

Operating and service instructions

for contractors

VIESSMANN

Vitomax 200-HS

Type M73A

Oil/gas high pressure steam boiler

With or without economiser

Rated steam output 0.5 to 4.0 t/h



VITOMAX 200-HS



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 designed for qualified personnel.

- Work on gas installations must only be carried out by a registered gas fitter.
- Work on electrical equipment must only be carried out by a qualified electrician.
- The system must be commissioned by Viessmann Industrieservice, the system installer or a qualified person authorised by the installer.

Regulations

Observe the following when working on this system

- All legal instructions regarding the prevention of accidents
- All legal instructions regarding environmental protection
- Health and Safety at Work Act (BetrSichV) [Germany]

- The Code of Practice of relevant trade associations
- Directive 97/23/EC, as well as the relevant safety regulations of the following countries
 - Ⓧ DVGW, TRGI, TRF and VDE, TRD
 - Ⓧ KG, ABV, LRG-K, LRV-K, DKBG
 - Ⓧ SEV, SUVA, SVGW, SVTI, SWKI, VKF and EKAS guideline 1942: LPG, part 2

If you notice oil leaks and 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. Do not switch lights or electrical appliances on or off.
- Close the quick-acting fuel valve and shut-off valve.
- Open windows and doors.
- Remove all people from the danger zone.
- Notify your gas or electricity supplier from outside the building.
- Shut off the electricity supply to the building from a safe place (outside the building).

Safety instructions (cont.)

If you smell flue gas



Danger

Flue gas can lead to life-threatening poisoning.

- Shutdown system.
- Ventilate boiler room.

Working on the system

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



Please note

Electronic modules can be damaged by electrostatic discharges.

Before beginning work, touch earthed objects, such as water pipes, to discharge static loads.



Danger

Risk of burning from hot surfaces so that

- steam line,
 - hot water line,
 - cleaning cover and closures/plugs at the boiler system,
 - boiler doors, as well as components behind the doors,
- can all become very hot. Observe safety in the workplace!

Repair work



Please note

Repairing components that fulfil a safety function can compromise the safe operation of your system.

Replace faulty components only with original Viessmann spare parts.

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-authorised 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.

Draining hot water



Please note

The blow-down and T.D.S. water from boiler systems can reach temperatures of 100 °C and higher.

Set up the system so that this water is cooled down to < 35 °C prior to it entering the sewer system. Where necessary, refer to the local water authority.

Safety instructions (cont.)

Draining condensate from the flue gas side



Please note

When the boiler system starts or under certain conditions, condensate can form in the flues, the flue gas collector and downstream in the flue or chimney.

The system user must provide suitable installations to safely drain such condensate.

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

Technical safety information

Any damage to the boiler that could lead to risks requires an immediate boiler shutdown.

If major damage occurs at the boiler or vessels, notify the authorising supervisory body without delay prior to carrying out repairs.

Observe all technical safety instructions. Steam generators require local permits both for their installation and their operation. This permit must be available prior to commissioning.

In the case of explosions, the user must immediately notify the authorising supervisory body, irrespective of whether anyone was injured or not. Prior to the official investigation, the status created by the accident must not be changed apart from what is necessary to prevent further damage or as required for rescuing personnel.

The boiler house must only be entered by authorised personnel. Always keep the boiler house clean, well lit and free from all objects that do not belong there and that might impair the operation. The use of any part of the system as a drying area is prohibited.

During operation, all required exits must be left unlocked and free from obstructions. The operating personnel must log all events, such as faults, adjustments, consumption of spare parts and repairs. A log must be maintained of all regular readings of the control instruments.

Technical safety information (cont.)

Obvious signs at weld seams, leaking damaged areas, severe corrosion, unusual characteristics of operating instruments and system components as well as unusual noise inside the boiler must be notified immediately. Faults and defects on the system that cannot be remedied by experts locally must be notified to the manufacturer. Protect all boiler parts and control equipment from rain, water leaks and expelled steam. Immediately repair all damage and leaks.

Apart from the relevant legal requirements, all practical instructions issued by our technical personnel to the operating personnel are applicable.

It is impossible to clarify and describe all potential cases of indicators and possible faults. These guidelines should therefore, after a reasonable time in operation, be supplemented based on the experiences gained up to that point.

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Storage of Vitomax boilers prior to installation as part of the system

Please note:

This information applies to the storage **prior** to the system installation.

1. Vitomax boilers must be stored in enclosed rooms, free from weather influences under dry conditions.
 2. The room temperature must not fall below 0 °C nor exceed +50 °C.
 3. In its delivered condition the boiler is protected as standard on the water side with dummy flanges or caps against the ingress of foreign matter.
 4. Remove the shipping packaging to prevent the formation of condensate.
- Check the effectiveness of the desiccant regularly. See the details provided by the desiccant manufacturer.
 - Ensure that the desiccant does not come into contact with the boiler material (e.g. through suspended fixing).
 - Preserve the dry flue gas side with a thin film of graphite or boiled oil.
 - Instead of the moisture extraction on the flue gas side by means of a desiccant; a dryer with air circulation can also be connected.

To prevent corrosion in the non-pressurised state, observe the following if the boiler is stored for longer than 4 weeks:

- Protect the interior of the boiler against moisture on the flue gas side and on the DHW side with a desiccant, e.g. silica gel.
- The amount of desiccant depends on the boiler volume.

Operating tips

According to the Steam Boiler Order [Germany], a steam boiler category IV may only be taken into use when the relevant authority has granted permission for the installation of the system, and an authorised expert has tested the system.

According to the Steam Boiler Order [Germany], steam boilers category IV may only be operated, supervised and maintained by a trained boilerman.

The approved inspection body may grant, upon application, permission to operate the boiler without supervision subject to it being equipped in accordance with the TRD 604.

The system must be commissioned by the Viessmann Industrieservice, the system installer or a qualified person authorised by the installer as well as the relevant expert.

Within 4 weeks of the combustion equipment being commissioned, the operator must notify the local flue gas inspector accordingly [check local regulations].

Operating tips (cont.)

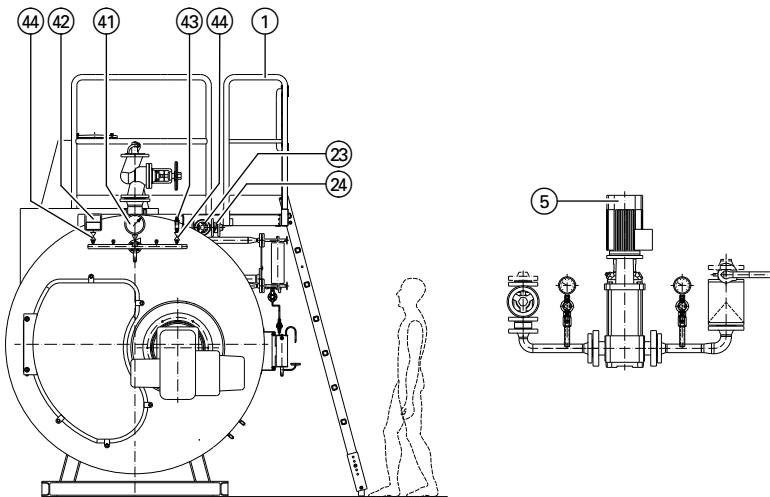
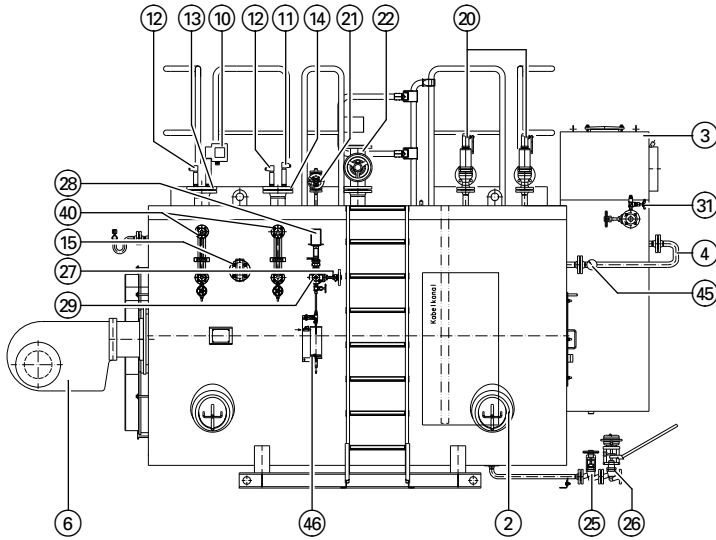
Record all actual values in a test report. These must be confirmed by the installer, the relevant expert and the system operator.

We would recommend that you operate the boiler constantly at the required operating pressure. The operation of the boiler at pressure will still be beneficial, even if no heat demand occurs for a longer period of time.

In systems comprising several boilers, of which one is constantly used as standby boiler, only change the operation over after longer intervals, e.g. during the annual inspection of the total system.

Functions

Installation drawing



Functions (cont.)

ble.

Note

Illustration of the fitting assembly refers to modulating operation. Provide two further pressure regulators for stepped operation; the pressure transducer for the burner control will then not be required.

- | | |
|---|---|
| ① Platform | ⑳ Air vent shut-off valve |
| ② Control panel
See separate documentation | ㉑ Steam shut-off valve |
| ③ Integral economiser | ㉒ Feedwater shut-off valve |
| ④ Connection line between economiser and boiler | ㉓ Feedwater non-return valve |
| ⑤ Feedwater pump (module) | ㉔ Blow-down shut-off valve |
| ⑥ Burner | ㉕ Blow-down valve |
| ⑩ Level electrode
(WR – water level control) | ㉖ T.D.S. shut-off valve |
| ⑪ Level electrode
(HW – maximum water level) | ㉗ T.D.S. valve |
| ⑫ Level electrode
(NW – minimum water level) | ㉘ Mating flange DN 20 |
| ⑬ Accessory, flanged connection
DN 100 | ㉙ Air vent valve for economiser |
| ⑭ Accessory, flanged connection
DN 100 | ㉚ Water level indicator |
| ⑮ Conductivity electrode | ㉛ Pressure gauge |
| ⑳ Safety valve | ㉜ Maximum pressure limiter |
| | ㉝ Pressure transducer |
| | ㉞ Straight-through shut-off valve with cap (option) |
| | ㉟ Dial thermometer |
| | ㊱ Sampling cooler |

In the following, selected components of a steam boiler system are described. For details, see the documentation provided by the manufacturer of the individual components.

