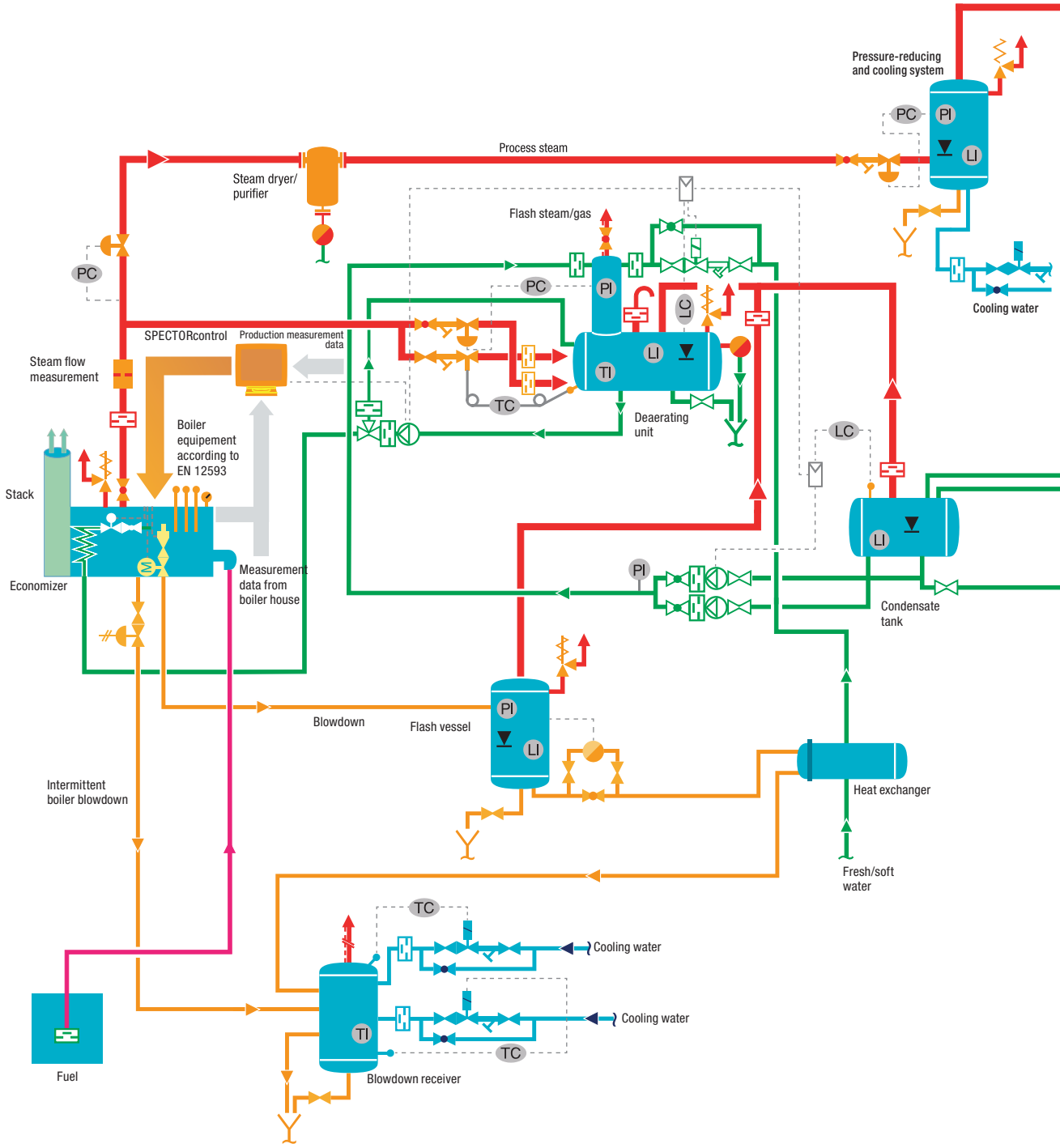
GESTRA®

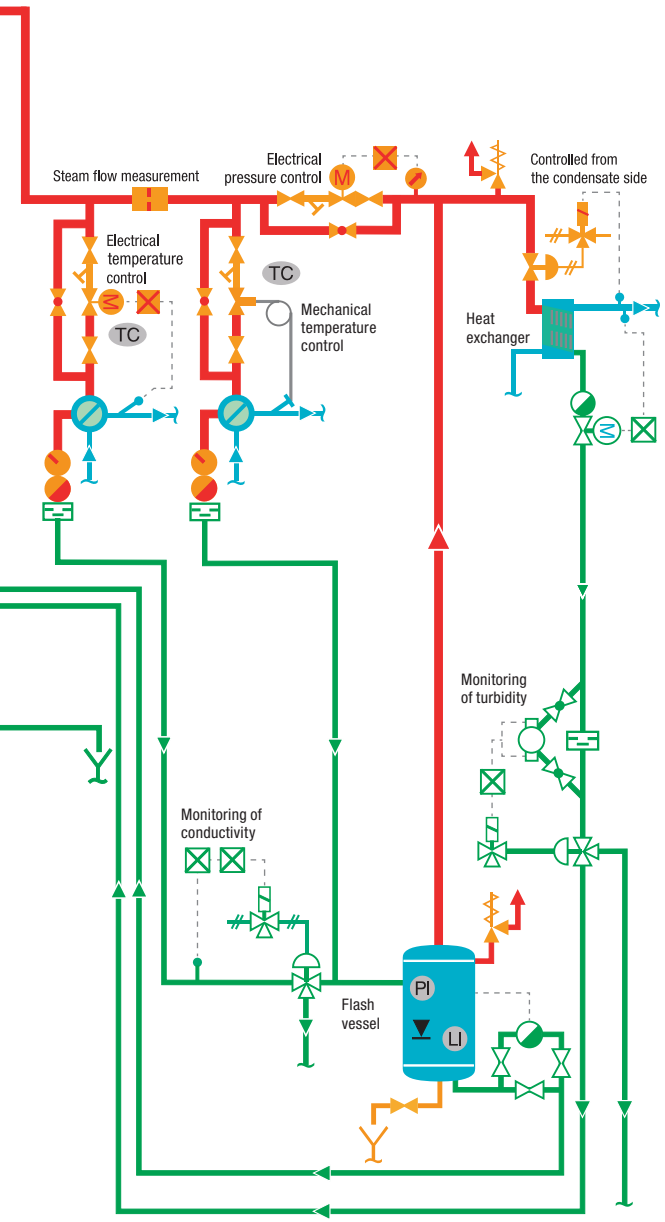
Special equipment and vessels for heat recovery

The best tailored system for every application

Engineering steam performance

Steam and condensate systems with one-stop sophistication





Contents

Foreword

GESTRA is known all over the world as a manufacturer of high-quality steam traps, non-return valves and special equipment for the steam and condensate industry.

GESTRA is the largest supplier of boiler equipment in Europe and has achieved this leading position by focusing on quality and safety, as well as on innovative, forward-looking solutions.

