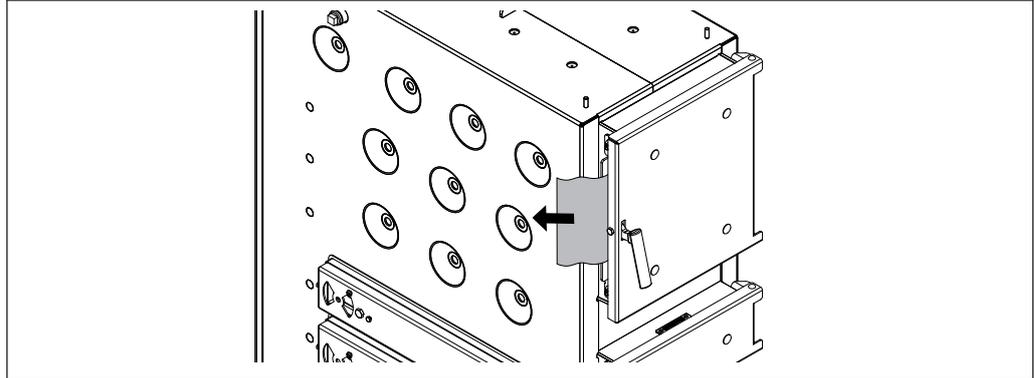


- Open the door
- Insert a sheet of paper at both the top and the bottom of the door stop between the door and the boiler
- Close the door
- Try to pull out the sheets of paper
  - If the paper cannot be removed: the door is sealed.
  - If the paper can be removed: The door is not sealed properly - push the hinge toward the back.
    - ⇒ See "Adjusting the doors" [page 86]

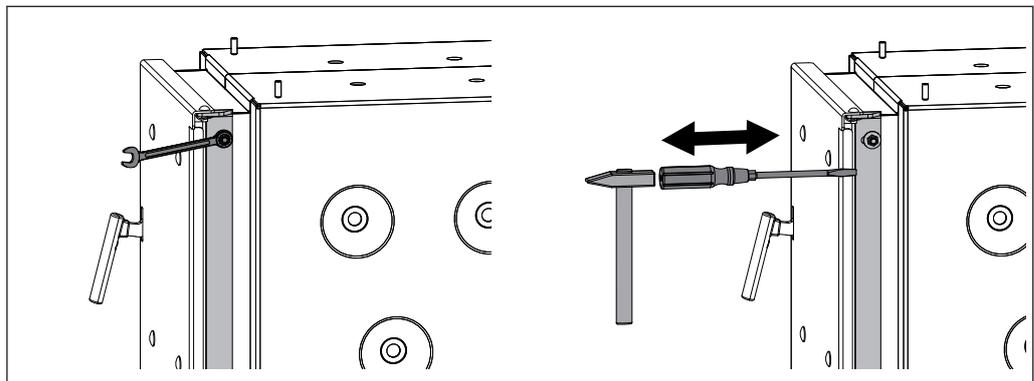
**On the side with the door handle**

**Checking the setting:**

- Close the door
  - The door can be closed with a normal amount of effort: Setting OK
  - If the door cannot be closed with the usual force or must be forced closed: Push the locking plate toward the front
    - ⇒ See "Adjusting the doors" [page 86]

