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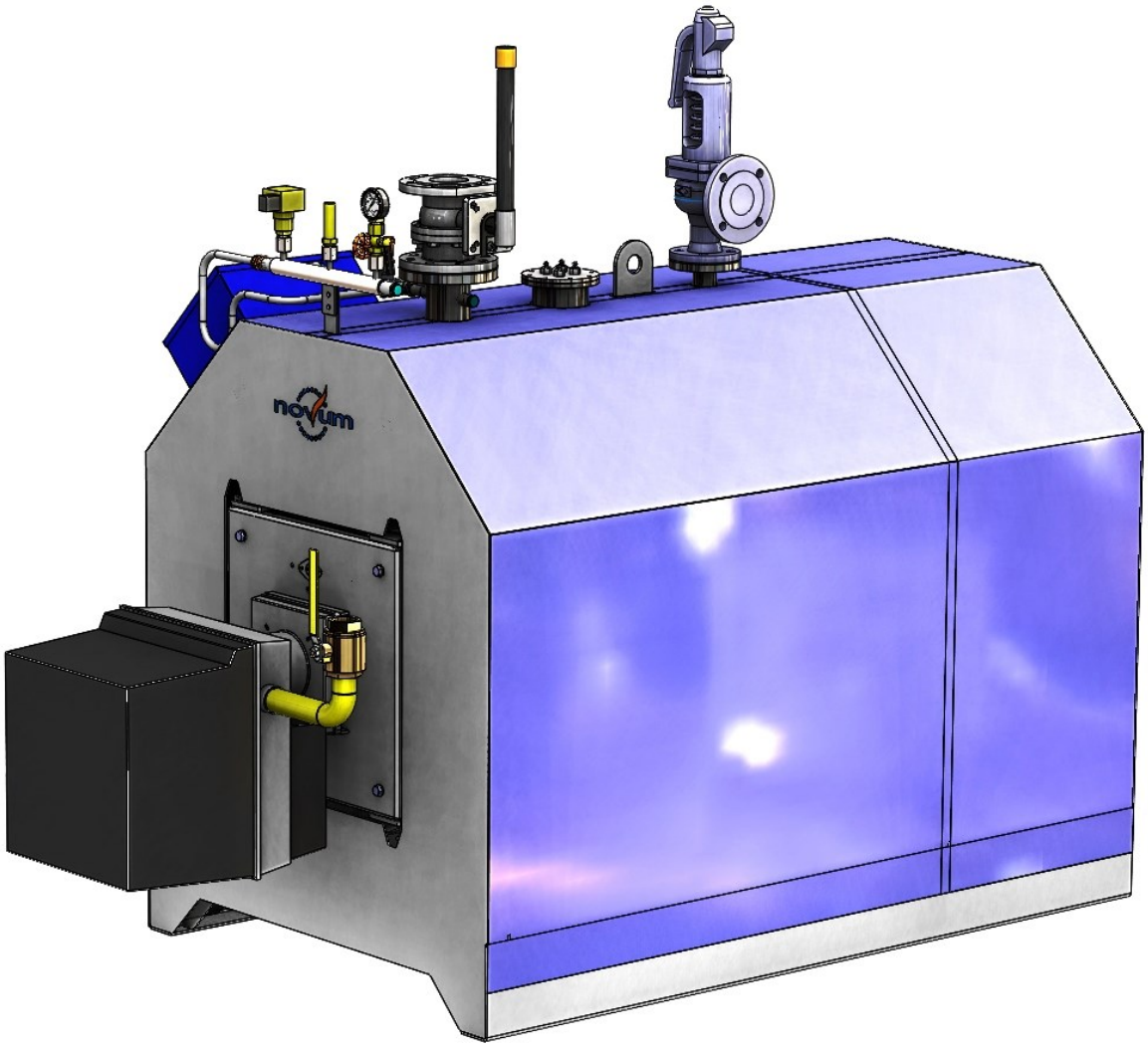


