

Vitomax HS
Type M73
Type M75
Type M93
Type M95

High pressure steam boiler



VITOMAX HS



Safety instructions

Safety instructions



Please follow these safety instructions closely to prevent accidents and material losses.

Safety instructions explained



Danger

This symbol warns against the risk of injury.



Please note

This symbol warns against the risk of material losses and environmental pollution.

Note

Details identified by the word "Note" contain additional information.

Target group

These instructions are exclusively intended for qualified contractors.

- Work on gas installations may only be carried out by a registered gas fitter.
- Work on electrical equipment may only be carried out by a qualified electrician.

Regulations to be observed

- Pressure Equipment Directive
- Health and Safety at Work Act (BetrSichV) [Germany] and extended technical rules for operational safety (TRBS)
- Country-specific safety regulations for the installation site
- National installation regulations
- Statutory regulations for the prevention of accidents
- Statutory regulations for environmental protection
- Codes of practice of the relevant trade associations

Safety instructions for working on the system

Commissioning

Note

Unpleasant odours may develop during commissioning. Ensure the installation room is well ventilated.

Before working on the system

- Close the fuel shut-off valve and secure against unintentional reopening.
- Isolate the system from the power supply, e.g. by removing the separate fuse or by means of a mains isolator, and check that it is no longer 'live'.
- Safeguard the system against reconnection.

Hot surfaces



Danger

Hot surfaces can lead to burns. Never touch hot surfaces, e.g.

- Steam pipes
- Hot water pipes
- Cleaning apertures and closures on the boiler system
- Boiler doors, as well as components behind the doors

Observe occupational safety. Wear protective clothing where necessary.

Electrostatic discharge



Please note

Electronic assemblies can be damaged by electrostatic discharge. Prior to commencing work, touch earthed objects such as heating or water pipes to discharge static loads.

Repair work



Please note

Repairing components that fulfil a safety function can compromise the safe operation of the system. Replace faulty components only with genuine Viessmann spare parts.

Safety instructions (cont.)**Auxiliary components, spare and wearing parts**

- ! Please note**
Spare and wearing parts that have not been tested together with the system can compromise its function. Installing non-authorized components and making non-approved modifications or conversions can compromise safety and may invalidate our warranty.
For replacements, use only original spare parts supplied or approved by Viessmann.

Dismantling and disposal

When dismantling and disposing of thermal insulation materials and gaskets on the gas side, observe the applicable safety regulations.
The product and its components must be disposed of according to local environmental regulations.
This applies in particular to the disposal of thermal insulation materials and gaskets/seals on the gas side.

Safety instructions for operating the system**General**

The materials included in the product pose no threat to health during operation.

If you notice oil leaks or the smell of gas

- ! Danger**
Escaping fuel can lead to explosions which may result in very serious injuries.
- Do not smoke. Prevent naked flames and sparks. Never switch lights or electrical appliances on or off.
 - Close the quick-acting fuel valve and shut-off valve.
 - Ventilate the boiler house.
 - Evacuate any people from the danger zone.
 - Notify your gas or electricity supply utility from outside the building.
 - Have the power supply to the building shut off from a safe place (outside the building).

If you smell flue gas

- ! Danger**
Flue gas can lead to life threatening poisoning.
- Shut down the system.
 - Ventilate the installation site.

Draining hot water

- ! Please note**
The blow-down and TDS water from boiler systems can reach temperatures of over 100 °C. Before draining water into the sewage system, allow it to cool to a temperature of < 35 °C. If necessary, consult the local water board.

Draining condensate from the flue gas side

- ! Please note**
When starting up the boiler system, or under certain operating conditions, condensate may build up in the flue passes, the flue gas collector and the downstream flues, including the chimney.
The condensate must be drained away safely by means of suitable installation measures put in place by the system installer.

Subject to the regulations in the country concerned, this condensate may need to be neutralised. In such cases, consult the local water board or the body responsible for issuing permits.

General information**Shut down the boiler immediately if there is any safety-related damage.**

Observe safety-related instructions.
After an accident, the condition of the system must not be changed before the investigation takes place, unless necessary in order to rescue people or prevent further damage.

Only authorised personnel are permitted to enter the boiler house.

Keep the boiler house clean at all times.

Do not store anything in the boiler house.

Keep exits clear.

Never use the boiler house or system components as a drying area.

The operating personnel must log the following:

- Settings
- Readings
- Faults
- Replacement of spare parts
- Repairs

Any defects must be dealt with immediately by trained personnel, e.g.:

- Abnormalities on weld seams
- Leaks
- Heavy corrosion
- Faulty instrument displays
- Noise in the boiler

Safety instructions

Safety instructions (cont.)










Faults and defects that cannot be remedied locally must be reported to the manufacturer. Protect all boiler parts and control equipment from rain, water leaks and expelled steam.

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Symbols

Symbol	Meaning
	Reference to other document containing further information
	Step in a diagram: The numbers correspond to the order in which the steps are carried out.
	Warning of material losses and environmental pollution
	Live electrical area
	Pay particular attention.
	<ul style="list-style-type: none"> ▪ Component must audibly click into place. or ▪ Acoustic signal
	<ul style="list-style-type: none"> ▪ Fit new component. or ▪ In conjunction with a tool: Clean the surface.
	Dispose of component correctly.
	Dispose of component at a suitable collection point. Do not dispose of component in domestic waste.

The steps in connection with commissioning, inspection and maintenance are found in the "Commissioning, inspection and maintenance" section and identified as follows:

Symbol	Meaning
	Steps required during commissioning
	Not required during commissioning
	Steps required during inspection
	Not required during inspection
	Steps required during maintenance
	Not required during maintenance

Note

All diagrams in this document are schematic, illustrative examples.

Designation of boiler types

With the boiler type, the respective stage of development is indicated in capital letters.

Example M93B: Boiler type M93 version B

Intended use

The appliance is intended solely for installation and operation in sealed unvented heating systems, with due attention paid to the associated installation, service and operating instructions. The appliance is intended exclusively for steam generation and for heating water in accordance with EN 12953 and AGFW datasheet FW510 (VdTÜV datasheet TCh 1466).

Commercial or industrial use for a purpose other than steam generation or the heating of water shall be deemed inappropriate.

All other use is deemed inappropriate. Any resulting losses are excluded from the manufacturer's liability.

Any usage beyond this must be approved by the manufacturer in each individual case.

Intended use presupposes that a permanent installation in conjunction with permissible components designed for this purpose has been carried out.

Intended use also includes adherence to maintenance and inspection intervals.

Systems with operating temperatures > 110 °C

Category IV boiler systems compliant with Pressure Equipment Directive

Requirements for commissioning

- System installation has official approval.
- The system has been checked by an expert authority.
- Commissioning of the control system is carried out by a qualified organisation.

Requirements for operators

Only qualified personnel may operate, supervise and service the system.



Danger

The surfaces of steam boilers and hot water boilers and other areas of the system are potentially hot. **Risk of injury!**

Always wear protection when touching the relevant areas during operation.

Requirements for operation without supervision

- Boiler system is equipped in accordance with EN 12953, Part 6.
- The system has received official approval for operation.

Checking system operation

Scope checks should be determined in accordance with EN 12953-6

Installation overview

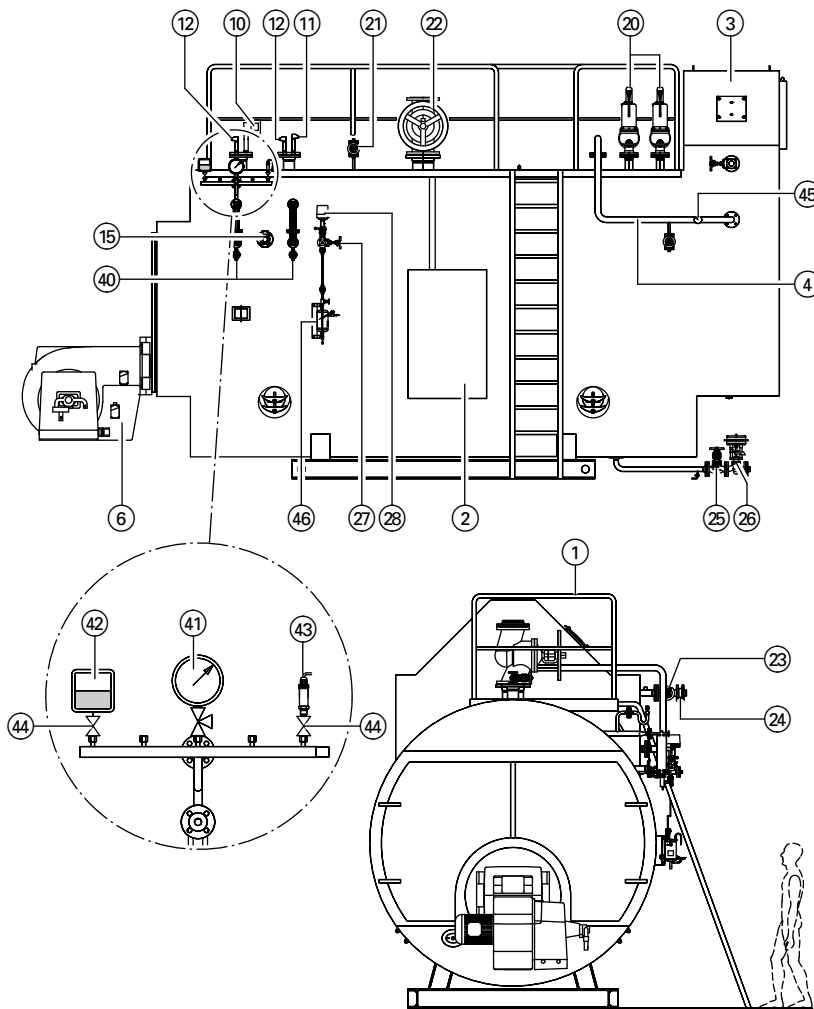


Fig. 1 Example installation diagram. Standard delivery may vary subject to order.

Note

CE-approved boiler with accessories fitted on site. Standard delivery may vary subject to order.

- | | |
|---|--|
| <ul style="list-style-type: none"> ① Boiler control platform with conductor (optional) ② Control panel (see separate documentation) ③ Integral ECO (subject to boiler size) (optional) ④ Connection line ECO - boiler (optional) ⑥ Burner ⑩ Level electrode (WLC: Water level controller) ⑪ Level electrode (HWL: Highest water level) ⑫ Level electrode (LWL: Lowest water level) ⑮ Conductivity electrode ⑳ Safety valve (number is country-specific) ㉑ Air vent shut-off valve (optional) | <ul style="list-style-type: none"> ㉒ Steam shut-off valve ㉓ Feedwater shut-off valve ㉔ Feedwater check valve ㉕ Blow-down shut-off valve ㉖ Blow-down valve ㉗ Desalination shut-off valve ㉘ Desalination control valve ㉙ Water level indicator ㉚ Pressure gauge ㉛ Maximum pressure limiter ㉜ Pressure transducer ㉝ Straight-through shut-off valve with cap (optional) ㉞ Temperature indicator for feedwater ㉟ Sample cooler |
|---|--|

Note

Illustration of fitting assembly ④① to ④④, applies to modulating operation. For stepped operation, provide the required number of pressure regulators in place of the pressure transducer.

Description of selected components in a steam boiler system



Detailed information

Manufacturer's documents for the individual components

Level electrodes ⑩ to ⑫

Permanently modulating water level control ⑩

Level electrode for continual and load-dependent steam boiler filling

Function	Operation	Operating information
Continual water level control comprising: ▪ Level electrode ▪ Level controller Continual control of the boiler water level via a feedwater control valve or variable speed pump	Water level differs from set value.	The controller issues pulse to feedwater control valve or variable speed pump. The filling of the steam boiler is continual and load-dependent.

Tab. 1

Maximum water level (HW electrode ⑪)

Level electrode to safeguard against overfilling

Function	Operating condition	Operating information
Self-monitoring overflow protection comprising: ▪ Level electrode ▪ Evaluation device	Standard water level	Electrode is not immersed in conducting boiler water.
		Feedwater pump operation enabled.
		Feedwater pump operates.
		The filling of the steam boiler is continual and load-dependent.
	High water level	Electrode is immersed in conducting boiler water. Registers a high resistance.
		The feedwater pump is shut down via the pump relay.
		Feedwater supply to the steam boiler interrupted.
The level drops again	Feedwater pump starts automatically, dependent on demand.	

Tab. 2

Additional HW electrode for up to 72 h operation without continuous supervision according to TRD 604

According to EN 12953-6, for a system with up to 72 h operation without continuous supervision, this function can also be performed by level electrode ⑩.

Note

Observe country-specific regulations.

Description of selected components in a steam... (cont.)

Lowest water level (NW electrode/low water level LWL ⑫)

Level electrode to safeguard against water shortage

Function	Operating condition	Operating information
Self-monitoring low water indicator comprising: <ul style="list-style-type: none"> ▪ 2 level electrodes ▪ Evaluation devices 	Standard water level	Burner operation enabled.
		Safety chain closed.
		Electrode is immersed in conducting boiler water. Registers low resistance.
	Too low water level	Electrode is not immersed in conducting boiler water. Registers a high resistance.
		Safety chain and burner operation constantly interrupted.
	Min. boiler water capacity reached	Re-enable safety chain.
Burner block lifted.		

Tab. 3

Safety valve ⑳

- Function
- Physical protection of the steam boiler against pressures in excess of the max. permissible operating pressure PS
 - Valve response pressure = permissible steam boiler operating pressure
 - Valve discharge rating \geq max. steam output (steam boiler)
 - Maximum pressure increase until the SIV opens completely (at maximum discharge) = PS + 10 %
 - Closing pressure is PS - 10 %


Testing/checks	Operating information
Operating checks at regular intervals or in accordance with country-specific regulations	Vent the lever briefly - do not release the lever (see manufacturer's operating instructions).
Regular checking by an authorised contractor or test body	Never remove the lead seal.

Tab. 4

Air vent shut-off valve ㉑ (optional)

Function	Operation	Operating information
Venting the steam boiler during filling or after a new system start at atmospheric pressure	Open the valve during the heating process. As soon as you see steam emerging, close the valve again.	Discharge hot air/steam safely.