Functions (cont.)

Level electrodes ⑩ to ⑫

Permanently modulating level monitoring ⑩

Level electrode for continual and load-dependent boiler filling

Function	Method of operation	Operating information
Continual water level control comprising <ul style="list-style-type: none"> ■ A level electrode ■ An associated level controller 	Water level below or exceeds the selected set value	The controller issues a pulse to the feedwater control valve Boiler is filled continually and subject to load
Continual control of the boiler water level via the feedwater control valve		

Functions (cont.)

Level monitoring water level "too high" (HW electrode ①)

Level electrode to safeguard against maximum water levels

Function	Operating condition	Operating information
Self-monitoring overflow protection comprising <ul style="list-style-type: none"> ■ A level electrode ■ The associated evaluating device 	Standard water level	Electrode is not immersed in the conducting boiler water and registers a high resistance
		Feedwater pump operation enabled
		Feedwater pump runs
		Boiler is filled continually and subject to load
	Water level too high	Electrode is immersed into the boiler water and registers a low resistance
	The feedwater pump is stopped via the pump relay Feedwater supply to the boiler interrupted	
The level drops again	Feedwater pump can start subject to demand	

Note

See also country-specific regulations.

Functions (cont.)

Level monitoring water level "too low" (NW electrode ⑫)

Level electrode to safeguard against minimum water levels

Function	Operating condition	Operating information
Self-monitoring low water indicator comprising <ul style="list-style-type: none"> ■ Two level electrodes ■ The associated evaluating devices 	Standard water level	Electrode is immersed into the conducting boiler water and registers a low resistance
		Safety chain closed
	Burner operation enabled	
	Water level too low	Electrode is out of the boiler water and registers a high resistance
		Safety chain and burner operation constantly interrupted
	The minimum boiler water content is achieved again	Re-enable safety chain
		Burner block lifted

Operation

Safety valve ⑳

Function

- Physical protection of the boiler against pressures in excess of the max. permissible operating pressure P1
- Valve response pressure = max. permissible steam boiler operating pressure
- Valve discharge capacity \geq max. steam output (boiler)
- Pressure increase max. P1 plus 10% with max. blow-off rating
- Closing pressure at P1 minus 10 %

Testing/checks	Operating information
Operating checks in regular intervals or in accordance with country-specific regulations	Briefly cracking open by lifting the lever – Do not release the lever. Note the manufacturer's operating instructions
Regular checking by an authorised contractor or test body	Never remove the lead seal

Functions (cont.)

Air vent shut-off valve ⑳

Function	Operation	Operating information
Venting the boiler during filling or after a new system start from atmospheric pressure	During heat-up, open the valve and close it again, as soon as visible steam is expelled	Air / steam must be able to be routed away safely

Steam shut-off valve ㉑

Function	Operation	Operating information
Main boiler shut-off towards the steam mains	Enable steam or close boiler with damper valves	Open slowly to prevent water hammer

Blow-down ㉒ and ㉓

Function

- Periodic removal of sludge deposits

Method of operation	Operating information
Automatic blow-down via programmable valve at regular intervals	The programmable switch opens via the control valve of the blow-down valve and briefly drains off boiler water. The vacuum force thus created removes the sludge from the boiler
	Manual activation possible at any time
Manual blow-down at regular intervals or in accordance with country-specific regulations	Push the locking lever of the blow-down valve to the side
	Push down on the activating lever of the blow-down valve for two to three seconds
	Please note When acting manually, be mindful of the lever kickback



Please note

When acting manually, be mindful of the lever kickback

Functions (cont.)

T.D.S. unit (27) and (28)

Function

- Continual checking and regulation of the salt content through temperature-compensated conductivity electrode
- Desalination via the TDS valve
- Maintenance of specified limits by opening and closing the valve

Method of operation	Operating information
Conductivity drops	Flow rate is reduced
Conductivity value exceeds the selected set value	Valve is opened further
Conductivity exceeds the highest value	Safety chain is opened Burner stops

Water level indicator (40)

Function

- Visual and direct water level indication

Method of operation	Operating information
Visual water level check	Valve on the steam and water side; shut-off device OPEN
	Flushing valve, shut-off device CLOSED
When there are no personnel present	Keep valve CLOSED
Carry out operating checks at regular intervals or in accordance with country-specific regulations	Close the valve on the water and steam side
	Open blow-down valve, drain and check the valve 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	When the water column rises slowly, check that there are no blockages

Functions (cont.)

Pressure monitoring facility ④1 to ④4

Component	Function	Operating information
The pressure monitoring unit is directly connected to the boiler via the fitting assembly and comprises		
■ Pressure gauge ④1	Operating pressure indicator	Operating checks at regular intervals or in accordance with country-specific regulations
■ Pressure limiter ④2	Protection of the boiler against over-pressure when the maximum pressure is exceeded	Checking with a calibrated test pressure gauge by an authorised contractor or test body
		Safety chain opened by opening a contact in the pressure limiter
		Burner stops
		Safety chain reset by means of the appropriate key in the control panel. Reduce the boiler pressure via the air vent valve or the main steam valve by approx. 1 bar below the switching point of the max. pressure limiter and reset the max. pressure limiter
■ Pressure transducer ④3	Load-dependent regulation of the boiler combustion subject to the operating pressure	Burner starts again
■ Straight-through shut-off valve with cap ④4	Enables the replacement of faulty components	Exclusively by authorised contractors

Functions (cont.)

Sampling cooler ⁽⁴⁶⁾

Function	Operating information
Removal of water samples to carry out comparative tests	Values to be checked in accordance with country-specific regulations and to be recorded in the boiler 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 ■ Sulphite

Shutting down the system

For short interruptions ≤ 3 days, maintain the positive pressure in the boiler system incl. all boiler-related drives (thermal water treatment etc.). See also page 38.

For longer interruptions, see chapter "Preservation".

Preservation

The procedures listed in the following should be considered as preservation options. Further procedures with alternative chemicals should be agreed with their manufacturer. The basis of these instructions is the VdTÜV datasheet TC1465 "Preserving the water side of steam boilers" [Germany].

To prevent corrosion setting in during idle periods when the boiler is not pressurised, preserve the boiler surfaces on the flue gas and water sides subject to the length of the period during which the boiler is taken out of use. There is a differentiation between wet preservation during which exposure to oxygen is to be avoided and dry preservation during which moisture levels are to be minimised.

Preservation (cont.)

Wet preservation

1. Fill the boiler incl. economiser (if installed) up to the highest possible level with treated feedwater. To prevent oxygen corrosion, add an oxygen binder to the boiler water (e.g. sodium sulphite) in accordance with the manufacturer's instructions. For this, ensure good admixing with the boiler water (thermal or mechanical agitation).
2. In multi boiler systems if only some boilers must be preserved, these can be filled with desalinated boiler water from the boilers that remain in use. This will also maintain the temperature. Ensure that the temperature remains constant.
3. Maintaining pressure in a fully filled boiler using nitrogen (preferably nitrogen 5.0) of 0.1 to 0.2 bar can prevent boiler corrosion.

Chemical wet preservation chemically binds the oxygen thereby protecting the boiler material against corrosion. The chemical wet preservation can be implemented when steam boilers are taken out of use for short or longer periods. An adequate amount of oxygen binders, corresponding putrefaction by alkalis, a thorough mixing of the preservation solution and complete filling of the boiler or system, effectively prevent corrosion due to idle periods whilst giving a great deal of security with a reasonable amount of effort and cost.

Never use this procedure where there is a risk of frost.

Apart from the chemical wet preservation, physical-technical methods may also be applied. With the wet preservation, the rapid boiler availability is an advantage.

Preservation with sodium sulphite

For steam boilers, add the sodium sulphite in soluble form to the completely drained steam boiler via the feedwater pump. Fill the steam boiler completely. Also fill any installed economisers. The pH value should be between 11 and 12. Keep all valves closed during the preservation process. The preservation solution should be circulated weekly. Initially, check the sulphite excess frequently, then at least once monthly. When the content drops and falls below the specified standard values, recirculate again and add agent, as required.

Preservation (cont.)

Sodium sulphite excess

	Idle time	Sodium sulphite content in the preservation solution mg Na ₂ SO ₃ /l	Additional sodium sulphite	
			Without water g/m ³	Crystallised g/m ³
Fill water for steam boilers:				
■ Water of low salt content	1 week	20 - 50	20 - 50	40 - 100
■ Fully desalinated water	1 month	100 - 200	100 - 200	200 - 400
■ Condensate	Longer than 1 month	200 - 500	200 - 500	500 - 1000
■ Water with salt content e.g. fully softened water or boiler water	1 week	40 - 100	40 - 100	80 - 100
	Longer than 1 week	400 - 1000	400 - 1000	800 - 2000

When using cold-prepared water which has not been deaerated, add an additional 80 g (without water) or 160 g (crystallised) sodium sulphite per m³.

Preservation with film forming amines

A wet preservation with film forming amines is not permissible.

Note

- *Observe all conditions for draining waste water into sewer systems or into the main discharge system when draining the preserving solution.*
- *When using the preserving agents, observe the working instructions and safety datasheets supplied by the product manufacturer.*
- *Also agree the steps for the preservation of the water side with the manufacturer of the preserving agent.*

Preservation through physical-technical measures

The following preservation steps through physical-technical processes are also possible, such as

- Maintaining a positive steam pressure in the boiler
- Flow preservation of steam boilers. These processes require system-specific equipment (valves, pipework, pumps) and should be taken into consideration when designing the system.

Preservation (cont.)