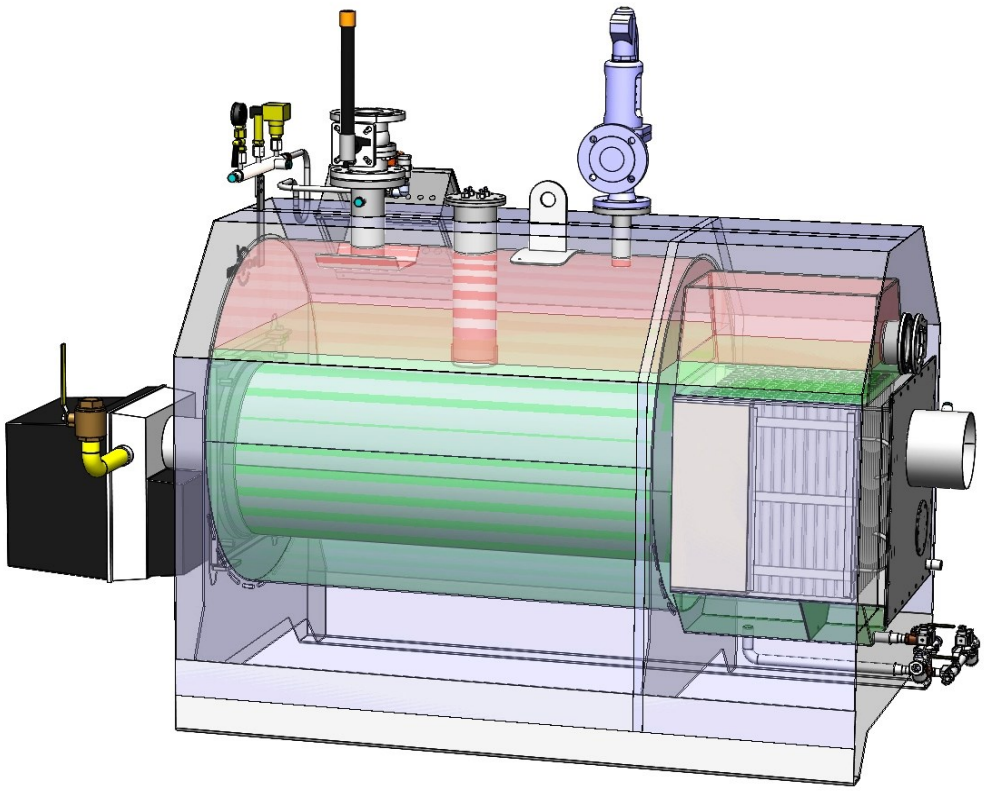
General

This manual provides an overview of the most important aspects for the installation, assembly, maintenance and use of the Novumax LD-HR low-pressure steamboiler. The requirements described in this document must be strictly followed.
The data published in this technical information is based on the most recent information. The information is provided is subject to subsequent changes. Novum reserves the right to change the Novumax LD-HR boiler type at any time without obligation to adjust previously made deliveries accordingly.