In the German market, GESTRA has been offering complex solutions for steam and condensate systems for many years now – with great success. As a “one-stop shop”, we offer special equipment and vessels for heat recovery that are fitted with premium-grade industrial valves and modern control systems. In this brochure, we present and explain a selection of the heat recovery units from our wide range of products.

Quality – Made in Germany

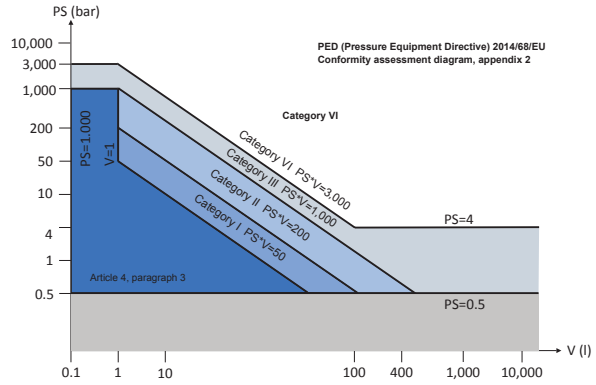
As a manufacturer of top-class heat recovery equipment, GESTRA concerns itself with all aspects of plant safety and reliability. We consider these factors in great detail early on when designing our components. Safety margin, operational reliability and plant availability form the foundation of our design philosophy.