Dry preservation

Note

*This method is used when longer idle periods are expected and to ensure protection against frost. This method means that a quick return of the system into use is **not** possible.*

Complete drying out

After cooling down in the idle stage, the boiler will be quickly drained at a pressure of approx. 3 bar. Observe the maximum permissible temperature for draining into the public sewage system.

Where required, catch the water in a collecting tank and drain it after it has cooled down sufficiently.

Flush steam boilers with a high salt content in their boiler water ($> 5\,000\ \mu\text{S}/\text{cm}$) once more on the water side. Afterwards, open all man, head and hand holes.

Preserving the hot gas side

Flue gas side

After the boiler has been taken out of use, clean the heating surfaces on their hot gas side. The normal draught ensures that the heating surfaces on the hot gas side are adequately dried. Accelerate the process by means of a fan heater; if required open the flue gas shut-off dampers for this process and then close again.

It is recommended to treat the combustion chamber and the hot gas flues with preserving oil (graphite or boiled oil). This can be sprayed on or applied with a brush. The boiler doors remain open.

Dry out components, such as economisers, separately.

Position desiccants (e.g. silica gel, blue gel) in shallow bowls inside the open and drying boiler or hang them inside the boiler so that any contact with the boiler material is safely prevented. Then close the boiler. Check the desiccants at least monthly. They should be replaced as and when required.

Preservation with ammonia or nitrogen

These methods require extensive technical and technological effort. When using these preserving methods, formulate system-specific operating instructions.

Keep the surfaces dry during idle periods (by adding a desiccant such as silica gel or by air circulation via a connected dryer).

A dry preservation is not recommended under special installation conditions in areas with high relative humidity (in the tropics, near the sea).

Preservation (cont.)

Further details

For further details, see the VdTÜV data-sheets (no. 1465, Oct. 1978) and the VGB (no. R116H, 1981) [or local regulations].

Maintenance instructions

The TRD regulation specifies the maintenance of a steam boiler system, which can be carried out by the Viessmann Industrieservice or by an authorised contractor.

You can contact Viessmann Industrieservice on

Tel.: +49 (0)30/6602 389

Fax: +49 (0)30/6602 136

Email: Industrieservice@viessmann.com

Internet: www.viessmann-industriekessel.de/Industrieservice

Water quality for steam boiler systems

Steam boilers

In its natural state, most untreated water will be unsuitable as boiler feedwater.

The type of boiler feedwater treatment should be matched to the raw water quality. As its quality may change, regular checks are required.

The water feed pipe downstream of the boiler feedwater treatment should be equipped with a suitable water meter to record the volume of top-up water added to the return condensate; this also provides an indirect check on the steam draw-off volume.

It is always advisable to return as much condensate as possible to the feedwater tank. The condensate may also have to be treated so it conforms to the requirements of the boiler feedwater (according to table 1).

These requirements, plus those of the boiler water (according to table 2), mean that – according to the raw water condition and the top-up water volume – at the very least a suitable chemical or thermal water treatment system must be installed, and there should be a facility for adding oxygen binders (possibly alkalines and phosphates) into the feedwater tank supply line.

The requirements are monitored by measurements made by suitable, preferably uncomplicated devices (either every 24 h or 72 h or in line with national requirements, subject to operating mode). These test values, the volume of top-up water, the chemical consumption and the required maintenance should be entered into a boiler log to enable the operating conditions to be checked at any time.

Table 1: Saline boiler feedwater requirements

Permiss. operating pressure	bar	> 0.5 < 20	> 20
General requirements		Colourless, clear and free of undissolved substances	
pH value at 25 °C		> 9	> 9
Conductivity at 25 °C	µS/cm	Only standard values applicable to boiler water	

Water quality for steam boiler systems (cont.)

Permiss. operating pressure	bar	> 0.5 < 20	> 20
Total alkaline earths (Ca ²⁺ + Mg ²⁺)	mmol/litre	< 0.01	< 0.01
Oxygen (O ₂)	mg/l	0.05	< 0.02
Bound carbon dioxide (CO ₂)	mg/l	< 25	< 25
Iron, total (Fe)	mg/l	< 0.2	< 0.1
Copper, total (Cu)	mg/l	< 0.05	< 0.01
Oxidability (Mn VII → Mn II) as KMnO ₄	mg/l	< 10	< 10
Oil, grease	mg/l	< 1	< 1
Organic substances	—	See comment ^{*1}	

Table 2: Boiler water requirements

Permiss. operating pressure	bar	Feedwater conductivity > 30 µS/cm		Feedwater conductivity ≤ 30 µS/cm > 0.5
		> 0.5 to 20	> 20	
General requirements		Colourless, clear and 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 _{S8.2})	mmol/litre	1 to 12	1 to 10	0.1 to 1.0 ^{*2}
Conductivity at 25 °C	µS/cm	< 6000	See Fig. 1, page 25	< 1500

^{*1} 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 can decompose into carbon dioxide and other acidic products that would increase the conductivity and result in corrosion and deposits. They can also lead to the formation of foam and/or coatings that must be kept to the minimum levels possible. The TOC content (Total Organic Carbon) should also be kept to a minimum.

^{*2} When using demineralised water with a mixed bed quality (LF < 0.2 µS/cm) phosphate injection is not required; alternatively the AVT method (conditioning with volatile alkalization agents, pH value of the feedwater ≥ 9.2 and pH value of the boiler water ≥ 8.0) can be applied. In such cases, the conductivity downstream of a severely acidic cation exchanger must be < 5 µS/cm.

^{*3} Standard adjustment of the pH value through injection of Na₃PO₄; additional NaOH injection only if the pH value is < 10.



Water quality for steam boiler systems (cont.)

Permiss. operating pressure	bar	Feedwater conductivity > 30 µS/cm		Feedwater conductivity ≤ 30 µS/cm > 0.5
		> 0.5 to 20	> 20	
Phosphate (PO ₄)	mg/l	10 to 20	10 to 20	6 to 15
Silicic acid (SiO ₄) ^{*4}	mg/l	Pressure-dependent, see the diagrams on pages 25 and 26		

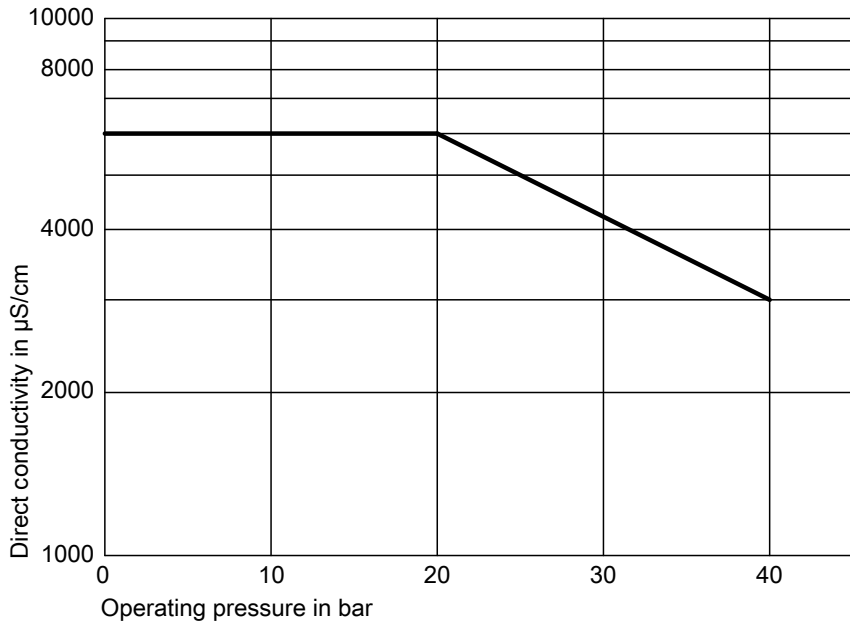
Note

The addition of phosphate is recommended, but is not always essential.

Conversion: 1 mol/m³ = 5.6 °dH; 1 °dH = 0.179 mol/m³; 1 mval/kg = 2.8 °dH

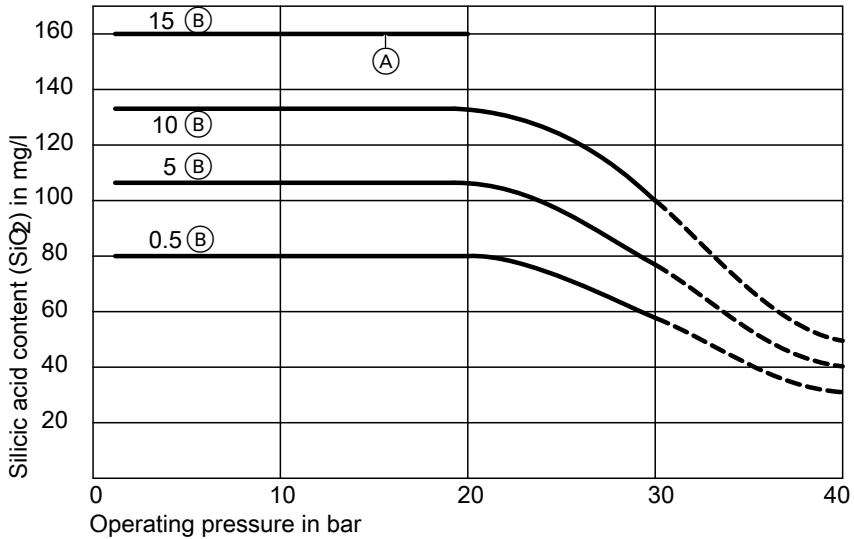
Operation with salt-free boiler feedwater is also possible as an alternative to operation with saline boiler feedwater.

^{*4} *If phosphate is used, higher PO₄ concentrations are permissible, subject to consideration of all other values, e.g. with balanced or coordinated phosphate treatment. (See section "Conditioning")*

Water quality for steam boiler systems (cont.)**Maximum permissible direct boiler water conductivity, subject to pressure**Feedwater conductivity >30 $\mu\text{S/cm}$ 

Water quality for steam boiler systems (cont.)