Tab. 5

 **Danger**
 Hot air/steam can cause severe burns.
 Discharge hot air/steam safely. Observe safety regulations.

Steam shut-off valve ㉒

Function	Operation	Operating information
Main steam boiler shut-off to the steam supply	Releasing steam or isolating the steam boiler	Open slowly to avoid steam hammer.

Tab. 6


Description of selected components in a steam... (cont.)

Blow-down (25) and (26)

Function: Periodic removal of deposits from the boiler

Operation	Operating information
Regular automatic blow-down via automated programs	Program switch opens the blow-down valve via the control valve. Briefly drain off the boiler water. The resulting suction removes the sludge from the steam boiler. Manual activation possible at any time.
Observe country-specific regulations concerning regular manual blow-down.	Push the locking lever of the blow-down valve to the side.
	Push down on the activating lever of the blow-down valve for 2 to 3 seconds.

Tab. 7

 **Danger**
A lever that kicks back may cause injury.
Do not release the lever.

TDS unit (27) and (28)

Function

- Continual checking and regulation of the salt content through temperature-compensated conductivity electrode
- Desalination via TDS valve
- Valve operates within specified limits

Operation		Operating condition
Conductivity	Falling	Flow rate is reduced.
	Exceeds the set value	Valve is opened further.
	Exceeds the highest value	Safety chain is interrupted. Burner operation is interrupted.

Tab. 8

Water level indicator (40)

Function: Visual and direct water level indication

Operation	Operating information
Visual water level check	Valve on the steam and water side: Shut-off device is "OPEN"
	Flushing valve: Shut-off device is "CLOSED"
When there are no operating personnel present	Keep valves "CLOSED"

Description of selected components in a steam... (cont.)

Operation	Operating information
Regular operating checks. Observe country-specific regulations.	Close the valve on the water and steam side
	Open flushing valve, drain and check the valves for tightness
	Open the valve on the water side; check for discharge noise
	Close valve on the water side
	Open the valve on the steam side; check for discharge noise
	Leave the valve on the steam side open
	Close the flushing valve
	Open valve on the water side
The water column rises quickly to the correct level.	If the water column rises slowly, check if there is a blockage

Tab. 9

Pressure monitoring unit ④① to ④④

The pressure monitoring unit is directly connected to the steam boiler via the fitting assembly.

Component	Function	Operating information
Pressure gauge ④①	Operating pressure indicator	Regular operating check. Observe country-specific regulations.
Pressure limiter ④②	If maximum pressure is exceeded: Protect the steam boiler against positive pressure	Checking with a calibrated test pressure gauge by an authorised contractor or test body
		Safety chain interrupted by opening a contact in the pressure limiter. Burner operation is interrupted. <ul style="list-style-type: none"> ▪ Safety chain is reset by pressing the button on the control panel and the pressure limiter. ▪ Reduce boiler pressure via air vent valve or main steam valve: Approx. 1 bar below the switching point of the max. pressure limiter ▪ Reset the max. pressure limiter. ▪ Burner starts again.
Pressure transducer ④③	Load-dependent regulation of the boiler combustion subject to the operating pressure	
Straight-through shut-off valve with cap ④④	Enables the replacement of faulty components	Only by authorised contractors

Tab. 10

Sample cooler ④⑥

Function	Operating information
Removal of water samples to carry out comparative tests	Measure and document the following values in the operator's log: <ul style="list-style-type: none"> ▪ pH value ▪ Residual hardness ▪ p value (value to determine the free alkalinity) ▪ m value (value to determine the entire alkalinity) ▪ Phosphate ▪ Sulphide Measure and document additional values according to the country-specific regulations.

Tab. 11

Shutdown

Shutdown means shutting down the system via the circuit breaker at the control panel. The duration of the shutdown determines the preservation measures described in this chapter.

A short-term shutdown is not recommended, as every start-up process subjects the boiler to additional stresses. For up to 72 hours, for example over a weekend, the boiler should be left to continue operating.

If pressure can be reduced via an additional pressure regulator or via the programmable logic controller (PLC), then the boiler pressure can be reduced by up to 2 bar below operating pressure. Close the steam valve downstream of the thermal water treatment (TWT) outlet.

Note

Keep the TWT and boiler under pressure when taking the system briefly out of use.

Steps to shut down the boiler

1. Shut down combustion system and close the fuel valve.
2. Feed the boiler up to the controlled water level.
3. Close the steam and feedwater valve (see notes on TWT).
4. Switch the circuit breaker on the control panel to "OFF".

What preservation is for

A depressurised boiler system is at risk from idle-time corrosion. Preservation prevents such corrosion. Preservation measures are carried out on surfaces on the flue gas and water side of boiler systems. The type of preservation depends on the type and duration of the interruption in operation.

Type of preservation	Effect
Wet preservation	Keeps oxygen away from the boiler system
Dry preservation	Keeps moisture in the boiler system to a minimum

Tab. 12

Interruption in operation

Duration	Recommendation
≤ 3 days	Maintain the positive pressure in the boiler system incl. all boiler-related equipment (thermal water treatment, etc.).
> 3 days	Select type of preservation.

Tab. 13

Note

If using chemicals other than those stated here, please consult the manufacturers of the chemicals with regard to the procedures to be used.

Basic rule:

VdTÜV datasheet TC 1465 "Preserving the water side of steam boilers"

Brief interruption in operation ≤ 3 days

Treatment for preservation of the water side

Operating condition	Measures
The boiler is switched off.	Add oxygen binder to the feedwater 1 hour before switching off . Dosing: 2 to 3 times the standard dose
The boiler remains on.	Maintain the boiler system pressure and temperature.

Tab. 14

Treating the flue gas side

- Keep heating surfaces dry.
- Heavy contamination causes moisture and must be removed.

Preservation with ammonia or nitrogen

- Both preservation methods require extensive technical effort.
- Consult the chemical manufacturers before use.
- The operator must compile system-specific operating instructions.

Shutdown (cont.)

Interruption in operation > 3 days

Treatment for preservation of the water side

Dry preservation

Note

Restarting the system quickly is not possible.

Applications:

- Prolonged boiler idle periods
- Risk of frost^{*1}

1. Drain the steam boiler.



Please note

Draining hot water into the sewage system causes environmental damage. Therefore cool the water to < 35 °C beforehand. If necessary, collect it in containers.

2. Flush the steam boiler again on the water side, using high salt content flushing water (> 5000 µS/cm).

3. Open the water closures.

Note

Components such as ECO must be dried out separately.

4. Dry the boiler system thoroughly.
5. Place desiccant (silica gel) in the boiler system in accordance with the manufacturer's instructions.

Note

Ensure that the desiccant does not come into direct contact with the boiler material.

6. Close the boiler system.
7. Check the effectiveness of the desiccant regularly.

Wet preservation

1. Fill the boiler system (incl. ECO, if installed) up to the highest possible level with treated feedwater.

2. **Note**

To prevent oxygen corrosion, mix oxygen binder, e.g. sodium sulphite, into the boiler water in accordance with the manufacturer's instructions.

Mix the oxygen binder thoroughly with the boiler water by means of thermal or mechanical circulation.

3. Check the concentration of the oxygen binder at regular intervals and at least every month. If necessary, add more oxygen binder.

Preservation with sodium sulphite

1. Add the sodium sulphite in soluble form to the completely drained steam boiler via the feedwater pump.

Note

When carrying out the preservation, keep all valves/fittings closed.

2. Fill the steam boiler completely. Also fill the ECO (if installed).
3. Set pH value to between 11 and 12.
4. Circulate preservation solution weekly.

5. **Circulation**

Initially, check the sulphide excess frequently, then at least monthly. If the concentration falls below the specified standard values, recirculate and top up if necessary.

6. For unvented, cold treated water: Add an additional 80 g desiccated or 160 g crystallised sodium sulphite per 1 m³.

^{*1} See the "Using antifreeze in boilers" chapter in the technical guide

Shutdown (cont.)**Sodium sulphite excess**

Type of fill water for steam boilers	Idle time	Sodium sulphite concentration Na ₂ SO ₃ in preserving solution mg/l	Additional sodium sulphite	
			Desiccated g/m ³	Crystallised g/m ³
Low salt content, fully desalinated or condensate	1 week	20 - 50	20 - 50	40 - 100
	1 month	100 - 200	100 - 200	200 - 400
	> 1 month	200 - 500	200 - 500	500 - 1000
Saline, e.g. softened water or boiler water	1 week	40 - 100	40 - 100	80 - 100
	> 1 week	400 - 1000	400 - 1000	800 - 2000

Tab. 15

**Please note**

Film forming amines can cause damage to the boiler.
Do not use film forming amines.

Applicable regulations:

- For draining preserving solutions:
Observe conditions for draining waste water into sewer systems or the main discharge system.
- For the use of preserving agents:
Observe working instructions and safety datasheets supplied by the product manufacturer.

Preservation through physical-technical measures

The following physical-technical procedures can also be used for preservation:

- Maintain a positive steam pressure in the steam or hot water boiler
- Flow preservation of steam boilers

Preserving individual areas of a multi boiler system

The relevant individual boilers are kept at temperature by pumping boiler water from the rest of the boiler system through them.

Corrosion protection on the entire boiler shell

A fully filled boiler shell is maintained at a pressure of 0.1 to 0.2 bar using nitrogen, specifically nitrogen 5.0.

**Please note**

Frost may cause damage to the boiler.
Do not use wet preservation if there is a risk of frost!^{*1}

**Please note**

Do not use layer-forming monoamines.
The use of film-forming polyamines must be agreed with and approved by the boiler manufacturer.

Recommendation

Agree the steps for the preservation of the water side with the manufacturer of the preserving agent.

Applicable regulations**Draining preserving solutions**

- Conditions for draining waste water into sewer systems or the main discharge system

Use of preserving agents

- Working instructions and safety datasheets supplied by the product manufacturer

Treating the flue gas side

1. Clean the heating surfaces on the flue gas side. Maintain the alkaline balance of the water used for cleaning at pH 8 to 9, or, in the case of ammonia, pH 10.
2. Dry the heating surfaces on the flue gas side (allow normal air flow).
3. Accelerate the ventilation process by means of a fan heater. If necessary, open the flue gas shut-off dampers, then close them again.
4. Spray preserving oil, e.g. graphite or varnish, onto the flame tube walls and hot gas flues, or apply it with a brush.
5. Keep the boiler door(s) open. Keep the boiler surfaces dry during idle periods.
6. Apply a desiccant (silica gel).
7. Use a dryer with a fan.

*1 See the "Using antifreeze in boilers" chapter in the technical guide

Shutdown and preservation

Shutdown (cont.)

Recommendation for areas with high relative humidity

Do not use dry preservation in areas with high relative humidity (in the tropics, near the sea) due to the special installation conditions that prevail in these areas.



Detailed information

- Operating instructions for preservation on the water and hot gas side
- Datasheets of the VdTÜV, no. MB TECH 1466, dated 2014-01, and the VGB, no. R116H, dated 2009

Information on maintenance

Correct maintenance ensures trouble-free, efficient and environmentally responsible system operation:

- Observe the specified maintenance intervals
- Only use authorised companies:
 - Viessmann Industrial Service (see contact details)
 - Other authorised contractors

Preventing excessive flue gas temperatures

Excessively high flue gas temperatures make the system less efficient

Recommendation

Continuous monitoring of the flue gas temperature using a flue gas thermometer.

Cause of fault	Remedy
Altered burner adjustment	Adjust the burner correctly
Contaminated boiler system	Clean the boiler system

Tab. 16

Standard values for water quality

Advantages of complying with the guidelines

- Prolongs boiler service life.
- Reduces repair costs.

Advantages of using a chemical water treatment

- The specified standard values and water conditions are observed.
- No additional corrosion protection is required
 - if the system is designed as a hot water heating system sealed against corrosion and
 - If all other instructions stated in the "Standard values for water quality" chapter are complied with.

Recommendation

Use a chemical water treatment system in the boiler system.

Please contact Viessmann for a quotation.

Note

Observation of the following requirements is a necessary condition for safeguarding your warranty rights. The warranty excludes damage due to corrosion and scaling. Prevention of damage due to scaling.

Raw water

Not usually suitable as boiler feedwater in its delivered state and must be treated before use. The type of boiler feedwater treatment depends on the raw water quality. As the water quality may change, regular checks are required.

Top-up water

A suitable water meter should be installed in the water supply pipe for treating the boiler feedwater. This records the amount of top-up water added to the recycled condensate. It will also indirectly monitor the amount of steam removal.

Condensate return

Where possible, feed the condensate back to the feedwater tank without loss. To fulfil the boiler feedwater requirements (Tab. 15), the condensate may need to be treated.

Water treatment system

Depending on raw water quality and amount of top-up water, the raw water and top-up water must be adjusted to fulfil the boiler water requirements (Tab. 17 & 18 page 20).

In order to do this, a suitable chemical and thermal water treatment system must be installed.

Recommendation

Contact Viessmann for a quotation for a water treatment system.

If required, there must be an option to add oxygen binders to the feedwater tank or its inlet pipe (residual hardness stabilisers, alkalising agents and phosphates).

Depending on the operating mode (24 h or 72 h) and country-specific regulations, suitable test devices are used to ensure compliance with the requirements.

Entry in the operator's log

- Measurements
- Amounts of top-up water
- Chemical consumption
- Required maintenance

The operator's log can be used to simulate the operating conditions at any time.

Saline boiler feedwater requirements

Permissible operating pressure	bar	0.5 ≤ PS ≤ 20	PS > 20
General requirements		Colourless, clear, free of undissolved substances	
pH value at 25 °C		> 9	
Conductivity at 25 °C	μS/cm	Only standard values applicable to boiler water	
Total alkaline earths (Ca ²⁺ + Mg ²⁺)	mmol/l	< 0.01	
Oxygen (O ₂)	mg/l	< 0.05	< 0.02
Bound carbon dioxide (CO ₂)	mg/l	< 25	
Iron (Fe), total	mg/l	< 0.2	< 0.1
Copper (Cu), total	mg/l	< 0.05	< 0.01
Oxidability (Mn VII → Mn II) as KMnO ₄	mg/l	< 10	
Oil, grease	mg/l	< 1	

Tab. 17

Organic substances

In general, organic substances are mixtures of different compounds. The constitution of such mixtures and the characteristics of their components when subjected to boiler operating conditions are hard to predict.