The QM system at GESTRA was examined and approved in 1987, the year of publication for the ISO 9000 series, by Lloyd's Register Quality Assurance according to ISO 9001. Diverse technical codes and standards apply in the various regional markets. These include PED, IBR, SQL, ASME or GOST.

In most cases, we are able to serve enquiries from these markets and submit a comprehensive offer. The Pressure Equipment Directive PED 2014/68/EU applies for the European Internal Market.

Module classification

Category	Module
I	A
II	A1, D1, E1
III	B (design) +D, B (design) +F, B (type) +E, B (type) +C2, H
IV	B (type) +D, B (type) +F, G, H1



Module description

Module	Description	QA system	Involvement of a notified body
A	Internal production inspection	No	No
A2	Internal production inspection with monitored pressure equipment inspections at irregular intervals	No	Yes
B	EU type examination	No	Yes
B	EU design examination	No	Yes
C2	Type conformity based on an internal production inspection with monitored pressure equipment inspections at irregular intervals	No	Yes
D	Type conformity based on quality assurance for the production process	Yes	Yes
D1	Quality assurance for the production process	Yes	Yes
E	Type conformity based on quality assurance for the pressure equipment	Yes	Yes
E1	Quality assurance of final inspection and pressure equipment	Yes	Yes
F	Type conformity based on inspection of the pressure equipment (product verification)	No	Yes
G	Conformity based on a single inspection (unit verification)	No	Yes
H	Conformity based on full quality assurance	Yes	Yes
H1	Conformity based on full quality assurance with design examination	Yes	Yes