Maximum permissible boiler water silicic acid content (SiO_2), subject to pressure



(A) This level of alkalinity is no longer permissible >20 bar

(B) $K_{S,8.2^-}$ value in mmol/l

Conditioning

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

This conditioning can contribute to:

- Support for the formation of magnetic layers or other protective oxidation layers
- A reduction of corrosion through optimisation of the pH value
- Stabilising the hardness and preventing or reducing scaling and deposits
- Achieving chemical binding of residual oxygen

Conventional conditioning agents may, for example, contain sodium and potassium hydroxide, sodium phosphate, sodium sulphite, ammonia and diamide.

Note

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

Water quality for steam boiler systems (cont.)

General information regarding conditioning

■ Conductivity

- Saline

This means feedwater with electrical conductivity of $>30 \mu\text{S}/\text{cm}$ (e.g. downstream of softening plants).

- Low salt content

This means feedwater with electrical conductivity of $0.2\text{--}30 \mu\text{S}/\text{cm}$ (e.g. downstream of desalination plants).

- Free of salt

This means feedwater with electrical conductivity of $<0.2 \mu\text{S}/\text{cm}$ and a silicic acid concentration of $<0.02 \text{ mg}/\text{l}$, as well as condensate with electrical conductivity $<5 \mu\text{S}/\text{cm}$ (e.g. downstream of full desalination plants 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 alkalising 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 alkalising agents. A balanced conditioning with phosphate or its derivatives can also be beneficial through regulating the pH value of the boiler water. However, organic conditioning agents have also been in use for years.

If organic conditioning agents are used, the amounts and processes to be used as well as the required analyses must be specified by the supplier of these chemical products.

■ Oxygen and carbon dioxide or oxygen binders

Carbon dioxide and oxygen are expelled from the feedwater through full thermal deaeration. The use of oxygen binders is required if it proves impossible in practical use, e.g. through repeated idle periods, to keep the oxygen content of the feedwater below the permissible values. This "correcting chemical" is admixed with the feedwater through the dosing facility.

Please note:

Amines that form a film are not oxygen binders.

Note

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 fracture corrosion. As a result, sodium hydroxide as alkalization agent is only permissible in slightly buffered feedwater with conductivity of $<30 \mu\text{S}/\text{cm}$, if the recommended pH range cannot be achieved with sodium phosphate alone. With this method, sudden fluctuations in pH value result in low sodium hydroxide content.

Water quality for steam boiler systems (cont.)

Deviation during conditioning

Actual values deviating during constant operation from those specified may be the result of the following:

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

Carry out immediate changes to reinstate the correct operation. For example, feeding in returned condensate must not influence the feedwater quality and may have to be treated.

The chemical composition of the boiler water can be monitored both by dosing specific chemicals and by continuous or intermittent blow-down of a part of the water volume. This must be done in such a way that solute as well as suspended contaminants can be removed.

Conditioning/Warranty

Please note

The warranty will be void:

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

Sampling

Sampling of water and steam from the boiler system should comply with ISO 5667-1 and the treatment and handling of samples should comply with ISO 5667-3.

Samples are taken by means of a sampling cooler. This cools down the water sample to a temperature of approx. 25 °C.

To be able to draw off a useful sample, flush the sampling line for an appropriate time.

The sample should be analysed immediately after drawing as values might change as a result of prolonged settling.

Opaque or contaminated sample water should be filtered prior to testing.

For this, see also the "Operating instructions of the sample cooler".

Sampling points

Provide sampling points at representative positions in the system. Typical sampling points are:

- Boiler feedwater entry valve
- Boiler water from a downpipe or a continuous TDS line

Water quality for steam boiler systems (cont.)

- Top-up water downstream of the top-up water treatment system or the storage tanks
- Condensate at the condensate tank outlet, if installed; otherwise draw the sample off as near to the feedwater tank as possible

Analysis

General information

Verify compliance with the values specified in **table 1** (page 22) and **table 2** (page 23) through analyses.

If the analyses are carried out in accordance with different standards or by indirect means, calibrate such methods. A clean surface with water supply and drainage facility should be made available for carrying out the analyses. The required equipment should 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.

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

Analysis procedure/test equipment

In continuous boiler operation, the boiler values can be checked adequately with the test equipment. In the case of severe deviations, confirm the actual values through correspondingly standardised analysis procedures to help remedy the problem.

Parameters must be checked in accordance with the following standards:

Acid capacity	EN ISO 9963-1
Conductivity	ISO 7888
Copper	ISO 8288
Iron	ISO 6332
Oxygen	ISO 5814
pH value	ISO 10523
Phosphate	ISO 6878-1
Potassium	ISO 9964-2
Silicic acid ^{*5}	
Sodium	ISO 9964-1
TOC ^{*6}	ISO 8245
Total hardness as Ca + Mg	ISO 6059

^{*5} There is currently no European or international standard; see for example DIN 38405-21 standardised German procedure for water, waste water and sludge examination; anions (group D); photometric determination of solute silicic acid (D 21).

^{*6} As an alternative, the permanganate index can be checked in accordance with ISO 8467, if these values are specified.

Water quality for steam boiler systems (cont.)

Measure the acid conductivity in the form of the hydrogen ion concentration continuously in the same manner as the conductivity in hydrogen form, after the sample has gone through a severely acidic ion exchanger with a volume of 1.5 l.

The exchanger is inserted into a cylinder with a diameter:height ratio of 1:3 or less, whereby the exchanger medium takes up at least three quarters of the cylinder volume.

Regenerate the ion exchanger when it has been exhausted by two thirds. This can be recognised when using an exchanger with colour indicator and transparent cylinder.

Preamble

This manual contains general information regarding the installation, commissioning, operation, maintenance and inspection. It must be supplemented and specifically adapted in accordance with country-specific regulations. In addition, any instructions for the equipment and auxiliary systems that are part of the boiler system must be incorporated into the manual supplied with the system. Only technically trained and instructed personnel may operate this system.

Installation

Requirements for structural systems are always subject to the regulations applicable in country of installation. The following represent some fundamental requirements:

Installation requirements

Steam boiler systems must be installed so that all parts can be correctly operated, maintained, repaired and monitored. The health and safety at work of employees must be safeguarded at all times.

Steam boilers and ancillary equipment that form part of the steam boiler system must be installed with regard to the prevention of shock, vibrations and sound emissions as well as the protection against any other risks, so that the systems are compliant with all technical safety aspects.

Valves and fittings of the steam boiler and the steam boiler system together with any safety and pressure relief facilities fitted to them must be installed, so that these can safely discharge or can be safely activated, and that the relief process can be clearly recognised.

Installation (cont.)

Clearances for operation and maintenance

Areas that must be accessed for control and maintenance of the steam boiler system must offer a head clearance of at least 2 m and a clear width of at least 1 m. Individual boiler fittings may restrict the clear width to 0.8 m.

In all other areas, a passage width of 0.5 m will suffice.

In the case of cylindrical boiler bodies, the passage width on one side can be reduced to 0.3 m.

The clearance between the boiler top and the ceiling above must be at least 0.75 m, when access to that area is required for operation and maintenance.

All inspection apertures of the steam boiler system must be freely accessible or must be able to be made accessible easily.

Access to boiler rooms

The boiler room must not include installations to which personnel require access who are not charged with working on the steam boiler system or who might prevent the boilerman from carrying out his work.

Unauthorised personnel must not be given access to the steam boiler system. Affix prohibition notices on all entries to the boiler room so that they are clearly legible at any time. The boiler user must determine the authorised circle of personnel.

Rescue routes, emergency exits

Rapid unhindered access to and from the steam boiler rooms must be ensured at all times through the number, location, type and condition of escape routes.

Escape routes must lead away from the danger area by a short and direct route. Exits must be identified.

Boiler rooms should have two exits opposite each other, one of which should be designed as an emergency exit.

Escape routes and their exit points must have a clear width of at least 0.6 m and a clear head height of at least 2 m; they must always be kept free and unobstructed.

Doors in the way of escape routes must be able to be opened easily from the inside and must open in the direction of escape.

The boiler room must be able to be adequately ventilated. For this, openings must be provided at suitable points. If the combustion air is drawn from the boiler room, ensure that the boiler room is never subjected to more than 0.5 mbar negative pressure.

Installation (cont.)

Platforms and handrails

To be able to safely operate fittings/ valves that must be activated or tested daily or every three days, provide steps, lean-to ladders with platform and protruding handrails or platforms with steps, fixed ladders or lean-to ladders. Observe German Health & Safety at Work Act (UVV) "Ladders and steps".

Walk-on platforms or boiler covers higher than 1 m above floor level and stairs with more than five steps require a handrail.

Access and working platforms and similar must not restrict the ventilation in the boiler room.

Flue gas routing

Flue gases from steam boiler systems must be routed so that they represent no risk to personnel and third parties.

Lighting

Adequate lighting is required for the steam boiler system, in particular in the area of valves/fittings, controls and safety equipment as well as in access and escape routes.

Emergency lighting must be provided for the escape routes and their exits. The lighting installation must be maintained in good working order at all times.

Commissioning

First commissioning

Generally, commissioning is carried out by Viessmann Industrieservice, the system installer or a contractor authorised by them.

Commissioning preparations

Prior to commissioning the boiler, the following steps are a minimum requirement and are the installer's responsibility:

Commissioning (cont.)

- Checking the pipework depending on version (e.g. retainers, expansion joints, drainage systems, emptying, venting).
- Checking the fittings/valves for correct selection and installation (e.g. correct pressure stage and materials, flow direction, controls, correct flange connection).
- Ensuring the safe operation of all boiler house facilities (equipment, working and access platforms, hand-rails, insulation, heating, ventilation).
- Testing the lighting system.
- Checking the availability of fire fighting and "First Aid" equipment.
- Opening the front cleaning apertures of the boiler and checking the turbulators (if part of the standard delivery) and removing shipping brackets.
- Operational telephone system.

Starting the boiler

The commissioning steps are subject to the respective boiler equipment and the type of ancillary systems. The specific sequences must be determined individually for each specific case.