Organic substances may break down into carbonic acid or other acid products. These increase conductivity and cause corrosion and deposits.

They can also lead to the formation of foam and deposits, which must be kept to a minimum. The TOC content (Total Organic Carbon) should also be kept to a minimum.

Boiler water requirements

Feedwater conductivity		> 30 μS/cm		≤ 30 μS/cm
Permissible operating pressure	bar	0.5 ≤ PS ≤ 20	PS > 20	PS > 0.5
General requirements		Colourless, clear, free of undissolved substances		
pH value at 25 °C		10.5 to 12	10.5 to 11.8	10 to 11 ^{*2,3}
Acid capacity (K _{S 8.2})	mmol/l	1 to 12	1 to 10	0.1 to 1.0 ^{*2}
Conductivity at 25 °C	μS/cm	< 6000	See Fig. 2	< 1500
Phosphate (PO ₄)	mg/l	10 to 20		6 to 15
Silicic acid (SiO ₄) ^{*4}	mg/l	Pressure-dependent, see Fig. 2 & 3		

Tab. 18

Detailed information EN 12953-10

^{*2} Demineralised water with mixed bed quality (conductivity < 0.2 μS/cm) may be used without a phosphate injection. As an alternative, AVT operation may be applied. Conditioning with volatile alkalis agents: pH value of feedwater pH ≥ 9.2 and pH value of boiler water pH ≥ 8.0. In such cases, the conductivity downstream of a severely acidic cation exchanger must be < 5 μS/cm.

^{*3} Standard pH value setting: Injection of Na₃PO₄, additional injection of Na OH (if the pH value < 10)

^{*4} If allowance is made for all other values, higher PO₄ concentrations are permissible when using phosphate. This applies, for example, to compensated or coordinated phosphate treatment (see section "Conditioning").

Saline boiler feedwater requirements (cont.)

Permissible direct conductivity of the boiler water, subject to pressure; feedwater conductivity > 30 $\mu\text{S}/\text{cm}$



Fig. 2 Direct conductivity

Conversion:

$$1 \text{ mol}/\text{m}^3 = 5.6 \text{ }^\circ\text{dH}$$

$$1 \text{ }^\circ\text{dH} = 0.179 \text{ mol}/\text{m}^3$$

$$1 \text{ mval}/\text{kg} = 2.8 \text{ }^\circ\text{dH}$$

Recommendation

Addition of phosphate, although not always necessary.

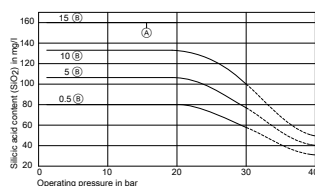


Fig. 3 Silicic acid content

(A) This level of alkalinity is not permissible > 20 bar.

(B) $K_{\text{S}8.2}$ - value in mmol/l

Recommendation

Operation with salt-free boiler feedwater is also possible as an alternative to operation with saline boiler feedwater.

Conditioning

General comments

Certain feedwater and boiler water characteristics must be improved (conditioned) through chemical treatment.

Aim of the conditioning:

- Support for the formation of magnetic layers or other protective oxidation layers
- Reducing corrosion, as the pH value is optimised
- Stabilising the hardness and preventing or reducing scaling and deposits
- Chemical binding of residual oxygen

Constituents of conventional conditioning agents: E.g. sodium and potassium hydroxide, sodium phosphate and sodium sulphite, ammonia and diamide

Note

In some countries or production processes, the use of some of these chemicals may be restricted.

Conductivity

Saline

- Feedwater with an electrical conductivity of > 30 $\mu\text{S}/\text{cm}$ (e.g. downstream of a softening system)

Low salt

- Feedwater with an electrical conductivity of 0.2 to 30 $\mu\text{S}/\text{cm}$ (e.g. downstream of a desalination system)

Saline boiler feedwater requirements (cont.)

Salt-free

- Feedwater with an electrical conductivity of $< 0.2 \mu\text{S}/\text{cm}$ and silicic acid concentration $< 0.02 \text{ mg/l}$
- Feedwater with an electrical conductivity of $< 5 \mu\text{S}/\text{cm}$ (e.g. downstream of a full desalination system with mixed bed quality)

Acid capacity $K_{\text{S} 8.2}$

A higher acid capacity in feedwater would indicate an excess of bound carbon dioxide.

This results in a higher putrefaction by alkalis of the boiler water, which leads to an increased risk of corrosion on the steam boiler, and also on the steam network downstream of the boiler through separation of vapour-volatile carbon dioxide.

Adjusting the alkalinity

The selection of the alkalis agent depends, amongst other things, on the use of the steam, the steam pressure and the type of water treatment. There are solid and volatile alkalis agents. Organic conditioning agents can also be used.

The amounts, procedures and analysis regulations of the supplier of the chemical products must be specified.

Oxygen and carbon dioxide or oxygen binders

Carbon dioxide and oxygen are expelled from the feedwater through full thermal deaeration.

In practical operation, if the oxygen content of the feedwater cannot be maintained below the permissible values, e.g. by increasing the idle periods, then the use of oxygen binders is required.

These "corrective chemicals" are mixed with the feedwater via the dosing equipment.

! Please note

- Film forming amines may cause damage to the boiler.
Do not use film forming amines.

Stress corrosion cracking

In case of damage, evaporation can lead to a concentration of the solute non-volatile boiler water constituents (salts, solid conditioning agents). Such conditions can lead to local alkali concentrations that result in stress corrosion cracking.

Preventing stress corrosion cracking⁵

If the recommended pH range is not achieved with sodium phosphate alone, sodium hydroxide may be used as the alkalis agent as an exception. With this method, sudden fluctuations in pH value result in low sodium hydroxide content.

Deviation during conditioning

Possible causes of differing values in continuous operation:

- Inadequate treatment of the top-up water
- Inadequate feedwater conditioning
- Advancing corrosion on some system components
- Water contamination: Ingress of contaminants from other systems, e.g. condensate tank, heat exchangers

Restoring correct operation immediately:

- Take suitable measures immediately.
- Recycled condensate must not be allowed to affect the feedwater quality.
- Recycled condensate must be treated if necessary.
- Check the chemical composition of the boiler water:
 - Through dosed addition of specified chemicals
 - Through continual or intermittent partial blow-down of the water volume

Recommendation

Remove dissolved and suspended impurities.

Conditioning and warranty

Note

Voiding the warranty

- *If film forming amines are used*
- *If dosing agents are used that are not listed in the guidelines*

⁵ With low buffered feedwater, conductivity $< 30 \mu\text{S}/\text{cm}$

Saline boiler feedwater requirements (cont.)

Sampling of water and steam

Guidelines

- Implementation according to ISO 5667-1
- Preparation of sampling and handling of samples according to ISO 5667-3

Sample cooler

The sample cooler is to be used for sampling.



Operating instructions for sample cooler

To be able to obtain a useful sample, the sampling line must be flushed for an appropriate time. Opaque or contaminated sample water must be filtered prior to testing.

The water sample is cooled by the sample cooler to approx. 25 °C.

Sampling points

Sampling points must be located at representative positions in the system.

Typical sampling points for boiler water:

- Boiler feedwater entry valve
- A drop chute or a continuous TDS line
- Downstream of the top-up water treatment system or the storage tanks
- At the outlet of the condensate tank (if installed)

Note

Take the sample as close to the feedwater tank as possible.

Sample analysis

The sample must be analysed immediately after extraction, as the values may change if left to stand too long.

General

The samples must be analysed to ensure that the boiler water properties match the values specified in Tab. 15 and 16.

If the boiler water properties are analysed according to other standards or by using indirect methods, these methods must be calibrated.

Procedure

A clean surface with water supply and drainage facility must be chosen to carry out the analysis. The required equipment must also be kept in a cupboard at the workplace.

Note

For some types of water, the amount of solute matter can be estimated by means of the conductivity. In addition there is a correlation between the pH value and both conductivities.

Recommendation

Please contact Viessmann for a quotation for water analysis components to aid continual monitoring of the O₂ and pH values as well as water hardness levels.

Test equipment and standardised analysis procedures

Test equipment

The test equipment is sufficient for taking measurements during ongoing boiler operation.

Standardised analysis procedures

If there are greater discrepancies, the values must be confirmed via the corresponding standardised analysis procedures. The cause of the discrepancy must be remedied.

Ion exchanger

1. The sample must pass through a strongly acidic ion exchanger with a volume of 1.5 l.
2. Continuously measure the conductivity of the acid (hydrogen ion concentration).
3. Continuously measure the conductivity in hydrogen form.

The exchanger is installed in a cylinder, with a diameter to height ratio of 1 to 3 or below. The exchanger medium takes up at least ¾ of the cylinder volume. The ion exchanger must be replaced as soon as it is ¾ depleted.

Saline boiler feedwater requirements (cont.)**Recommendation**

Use an ion exchanger with a colour display and a transparent cylinder. This allows you to determine the level of depletion.

Standards used to test the parameters:

Acid capacity	EN ISO 9963-1	Oxygen	ISO 5814
Conductivity	ISO 7888	pH value	ISO 10523
Copper	ISO 8288	Phosphate	ISO 6878-1
Iron	ISO 6332	Potassium	ISO 9964-2
		Silicic acid ^{*6}	–
		Sodium	ISO 9964-1
		TOC ^{*7}	ISO 8245
		Total hardness of calcium (Ca) + magnesium (Mg)	ISO 6059

^{*6} There is currently no European or international standard available. See for example DIN 38405-21 German standard methods for the examination of water, waste water and sludge; anions (group D); determination of dissolved silicic acid by spectrometry (D 21).

^{*7} As an alternative, with specified values the permanganate index can be measured according to ISO 8467.

Recommendation for commissioning

Approved for commissioning:

- Viessmann Industrial Service GmbH (for contact details see 30) or
- System installer
- An approved contractor or institution nominated by the system installer

A competent expert authority must be present. The completion of a **test report** is required.

Required signatories:

- System installer
- Official expert authority
- System user

The local flue gas inspector must be notified of the commissioning within 4 weeks.

Recommended operating conditions

- *Do not interrupt boiler operation, even if no heat is being drawn off temporarily*
- *Continuous monitoring of the specified operating pressure*
- *Water temperature: 70 °C*

Multi boiler systems with a boiler on permanent standby

Operating mode changeover should only be performed at longer intervals, e.g. during the annual inspection of the entire system.

Preparations for commissioning

It is a minimum requirement to perform the following steps under the responsibility of the installer before starting the boiler for the first time.

Check:

- Project-specific design of all pipes:
 - Retainers and extension options
 - Dewatering and drainage systems
 - Ventilation facilities
- Correct choice and installation of all fittings:
 - Correct pressure rating and materials
 - Flow direction and operating options
 - Correct flange connections
- Safe operation of all equipment in the boiler room:
 - Easy access to platforms and plinths
 - Handrails and insulation
 - Heating and ventilation
- Illumination
- Firefighting and "first aid"
- Turbulators (if installed) and removal of transport brackets
- Telephone system

Commissioning sequence

The commissioning sequence

- depends on the boiler equipment and type of auxiliary systems.
- must be determined for the specific system.

Standard sequence using a system for up to 72 h operation without continuous supervision as an example

- Commissioning the chemical water treatment system in accordance with the manufacturer's operating instructions; adjustment of the safety equipment for monitoring the required water quality
- Fill the feedwater tank with treated water and flush the feedwater pipes
- Commissioning the dosing equipment for feedwater conditioning
- Commissioning the control panel
- Commissioning the feedwater pumps
- Fill the boiler with feedwater until you can see the water level in the sight glass
- Adjusting the water level control
- Checking the water level limiting equipment
- Commissioning the burner
- Function check of the safety pressure limiter
- Safety valve function check
- TDS controller adjustment
- Checking the closures on the water side

Commissioning the control panel

- Visual inspection
- Switching on mains isolator
- Switching on the individual control fuses
- Checking individual functions
- Checking the function of the display
- Checking the rotational direction of motors and actuators
- Checking the "EMERGENCY STOP" function

Commissioning the feedwater pumps

- Filling the pumps with medium
- Starting the pumps and checking the rotational direction
- Adjust the operating pressure of the pumps during the first filling of the boiler. Supply pressure must be lower than the max. operating pressure
- Checking the activity and function of the dry-run protection

Filling the boiler with feedwater

Check:

- Drain outlet (blow-down valve) is closed
- TDS valve is in the "CLOSED" position
- Air vent valve is open (optional)
- Steam valve is closed
- All inspection ports in the water area are watertight. Replace damaged gaskets
- Air vent valve is open and drain outlet is closed (if ECO installed)
- Water level indicators are open. Flush on the DHW side if required

Adjusting the water level control

1. Stepped control

- Checking the switching points for pump "ON" and pump "OFF" via the water level indicator.

2. Constant control

1. As soon as the water level has been reached, adjust the 0 % point on the low water level indicator.
2. Fill the boiler up to the top edge of the sight glass and adjust the 100 % point at the controller.
3. Set the feedwater valve to "CLOSED" via the controller and adjust the 0 % point of the valve at the controller.
4. Set the feedwater valve to "OPEN" via the controller and adjust the 100 % point of the valve at the controller.
5. Set the limit switch at the straight-through feedwater valve for pump to "OFF".
6. Preset the switching points for pump "ON" and pump "OFF" at the controller, whilst the boiler starts with the steam valve closed.
7. Set feed pump switch to automatic at the control panel and check the function of the water level control.
8. Constant control steps 1+2 must be repeated once the burner has started and the boiler is under pressure. As the boiler water heats up and consequently expands, check the low and high water level indicators again.
9. Reduce the water level back to the 0 % point via the blow-down valve and readjust at the controller.
10. Bring the boiler to the required water level and adjust the set value at the controller.

Checking the water level limiter

- As soon as the low water indicator level (LWL) has been reached, reset the water level limiter in the control panel via the boiler safety chain reset.
- Refer to the manufacturer's operating instructions to check if the water level limiters meet the operating conditions. For this, take the feed system out of use and reduce the water level in the boiler to the low water level by drawing steam or by means of a blow-down.

Note

Both water level limiters must respond.

Commissioning sequence (cont.)