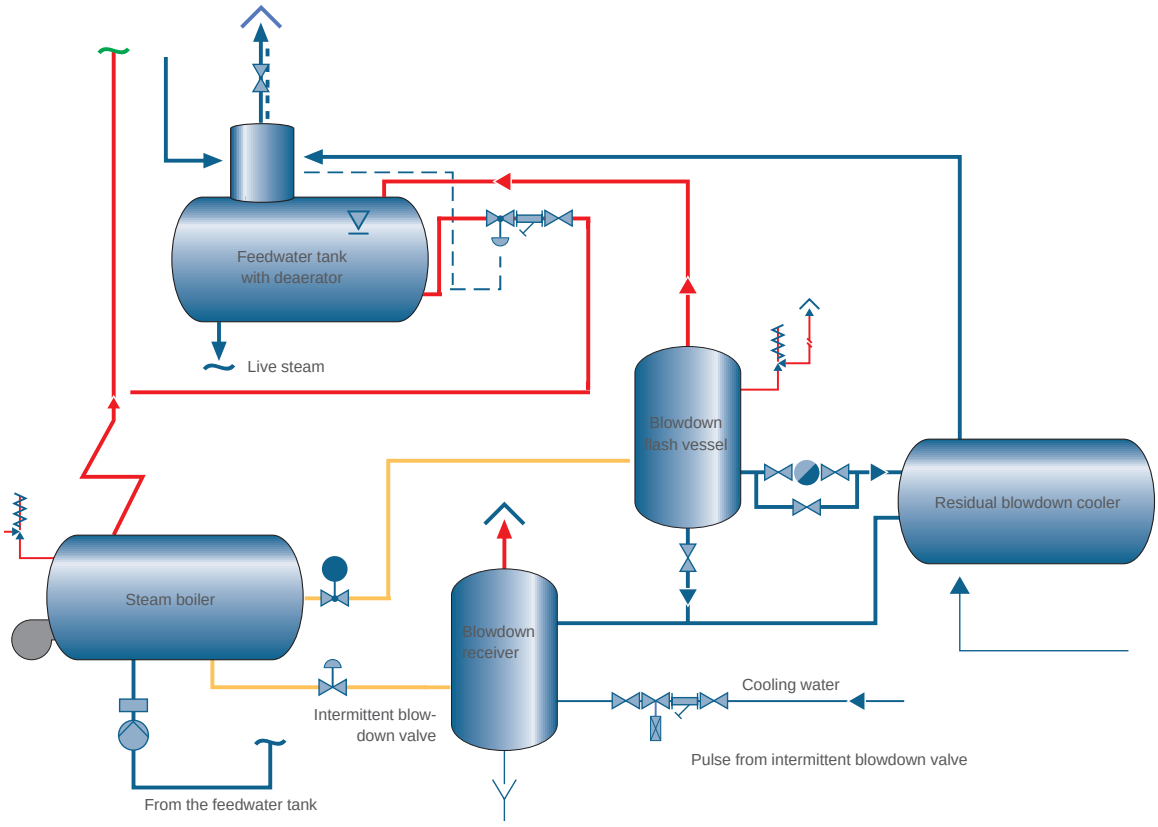
GESTRA energy recovery systems

Whether continuous blowdown is controlled automatically or set manually, it is easy to make use of the dissipated heat afterwards. In a GESTRA blowdown flash vessel, for example, the energy generated by continuous blowdown is recuperated to a large degree by flashing. The flash steam generated here can be used as buffer steam in the feedwater deaerator. What's more, in a residual blowdown cooler located downstream, the heat remaining in the flash vessel can be used to preheat the feedwater. Flash steam coolers are another method of recovering heat. They can be used for preheating the make-up water using flash steam from the feedwater deaerating system, for example. GESTRA's experienced systems and process engineering specialists are at hand to provide you with individual advice.

In Germany and many other countries, heat recovery systems from GESTRA are eligible for investment subsidies.

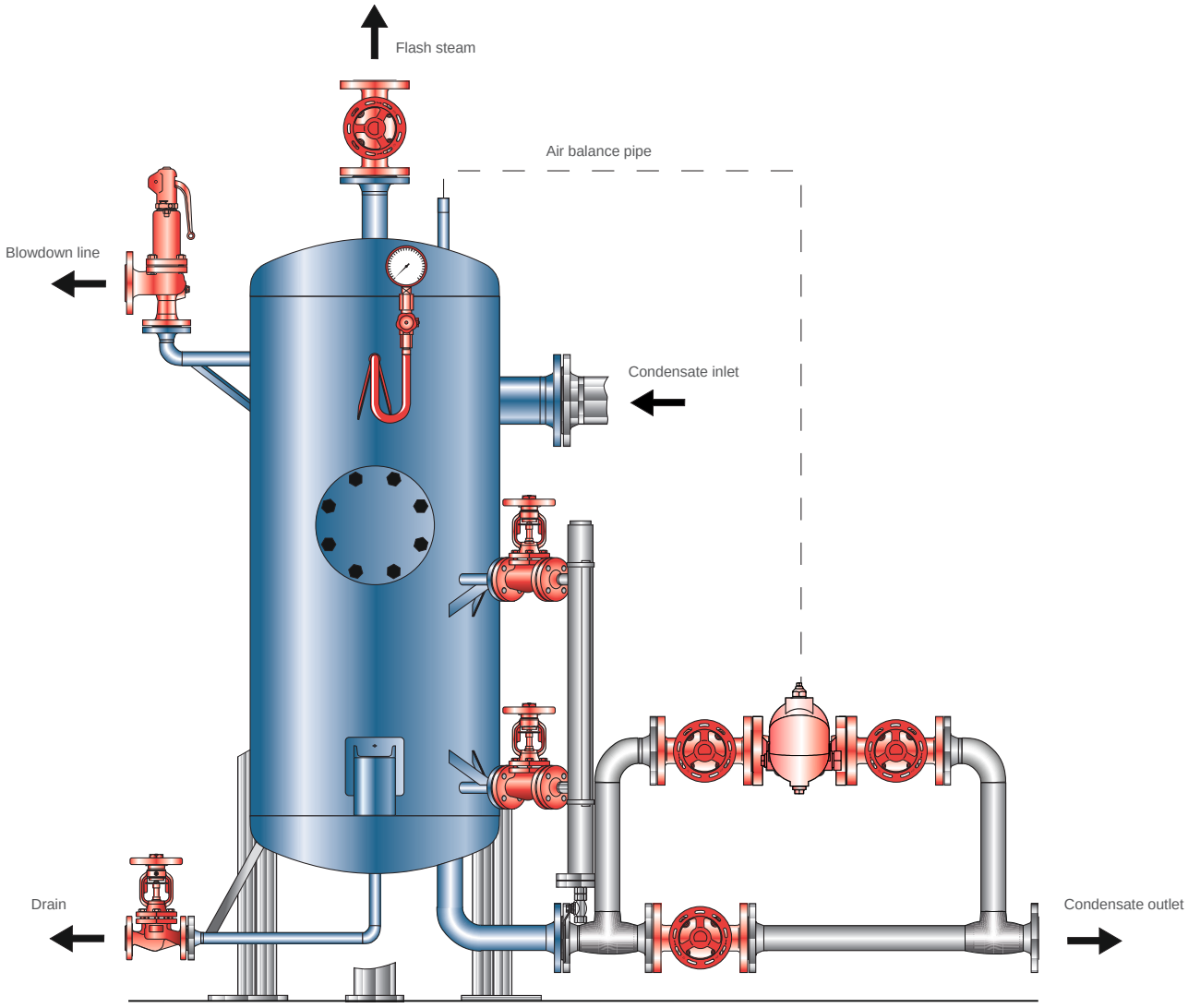
Recovering energy after continuous blowdown