The following details a sample sequence for a system requiring no supervision for 72 hours according to TRD 604/Sheet 1 [Germany].

Stages of the work

- 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
- Filling the feedwater tank with treated water and flushing the feedwater lines
- Commissioning the dosing equipment for feedwater conditioning
- Commissioning the control panel
See page 35
- Commissioning the feed pumps
(See also the commissioning instructions of the pump manufacturer with reference to the required operating conditions)
See page 35
- Filling the boiler with feedwater until the water level is visible in the sight glass
See page 35
- Adjusting the water level control
See page 35
- Checking the water level limiting equipment
See page 36
- Burner commissioning
See page 36
- Function check of the safety pressure limiter
See page 36
- Safety valve function check
See page 37
- TDS controller adjustment
See page 37

Commissioning (cont.)

- Boilout
See page 37
- Plugs/closures on the water side
See page 37

Commissioning the control panel

- Visual inspection
- Switch ON the mains isolator
- Setting the individual control MCBs
- Checking individual functions
- Checking the display/indicator functions
- Checking the rotational direction of motors and actuators
- Function test "EMERGENCY STOP".

Commissioning the feed pumps

- Filling the pumps with medium
- Starting the pumps and checking the rotational direction
- Adjusting the operating pressure of the pumps during the first filling of the boiler
- Supply pressure must be lower than the max. operating pressure
- Checking whether the boil-dry protection device is active and operates.

Filling the boiler with feedwater

Check the following:

- Is the drain (blow-down valve) closed?
- Is the TDS valve in its "CLOSED" position?
- Is the air vent valve open?
- Is the steam valve closed?
- Are all inspection ports in the water area watertight? Replace gaskets if required.

- When installing an economiser, are the air vent valve and drain closed?
- Are the water level glasses open?
Flush on the DHW side if required.

Adjusting the water level control

1. Staged control
 - Checking the switching points for pump ON and pump OFF via the water level indicator
 2. Constant control
 - After the water level has reached the low water indicator, adjust the zero point
 - Fill the boiler up to the top edge of the sight glass and adjust the 100 % point at the controller
 - Set the feedwater valve to CLOSED via the controller and adjust the zero point of the valve at the controller
 - Set the feedwater valve to OPEN via the controller and adjust the 100 % point of the valve at the controller
 - Set the limit switch at the straight-through feedwater valve for pump OFF
 - Preset the switching points for pump ON and pump OFF at the controller, whilst the boiler starts with the steam valve closed
 - Set feed pump switch to automatic at the control panel and check the function of the water level control
- Repeat this process after burner commissioning and when the boiler has been pressurised. As the boiler water heats up and consequently expands, check the low and high water indicator levels again.

Commissioning (cont.)

- Let the water level return to the zero point by opening the blow-down valve and readjust at the controller
- Bring the boiler to the required water level and adjust at the controller

Checking the water level limiting equipment

- When the low water indicator level (LWL) has been reached, reset the water level limiter in the control panel by resetting the boiler safety chain.
- Check the response of the water level limiter under operating conditions in accordance with the manufacturer's operating instructions. 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. Observe that both limiters must respond.

Commissioning the burner

Commission the burner in accordance with the operating instructions issued by the burner manufacturer. A prerequisite for commissioning is that the fuel supply is enabled and that, when operating with oil, the quick-acting oil shut-off valve at the tank operates correctly.

In the case of gas combustion, a healthy gas supply from the local gas supply utility must be enabled and the gas line inside the boiler house must be tested and certified in writing by the system installer as suitable prior to commissioning. The quick-acting gas shut-off valve at the entry into the building must function correctly. 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, raise the operating pressure under partial burner load or to burner stage 1 to an operating pressure of approx. 3 bar. After that value has been reached, the burner load is enabled up to rated output. Now slowly open the steam valve and close the air vent valve.

Clean the steam lines in accordance with the specification provided by the user (blow-through). Ensure the adequate drainage of the steam systems.

Subject to a steady steam draw-off the combustion can be finely adjusted.

Agree the operating pressure subject to the safety pressure with the system user.

Function check of the safety pressure limiter

Adjust the safety pressure limiter so that, before the safety valve responds, it switches the boiler to fault status. The setting pressure depends on the individual system and must be adjusted with reference to the safety and operating pressures. 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.

Commissioning (cont.)

Once the safety pressure limiter has responded and a fault shutdown of the boiler has been carried out, the safety pressure limiter should be reset after a pressure drop in the boiler and the boiler should be started again 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. Prior to implementing the function check, verify that the discharge pipe has been correctly routed and secured, that the dewatering line has been connected to the safety valve and that its outlet is unobstructed and that no personnel are anywhere near this area.

To check the safety valve, take the following steps:

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

The safety valve must open when the set pressure has been reached; this must be equal to or lower than the maximum permissible operating pressure of the boiler. The boiler pressure can rise up to 10 % above the permissible operating pressure before the safety valve opens. If the pressure inside the boiler remains below this value, then the valve functions correctly and the boiler can be shut down. 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".

TDS controller adjustment

This adjustment must also be made in accordance with the manufacturer's instructions. The maximum permissible boiler water conductivity is specified in the water standards (e.g. EN 12953, part 10 or page 23); these may differ. The max. value must not exceed 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.

Boilout

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

Plugs/closures on the water side

During commissioning, check all plugs/closures and flanges on the water side for tightness and retighten in accordance with page 46 point 17.

Commissioning (cont.)

Verification

Create a first commissioning report where the established and set values are recorded. This report must be signed by the customer.

Instructions

Instruct the operating personnel after the first commissioning. Create a report regarding these instructions.

Returning the boiler into use after idle periods

Generally, it would be the local operators who would return the boiler into use after an idle period. Starting the boiler from the external control room is not permissible.

The boiler must be returned into use in the following sequence:

- Walk around the system to visually check its correct condition
- Control panel commissioning – Circuit breaker ON
- Commissioning the feed
- Checking the water level and the function of the water level indicator as well as that of the water level control
- Commissioning the combustion with a closed steam valve

- Controlling the output to partial load or stage 1
- Check the water level and, upon reaching high water, reduce the water level by means of a blow-down.
- When the boiler pressure has risen to 3 bar below the permissible operating pressure, slowly open the steam valve.
- Further checks as described in chapter "Utilisation and operation".
- For one hour after starting the boiler the system should be supervised by an operator (only applicable to systems without temporary supervision).

Shutdown

Shutdown means shutting down the system via the circuit breaker at the control panel.

Commissioning (cont.)

The length of the shutdown period also determines the preservation measures described in chapter "Preservation". A short-term shutdown is not recommended, as every start-up process subjects the boiler to additional stresses. For a period of up to 24 hours or over a weekend, the boiler should continue in operation. If pressure can be reduced via an additional pressure regulator or via the PLC, then the boiler can be operated with reduced pressure (approx. 2 bar). Only close the steam valve downstream of the thermal water treatment (TWA) outlet.

Note

For this ensure that the thermal water treatment plant is not closed off by damper valves, i.e. that it is not isolated from the system pressure. Keep the thermal water treatment plant – and the boiler – under pressure during short shutdown periods.

Steps to take the boiler out of use

- Shut down combustion and close the fuel valve
- Feed the boiler up to the controlled water level
- Close the steam (see information regarding the thermal water treatment plant above) and feed valves
- Switch off the circuit breaker

Monitoring

Utilisation and operation

The supervision intervals are subject to the user specification and the national regulations applicable in the country of installation. The operating, maintenance and checking tasks as listed from page 59 are suggested by the operator. These tasks are suggested as minimum requirements.

Checks are differentiated according to:

Per shift/day/week/month:

Carried out by the operator(s).

The period "Day" for systems with operation for 72 hours without supervision means every three days.

Every 6 months/12 months:

These checks should be carried out by a specialist contractor, e.g. the Viessmann Industrieservice or the manufacturers of the boiler system, combustion equipment or water treatment.

All checks and their results must be recorded with traceability.

Boiler log

This boiler log should be presented to the authorised supervisory body during every inspection. Make the following entries in the boiler log:

- Signed confirmation by the boilerman of the inspection tasks carried out
- 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 case of operating faults

Note

See *technical safety information* on page 4.

Generally, the operating instructions should be observed regarding action in case of operating faults. The following highlights some aspects that are the result of general operating experience.

If steam lines, fittings/valves and other operating equipment on the steam boiler system leak, and these leaks cannot be remedied immediately, limit their effect, identify and monitor them.

Areas at risk should only be entered if this is requested by the authorised person and the safety measures required for work inside the areas at risk have been implemented.

System parts that have been shut down as a result of a fault must only be started following the instructions of the person with the appropriate responsibility, once the cause for the shutdown has been removed and the system components have been tested locally prior to the new start.

Immediately shut down the steam boiler system and inform the supervisor as quickly as possible if a boiler condition is suspected that could cause a dangerous condition. This applies particularly if, for example

- A boiler wall shows signs of glowing red hot or of a deformation anywhere
- The safety valve cannot be made to respond correctly
- A correct operation of the controllers, the limiters or flame monitors cannot be ensured
- A fuel leak is recognised

- Irregularities in the combustion operation or a deflagration have/has occurred

- Medium is leaking from the pressure part of the boiler

If dangerous conditions for boilers exist, shut off such conditions from boilers connected in parallel.

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

Repairs

General requirements

Repair work may only commence after the person responsible for such repairs has determined the required safety measures, has inspected their implementation and has declared the place of work to be safe to proceed. 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 closure systems 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 hot pressurised medium

Work by personnel on systems or parts of systems that carry hot pressurised medium (e.g. valves in steam lines) is not permitted if, during such work, the risk of releasing the medium cannot be totally excluded.