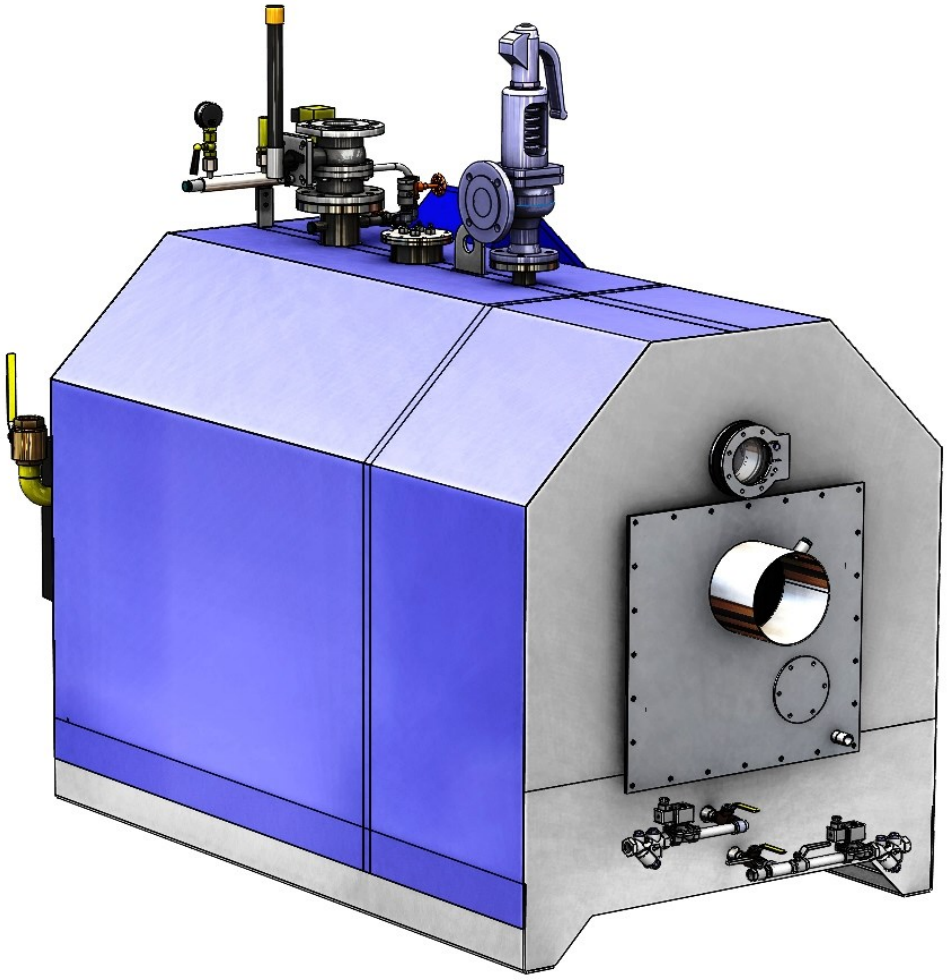
Boiler description

The Novumax LD-HR is a high-efficiency low-pressure steam boiler constructed for burning natural gas or propane. It can be used to generate low-pressure steam up to 0,45 bar. A pressurerised burner is used for this. This burner forms a flame in a generously sized firetube. The flue gases are further cooled in a stainless steel watertube heat exchanger located behind the firetube and then flow to the fluegas outlet. The firetube and the heat exchanger are housed in a cylindrical boiler body. This hull is filled with water to a level that is above the firetube heat exchanger. Steam evaporates on the water line, which builds up the pressure in the boiler.
The pressure part of the boiler is entirely made of stainless steel (AISI 316L). This prevents waterside corrosion. Furthermore, the flue gases in the heat exchanger are cooled to close to the water/steam temperature. The cold make-up water is introduced into the boiler in counter-current with the flue gases. As a result, the flue gases in the heat exchanger will condense and a high efficiency will be achieved.

The steam outlet is located at the top of the boiler; the make-up connection at the rear bottom. Furthermore, the boiler is equipped with the necessary control and safety components



such as: safety valve, pressure gauge, max. pressure protection, level control, level protection and blow-down control. The front has a burner plate with burner connection and sight glass. The hull of the boiler has a rockwool insulation and is finished with a steel plating painted blue.



Boiler equipment

The following equipment has been installed on the boiler :

- Steamvalve (type ball valve), material stainless steel. The valve must be provided with a steamline for transport to the steam users. The steamline must be made of steel or stainless steel; if necessary, to be drained (approximately every 20 meters). Because the steam temperature is around 105˚C, the pipe must be insulated.
- Safety valve, spring loaded, cast iron material. The valve is adjusted to a blow-off pressure of 0.5 bar(g) and is supplied with a test certificate. The valve is equipped with a valve lifter (lever). This should not be used unless strictly necessary. A safety valve, once opened, is then usually no longer 100% closed and therefore continues to leak. The valve must be fitted with a proper blow-off pipe. This pipe must be laid with minimal resistance (max. 5 kPa) to the outdoors. The outlet must be designed in such a way that steam and water coming from this pipe do not cause

Installing the Novumax LD-HR

Legal requirements

The boiler must be connected to an installation that complies with all local regulations.