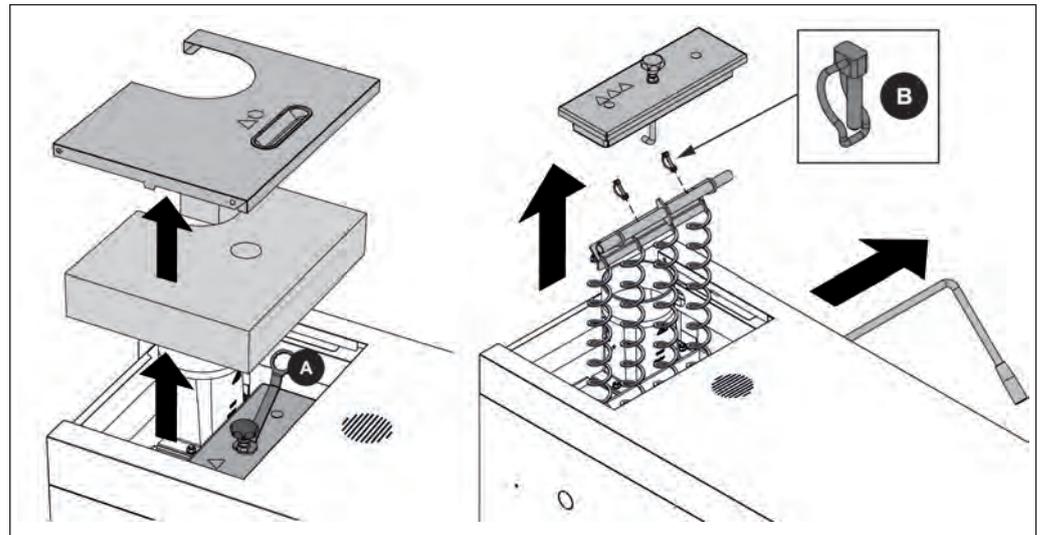
**Checking the seal:**

- Open the door
- Insert a sheet of paper at both the top and the bottom area at the side of the door handle between the door and the boiler
- Close the door
- Try to pull out the sheets of paper
  - If the paper cannot be removed: the door is sealed.
  - If the paper can be removed: The door is not sealed properly - push the locking plate toward the back.
    - ⇒ See "Adjusting the doors" [page 86]

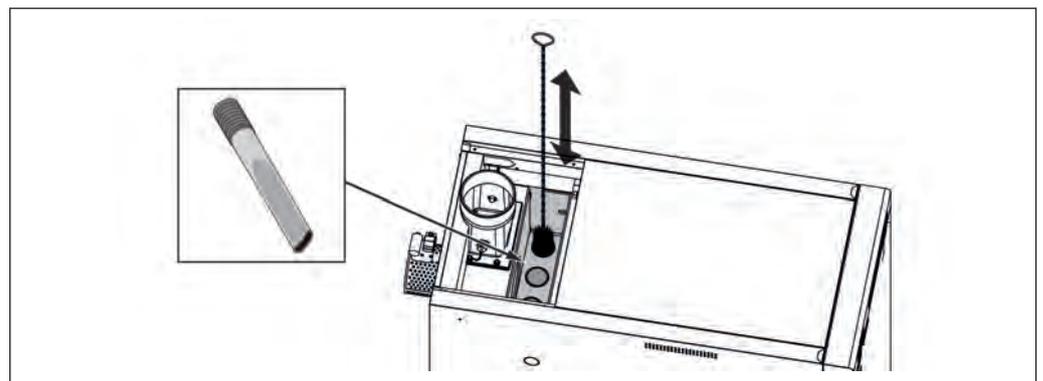
**Adjusting the doors**

- Using an Allen key (AF 13), 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