Commissioning the burner

Requirements

- Fuel supply is enabled.
- For gas combustion:
 - Gas supply must have been enabled by the local gas supplier.
 - The quick-acting gas shut-off valve at the entry into the building must function correctly.
 - Gas lines in the boiler house must be checked and released for commissioning in writing by the installer.
- For oil operation:
 - Quick-acting oil shut-off valve at the tank must function correctly.

Start the burner according to the operating instructions.



Burner manufacturer's documentation

Any required gas warning equipment must function correctly. No unauthorised personnel should be in the boiler house when the burner is being commissioned. Once the combustion is steady, start the steam boiler at max. 30 % of combustion heating output and heat up to a pressure of approx. 20 % below operating pressure. Once that value has been reached, enable the burner load up to rated output. Now slowly open the steam valve and close the air vent valve (optional). Clean (blow out) the steam pipes according to the user specifications. Ensure adequate drainage of the steam systems. Once steam removal is steady, fine tune the combustion system. Agree the operating pressure subject to the safety pressure with the system user.

Function check of the safety pressure limiter

Required settings for the safety pressure limiter: The safety pressure limiter must switch the boiler to fault state before the safety valve responds. The set pressure depends on the system.

It must be set subject to the safety pressure and operating pressure. It must lie below the response pressure of the safety valve.

Make the function check with a closed steam valve and by bypassing the pressure controller (key switch or test button on the control panel).

The burner may be operated with partial load. After the safety pressure limiter has responded and has switched off the boiler, it must be reset once the boiler pressure has dropped again.

The boiler can then be restarted in standard mode. After a successful function check, the safety pressure limiter must be sealed to protect it against unauthorised adjustment.

Safety valve function check

This function check serves to check the set pressure and to verify that the safety valve is capable of blowing off the amount of steam occurring at full load.

Check first:

- The discharge pipe has been properly routed and secured
- The drain line is connected to the safety valve
- The outlet is clear

Make sure that there are no people in the area.

To check the safety valve:

- Close the steam valve
- Bypass the pressure regulator (key switch or test button on the control panel)
- Bypass the safety pressure limiter in the control panel
- Set the burner to full load

The safety valve must open as soon as the set pressure has been reached. The set pressure must be equal to or less than the permissible operating pressure of the boiler.

The boiler pressure can rise up to 10 % above the permissible operating pressure before the safety valve opens.

As long as the pressure in the boiler remains below this value, the safety valve will function perfectly. The boiler can then be switched off. The function check must only be carried out with a trained supervisor. For this ensure that the boiler can be shut down immediately and at any time via the "EMERGENCY STOP".

Commissioning sequence (cont.)

TDS controller adjustment

Set according to the manufacturer's specifications. The max. possible conductivity of the boiler water is stated in the water standards, e.g. EN 12953-10 or the chapter "Standard values for water quality" on page 19. Statements made in the water standards may differ. Never exceed the maximum values of 6000 $\mu\text{S}/\text{cm}$ to 20 bar.

Agree the control value with the user. Test the limit value switch function regarding the max. conductivity by reducing the set value.

Checking the closures on the water side

During commissioning, check all closures and flanges on the water side for tightness and retighten according to table 19 on page 34.

Commissioning following boiler idle time

Commissioning following idle time must generally be carried out by the on-site operating personnel. Starting the boiler from the external control room is not permissible.

The following sequence must be observed:

1. Walk around the system to visually check its correct condition
2. Commission the control panel – circuit breaker "ON"
3. Commission the feed
4. Check the water level and the function of the water level indicator as well as that of the water level control
5. Commission the combustion with the steam valve closed
6. Control the output to partial load or stage 1
7. Check the water level and reduce it by means of a blow-down as soon as high water has been reached.
8. As soon as the boiler pressure rises to 3 bar below the permissible operating pressure, slowly open the steam valve.
9. For further checks see chapter "Recommendation for monitoring" on page 29
10. For systems without temporary supervision: After starting commissioning, the system must be monitored for 1 hour by the operating personnel.

Boilout

For technical or safety reasons, a boilout prior to commissioning the boiler is not required for shell boilers.

Report

The commissioning must be logged by recording the set and adjusted values.

This report must be signed by the customer.

Instructions

The operating personnel must be trained following commissioning.

Commissioning must be logged.

Recommendation for monitoring

The monitoring intervals are subject to the user specification and the national regulations applicable in the country of installation. The operator should treat the operating, maintenance and inspection tasks detailed in the checklist on page 55 as a minimum requirement.

Testing intervals

- **Per shift/day/week/month**

Performed by the operator: For systems with operation for 72 hours without supervision, the period "Day" means "every 3 days".

- **Every 6 months/12 months**

If possible, these checks should be performed by a contractor service department, e.g. Viessmann Industrieservice or the manufacturer of the boiler system or burner, or by the water treatment company.

All test results must be recorded in a verifiable manner (master copy included in the appendix).

Operator's log

This operator's log should be presented to the authorised supervisory body during every inspection.

The following should be recorded in the operator's log:

- Confirmation of the inspection tasks carried out signed by boiler technicians
- Confirmation by a trained person regarding the inspection and maintenance work carried out at the control and limiting equipment every six months

- Result of the regular water checks carried out as part of standard operation
- All fault cases and special findings during inspections and maintenance of the steam boiler system

What to do in the event of operating faults

For action in the event of operating faults, refer to the operating instructions. The following highlights some aspects that are the result of general operating experience.

Immediately shut off any leaking steam pipes, valves/fittings and other operating equipment of the steam boiler system. If they cannot be shut off, delimit, mark and monitor the leaking areas.

Hazard prevention:

- Hazardous areas may only be entered if instructed to do so by the person responsible and once the danger area has been made safe to the extent required.
- System components which have been switched off may only be switched on again on the instruction of the person responsible. Before the instruction is given, remedy the causes of the shutdown and check the components on site.
- Immediately shut down the steam boiler system and inform the supervisor, as soon as it is suspected that the steam boiler may be entering a hazardous state.

Particularly hazardous events are e.g.

- A boiler wall shows signs of glowing red hot or of a deformation.
- The safety valve fails to respond.
- Correct operation of the controllers, water level limiters or flame monitors cannot be ensured.
- A fuel discharge is identified.
- An explosion occurs or irregularities are noticed in combustion mode.
- A leakage of medium is identified in the boiler pressure component.

If safety-related conditions exist for specific boilers (see page 3), shut them off from any boilers connected in parallel.

If emergency operation has to be enabled for operational reasons, agree the required measures with the approved inspection body and the manufacturer.

What to do in the event of operating faults (cont.)

Contact details for Viessmann Industrial Service

GmbH

Telephone: +49 180 3843776

Email: industrialservice@viessmann.com

Maintenance

General requirements

Repair work may only commence after the person responsible for such repairs has carried out the following steps.

- The required safety measures have been determined.
- The implementation of the safety measures has been checked.
- The work area has been given the all clear.

Following the completion of the work, safety measures may only be removed on the instruction of the person whose responsibility they are. Keep all gaskets in the closures, e.g. doors, clean and dry.

Additives, such as sealing compounds or separating agents must generally not be used. Exceptions require the agreement of the gasket manufacturer. Only use gaskets in their original condition and in accordance with the manufacturer's installation and operating instructions.

Working on the boiler system



Danger

Systems and components (e.g. steam pipe valves/fittings) may be pressurised and/or carrying a hot medium. Uncontrolled release of the medium may cause serious injury. Do not start work on boiler systems until the boilers have been depressurised and cooled down.



Danger

Hot air/steam can cause severe burns. Discharge hot air/steam safely. Observe safety regulations.

During operation, boiler systems are under pressure and carry hot media.

Work inside areas at risk may only be commenced after:

- The system or system parts has/have been safely depressurised and no vacuum is present.
- The system has been depressurised.
- A person to whom the operator has delegated the responsibility confirms that these measures have been carried out and certifies in writing that it is safe to work in this area.

The same applies to pipes which are separated from the system to allow it to be shut down. These required measures that depend on the individual system must be laid down in writing by the user in the form of operating instructions.

Inspection

Safe inspection of the steam boiler

Recommendation

When inspecting the steam boiler we recommend observing DGUV rule 113-004 (D) "Tanks, silos and confined spaces, Part 1: Working in tanks, silos and confined spaces".

Before an authorised person can enter the steam boiler, all pipe connections (steam, feed and drainage facilities) to the steam boiler still in operation must be securely and visibly separated. Pipe sections must be removed or blank flanges installed.

If pipelines with welded or seal-welded fittings are separated off by 2 shut-off devices in series, the outdoor air connection device that lies between them must be opened.

These shut-off devices must be locked and secured against unauthorised activation. Removing the hand wheels from these shut-off devices is not enough. Warning signs stating "**Danger! Persons inside the steam boiler**" must be affixed to the shut-off devices in a clearly visible location, and in such a way that the signs cannot be easily removed.

These warning signs may only be removed with the approval of the site manager. Steam boiler and flues must be well ventilated. In particular the start of the steam boiler inspection must be requested by the person with the appropriate authority. The inspection must be supervised. The person responsible for this must ensure that nobody is present in the above mentioned system components. Only then can the safety measures be removed.

Repairs and inspection

Inspection (cont.)

When inspecting the steam boiler and flues, only electrical equipment provided for that purpose by the operator or their representative may be used. This equipment including the connection cable and pipework must conform to the relevant regulations. Lamps must only be operated at safety voltages of up to 42 V.

The same regulations for hand-held electrical devices. If lamps or hand-held devices are being fed from an isolating transformer, higher voltages of up to 380 V are permissible. Extra low voltage (ELV) and isolating transformers must be located outside the steam boiler.

Inspections

The type and interval of the inspections depend on the regulations that apply in the country of installation. The Declaration of Conformity proposes that the system should be tested at the following intervals:

External test:	Annually
Internal test:	Every 3 years
Repeated pressure test:	Every 9 years, max. test pressure in accordance with the initial pressure test



Steps - commissioning, inspection and maintenance

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Commissioning the system



Operating instructions for burner and accessories

1. Check that the fuel being used is permissible for the current system configuration.
2. Open the boiler door/doors.
3. Insert the turbulators into the hot gas flues as far as they will go.
4. Close the boiler door(s).
5. Check that the inspection ports at the back of the boiler are closed.
6. Open the installation room vents.
7. Check the function of the water treatment system.
8. Fill the steam boiler with treated water to above the low water indicator level.

Note

Only use water that is suitable for the steam boiler (EN 12953-10). See "Standard values for water quality" from page 19 onwards.

9. Check all fitted components (pipework, valves, controllers, pumps etc.) for function and tightness.
10. Check the fuel supply pressure and tightness.
11. Open the flue gas damper (if installed).
12. Open the shut-off valves in the gas or oil line.
13. Start the system in the following order:
 1. Mains isolator
 2. Switches for all the equipment required for operating the boiler system
 3. ON/OFF switch for the burner

Note

Observe the burner manufacturer's operating instructions

14. Start the boiler at max. 30 % of combustion heating output and heat up to a pressure of 20 % below operating pressure.

Version with integral ECO

Manually activate the blow-down valve to repeatedly initiate a feedwater flow through the ECO. This will prevent steam hammer during heat-up.

15. Vent the boiler at the air vent valve during heat-up until steam is expelled. Then close the valve.

Note

If no air vent valve is included as part of standard delivery, vent the boiler via the safety valve during heat-up. When doing so, observe the relevant safety regulations.



Danger

Hot air/steam can cause severe burns. Discharge hot air/steam safely. Observe safety regulations.

16. Slowly open the steam valve after the required steam pressure has been reached, otherwise there is a risk of steam hammer.
17. While the system heats up, check the correct function of all control and safety equipment.
18. Observe the pressure and temperature test equipment.
19. If required, drain and vent the connection lines.
20. Check the closures for tightness and tighten if required. Tighten all closures when the permissible operating pressure has been reached.
21. After approx. 50 hours run, check the boiler door(s) for tightness. Tighten fittings if required.

Torque values under cold and hot conditions

Lock	Dimensions	Torque
Handhole	100 x 150 mm, M16	100 Nm
Headhole	220 x 320 mm, M20	200 Nm
Manhole	320 x 420 mm, M24	350 Nm
Inspection port	M10/M12	20 Nm
Fitting, boiler door(s)	M12	20 Nm

Tab. 19





Shutting down the system



Danger

Opening pressurised boiler connections and closures on the water and/or steam side may result in serious injury.

Only open connections and closures on the water and steam side after the boiler has been fully depressurised and has cooled down.

1. Shut down the burner.

2. Close the shut-off valves in the oil lines (at the tank and filter) or the gas shut-off valve.
3. Isolate the system from the power supply.
4. Close all valves.



Removing the burner (if required)

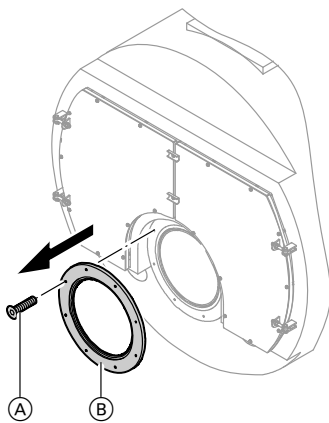


Fig. 4

1. Remove the fuel supply line.
2. Undo screws (A) and remove the burner with burner plate (B).



Please note

The burner and burner plate can twist or tilt during removal. This can cause damage to the burner entry point or boiler doors. Use a suitable tool/lifting apparatus.



Installation information "Insulation for burner entry point", burner installation and service instructions



Opening the boiler door(s)

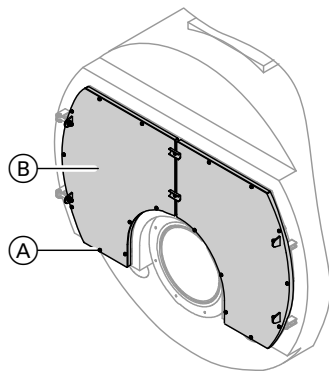


Fig. 5

Undo screws (A) and open boiler door(s) (B).

Note

There are versions of boiler door with hinges that open to the right or left.



Replacing the boiler door hinges.