Technical data

See Novumax LD-HR sheet: technical data.

Transport

When unloading and hoisting the boiler, use must be made of existing lifting eyes. The boiler may also be rolled over the beams under the boiler.

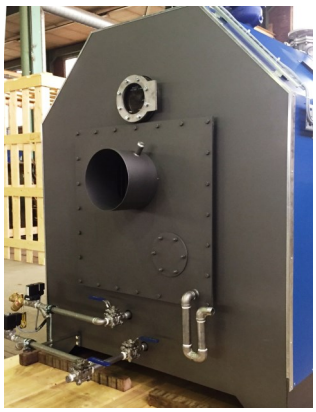
Installation

The boiler can be placed on the boilerhouse floor without further provisions. The boiler support frame does not heat up during boiler operation. There must be sufficient space for maintenance and inspection during installation in the boiler house. The installation floor must be level. The installation room must be kept frost-free at all times.

Fluegas inspection

The rear of the boiler is equipped with a dismountable fluegas plate. The fluegas outlet connection is fitted on this fluegas plate. Since it must be possible to remove this fluegas plate for service purposes, the stack must be dismountable. For normal maintenance and inspection work, however, it is sufficient to use the smaller lid in the fluegas plate. Both the flue gas plate and the inspection cover are sealed with a gasket made of Teflon tape, bolts and nuts.

Condensate drain/ siphon



At the lowest point of the flue gas plate there is a condensate drain sock (¾"), which is equipped with a siphon. This trap must be connected to a drain pipe made of stainless steel, plastic or copper. This pipe must be laid down with a slope. The pipe must be equipped with an open funnel in the immediate vicinity of the siphon, such that no condensation water remains in the boiler when the drain pipe is clogged. The trap is made of stainless steel pipe nipples and 90˚ elbow pieces. Since these are all fitted connections, dismantling, cleaning and assembly is easy to carry out.

Filling and draining bottomvalve

At the rear of the boiler, there is a ½" filling and draining valve (side connection of automatic drain). The boiler is almost completely emptied by draining. For tapping should the boiler be allowed to cool (<50°C)

Combustion chamber pressure

On the front door, there is a test point on which the combustion chamber pressure can be measured. Make sure that this measuring nipple is normally closed.

Fluegas outlet

The horizontal stub of the flue as outlet connection must be connected to a fluegas outlet channel (stack) of high-quality corrosion-resistant material (stainless steel or thick-walled aluminum, not plastic). The stack has to comply local rules. The following condition must be met when designing and installing a fluegas outlet:

- The duct and its connections must be watertight and airtight. Flue gas outlets must be insulated against the risk of contact.
- Angled connections may not be used (minimum 90˚ bends with 3 segments). Connection channels must be designed to be flow-friendly, with as few bends as possible, sharp edges etc. Multiple bends in succession must be avoided. An unfavorable channel loop resp. inlet and outlet connections can negatively influence the proper functioning of boiler / burner combinations.
- Thermal expansions of duct sections must be taken into account. If necessary, compen-

sators must be applied.
- Condensation that develops in the canal, or rainwater, must be drained to the sewer system at the lowest points. It is allowed to let all the condensate flow back to the boiler and to make use of the drain facility in the boiler's smoke box.
- The back pressure that arises in the duct as a result of the burner installation operating (at full load) must not exceed the maximum back pressure of the flue gas discharge system. See for this Novumax LD-HR technical data. The calculation should be based on a flue gas quantity as stated in this sheet in kg/hr and a maximum flue gas temperature of 120˚C.
- The flue gas outlet connection of the boiler is equipped with a ½ "connection with plug. This connection can be used for measurements on the flue gas flow. For official NOx measurements, however, special measuring provisions are required in the flue gas discharge duct (Scope 6 according to AB 3.2.1.)