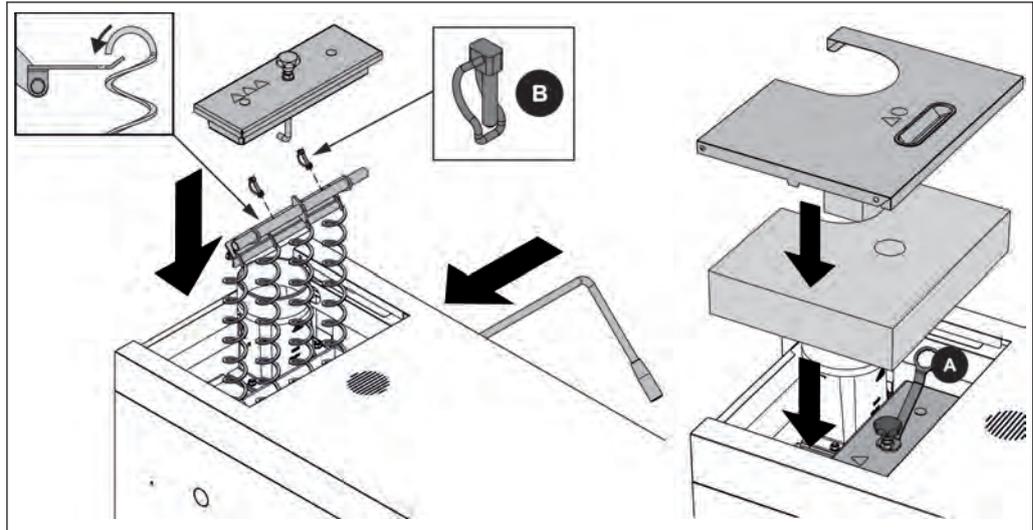
6.4.8 Cleaning the heat exchanger pipes



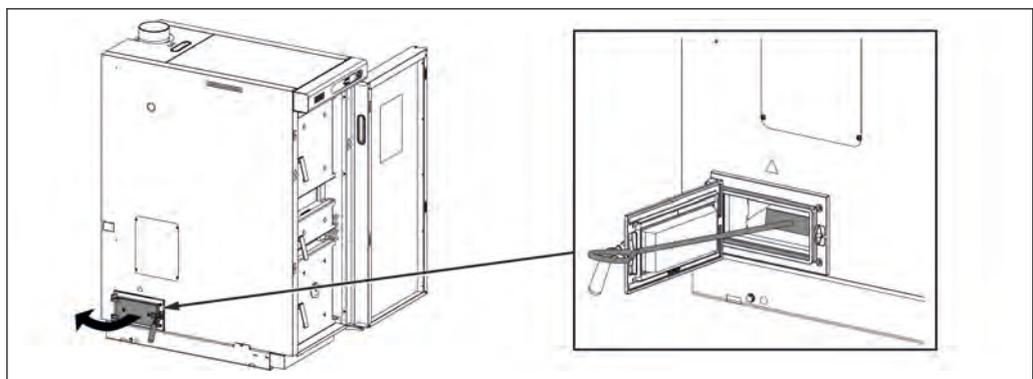
- Lift off the back insulating cover and remove the heat exchanger cover
  - Use spanner (A) provided
- Remove both piping lock pins (B) and take out the WOS lever
- Lift out the turbolators together with the mounting bracket



- Remove the ash above the pipes with an ash vacuum and 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

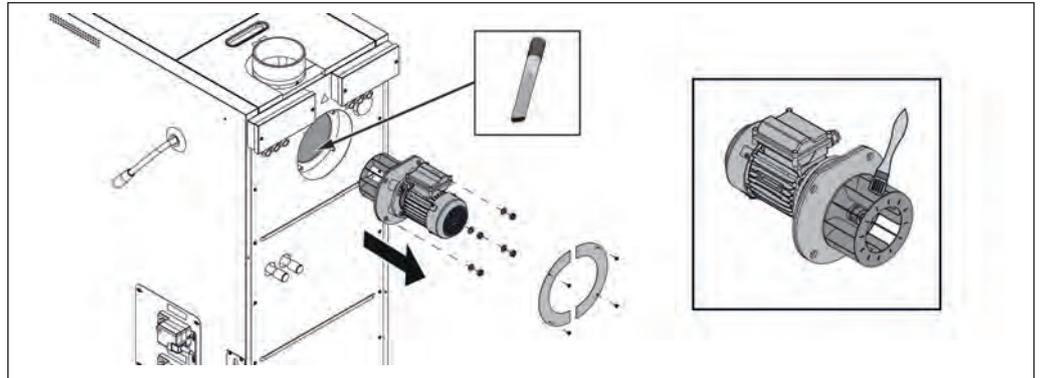


- Hang the WOS turbolators on the linking plate of the stay tube
  - ↳ Make sure that you fit the turbolators in the right position:
  - ↳ Hold the linking plate with the edge toward the top
  - ↳ Hang the WOS turbolators over the edge
- Thread the turbolators into the heat exchanger pipes
- Insert the WOS lever and secure with pipe locking pins (B)
- Fit the heat exchanger cover by using spanner (A) and position back insulating cover