Removing the inspection port closures

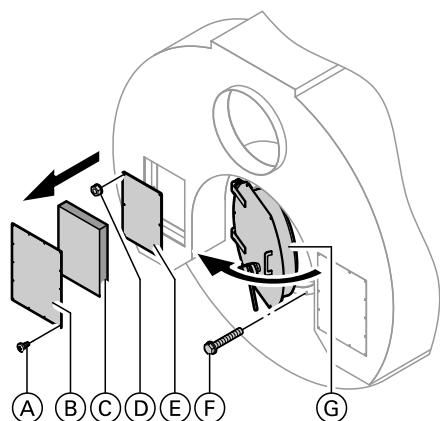


Fig. 6

1. Flue gas collector

1. Undo screws (A) from insulating fascia (B) and remove together with thermal insulation mat (C).
2. Undo screws (D) and remove cleaning cover (E).

2. Flame tube entry

2. Remove screws (F) and pivot cleaning door (G) open.

3. ECO/flue gas hood (option)

- Remove nuts (H) and cover (K).

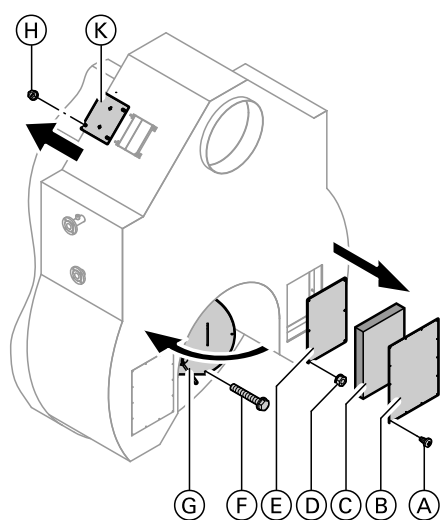


Fig. 7



Removing and cleaning the turbulators (if installed)

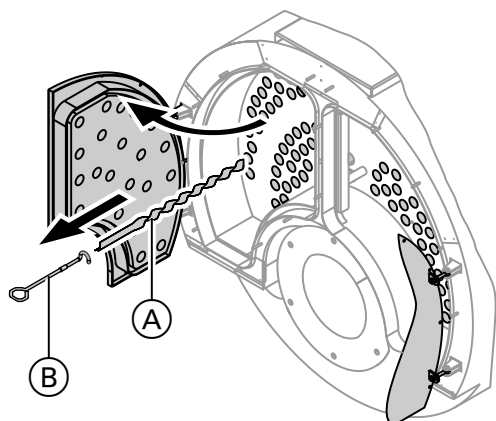


Fig. 8

1. Without using force, remove turbulators (A) with turbulator extractor (B).
2. Clean the turbulators.



Cleaning the heating surface and flue gas collector

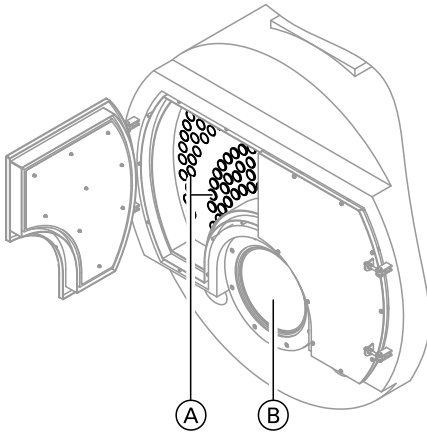


Fig. 9

1. Clean flues (A), flame tube (B) and the reversing chamber and remove combustion residues.
2. Remove combustion residues from the flue pipe and the flue outlet.



Cleaning Economiser heating surfaces

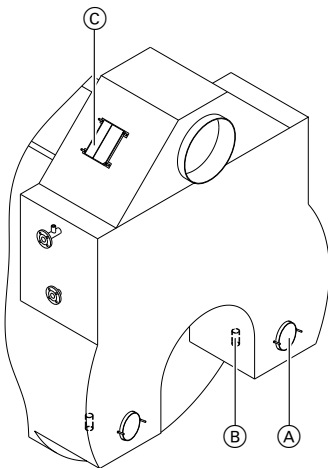


Fig. 10

1. Remove combustion residues via inspection ports (A) or drain cleaning water through condensate drain connectors (B) on the flue gas collector.
2. Clean the heat exchanger surfaces through inspection port (C), e.g. with pressure lances or, in cases of severe contamination, with feedwater.

Note

In the case of wet cleaning always ensure that the exchanger surfaces are at almost identical temperatures to the feedwater to prevent thermal stresses and thermal shocks.



Checking the gaskets and packing cords on the flue gas side



Cleaning the sight glass

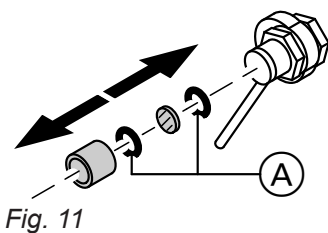


Fig. 11

Clean the sight glass. Check gaskets (A). Replace if necessary.





Checking the thermal insulation components and gaskets

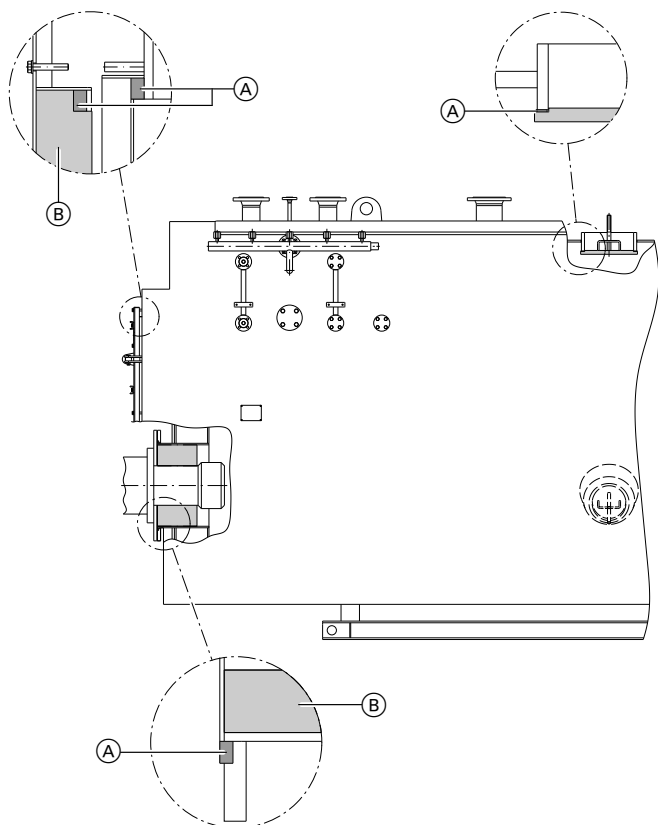
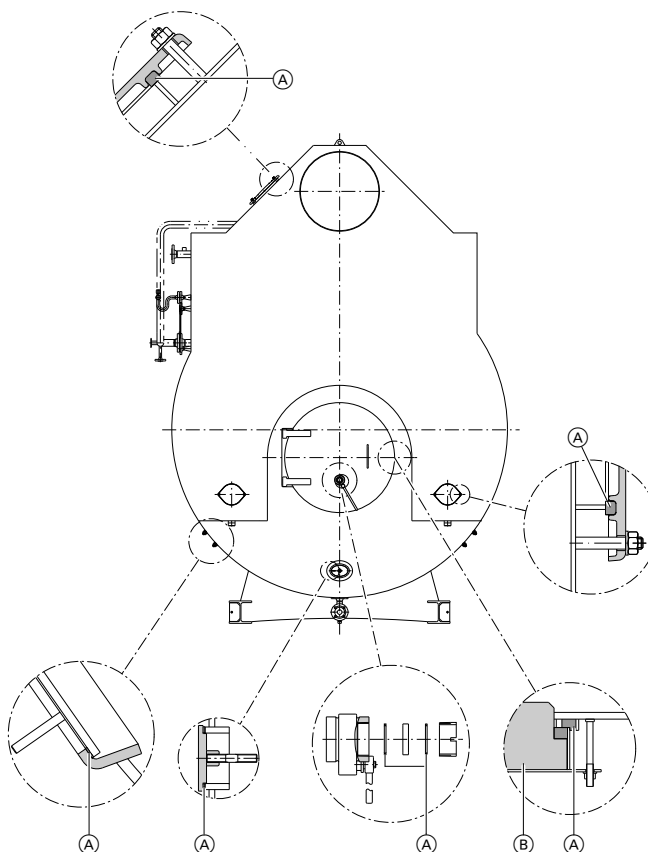


Fig. 12



Check gaskets (A) and thermal insulation sections (B), replace if necessary.



Inserting turbulators (if installed) and closing boiler door(s)

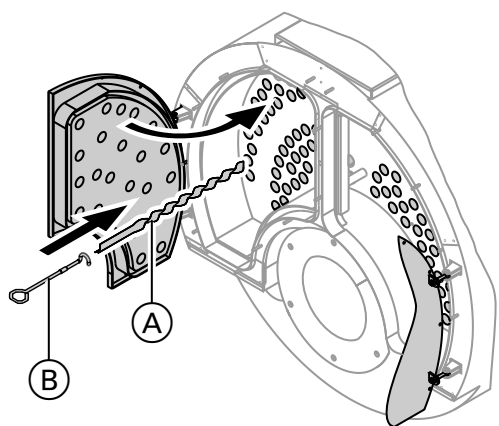


Fig. 13

1. Fully insert turbulators (A) into the 3rd flue. Use turbulator extractor (B).
2. Close the boiler door(s).
3. Tighten fittings evenly with approx. 20 Nm, until the boiler doors are flue gas-tight all the way round.



Danger

Leaks can result in poisoning through escaping gas.

Check the boiler door gasket for correct seating and realign if necessary.



Closing and securing the inspection ports

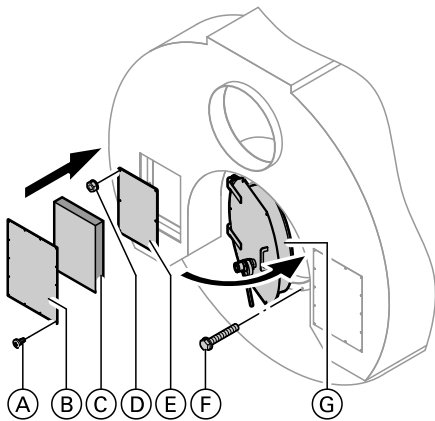


Fig. 14

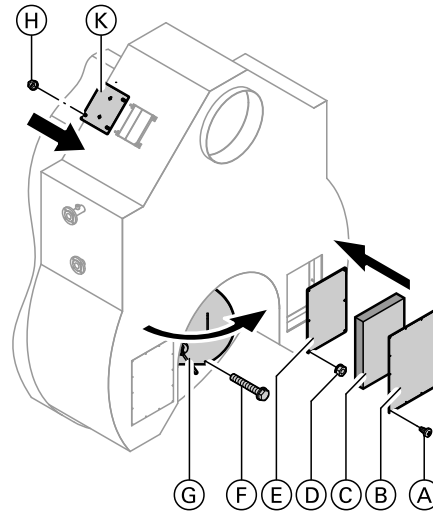


Fig. 15

Fit in reverse order to the description on page 36 "Removing the inspection port closures". Tightening torque approx. 20 Nm.



Checking the water chamber for deposits

1. Fully drain the boiler.
2. Clean the water chamber by hosing it down. Remove deposits via the drain outlet. Remove stubborn deposits with approved chemical solvents.
3. Clean the sealing faces and thread of the inspection port. Replace the gaskets. Lubricate the thread. After commissioning, tighten the closures. Check again after 24 hours run and tighten again if necessary (see Tab. 19 on page 34).



Checking the water side connections for tightness

Fill the boiler system with water.

Replace the gaskets every time the connections are opened:

1. Clean the sealing face.

2. Replace the gasket (see installation instructions).
3. After commissioning the system, tighten the closures (see Table 16 on page 34).



Checking the tightness of the inspection ports



Danger

The surfaces of steam boilers and hot water boilers and other areas of the system are potentially hot. **Risk of injury!** Always wear protection when touching the relevant areas during operation.



Installation instructions for the gaskets

Note

Replace the gaskets every time the closures and inspection ports are opened. Use only gaskets approved by the boiler manufacturer.



Checking the tightness of the inspection ports (cont.)

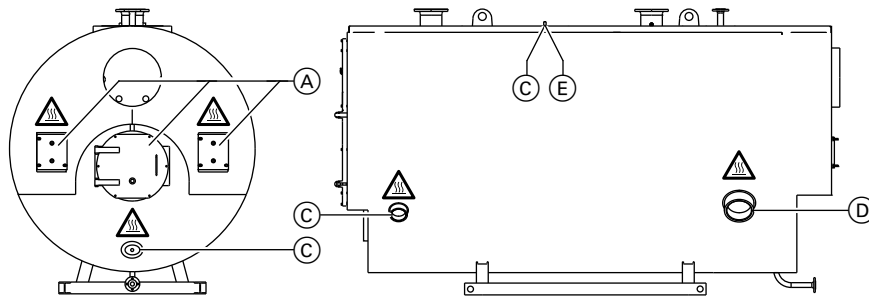


Fig. 16

- Caution - hot surface!
- Inspection ports
- Handhole

- Headhole
- Manhole

Note

If the optional thermal insulation is fitted, this must first be removed.



Checking the water level and system pressure

See page 12ff.



Checking the safety and control equipment



Checking the safety valve



Information on the safety valve



Checking the water quality

Document the top-up volume and overall hardness of the boiler water.

See chapter "Standard values for water quality" on page 19



Checking the thermal insulation



Checking the installation room ventilation



Checking the flue pipe for tightness



Adjusting the burner

The combustion heating output of the burner must not exceed the permissible combustion heating output of the boiler. Adjust the maximum gas or oil throughput of the burner to the rated boiler heating output.

Note

Limited-period operation (emergency mode) with fuel oil EL when equipped with ECO. Operation with fuel oil EL when equipped with ECO requires shorter cleaning intervals for the flue gas side.



Burner service instructions

Information on the use of low-NO_x burners

Incorrectly adjusted low-NO_x burners increase the levels of vibration and resonance during operation. This phenomenon can result in damage to the thermal insulation in the area of the boiler door(s), the cleaning aperture closures and the flue gas collector.