Work in areas at risk may only commence if the system or parts of the system have previously been reliably depressurised and are also not under negative pressure, that this state has been secured and a person authorised by the user has checked the implementation of this measure and has certified in writing that the area of work is safe. (This also applies if line sections have been isolated for the purpose of a shutdown.) 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

Entering the steam boiler

Prior to entering the steam boiler, pipe connections (steam, feed and drain facilities) to the operational boiler must be securely and visibly separated by means of adequately strong dummy flanges or by removing pipe sections. If on pipework with welded-in or seal-welded fittings the break is made by in-line shut-off facilities, the intermediate connecting device that connects to the outdoor air 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: "Danger! Persons inside the steam boiler" must be affixed to the shut-off devices in a clearly visible location, so that the signs cannot be easily removed. Removing the warning signs is only permitted with the agreement of the works manager. Steam boiler and flues must be well ventilated.

The entry into the steam boiler must be explicitly requested by the person with the appropriate authority. The entry must be supervised. Prior to the safety measures being removed, a person with appropriate authority must ensure that no one is left inside the above parts of the system.

During the entry into the steam boiler and flues, electrical equipment may only be used if, including its cables and leads, it complies with the relevant safety regulations and has been provided by the user or their agents for work inside the steam boiler. Lamps must only be operated at safety voltages of up to 42 V. The same regulation applies to electrical tools. These may, however, be operated with higher voltages of up to 380 V, subject to their supply being routed through an isolating transformer. LV and isolating transformers must be located outside the steam boiler.

Inspections

The type and interval of inspections depends on the regulations that apply in the country of installation.

The following periods are suggested in the declaration of conformity:

External inspection of the system:	annually
Internal inspection of the system:	every three years
Repeated pressure test:	every nine years (max. test pressure in accordance with the initial pressure test)

Steps - commissioning, inspection and maintenance

For further information regarding the individual steps, see the page indicated

			Commissioning steps	Inspection steps	Maintenance steps	Page
•	•	•	1. Commissioning the system.....			45
•	•	•	2. Shutting down the system.....			46
•	•	•	3. Removing the burner (if required).....			47
•	•	•	4. Opening the boiler doors.....			47
•	•	•	5. Opening the cleaning cover.....			48
•	•	•	6. Removing and cleaning turbulators (if installed).....			48
•	•	•	7. Cleaning heating surface and flue gas collector.....			49
•	•	•	8. Cleaning the economiser heating surfaces.....			49
•	•	•	9. Checking all gaskets/seals and packing cords on the flue gas side			
•	•	•	10. Cleaning the sight glass in the cleaning aperture.....			50
•	•	•	11. Checking thermal insulation components and gaskets.....			51
•	•	•	12. Inserting turbulators (if appropriate) and closing the boiler doors.....			53
•	•	•	13. Securing the cleaning cover.....			54
•	•	•	14. Mounting the burner.....			54
•	•	•	15. Checking all connections on the water and steam side for leaks			
•	•	•	16. Checking the inspection ports for leaks.....			55
•	•	•	17. Checking the water quality.....			55
•	•	•	18. Checking the installation room ventilation			
•	•	•	19. Checking the flue pipe for tightness			
•	•	•	20. Adjusting the burner.....			55

Further details regarding the individual steps

Commissioning the system



Details provided by the burner manufacturer and regarding accessories

1. Check that the turbulators (if installed) are fully pushed into the hot gas flues (open the boiler doors).
 2. Check that the boiler doors and cleaning apertures at the back of the boiler are closed.
 3. Check that the installation room ventilation is unobstructed.
 4. Check the function of the water treatment system.
 5. Fill the steam boiler with treated water higher than the low water indicator level.
- Note**
In accordance with the TRD 611, only suitable water must be used with the steam boiler.
- For water quality guidelines, see from page 22.
6. Check all fitted components, such as pipework, valves, controllers, pumps etc. for function and tightness.
 7. Check the fuel pressure.
 8. Open the flue gas damper (if installed).
 9. Open the shut-off valves in the oil or gas line.
 10. Switch ON the mains isolator, the switch for the equipment required for the boiler system and the burner control switch in this order (observe the burner manufacturer's operating instructions).
 11. Start the boiler at a low heating output and gradually heat up to a pressure of approx. 3 bar below operating pressure.
Version with integral economiser:
To prevent steam hammer during heat-up, initiate a feedwater flow through the economiser several times, for example by manually activating the blow-down valve.
 12. Vent the boiler at the air vent valve during heat-up until steam is expelled. Then close the valve.
- Danger**
Expelled medium can lead to scalding.
Ensure the medium is drained off safely.
13. Slowly open the steam valve after the required steam pressure has been reached, otherwise there is a risk of steam hammer.
 14. While the system heats up, check the correct function of all control and safety equipment.

Further details regarding the individual steps (cont.)

15. Observe the pressure and temperature test equipment.
16. If required, drain and vent the connection lines.
17. Check the plugs/closures for leaks and retighten if required.
Retighten all plugs/closures again at max. permissible operating pressure. Torque values under cold and hot conditions:

Cover	Dimensions	Torque
Hand-hole	100 x 150, M16	100 Nm
Head-hole	220 x 320, M20	200 Nm
Manhole	320 x 420, M24	350 Nm

Shutting down the system



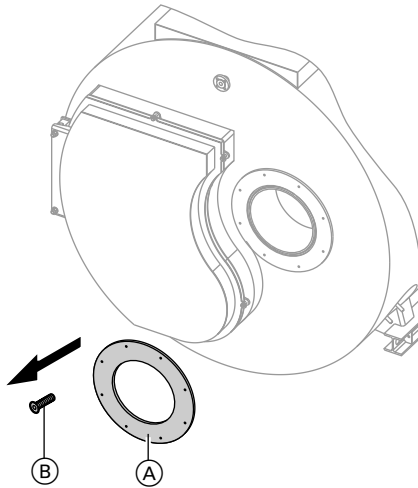
Danger

Opening the boiler connections and openings whilst the boiler is under pressure can lead to a high risk of severe personal injury. Only open the connections on the water and steam side and inspection apertures after the boiler has been completely depressurised.

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.

Further details regarding the individual steps (cont.)

Removing the burner (if required)



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

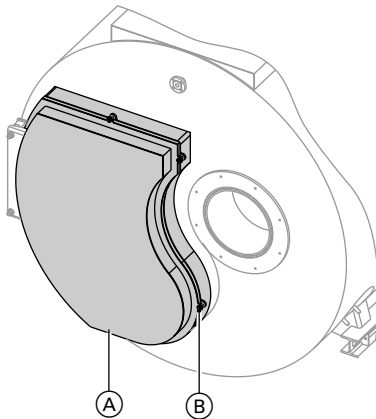


Please note

Ensure the burner and burner plate are not twisted on removal.

Use a suitable tool/lifting apparatus.

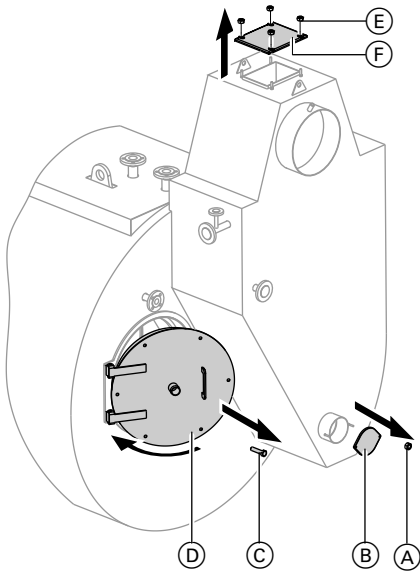
Opening the boiler doors



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

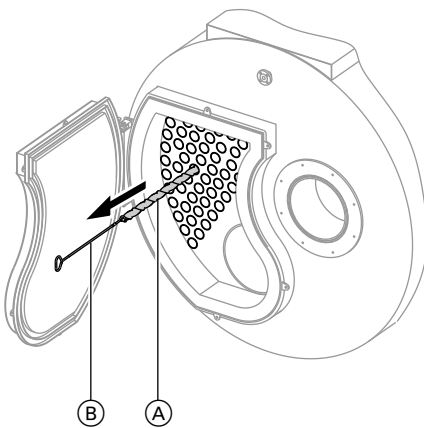
Further details regarding the individual steps (cont.)

Opening the cleaning cover



1. Flue gas collector
 - Remove nuts (A) and cleaning cover (B).
2. Flame tube entry
 - Remove screws (C) and pivot open cleaning door (D).
3. Economiser
 - Remove nuts (E) and cover (F).

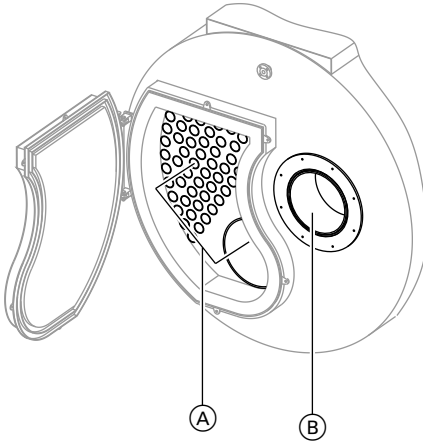
Removing and cleaning turbulators (if installed)



Extract turbulators (A) without using force using turbulator extractor (B) and clean them.

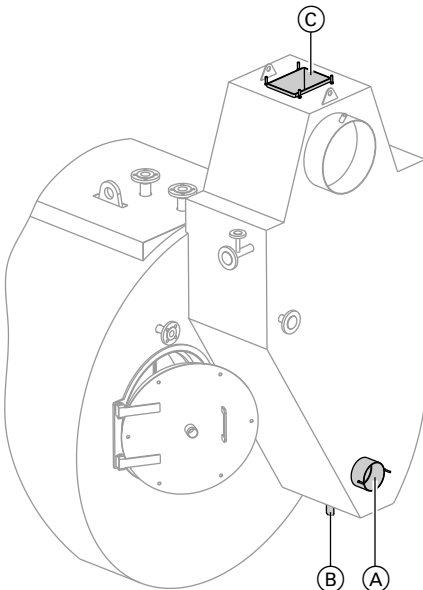
Further details regarding the individual steps (cont.)