Annual saving for 24 operating hours a day and 250 working days a year	19,000 EUR	▶	Equipment investment (flash tank and heat exchanger incl. fittings, without installation) 11,000 EUR	▶ Amortisation period approx. 7 months
Boiler capacity	10 t/h			
Boiler pressure	10 barg		*Basis for calculation	
Continuous blowdown flow-rate approx. 5%	500 kg/h		Light fuel oil EUR/t 450 EUR	
Heat recovery	456 x 106 W/a		Water treatment EUR/m³ 3 EUR	



GESTRA flash vessel systems

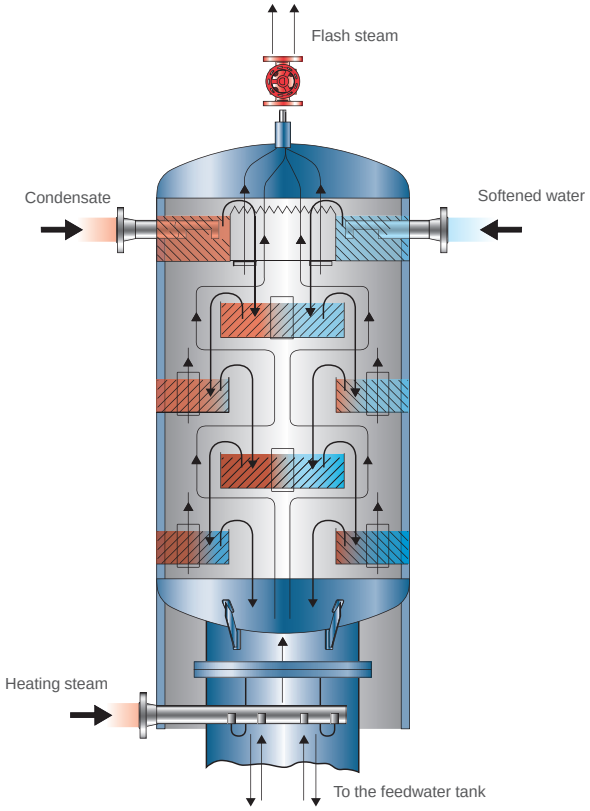
Flash vessels considerably lower running costs by making especially cost-effective use of the heat from the condensate. They can be used in all steam systems in which flash steam can be recovered from steam consumers at a lower pressure. This process releases heat that gives rise to flash steam. In the flash vessel, this flash steam separates from the water and is fed into a steam system at low pressure for further use. Such a process can be repeated several times, depending on whether and how the steam system can be operated with different pressure ratings. The residual condensate in the flash tank is conveyed to a collection tank and reused as boiler feedwater.