To prevent vibrations and resonances:

- Adjust the burner correctly.
- Prevent "Hard flame".
- Carefully monitor the operation of the burner during the 1st year of operation.
- Rectify operating faults immediately.

General conditions

The information and values in the tables relate to the following general conditions:

- O₂ content in dry flue gas
 - For natural gas 3.0 % by vol.
 - For fuel oil 3.0 % by vol.
- Feedwater temperature 102 °C
- TDS rate 0 %
- 100 % load
- Installation altitude < 500 m above sea level
- Combustion air temperature 25 °C

Calculating the combustion heating output

Calculation of the combustion heating output^{*8} using the nominal steam mass flow rate and operating pressure.

Values as an average for all boiler sizes.

^{*8} From boiler size D onward, the combustion heating output for operation with light fuel oil (HEL) is limited to 18 MW.





Calculating factor f

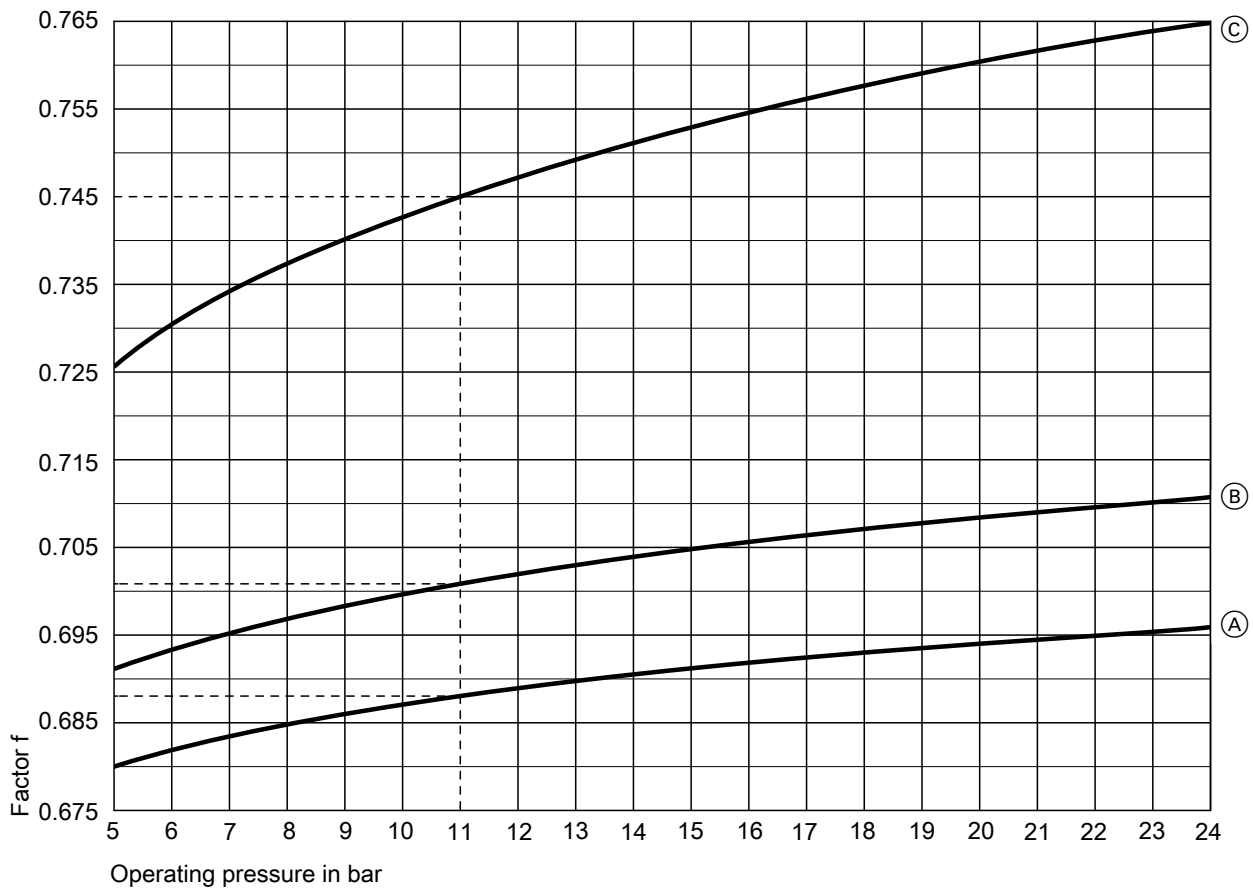


Fig. 17 M75C

- Ⓐ With ECO 2
- Ⓑ With ECO 1
- Ⓒ Without ECO

Calculating the combustion heating output

Combustion heating output in kW = factor f x nominal steam mass flow rate in kg/h

Example:

Nominal steam mass flow rate	10,000 kg/h	M75C
Operating pressure	11 bar	1. Operation with ECO 2 Factor f = 0.689 results in combustion heating output = 6890 kW, curve Ⓐ at 11 bar
		2. Operation with ECO 1 Factor f = 0.702 results in combustion heating output = 7020 kW, curve Ⓑ at 11 bar
		3. Operation without ECO Factor f = 0.745 results in combustion heating output = 7450 kW, curve Ⓒ at 11 bar




Adjusting the burner (cont.)

Flame tube temperature monitoring (FTM)

In line with the requirements of EN 12953-3, flame tube temperature monitoring (FTM) is necessary under the following conditions:

- Internal flame tube diameter for smooth pipes or average flame tube diameter for corrugated pipes > 1800 mm
- Combustion heating output for fuel oil > 14 MW or for natural gas > 18.2 MW

Furthermore, additional monitoring of the operating conditions is required if the flame tube clearance diameter for smooth pipes or the average flame tube diameter for corrugated pipes is > 1433 mm.

Type M73B and M73C

Boiler size			1	2	3	4	5	6	7	8	9
Nominal steam mass flow rate ⁹	t/h		0.50	0.70	1.00	1.30	1.65	2.00	2.50	3.20	4.00
Flame tube dimensions											
Diameter											
▪ Smooth pipe, int. \varnothing	d1	mm	468	508	556	581	631	656	706	756	806
▪ Corrugated pipe, int. \varnothing	d1	mm	—	—	—	—	—	—	—	750	800
Smooth pipe application limit		bar	>25	>25	>25	>25	>25	>25	>25	22	20
Length	a	mm	1350	1500	1710	1910	2130	2325	2535	2800	3085
Reversing chamber depth	b	mm	250			500					
Burner connections											
▪ Max. flame head \varnothing (optional wear-resistant burner entry point)	c	mm	240	240	290	290	320	370	370	420	470
▪ Max. flame head \varnothing (standard version)	c	mm	Adjusted subject to burner.								
▪ Minimum flame head length	e	mm	315			360					
Combustion chamber volume (min. values)											
▪ Flame tube		m ³	0.24	0.31	0.42	0.51	0.67	0.79	0.99	1.26	1.57
▪ Flame tube length and reversing chamber depth		m ³	0.29	0.37	0.54	0.64	0.82	0.95	1.19	1.48	1.83
Pressure drop on the flue gas side with natural gas											
For operating pressure											
▪ With ECO 2	5 bar	mbar	3.2	3.9	4.7	6.2	7.8	9.0	9.0	10.3	9.9
	23 bar	mbar	3.7	4.3	5.2	6.7	8.6	10.0	10.0	11.4	11.0
▪ With ECO 1	5 bar	mbar	3.2	3.7	4.5	5.8	7.4	8.5	8.9	10.1	9.8
	23 bar	mbar	3.6	4.1	5.0	6.4	8.2	9.4	9.8	11.1	11.2
▪ Without ECO	5 bar	mbar	3.3	3.8	7.4	8.8	10.4	9.9	10.6	12.5	12.4
	23 bar	mbar	3.9	4.4	8.7	10.4	12.3	11.6	12.5	14.8	14.6
Pressure drop on the flue gas side with EL fuel oil											
For operating pressure											
▪ With ECO 2	5 bar	mbar	3.0	3.6	4.4	5.8	7.3	8.4	8.4	9.7	8.9
	23 bar	mbar	3.5	4.0	4.9	6.3	8.0	9.4	9.3	10.7	9.9
▪ With ECO 1	5 bar	mbar	2.9	3.3	4.0	5.3	6.7	7.6	8.0	9.1	9.5

⁹ The actual nominal steam mass flow rate may vary subject to the specific system.




Adjusting the burner (cont.)

Boiler size			1	2	3	4	5	6	7	8	9
▪ Without ECO	23 bar	mbar	3.2	3.7	4.5	5.8	7.4	8.4	8.9	10.0	10.5
	5 bar	mbar	3.0	3.4	6.7	7.9	9.4	8.9	9.5	11.3	11.2
	23 bar	mbar	3.5	4.0	8.1	9.7	11.5	10.8	11.7	13.8	13.7

Type M75C

Boiler size			1	2	3	4	5	6	7	8
Nominal steam mass flow rate for operation with natural gas ^{*9}		t/h	5	6	7	8	10	12	14	16
Nominal steam mass flow rate for operation with light fuel oil (HEL) ^{*9}		t/h	5	6	7	8	10	12	14	14.4
Flame tube dimensions										
Diameter										
▪ Smooth pipe, int. Ø	d1	mm	856	906	931	981	1056	1106	1181	1231
▪ Corrugated pipe, int. Ø	d1	mm	850	900	925	975	1050	1100	1175	1225
Smooth pipe application limit		bar	18	18	16	16	13	13	10	10
Length	a	mm	3375	3625	3850	4075	4450	4800	5150	5525
Reversing chamber depth	b	mm	500							
Burner connections										
▪ Max. flame head Ø (optional wear-resistant burner entry point)	c	mm	520	520	590	590	590	710	710	810
▪ Max. flame head Ø (standard version)	c	mm	Adjusted subject to burner.							
▪ Minimum flame head length	e	mm	360							
Combustion chamber volume (min. values)										
▪ Flame tube		m ³	1.94	2.34	2.62	3.08	3.90	4.61	5.64	6.58
▪ Flame tube length and reversing chamber depth		m ³	2.23	2.66	2.96	3.46	4.34	5.09	6.19	7.20
Pressure drop on the flue gas side with natural gas										
For operating pressure										
▪ With ECO 2	5 bar	mbar	11.4	10.5	12.4	13.3	13.4	13.3	15.1	13.8
	23 bar ^{*10}	mbar	12.5	11.6	13.7	14.6	14.8	14.7	16.8	15.3
▪ With ECO 1	5 bar	mbar	9.8	10.1	11.5	12.3	11.9	12.7	13.9	12.4
	23 bar ^{*10}	mbar	10.8	11.1	12.8	13.6	13.1	14.1	15.5	13.7
▪ Without ECO	5 bar	mbar	11.3	12.5	13.6	13.3	12.7	14.5	13.1	11.2
	23 bar ^{*10}	mbar	13.3	14.7	16.1	15.7	14.9	17.2	15.3	13.0
Pressure drop on the flue gas side with EL fuel oil										
For operating pressure										
▪ With ECO 2	5 bar	mbar	10.2	9.4	11.1	12.0	11.9	12.0	13.4	9.6
	23 bar ^{*10}	mbar	11.2	10.4	12.3	13.1	13.3	13.2	14.9	10.8
▪ With ECO 1	5 bar	mbar	8.8	9.0	10.3	11.1	10.6	11.5	12.3	8.6

^{*9} The actual nominal steam mass flow rate may vary subject to the specific system.

^{*10} For boiler size B and above < 25 bar, the maximum operating pressure depends on the flame tube Ø.



Adjusting the burner (cont.)

Boiler size			1	2	3	4	5	6	7	8
▪ Without ECO	23 bar ⁺¹⁰	mbar	9.7	10.0	11.4	12.2	11.8	12.6	13.8	9.7
	5 bar	mbar	10.1	11.2	12.2	12.0	11.3	13.1	11.6	7.8
	23 bar ⁺¹⁰	mbar	11.9	13.2	14.4	14.1	13.4	15.4	13.6	9.2

Type M75C - continued

Boiler size			9	A	B	C	D	E	F	G	
Nominal steam mass flow rate for operation with natural gas ⁹		t/h	18	20	22	24	26	28	30	31.5	
Nominal steam mass flow rate for operation with light fuel oil (HEL) ⁹		t/h	15.7	17.3 ^{*11}	18.2 ^{*11}	18.8 ^{*11}	19.0 ^{*11}	22.1 ^{*11}	23.5 ^{*11}	24.4 ^{*11}	
Flame tube dimensions											
Diameter											
▪ Smooth pipe, int. \varnothing	d1	mm	1306	1381	1431	1506	1581	–	–	–	
▪ Corrugated pipe, int. \varnothing	d1	mm	1300	1375	1425	1500	1575	1625	1700	1750	
Smooth pipe application limit		bar	10	8	8	8	6	–	–	–	
Length	a	mm	5800	6075	6300	6550	6725	6900	7135	7675	
Reversing chamber depth	b	mm	500								
Burner connections											
▪ Max. flame head \varnothing (optional wear-resistant burner entry point)	c	mm	810	910	1010	1010	1010	1110	1110	1110	
▪ Max. flame head \varnothing (standard version)	c	mm	Adjusted subject to burner.							–	
▪ Minimum flame head length	e	mm	360								
Combustion chamber volume (min. values)											
▪ Flame tube		m ³	7.8	9.1	10.3	11.8	13.6	15.0	17.0	18.5	
▪ Flame tube length and reversing chamber depth		m ³	8.4	9.8	11.1	12.6	14.5	16.0	18.1	19.7	
Pressure drop on the flue gas side with natural gas											
For operating pressure											
▪ With ECO 2	5 bar	mbar	13.4	14.4	14.7	15.5	16.6	15.9	16.1	16.7	
	23 bar ⁺¹⁰	mbar	14.8	16.0	16.2	17.0	18.2	17.3	17.5	18.1	
▪ With ECO 1	5 bar	mbar	12.7	13.7	13.7	14.5	15.5	14.9	15.2	15.8	
	23 bar ⁺¹⁰	mbar	14.1	15.1	15.1	16.0	17.1	16.3	16.6	17.1	
▪ Without ECO	5 bar	mbar	11.9	12.6	13.5	14.0	14.9	14.6	15.0	15.6	
	23 bar ⁺¹⁰	mbar	13.9	14.8	15.5	16.2	17.1	16.7	17.0	17.6	
Pressure drop on the flue gas side with EL fuel oil											
For operating pressure											
▪ With ECO 2	5 bar	mbar	9.9	9.3	8.5	8.9	9.4	9.0	8.9	9.0	
	23 bar ⁺¹⁰	mbar	10.9	10.1	9.5	8.8	10.1	8.9	9.0	8.9	

⁺¹⁰ For boiler size B and above < 25 bar, the maximum operating pressure depends on the flame tube \varnothing .