Combustion air

The combustion air that is needed by the burner must reasonably be dust-free. Furthermore, it is of great importance that no foreign substances can be drawn in, including, for example, hydrocarbons and halogen compounds.

Burner

For installation of the gas burner: see installation and operating instructions of the burner.

Use of boiler

General

Since failure to properly follow the instructions below can cause danger, it is important that the necessary work is carried out by a competent person.

Commissioning

Before commissioning, check that:
- the boiler and the installation are filled with water up to a level between "solenoid valve in" and "solenoid valve off"
- the steam valve is closed
- the measuring nipple on the front door and the measuring sock on the smoke lid tightly closed
- burner is mounted properly (see manual of burner)
- the stack is properly installed and there are no leaks
- the blow-off line of the safety valve is well laid out
- the blow down pipe is well laid out
- the maximum pressure switch is set on the correct value and the pressure control functions properly
- softened water (<0,1 ˚dH is available, with sufficient flow and a supply pressure that is between 1–4 bar(o)

Heating up and operation of the boiler

By switching on the burner the boiler will be put into operation. Follow the instructions of the burner before commissioning the burner. After commissioning, check all water-side and flue-gas side gaskets for leaks. If the boiler pressure is equal to the set value, the steam valve can be opened slowly.

Boiler out of operation

By switching off the burner, the boiler will cool down and pressure will drop. A vacuum breaker has been fitted to prevent a vacuum from occurring in the boiler. As the boiler is made of stainless steel, there is no corrosion in the aerated boiler and no preservation is

required. It is recommended that the gas tap of the burner and the steam valve be closed if the boiler is not used for a longer period of time.

Burner control

The capacity control of the burner must be modulating and stable (no commuting behavior). Frequent switching off of the burner at full load position must be avoided as this causes burner malfunctions and high material stresses in the boiler. Under normal operating conditions, the burner must first be moved to the lowest load position before the burner is switched off. Frequent switching off of the burner at full load can cause damage to the boiler. Damage that occurs as a result of frequent switching off of the burner at full load is not covered by the factory warranty.
For operation of the gas burner: see installation and operating instructions of the burner.

Warning ⚠

There are surfaces on the boiler that have a surface temperature of up to 110˚C. These components include the steam and water-side connections, the sight glass and the flue gas connection. Touching hot parts can cause injury. This also applies to the drain water.

Condensate discharge

When the boiler is filled with cold water fluegas condensation will occur. This condensate is drained via the condensate drain connection with siphon. This condensate has a pH value of approx. 3. Check your local rules in aspect of neutralisation.

Maintenance and inspection

General

As failure to properly follow the instructions below can cause danger, it is important that the required work is performed by a person skilled in the art.

Work on the fluegas side:

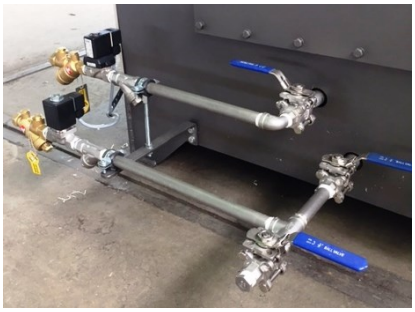
The boiler must be inspected once a year on the flue gas side and cleaned if necessary.
To do this, proceed as follows:
- switch off the main switch.
- close the gas tap.
- disconnect the gas line.
- disconnect electrical cabling to burner and gas line.
- Unscrew 4 M12 bolts from the burnerdoor.
- Carefully open the burnerdoor.
- Inspect the firetube and the heat exchanger.
- If necessary, clean the firetube and heat exchanger with a brush.
- Inspect the heat-resistant cover of the burner door and the gasket of the burnerdoor.
- Disassemble the inspection cover in the rear flue gas plate.
- Inspect the heat exchanger at the rear, and inspect the condensate drain with siphon. Clean if necessary.
- If the ceramic filler panels and / or the stainless steel filler panels located between the heat exchanger and boiler wall are damaged, they must be replaced. The flue gas plate must be completely dismantled for this purpose. New panels can be ordered from Novum.
- Assembly of disassembled parts in reverse order.
- Check the gaskets present and replace if necessary. The required packing material can be ordered from Novum.