GESTRA feedwater deaerating systems

The operation of steam generating units with a high heating surface load requires boiler feedwater that is treated in accordance with TRD 611, EN 12952 Part 12 or EN 12953 Part 10. The boiler feedwater must be free from hardness-producing chemicals, in order to avoid the build-up of scale on the heating surfaces of the steam generating unit. The aggressive properties of dissolved oxygen and carbon dioxide provokes severe corrosion damage on metal materials. Aggressive gases are reliably removed in the GESTRA feedwater deaerating system.

The feedwater deaerating system for boiler feedwater consists of the SW feedwater tank and the NDR deaerator dome. This system removes dissolved gases like oxygen, carbon dioxide and other gaseous substances from the condensate and softened water. We tailor the size and thermodynamic characteristics of our feedwater deaerating system to customer specifications.



The make-up water and return condensate enter the NDR deaerator dome, which is fitted with a series of welded tray compartments for maximum trickling. Heating steam is fed from below into the NDR deaerator dome, which is mounted on top of the SW feedwater tank. The deaerated make-up water and return condensate flow directly from the deaerated dome into the feedwater tank. A steam injector installed in the lower part of the feedwater tank is used to heat up the feedwater to approx. 107 °C.

Oxygen and carbon dioxide are dissolved in water according to Dalton's law of absorption, which states that gas solubility in a solution decreases together with the gas partial pressure above the station. The gas solubility in water therefore decreases as the water temperature rises. The make-up water and return condensate are distributed over the series of trays, coming into direct contact with the heating steam. This counterflow process reduces the solubility of oxygen and carbon dioxide, thus removing these gases. The released gases, known as flash steam, work their way to the top of the vessel, where they are vented from the deaerator done via the vent line.

We recommend a temperature-controlled heating system for warming up a cold feedwater tank. From a feedwater temperature of 70 °C, a pressure-controlled heating steam supply must be used during commissioning. Due to the fact that the feedwater temperature is above 100 °C, a minimum inlet height to the boiler feed pump is required to prevent the formation of steam bubbles in the pump housing.

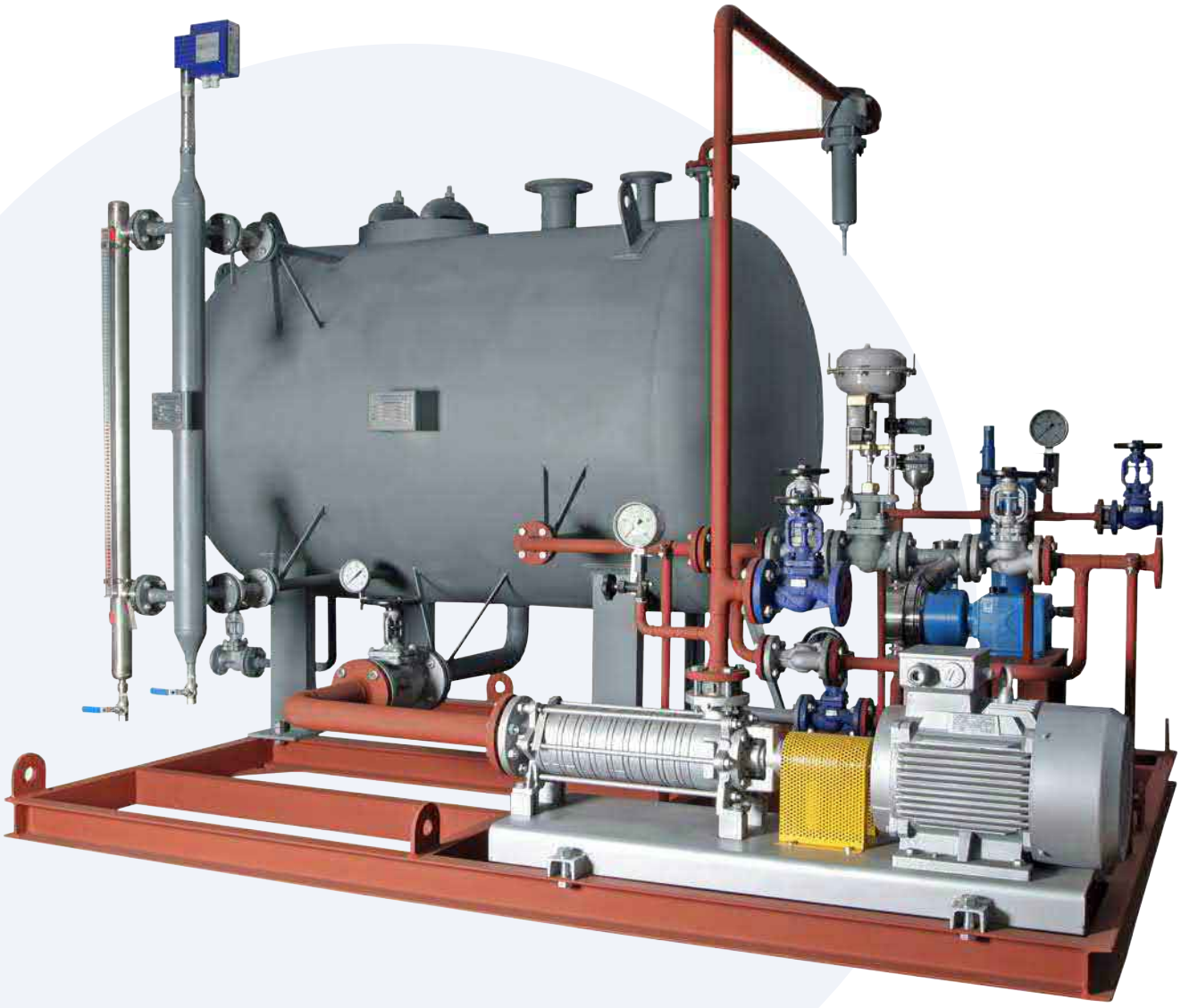
With the GESTRA feedwater deaerating system, the oxygen content can be reduced down to 0.02 mg/l.