⁹ The actual nominal steam mass flow rate may vary subject to the specific system.

⁺¹¹ According to EN 12953, flame tube temperature monitoring is required for a combustion heating output above 14 MW for oil combustion and above 18.2 MW for gas combustion.




Adjusting the burner (cont.)

Boiler size			9	A	B	C	D	E	F	G
▪ With ECO 1	5 bar	mbar	9.4	8.8	7.9	8.3	8.7	8.5	8.4	8.5
	23 bar ^{*10}	mbar	10.3	9.5	8.9	8.3	9.5	8.4	8.5	8.5
▪ Without ECO	5 bar	mbar	8.8	8.1	7.8	8.0	8.4	8.3	8.3	8.4
	23 bar ^{*10}	mbar	10.2	9.3	9.1	8.4	9.5	8.6	8.7	8.7

Type M93B

Boiler size			3	4	5	6	7	8	9
Nominal steam mass flow rate ^{*9}		t/h	1.0	1.3	1.65	2.0	2.5	3.2	4.0
Flame tube dimensions									
Diameter									
▪ Smooth pipe, int. \varnothing	d1	mm	681	706	756	781	831	881	931
▪ Corrugated pipe, int. \varnothing	d1	mm	—	—	750	775	825	875	925
Smooth pipe application limit		bar	>25	>25	22	22	20	18	18
Length	a	mm	1710	1910	2130	2325	2535	2800	3085
Reversing chamber depth	b	mm	500						
Burner connections									
▪ Max. flame head \varnothing (optional wear-resistant burner entry point)	c	mm	370	370	420	470	520	560	560
▪ Max. flame head \varnothing (standard version)	c	mm	Adjusted subject to burner.						
▪ Minimum flame head length	e	mm	360						
Combustion chamber volume (average values)									
▪ Flame tube		m ³	0.62	0.75	0.96	1.11	1.37	1.71	2.10
▪ Flame tube length and reversing chamber depth		m ³	0.80	0.94	1.18	1.35	1.65	2.01	2.44
Pressure drop on the flue gas side with natural gas									
For operating pressure									
▪ With ECO 2	5 bar	mbar	4.6	6.0	7.6	8.8	8.8	10.1	9.7
	23 bar	mbar	5.0	6.5	8.4	9.7	9.7	11.4	10.8
▪ With ECO 1	5 bar	mbar	4.3	5.6	7.1	8.3	8.6	9.8	10.3
	23 bar	mbar	4.7	6.2	7.9	9.1	9.5	10.9	11.5
▪ Without ECO	5 bar	mbar	7.1	8.5	10.1	9.5	10.3	12.2	12.1
	23 bar	mbar	8.4	10.0	11.9	11.2	12.1	14.5	14.3
Pressure drop on the flue gas side with EL fuel oil									
For operating pressure									
▪ With ECO 2	5 bar	mbar	4.1	5.4	6.8	7.9	7.9	9.1	8.7
	23 bar	mbar	4.7	6.1	7.8	9.1	9.0	10.7	10.1
▪ With ECO 1	5 bar	mbar	3.9	5.1	6.4	7.4	7.8	8.8	9.3
	23 bar	mbar	4.4	5.8	7.4	8.5	8.9	10.2	10.7
▪ Without ECO	5 bar	mbar	6.4	7.7	9.1	8.6	9.3	11.0	10.9
	23 bar	mbar	7.9	9.4	11.1	10.5	11.3	13.6	13.4

^{*10} For boiler size B and above < 25 bar, the maximum operating pressure depends on the flame tube \varnothing .

^{*9} The actual nominal steam mass flow rate may vary subject to the specific system.



Adjusting the burner (cont.)

Type M95B

Boiler size			1	2	3	4	5	6	7	8
Nominal steam mass flow rate for operation with natural gas ^{*9}	t/h		5	6	7	8	10	12	14	16
Nominal steam mass flow rate for operation with light fuel oil (HEL) ^{*9}	t/h		5	6	7	8	10	12	14	16
Flame tube dimensions										
Diameter										
▪ Smooth pipe, int. \varnothing	d1	mm	981	1056	1106	1156	1231	1306	1381	1431
▪ Corrugated pipe, int. \varnothing	d1	mm	975	1050	1100	1150	1225	1300	1375	1425
Smooth pipe application limit		bar	16	13	13	13	10	10	8	8
Length	a	mm	3375	3625	3850	4075	4450	4800	5150	5525
Reversing chamber depth	b	mm	500							
Burner connections										
▪ Max. flame head \varnothing (optional wear-resistant burner entry point)	c	mm	610	660	710	710	810	910	910	910
▪ Max. flame head \varnothing (standard version)	c	mm	Adjusted subject to burner.							
▪ Minimum flame head length	e	mm	360							
Combustion chamber volume (min. values)										
▪ Flame tube		m ³	2.55	3.17	3.70	4.28	5.30	6.43	7.71	8.89
▪ Flame tube length and reversing chamber depth		m ³	2.93	3.61	4.18	4.80	5.89	7.10	8.46	9.70
Pressure drop on the flue gas side with natural gas										
For operating pressure										
▪ With ECO 2	5 bar	mbar	11.2	10.3	12.2	13.1	13.2	13.1	14.9	13.6
	23 bar ^{*10}	mbar	12.3	11.4	13.5	14.4	14.6	14.5	16.6	15.1
▪ With ECO 1	5 bar	mbar	9.6	9.9	11.3	12.1	11.7	12.5	13.7	12.2
	23 bar ^{*10}	mbar	10.6	10.9	12.6	13.4	12.9	13.9	15.3	13.5
▪ Without ECO	5 bar	mbar	11.1	12.3	13.4	13.1	12.5	14.3	12.9	11.0
	23 bar ^{*10}	mbar	13.1	14.5	15.9	15.5	14.7	17.0	15.1	12.8
Pressure drop on the flue gas side with EL fuel oil										
For operating pressure										
▪ With ECO 2	5 bar	mbar	10.0	9.2	10.9	11.8	11.7	11.8	13.2	9.4
	23 bar ^{*10}	mbar	11.0	10.2	12.1	12.9	13.1	13.0	14.7	10.6
▪ With ECO 1	5 bar	mbar	8.6	8.8	10.1	10.9	10.4	11.3	12.1	8.4
	23 bar ^{*10}	mbar	9.5	9.8	11.2	12.0	11.6	12.4	13.6	9.5
▪ Without ECO	5 bar	mbar	9.9	11.0	12.0	11.8	11.1	12.9	11.4	7.6
	23 bar ^{*10}	mbar	11.7	13.0	14.2	13.9	13.2	15.2	13.4	9.0

^{*9} The actual nominal steam mass flow rate may vary subject to the specific system.

^{*10} For boiler size B and above < 25 bar, the maximum operating pressure depends on the flame tube \varnothing .




Type M95B - continued

Boiler size			9	A	B	C	D	E	F	G	
Nominal steam mass flow rate for operation with natural gas ⁹	t/h		18	20	22	24	26	28	30	31.5	
Nominal steam mass flow rate for operation with light fuel oil (HEL) ⁹	t/h		18	18.5 ^{*11}	18.7 ^{*11}	19 ^{*11}	23 ^{*11}	23.6 ^{*11}	24.4 ^{*11}	24.4 ^{*11}	
Flame tube dimensions											
Diameter											
▪ Smooth pipe, int. \varnothing	d1	mm	1506	1556	1606	–	–	–	–	–	
▪ Corrugated pipe, int. \varnothing	d1	mm	1500	1550	1600	1650	1675	1725	1775	1800	
Smooth pipe application limit		bar	8	6	6	–	–	–	–	–	
Length	a	mm	5800	6075	6375	6650	6950	7225	7475	7675	
Reversing chamber depth	b	mm	500								
Burner connections											
▪ Max. flame head \varnothing (optional wear-resistant burner entry point)	c	mm	910	1010	1010	1110	1110	1110	1210	1210	
▪ Max. flame head \varnothing (standard version)	c	mm	Adjusted subject to burner.					–	–	–	
▪ Minimum flame head length	e	mm	360								
Combustion chamber volume (min. values)											
▪ Flame tube		m ³	10.3	11.6	12.9	14.2	15.3	16.9	18.5	19.5	
▪ Flame tube length and reversing chamber depth		m ³	11.2	12.5	13.9	15.3	16.4	18.1	19.7	20.8	
Pressure drop on the flue gas side with natural gas											
For operating pressure											
▪ With ECO 2	5 bar	mbar	13.2	14.2	14.5	15.3	16.4	15.7	15.9	16.5	
	23 bar ^{*10}	mbar	14.6	15.8	16.0	16.8	18.0	17.1	17.3	17.9	
▪ With ECO 1	5 bar	mbar	12.5	13.5	13.5	14.3	15.3	14.7	15.0	15.6	
	23 bar ^{*10}	mbar	13.9	14.9	14.9	15.8	16.9	16.1	16.4	16.9	
▪ Without ECO	5 bar	mbar	11.7	12.4	13.3	13.8	14.7	14.4	14.8	15.4	
	23 bar ^{*10}	mbar	13.7	14.6	15.3	16.0	16.9	16.5	16.8	17.4	
Pressure drop on the flue gas side with EL fuel oil											
For operating pressure											
▪ With ECO 2	5 bar	mbar	9.7	9.1	8.3	8.7	9.2	8.8	8.7	8.8	
	23 bar ^{*10}	mbar	10.7	9.9	9.3	8.6	9.9	8.7	8.8	8.7	
▪ With ECO 1	5 bar	mbar	9.2	8.6	7.7	8.1	8.5	8.3	8.2	8.3	
	23 bar ^{*10}	mbar	10.1	9.3	8.7	8.1	9.3	8.2	8.3	8.3	
▪ Without ECO	5 bar	mbar	8.6	7.9	7.6	7.8	8.2	8.1	8.1	8.2	
	23 bar ^{*10}	mbar	10.0	9.1	8.9	8.2	9.3	8.4	8.5	8.5	

⁹ The actual nominal steam mass flow rate may vary subject to the specific system.

^{*11} According to EN 12953, flame tube temperature monitoring is required for a combustion heating output above 14 MW for oil combustion and above 18.2 MW for gas combustion.

^{*10} For boiler size B and above < 25 bar, the maximum operating pressure depends on the flame tube \varnothing .



Adjusting the burner (cont.)

Note

For boiler size C and above, with or without ECO, the permissible combustion heating output is limited to 18 MW with EL fuel oil in accordance with EN 12953-3.

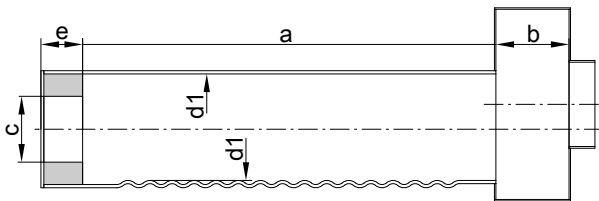


Fig. 18 Flame tube dimensions

Note

Adjust the maximum oil/gas throughput of the burner to suit the required maximum combustion heating output of the boiler.

For calculating the district heating output see page.

Type M73B

Boiler size		1	2
Flue gas volume			
▪ With ECO 2	m ³	0.58	0.72
▪ With ECO 1	m ³	0.59	0.73
▪ Without ECO	m ³	0.49	0.63

Tab. 20

Type M73C

Boiler size		3	4	5	6	7	8	9
Flue gas volume								
▪ With ECO 2	m ³	1.28	1.47	1.79	2.03	2.48	3.29	3.97
▪ With ECO 1	m ³	1.30	1.50	1.83	2.07	2.53	3.35	4.04
▪ Without ECO	m ³	1.24	1.43	1.74	1.97	2.41	3.19	3.85

Tab. 21

Type M75C

Boiler size		1	2	3	4	5	6	7	8
Flue gas volume									
▪ With ECO 2	m ³	5.1	6.0	6.6	8.0	9.2	11.9	14.0	17.0
▪ With ECO 1	m ³	5.2	6.1	6.7	8.1	9.3	12.1	14.3	17.3
▪ Without ECO	m ³	4.9	5.8	6.4	7.8	8.9	11.5	13.6	16.5

Tab. 22

Type M75C - continued

Boiler size		9	A	B	C	D	E	F	G
Flue gas volume									
▪ With ECO 2	m ³	19.8	22.5	24.9	27.9	31.2	34.5	37.9	40.4
▪ With ECO 1	m ³	20.2	22.9	25.4	28.5	31.8	35.2	38.6	41.2
▪ Without ECO	m ³	19.2	21.8	24.2	27.1	30.3	33.5	36.8	39.2

Tab. 23





Adjusting the burner (cont.)