Cleaning heating surface and flue gas collector



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

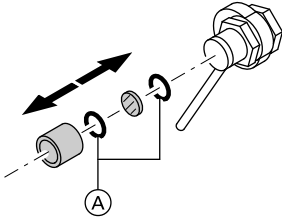
Cleaning the economiser heating surfaces



1. Remove combustion residues via cleaning aperture (A) or drain cleaning water via drain connector (B) on the flue gas collector.
2. Clean heat exchanger surfaces through cleaning aperture (C) with pressure lances or, in the case of severe contamination with feedwater. 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.

Further details regarding the individual steps (cont.)

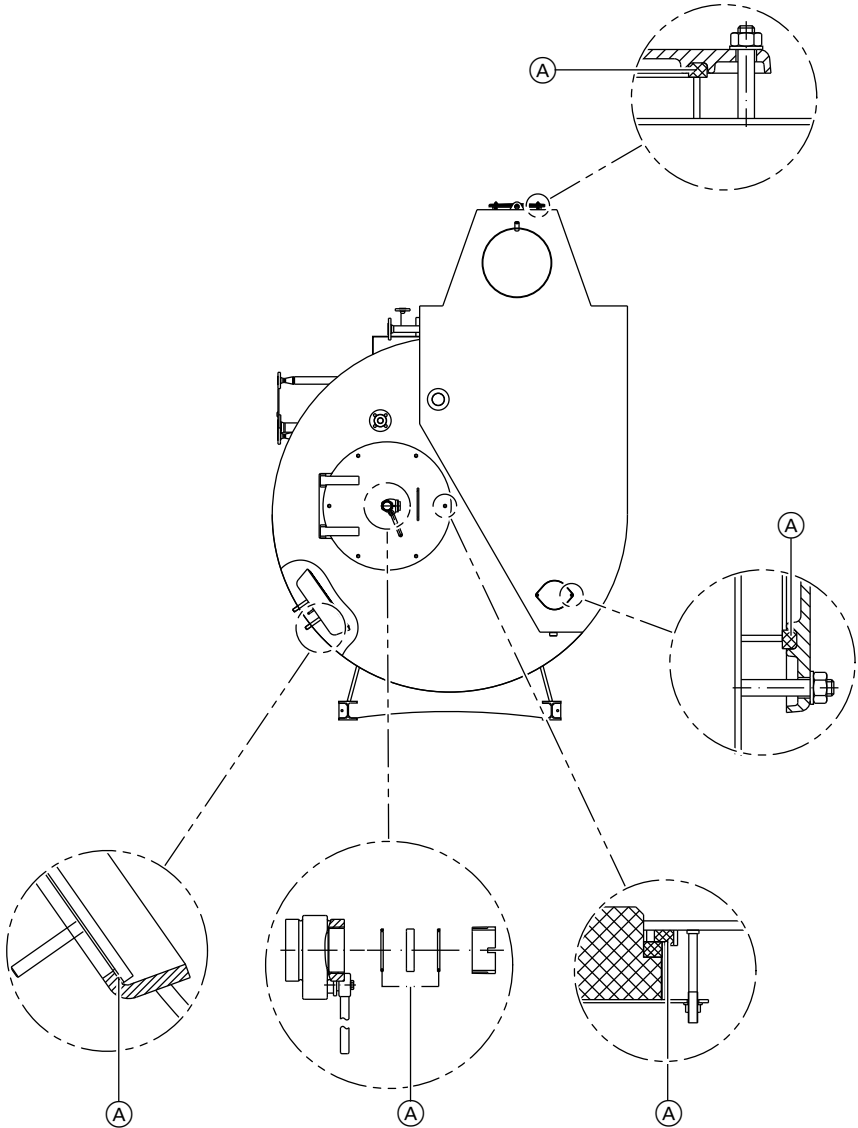
Cleaning the sight glass in the cleaning aperture



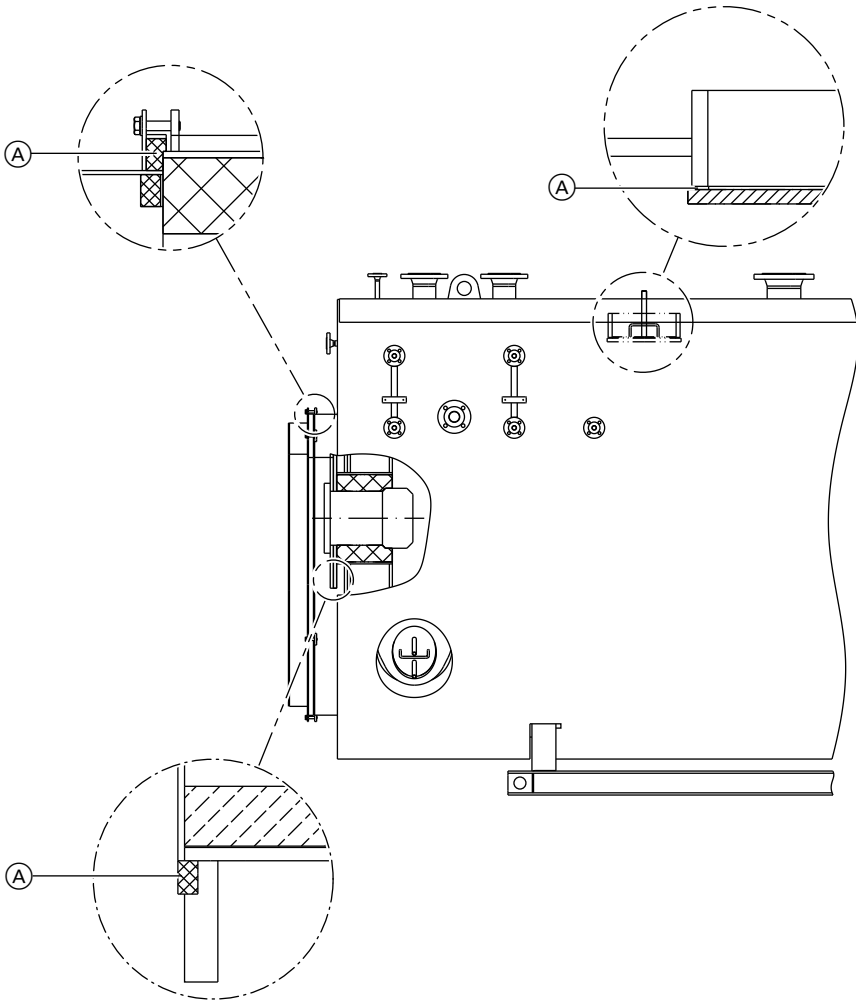
Sight glass with gaskets (A) should be checked for tightness and cleaned.

Further details regarding the individual steps (cont.)

Checking thermal insulation components and gaskets



Further details regarding the individual steps (cont.)



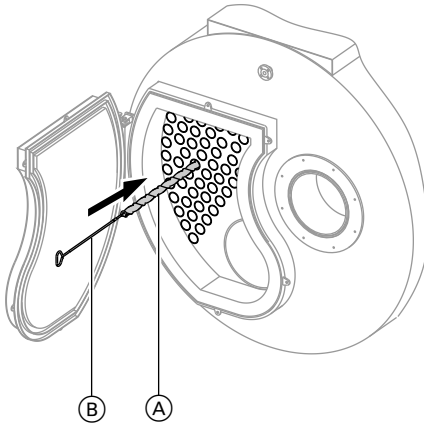
Check all gaskets/seals (A) and insulating parts for damage and a firm seat.

Note

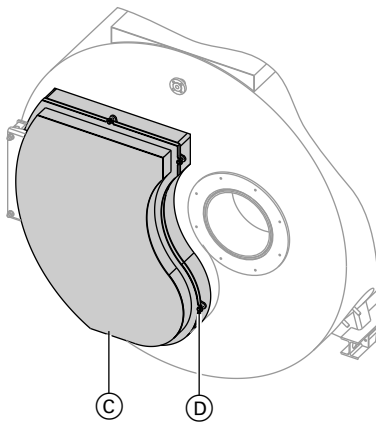
Only undamaged and properly fixed materials protect against the egress of gas and overheating, and consequently against material damage and injury.

Further details regarding the individual steps (cont.)

Inserting turbulators (if appropriate) and closing the boiler doors

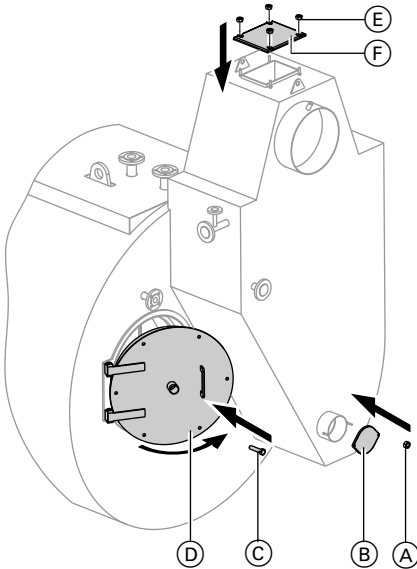


1. Push turbulators (A) using turbulator extractor (B) as far as they will go.
2. Close boiler door (C), tighten screws (D) evenly and diagonally (torque approx. 20 Nm).



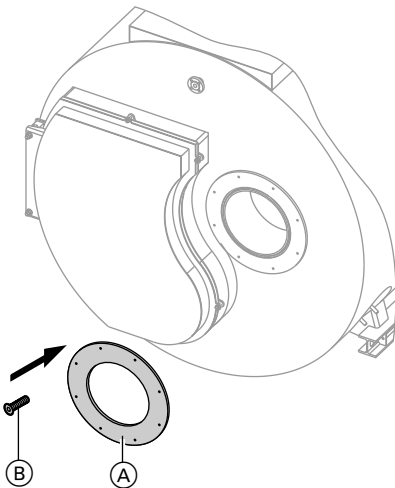
Further details regarding the individual steps (cont.)

Securing the cleaning cover



Fitting in reverse order, as described on page 48.

Mounting the burner



1. Secure burner plate (A) with screws (B) to the burner flange.
2. Thermally insulate the space between the flame head (burner) and the burner opening (boiler).
3. For pressure-jet gas burners, fit the gas supply pipe.