- Open the heat exchanger cleaning door and remove the ash with the furnace tool
  - ↳ Fire-proof container with cover

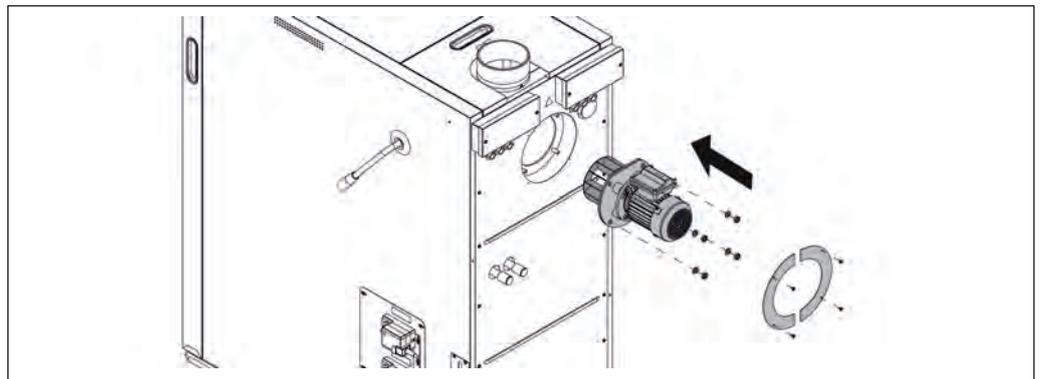
### 6.4.9 Cleaning the induced draft fan



- Remove the ID fan cover plates from the back of the boiler
- Remove the induced draft fan
  - Take care not to damage the seal!
- Clean the fan wheel using a soft brush or paint brush

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

- Remove dirt and deposits from the induced draft housing using a scraper
- Remove any ash which has gathered using an ash vacuum



- Fit the ID fan and the ID fan cover plates

### 6.4.10 Disposing of ash

Staff:	<input type="checkbox"/> Operator
Protective equipment:	<input type="checkbox"/> Protective workwear <input type="checkbox"/> Protective goggles <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety shoes <input type="checkbox"/> Dust mask

#### NOTICE

#### Environmental damage due to improper disposal!

- Collect ash in a metal container with a tight-fitting cover until its final disposal.
- Use metal containers exclusively for ash.
  - The improper disposal of ash can lead to environmental damage.
- Carry or push the ash container to the metal container.
- Open the cover of the metal container.
- Empty the ash container.
- Close the cover of the metal container again.

*Ashes should be placed in a metal container with a tight-fitting lid. The closed container of ashes should be placed on a noncombustible floor or on the ground, well away from all combustible materials, pending final disposal. If the ashes are disposed of by burial in soil or otherwise locally dispersed, they should be retained in the closed container until all cinders have thoroughly cooled. Other waste should not be placed in this container.*

#### ⚠ WARNING

#### Soot and flyash – Formation and Need for Removal

The products of combustion will contain small particles of flyash. The flyash will collect in the exhaust venting system and restrict the flow of the flue gases. Incomplete combustion, such as occurs during start-up, shut-down, or incorrect operation of the heater will lead to some soot formation which will collect in the exhaust venting system. The exhaust venting system should be inspected at least once every year to determine if cleaning is necessary.

- Establish a routine for the storage of fuel, care of the appliance, and firing techniques.
- Check daily for creosote buildup until experience shows how often cleaning is necessary.
- Be aware that the hotter the fire, the less creosote is deposited, and that weekly cleanings can be necessary in mild weather, even though monthly cleanings can be enough in the coldest months.
- Have a clearly understood plan to handle a chimney fire.