Water-side work

any danger to the environment. It is recommended to make a drain pipe (not sealable) in the lowest part of the horizontal drain pipe section. This drain line, if present, can also be fitted on the drain provision of the valve.

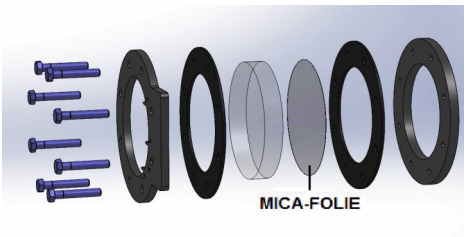
- Level control, consisting of 2 electrodes, a conductive switch amplifier and a solenoid valve in the make-up line. The electrodes are located on a connection flange on top of the boiler and are mounted vertically. If the level drops below the longer electrode, the switching amplifier (mounted in the control panel) sends the solenoid valve open. The boiler is topped up. When the level reaches the shorter electrode, the solenoid valve is closed again. Due to the consumption of steam and the draining of the boiler, the level will decrease again and the cycle will repeat itself.
- Level protection. There are 2 more electrodes on the connection flange on top of the boiler. These, together with the corresponding switch amplifiers in the control panel, provide the low water protection of the boiler (double design). It is important that the parts of the boiler that come into contact with flame and hot flue gases do not burn dry. If the level in the boiler becomes too low, the low water protection switches the burner off. Addressing low water protection is considered a malfunction; therefore, this fault must be reset manually on the control panel after the cause of the fault has been eliminated.
- Level indication. At the rear of the boiler there is a round sight glass with a diameter of 105 mm (visible part). This sight glass is mounted between 2 flanges with special EPDM gaskets. The water level in the boiler is visible through this sight glass. Markings on the outer flange indicate low water level, solenoid valve open level and solenoid valve close level. The sight glass construction also provides a water-side inspection option (with non-pressurized, cooled boiler). A transparent mica film has been applied to the water side of the sight glass. This is a thin, transparent foil that protects the sight glass against erosion and water-side attack. If this mica film is not used, the sight glass may break and injury or damage may occur. damage caused, see p. 7.
- Pressure protection. A maximum pressure switch is installed on a header in front of, on top of the boiler. This pressure switch is set slightly lower than the relief pressure of the safety valve. If the pressure in the boiler becomes too high, the pressure switch switches off the burner and the pressure rise due to heat transfer will stop. Addressing the maximum pressure switch is considered a malfunction; therefore, this fault must be reset manually on the control panel after the cause of the fault has been eliminated.
- Pressure control. A pressure sensor is also mounted on the header. This sensor gives the measured signal to a modulating controller. This controller is set to generate a constant boiler pressure. For this purpose, the controller controls the burner to higher or lower power, depending on the magnitude of the steam consumption. The pressure in the boiler can be read on the controller, but also on a manometer which is mounted on the header.

• Blow-down control. A blow-down connection with ball-valve and drain solenoid valve is fitted at the rear of the boiler. Multiple arrangements are possible. The most commonly used control is a proportional fill - discharge control: discharging during filling. The supplementation resp. drainage amount is determined by a mechanical flow regulator fitted in the pipe line. The capacities of these flow regulators are fixed when the boiler is delivered. The discharge percentage will always be the same fixed value. Optionally, a heat exchanger can be supplied with which the make-up water is pre-heated by the drain water.