Danger

Escaping gas leads to a risk of explosion.
Check all gas connections for tightness.

Further details regarding the individual steps (cont.)

Checking the inspection ports for leaks

Note

Replace the gaskets every time a connection has been opened.

Only use gaskets approved in accordance with TRD 401, appendix 1 or VdTÜV [or local regulations].



Gasket manufacturer's installation instructions.

Checking the water quality



For water quality guidelines, see from page 22.

Adjusting the burner

By the burner manufacturer or authorised heating contractor.

Spare parts

Wearing parts, gaskets

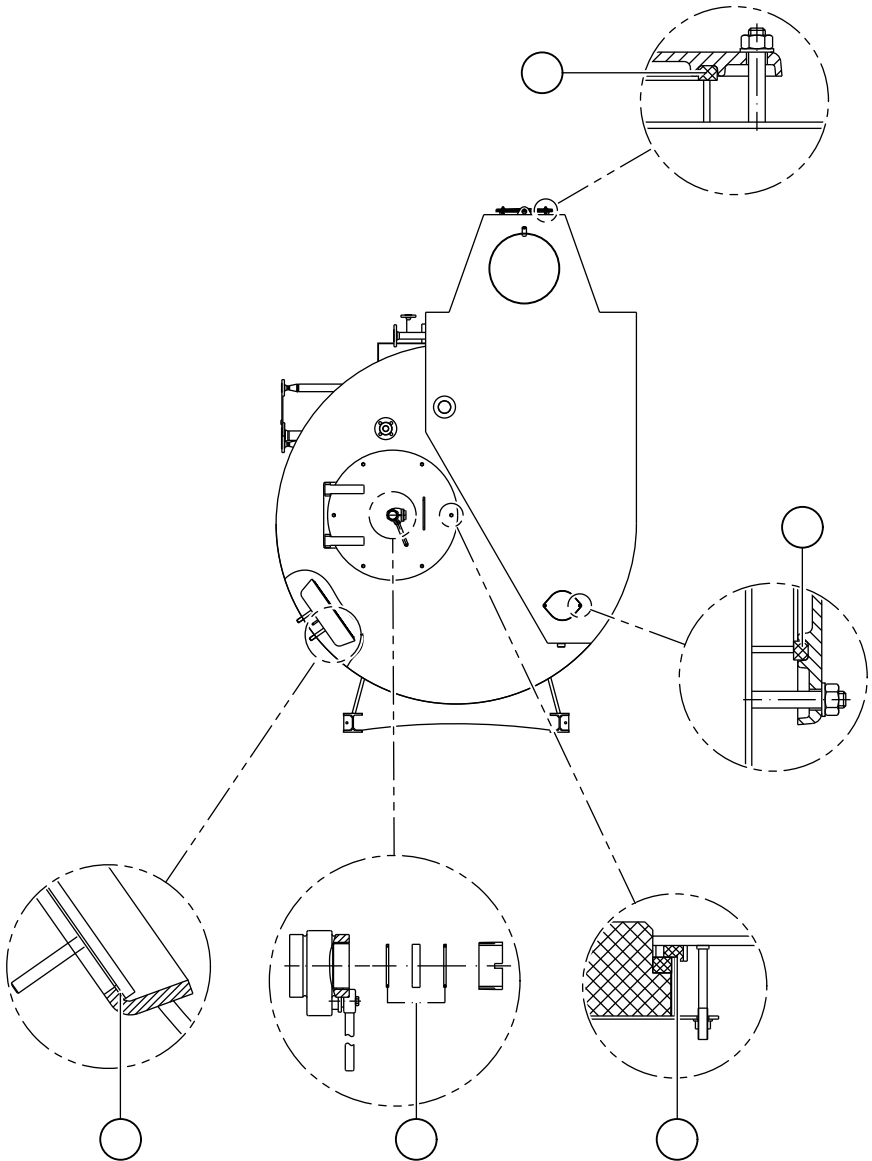
Note

When ordering spare parts, please quote the serial number and the boiler type (see type plate).

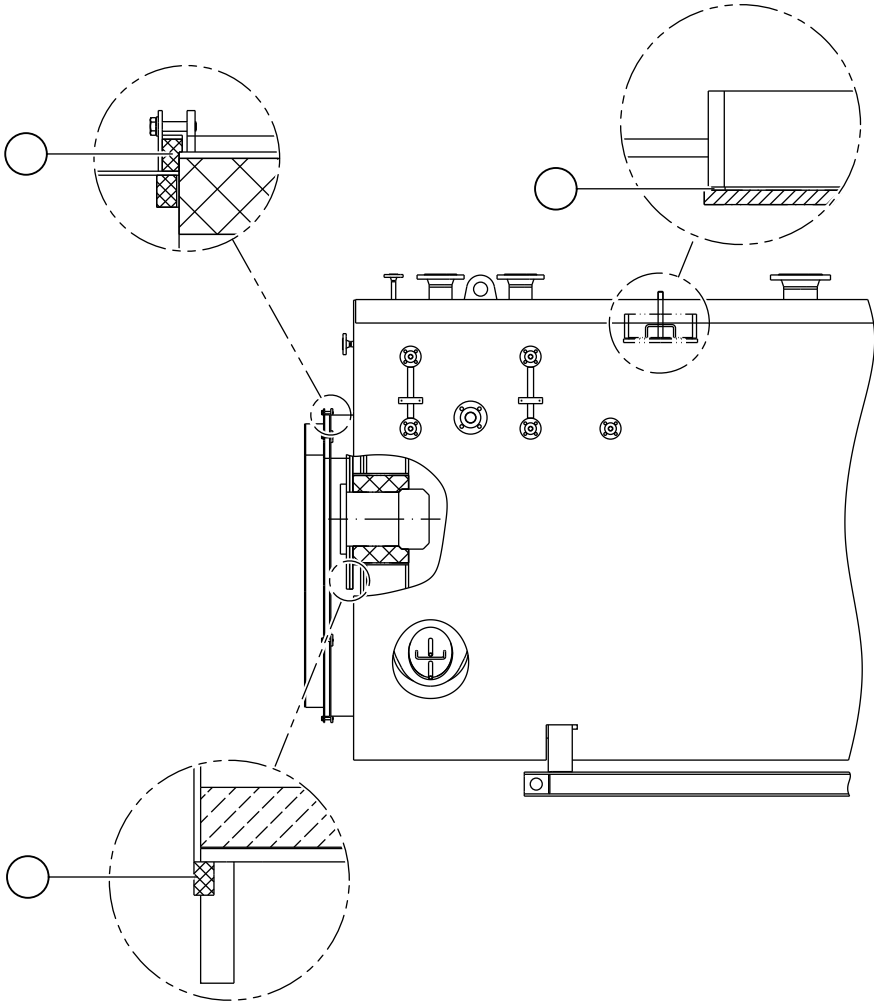
Quote required number of spare parts.

Obtain standard parts from your local trade supplier.

Wearing parts, gaskets (cont.)



Wearing parts, gaskets (cont.)



Operating, maintenance and inspection tasks

Operation of steam boiler systems Part 1- General instructions for users of steam boiler systems For steam boilers category IV Issue June 1983 (unchanged 8/93)		TRD 601 Operation Appendix 1		
Checklist for a steam boiler system (steam and hot water boiler) (S = Visual inspection; F = Function test; F* - at six monthly inspection (to TRD))				
Sheet 2 TRD 601 Operation	Tasks comprising operation, maintenance and inspections/tests per:	Shift	Day	
72 hours	Week	Month	6 months	
12 months	Type of tests (examples)			
3.2.1	Safety valves	S	F	Vent
3.2.2	Water level - display equipment	F	F*	Blow through and for boilers with p < 32 bar
3.2.3	Remote water levels	S		Comparison of display with the directly indicated water level
3.2.4	Sampling facility	F		Operation and clear passage
3.2.5	Water level controller	S	F*	Blow through and operation
3.2.6	Water level limiter		F*	Blow through or reduction to switching point
3.2.7	Flow limiter			Flow reducer
3.2.9/12	Thermostat or pressure switches	S	F*	Carry out comparative test
3.2.10/13	Temperature or pressure limiter	S	F*	Change in set value / test keys
3.2.8/11	Temperature or pressure indicators (pressure gauge)	S		Checking with precision thermometer / Zero point test
3.2.14	Drain and TDS facilities	F	F*	By activation
3.2.15	Boiler - fittings	S		By activation

Operating, maintenance and inspection tasks (cont.)

3.3.1	Feedwater and circulation facilities		S				The alternate operation
3.3.2	Feedwater and boiler water testing		X				Through analytical monitoring acc. to TRD 611
3.3.3	Devices for monitoring boiler water regarding ingress of foreign matter		S		F		Activation of test key
3.4.1	Flue gas dampers - limit switch				F*		Closing and re-opening of the damper
3.4.2	Burner control (servomotors for air and fuel)				F*		Operation
3.4.3	Combustion air fan, ignition and/or cooling air fan		S		F*		Quiet running, transfer of power (e.g. Vee-belts)
3.4.4	Air pressure-volume display and air pressure switch				F*		Interruption of the pulse line
3.4.5	Fuel shut-off facility		S		F		Operation
3.4.6	Fuel store and lines/valves/fittings		S				Operation, leaks
3.4.7	Fuel indicator		S		F		
3.4.8	Safety shut-off facility upstream of the burner (for a 72-hour-operation also in the return line)		S		F		Operation, leaks
3.4.9	Tightness checking facility or intermediate air vent valve		S		F		
3.4.10	Burner limit switch						Pivoting the burner, pulling the burner lance
3.4.11	Emergency stop switch				F	F*	Activation
3.4.12	Ignition		S				
3.4.13	Ventilation		S			F*	
3.4.14	Flame monitor		S		F		Through covering the sensor
3.4.15	Assessment of combustion		S				
3.4.16	Assessment of combustion chambers and flues					F*	
3.4.17	Emergency stop switch					F	

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