**⚠ WARNING****Creosote – Formation and Need for Removal**

When wood is burned slowly, it produces tar and other organic vapors, which combine with expelled moisture to form creosote. The creosote vapors condense in the relatively cold chimney flue of a slow-burning fire. As a result, creosote residue accumulates on the flue lining. When ignited this creosote makes an extremely hot fire. The chimney connector and chimney should be inspected at least twice monthly during the heating season to determine if a creosote buildup has occurred. If creosote has accumulated it should be removed to reduce the risk of a chimney fire.

#### 6.4.11 After maintenance

After completion of maintenance work and before switching on the system perform the following steps:

- Check that all previously loosened screw connections are tightened.
- Check whether all previously removed safety devices and open doors and covers are closed again properly.
- Make sure that all tools, materials and other equipment used have been removed from the work area.
- Clean the work area and remove any substances that may have leaked such as liquids, processing materials or similar.
- Make sure that all safety devices on the system are functioning properly.

## 7 Boiler faults

### 7.1 Safety instructions for troubleshooting

#### WARNING

#### Risk of injury due to incorrect troubleshooting!

- Before starting work, ensure that there is sufficient space for assembly.
- Pay attention to order and cleanliness at the assembly site. Loosely overlapping or scattered components and tools are sources of accident.
- If components have been removed, pay attention to correct assembly, refit all fasteners and observe tightening torques for screws.
- Do not release the blockage until you have ensured that the release will not lead to a dangerous movement of system components.
- Do not acknowledge the fault until it is eliminated or its cause is resolved.
- In case of doubt contact Froling customer service.
- Before starting up again, please note the following:
  - Make sure that all troubleshooting operations have been performed and completed according to the instructions in this manual.
  - Make sure that there is no-one in the danger zone.
  - Make sure that all covers and safety devices are installed and work properly.
  - Improperly performed troubleshooting operations can cause serious injuries and considerable property damage.

### 7.2 Troubleshooting table

Fault description	Cause	Remedy	Staff
Display is blank	General power failure	Check the power supply	Operator
No power to the controller	Main switch is turned off	Turn on the main switch	Operator
	Residual-current circuit breaker, circuit-breaker or boiler controller circuit-breaker tripped	Switch the protective circuit breaker on the control cabinet back on	Operator
High-limit thermostat has activated	Over-temperature	<ul style="list-style-type: none"> <li>▪ Allow system to cool</li> <li>▪ Check status of the system (note the fault messages)</li> <li>▪ Reset the high-limit thermostat</li> </ul>	Operator
Boiler combustion faults	Insufficient chimney draught due to deposits in the chimney	Have a chimney sweep clean soot, ash and tar oil deposits from the chimney connection and chimney.	Chimney sweep
	Insufficient combustion air	Check the air inlet to the boiler room and clean, if necessary	Operator

### 7.2.1 Reset the high-limit thermostat.

Staff:	<input type="checkbox"/> Operator
Protective equipment:	<input type="checkbox"/> Protective workwear <input type="checkbox"/> Protective gloves <input type="checkbox"/> Safety shoes
Special tools:	<input type="checkbox"/> Screwdriver

*The high-limit thermostat switches off the boiler at a temperature of 203-212°F (95-100°C). The pumps continue to run.*

Once the temperature falls below approx. 167°F (approx. 75°C), the high-limit thermostat can be reset mechanically.

- Unscrew the cap of the high-limit thermostat.
- Unlock the high-limit thermostat by pressing with a screwdriver.
- Refit the cap of the high-limit thermostat.



### 7.3 After troubleshooting

Once the fault is eliminated, perform the following steps to start the boiler up again:

- Reset the emergency stop device.
- Acknowledge the fault message at the boiler controller.
- Make sure that there is no one in the danger zone.
- Start the boiler according to the instructions in the “Heating the boiler” section.