The boiler must be inspected water-side once a year and cleaned if necessary. To do this, proceed as follows:
- Switch off the main switch.
- Wait until the boiler has cooled down sufficiently (<50˚C)
- Drain the boiler, empty it, at least to the extent that a large part of the firetube is exposed.
- Loosen the flange with electrodes on top of the boiler. Check electrodes for deposits; clean if necessary.
- Remove the flange of the sight glass on the rear of the boiler. Remove sight glass. Inspect pipe plate, firebox and other boiler walls for deposits and contamination. In the event of contamination, contact an accredited water treatment company and / or Novum
- Remove the connection line from boiler to header; check internally for contamination and blockage. Clean if necessary.
- Disassemble the drain line and drain fittings and check for internal contamination; if necessary, cleaning

Mount flanges, pipe parts, etc .: pay attention to the correct gaskets.
Assembly of borosilicate sight glass: pay attention to mica film on the water side (see page 4).



Checks

The following controls and safety measures must be checked periodically for proper operation. The frequency depends on the usage; we advise at least once every 3 months.
- level
- pressure control
- Level monitoring
- pressure monitoring
- blowdown line

Burner

For maintenance of the burner, see installation and operating instructions of the burner.

Boiler failures

Maximum pressure.

To reset using push button on boiler panel. Check the boiler control (settings of modulating controller, correct operation of pressure sensor and max. pressure switch on the boiler).

Low water protection.

Resettable with push button on boiler panel. Check whether sufficient make-up water is available. Check whether the water quality is good. Particularly if the drainage system does not work (properly), this has consequences for the water quality. Poor water quality gives a restless, fluctuating water level with the risk of malfunctions. Furthermore, a lot of water will disappear through the steam pipe.

Water quality

The boiler can be supplemented with:
- Fully softened tap water (<0.1˚dH).
- Reverse osmosis or demi water

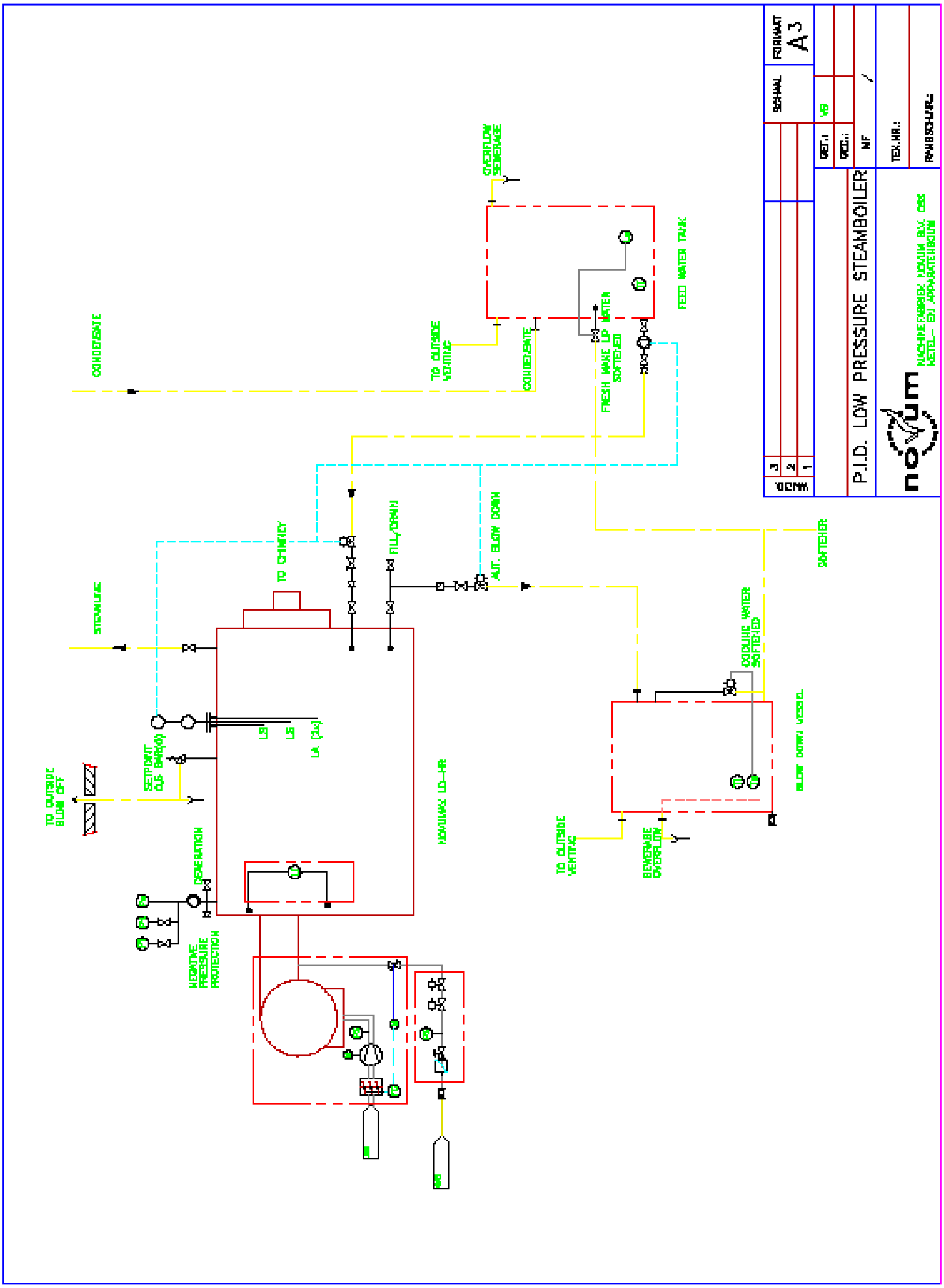
Softened tap water (<0.1˚dH) can have a chloride content of 10-150 ppm. We do not recommend using tap water with a chloride content > 100 ppm. The required drainage percentage depends on the chloride content of the tap water and the possible reuse of condensate. The condensate must not be contaminated with other substances. The pH value of the boiler water must be > 9˚dH. A purge percentage of 5-25% is required, depending on the chloride content. No dosing of chemicals (oxygen binders) is required. Residual hardness binders may be used. This can offer some protection if the boiler is unexpectedly operated with too hard water.