Type M93B

Boiler size		3	4	5	6	7	8	9
Flue gas volume								
▪ With ECO 2	m ³	1.66	1.86	2.43	2.72	3.31	3.97	4.74
▪ With ECO 1	m ³	1.69	1.90	2.48	2.77	3.37	4.04	4.83
▪ Without ECO	m ³	1.61	1.81	2.36	2.64	3.21	3.85	4.60

Tab. 24

Type M95B

Boiler size		1	2	3	4	5	6	7	8
Flue gas volume									
▪ With ECO 2	m ³	6.3	7.5	8.5	9.7	12.1	14.7	17.2	20.5
▪ With ECO 1	m ³	6.4	7.7	8.7	9.9	12.4	15.0	17.6	20.9
▪ Without ECO	m ³	6.1	7.3	8.3	9.4	11.8	14.3	16.7	19.9

Tab. 25

Type M95B - continued

Boiler size		9	A	B	C	D	E	F	G
Flue gas volume									
▪ With ECO 2	m ³	23.2	25.7	28.4	31.2	33.5	36.9	39.8	41.8
▪ With ECO 1	m ³	23.7	26.2	28.9	31.8	34.1	37.6	40.6	42.6
▪ Without ECO	m ³	22.6	24.9	27.6	30.3	32.5	35.8	38.6	40.6

Tab. 26



Diagnosis

Fault/ System characteristics	Cause of fault	Measure
Burner does not start.	No voltage present.	Switch ON the mains isolator.
	Safety chain activated.	Check safety equipment.
	Burner fault indicator illuminates.	Press reset button on the burner control unit.
	Fuel supply is interrupted.	Check shut-off valves in the fuel supply line and filter for obstructions.
		Remedy other faults in accordance with the burner manufacturer's instructions.
Oxygen corrosion (water side)	Topping up with unsuitable water.	Check water treatment system and injection system in accordance with VdTÜV guideline.
	Boiler has been too often taken out of service without being preserved.	Switch to standby (95 °C) instead of a complete shut down.
Flue gas temperature is too high.	The heat transfer is reduced by contamination on the flue gas and water sides.	Clean boiler.
	The rated boiler heating output is exceeded.	Check burner heating output.
Discharge from safety valve.	The discharge pressure does not match the max. permissible operating pressure.	Check discharge pressure and replace safety valve if necessary.
	Operating pressure is too high.	Check and correct adjustment of pressure regulator and pressure limiter.
	Valve seat is contaminated.	Clean valve seat.
	Water trap pipe (upstream of pressure regulator) is blocked.	Clean pipes.
Boiler produces saturated vapour.	Boiler water alkalinity is too high.	Blow-down boiler at regular intervals, install a TDS unit where necessary, treat water in accordance with the VdTÜV guidelines and notes from page 19 onwards, drain downstream steam line.
	Water level is set too high.	Check electrode length.
Steam hammer inside boiler	Feedwater is not fed in at the feedwater connector.	Connect feedwater line to the correct connector.
Steam knocking inside the condensate container/feedwater tank.	The check valve in the feedwater line is missing or faulty.	Install or clean the check valve (observe the flow direction).
	Steam trap in the system is faulty.	Identify and repair faulty steam trap.
	U-bends buckle.	Reduce steam pressure.
Boiler water level is too high.	Steam distributor above the boiler is not adequately drained.	Install a steam trap.
	Water level is set too high.	Check electrode length.
Water level limiter switches off.	Shut-off valve in the feedwater line is closed.	Open the shut-off valve.
	There is no feedwater in the feedwater tank.	Check mains water connection.
	Feedwater pump or water level controller is faulty.	Determine the cause of the damage to the water pump and water level controller in accordance with the installation instructions.
Water level limiter switches off.	Severe water level fluctuations through excessive alkalinity.	Drain water from boiler and feedwater tank. Refill with treated water. Blow down more frequently. Check water treatment system.
	Incorrect electrode length.	Check and adapt electrode length.

Wearing parts and gaskets

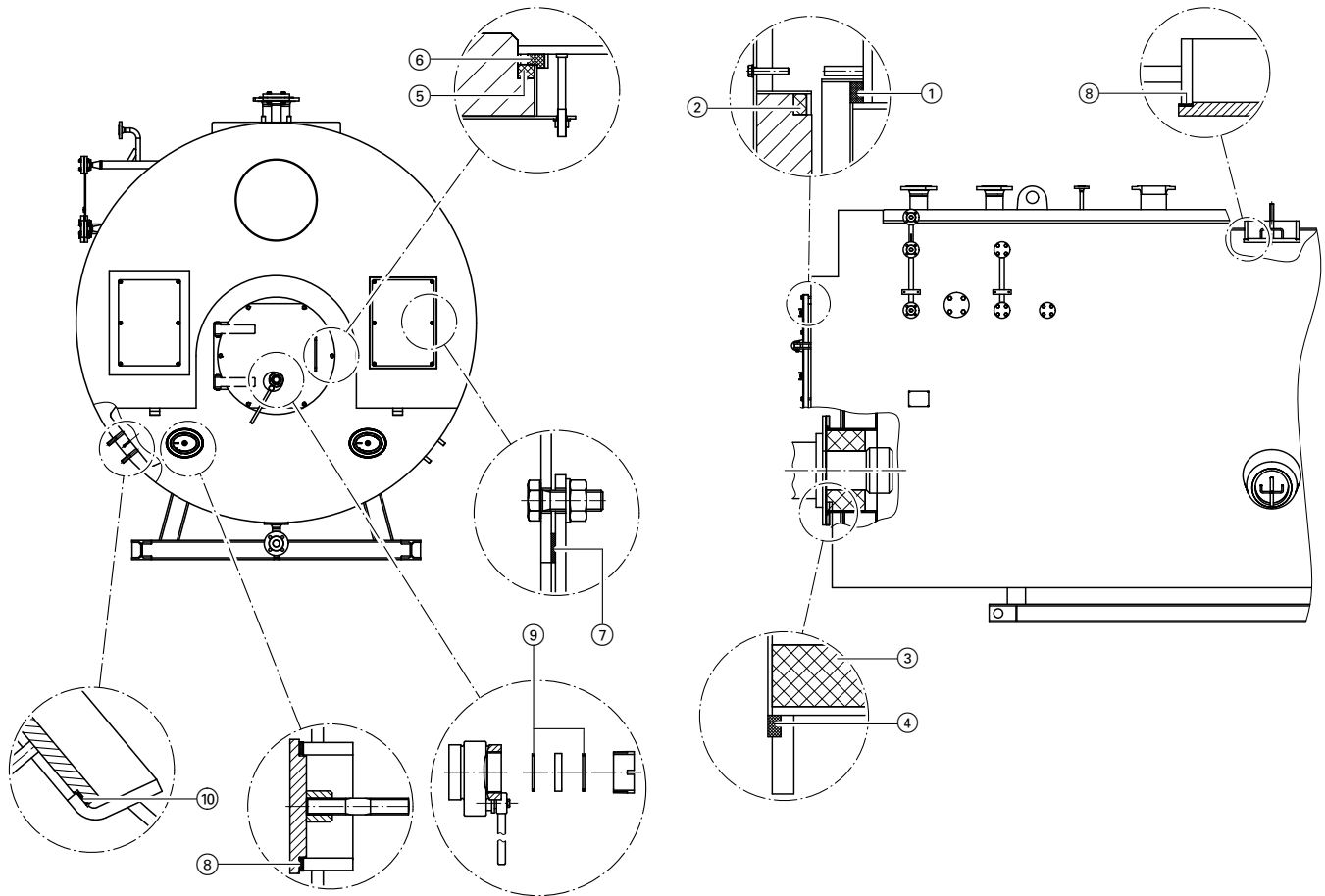


Fig. 19

Ordering information

Enter the serial no. of the boiler, the type and amount required. Obtain commercially available parts from your local trade supplier.

Order forms

Serial no.:

Vitomax HS, type M73 size ^{*12}		1	2	3	4	5	6	7	8	9
Pos.	Component	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity
1	Packing per boiler door									
2	Packing per boiler door									
3 ^{*13}	Insulation ring (optional)									
4 ^{*13}	Burner connection packing									
5 ^{*13}	Cleaning cover packing									
6 ^{*13}	Rear boiler floor packing									
7 ^{*13}	Packing per inspection port									
8	Handhole gasket 100 x 150 mm									
	Manhole gasket 325 x 425 mm									

^{*12}The last digit of the part number indicates the boiler size.

^{*13}A sufficient quantity of installation adhesive is provided.

Wearing parts and gaskets (cont.)

Vitomax HS, type M73 size ^{*12}		1	2	3	4	5	6	7	8	9
Pos.	Component	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity
9	Seal ring set									
10	Headhole gasket 225 x 325 mm									

Serial no.:

Vitomax HS, type M75 size ^{*12}		1	2	3	4	5	6	7	8
Pos.	Component	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity
1	Packing per boiler door								
2	Packing per boiler door								
3 ^{*13}	Insulation ring (optional)								
4 ^{*13}	Burner connection packing								
5 ^{*13}	Cleaning cover packing								
6 ^{*13}	Rear boiler floor packing								
7 ^{*13}	Packing per inspection port								
8	Handhole gasket 100 x 150 mm								
	Manhole gasket 325 x 425 mm								
9	Seal ring set								
10	Headhole gasket 225 x 325 mm								

Vitomax HS, type M75 continued, size ^{*12}		9	A	B	C	D	E	F	G
Pos.	Component	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity
1	Packing per boiler door								
2	Packing per boiler door								
3 ^{*13}	Insulation ring (optional)								
4 ^{*13}	Burner connection packing								
5 ^{*13}	Cleaning cover packing								
6 ^{*13}	Rear boiler floor packing								
7 ^{*13}	Packing per inspection port								
8	Handhole gasket 100 x 150 mm								
	Manhole gasket 325 x 425 mm								
9	Seal ring set								
10	Headhole gasket 225 x 325 mm								

Serial no.:

Vitomax HS, type M93 size ^{*12}		3	4	5	6	7	8	9
Pos.	Component	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity
1	Packing per boiler door							
2	Packing per boiler door							

^{*12} The last digit of the part number indicates the boiler size.^{*13} A sufficient quantity of installation adhesive is provided.

Wearing parts

Wearing parts and gaskets (cont.)

Vitomax HS, type M93 size ^{*12}		3	4	5	6	7	8	9
Pos.	Component	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity
3 ^{*13}	Insulation ring (optional)							
4 ^{*13}	Burner connection packing							
5 ^{*13}	Cleaning cover packing							
6 ^{*13}	Rear boiler floor packing							
7 ^{*13}	Packing per inspection port							
8	Handhole gasket 100 x 150 mm							
	Manhole gasket 325 x 425 mm							
9	Seal ring set							
10	Headhole gasket 225 x 325 mm							

Serial no.:

Vitomax HS, type M95 size ^{*12}		1	2	3	4	5	6	7	8
Pos.	Component	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity
1	Packing per boiler door								
2	Packing per boiler door								
3 ^{*13}	Insulation ring (optional)								
4 ^{*13}	Burner connection packing								
5 ^{*13}	Cleaning cover packing								
6 ^{*13}	Rear boiler floor packing								
7 ^{*13}	Packing per inspection port								
8	Handhole gasket 100 x 150 mm								
	Manhole gasket 325 x 425 mm								
9	Seal ring set								
10	Headhole gasket 225 x 325 mm								

Vitomax HS, type M95 size ^{*12}		9	A	B	C	D	E	F	G
Pos.	Component	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity
1	Packing per boiler door								
2	Packing per boiler door								
3 ^{*13}	Insulation ring (optional)								
4 ^{*13}	Burner connection packing								
5 ^{*13}	Cleaning cover packing								
6 ^{*13}	Rear boiler floor packing								
7 ^{*13}	Packing per inspection port								
8	Handhole gasket 100 x 150 mm								
	Manhole gasket 325 x 425 mm								
9	Seal ring set								
10	Headhole gasket 225 x 325 mm								

^{*12}The last digit of the part number indicates the boiler size.

^{*13}A sufficient quantity of installation adhesive is provided.

Recommendations for operation, maintenance and testing in accordance with EN 12953-6

Checklist for boiler system: Steam boiler

Key

- **O** = Monitoring, check for unusual noises, odours, smells, other unusual phenomena
- **T** = Function check on equipment components, including monitoring

Operation, maintenance and inspections/tests:	72 hrs	Months				Type of tests (examples)
		1	3	6	12	
Safety equipment against excessive pressure (safety valves)	O			T		Vent. Other function checks and monitoring in accordance with national regulations are possible.
Water level indicator	T					Blow through only with boilers at p < 32 bar
Blow down and drainage devices	T					By activation
Valves	O			T		In accordance with manufacturer's specifications
Feedwater control	O			T		
Low water level protection (LWL)	O	T				Function check by reducing the water level down to the switching points
Steam pressure and temperature indicator (pressure gauge)	O					Comparison with limiters and controllers
Pressure limiter	O	T				Function check by increasing the pressure up to the switching points
Temperature limiter	O	T				Change in set value/test keys
Circulation limiter	O	T				
Devices for protecting the water quality	O	T (1st)		T (2nd)		1. Comparison of measured values to reliable samples 2. Checking by a qualified specialist
Protection systems	O			T		Electrical and mechanical checks by a qualified specialist
Pressurised parts (pipes, inspection ports, flanges, gaskets, connections, etc.)		O				Check for tightness
Pressure and temperature controllers	O			T		Comparison
Feedwater supply	O		T			
Water quality	T					To specifications of EN 12953-10
Heat supply	O				T	Carried out by a suitably qualified specialist at least once per year, in line with the manufacturer's operating manual

Tab. 27

Suggested tests and test intervals

Note

The extent of inspections and time intervals are manufacturer's recommendations. As part of the commissioning, these should be matched to the individual system as part of the arrangements made with the system user, the supervisory authority and the manufacturer.

Recommendation

We recommend that the 6-monthly tests are conducted in accordance with the applicable regulations (e.g. EN 12953) by a qualified employee of the manufacturer.

Note

The checklists included in the appendix can be used as templates.

Steam and hot water boilers

Boiler type: _____ Boiler output: _____ Serial no.: _____
 Month: _____ Year: _____

Inspection checklist

Day	Operating pressure bar	Safety valve	Pressure regulator	Pressure limiter	Flue gas heat exchanger	Flue gas damper	Flame appearance	Combustion system
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								
27								
28								
29								
30								
31								

Service

Water treatment system

Steam generating system: _____

Month: _____ Year: _____

Inspection checklist

Day	Feedwater						
	Electrical conductivity at 25 °C μS/cm	Temperature °C	Appearance	pH value at 25 °C	Residual oxygen mg/l	Oxygen binder mg/l	Residual hardness mmol/l
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							

Records of commissioning, inspection and maintenance

	Commissioning	Maintenance/service	Maintenance/service
Date:			
By:			

	Commissioning	Maintenance/service	Maintenance/service
Date:			
By:			

	Commissioning	Maintenance/service	Maintenance/service
Date:			
By:			

	Commissioning	Maintenance/service	Maintenance/service
Date:			
By:			

	Commissioning	Maintenance/service	Maintenance/service
Date:			
By:			

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