## 8 Dismantling and disposal

*Dismantling is carried out exclusively by the manufacturer or by staff authorized by the manufacturer.*

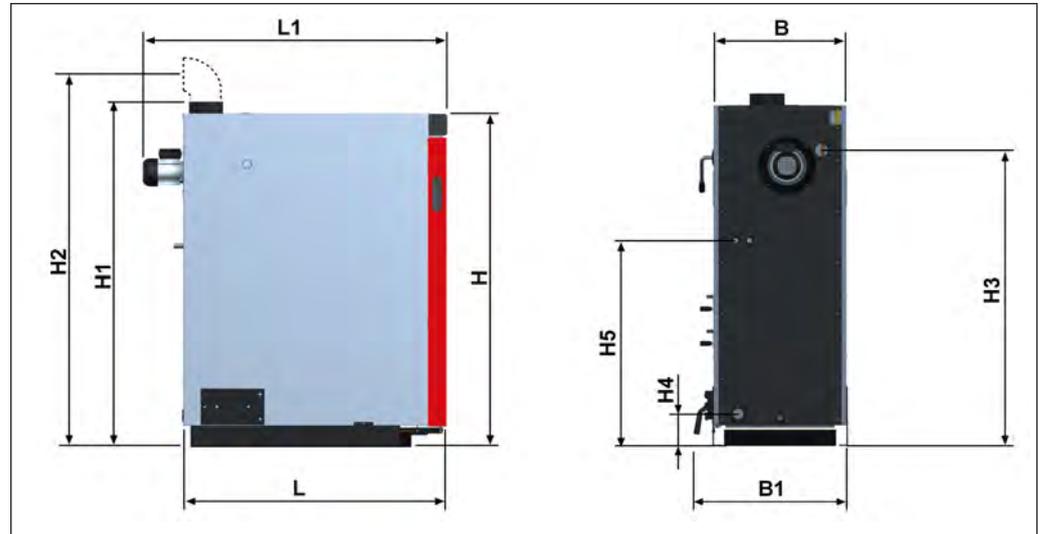
### WARNING

#### **Risk of death from improper dismantling!**

- Dismantling must be carried out exclusively by employees of the manufacturer or staff authorized by the manufacturer.
- Consult the manufacturer even in case of a subsequent relocation.
- Refrain from unauthorized dismantling and relocation.
  - An error during dismantling can lead to life-threatening situations or cause substantial damage to property.