Reverse osmosis water (RO water) or demi water is normally completely softened and low in chlorides. Steam condensate must not be contaminated with other substances. The pH value of the boiler water must be >7˚dH. A dblow down rate of 3 -10% is required. No dosing of chemicals (oxygen binders) is required. Residual hardness binders may be used. This can offer some protection if the boiler is unexpectedly operated with too hard water.

Regular monitoring of water quality is of great importance. Poor water quality can lead to:
- a strongly fluctuating water level, so that a lot of water is carried along with the steam an low-level malfunctions can occur.
- contamination of control and monitoring equipment, which can cause malfunctions, defects and damage to boiler and surroundings.

Spare parts list

Description	fabr.	material	type of	quantity
Level electrode		ceram./rvs	TP30	4
Gasket fire-door		glass fiber cord	22x22 mm	1
Sight glass front door		heat-resistant	Ø20	1
Gasket electrode		viton	Ø @@	1
The switching amplifier	GICAR		RL40	2
Modulating controller	Siemens		RWF50	1
Pressure sensor				1
Gasket sight glass kettle		EPDM	Ø160x105x3	2
Mica protective		mica	plateØ125x0.2	1
Sight glass boiler		borosilicate	Ø125x20Drain	1
solenoid valve	Burkert	stainless steel	255	1
Supplemental solenoid valve	Burkert	stainless steel	6213	1


P.I.D. LOW PRESSURE STEAMBOILER
FORMAAT A3
SCHAAL
OVERFLOW SEWERAGE
FEED WATER TANK
TO OUTSIDE VENTING
CONDENSATE
FRESH MAKE UP WATER SOFTENED
STEAMLINE
TO CHIMNEY
FILL/DRAIN
AUT. BLOW DOWN
SOFTENER
COOLING WATER SOFTENED
BLOW DOWN VESSEL
NOVUMAX LD-HR
TO OUTSIDE BLOW OFF
NEGATIVE PRESSURE PROTECTION