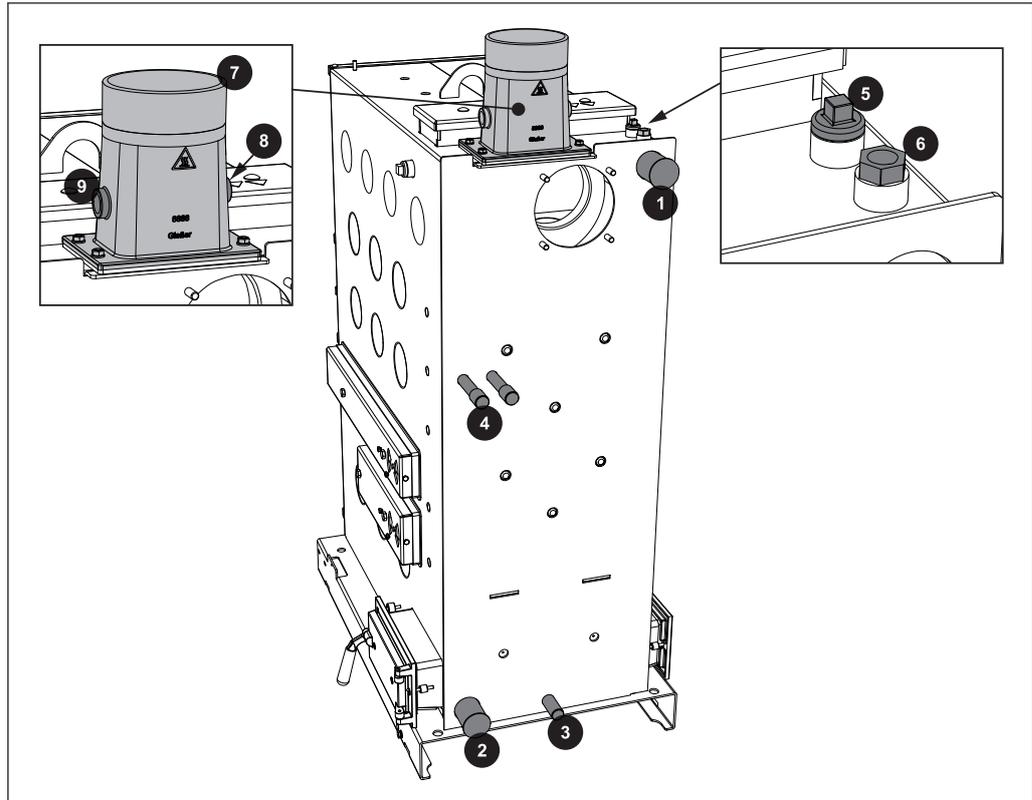
## 9 Technology

### 9.1 Dimensions



Dim.	Description	Unit	S3 Turbo 30	S3 Turbo 50
L	Length of boiler	mm inches	1160	1250
			45 ¾	49 ¼
L1	Total length including induced draft fan		1260	1350
			49 ½	53 ¼
B	Width of boiler		570	670
			22 ½	26 ⅓
B1	Total width inc. side cleaning door		680	780
			26 ¾	30 ¾
H	Height of boiler		1470	1570
			58	62
H1	Total height incl. flue gas nozzle		1530	1630
			60 ¼	64 ¼
H2	Height of flue pipe connection		1750	1850
			69	73
H3	Height of flow connection		1280	1380
			50 ½	54 ⅓
H4	Height of return connection		140	140
			5 ½	5 ½
H5	Height of safety battery connection		890	970
			35	38 ¼
H6	Height of drainage connection		120	120
			4 ¾	4 ¾

## 9.2 Components and connections



Item	Description	Unit	S3 Turbo
1	Boiler flow connection	inches	6/4
2	Boiler return connection	inches	6/4
3	Drainage connection	inches	1/2
4	Safety battery connection	inches	1/2
5	Immersion sleeve for thermal discharge valve (supplied by the customer)	inches	1/2
6	Immersion sleeve for boiler sensor and STL	inches	1/2
7	Flue gas pipe connection	inches	6
8	Flue gas temperature sensor connection	inches	1/2
9	Broadband probe connection	inches	3/4

### 9.3 Technical data

Description		S3 Turbo 30	S3 Turbo 50
Nominal heat output	kW	30	50
	Btu/h	102,500	170,000
Electrical connection	230V / 60Hz / fused 15A		
Power consumption at nominal load	W	120	180
	Btu/h	410	615
Weight of boiler incl. insulation and control	kg	530	620
	lbs	1170	1370
Total boiler capacity (water)	l	120	190
	gal	32	50
Minimum boiler return temperature	°C	60	
	°F	140	
Maximum permitted operating temperature	88		
	190		
Permitted operating pressure	bar	2	
	psi	30	
Airborne sound level	dB(A)	< 70	
Permitted fuel as per EN ISO 17225	Part 5: Firewood class A2 / D15 L50		
Fuel loading door dimensions (width / height)	mm	330 / 370	330 / 370
	inches	13 / 14.5	13 / 14.5
Fuel loading chamber capacity	l	140	210
	gal	37	55
Combustion time <sup>1)</sup> – hardwood	h	3.9 - 5.6	3.9 - 5.6
Combustion time <sup>1)</sup> – soft wood		2.8 - 3.9	2.7 - 4.0
1. Values specified for combustion time are guideline values at nominal load and will vary depending on water content (15-25%) and fill level (80-100%)			