GESTRA condensate recovery and return systems

In steam and condensate systems, positioning heat consumers lower than the condensate recovery tank is often unavoidable. If the operating pressure in the condensate system is high enough, the condensate line to the consumers can also be installed so that it rises constantly, in order to prevent sudden changes in height.

If there are jumps of more than seven metres, we recommend using condensate dampening pots (type ED) to prevent water hammer. These provide a cushioning effect to neutralise water hammer. If the operating pressure in the condensate system is insufficient for returning the condensate to the boiler house, condensate return units are required.

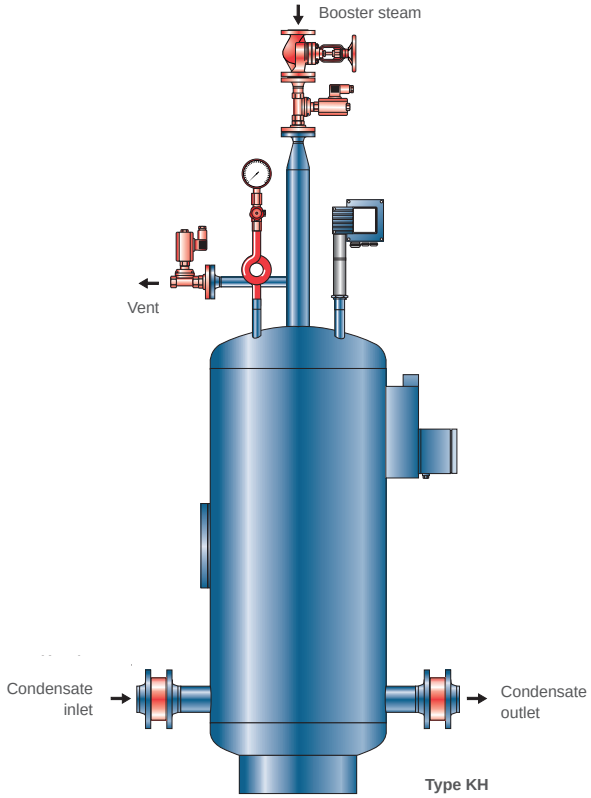
GESTRA condensate recovery tanks collect the condensate coming directly from steam consumers or a flash vessel. Booster steam is used for level-dependent transport of the condensate from the collection tank to the feedwater tank, either via a steam-powered condensate return units (type FPS or KH) or by means of condensate pumps.



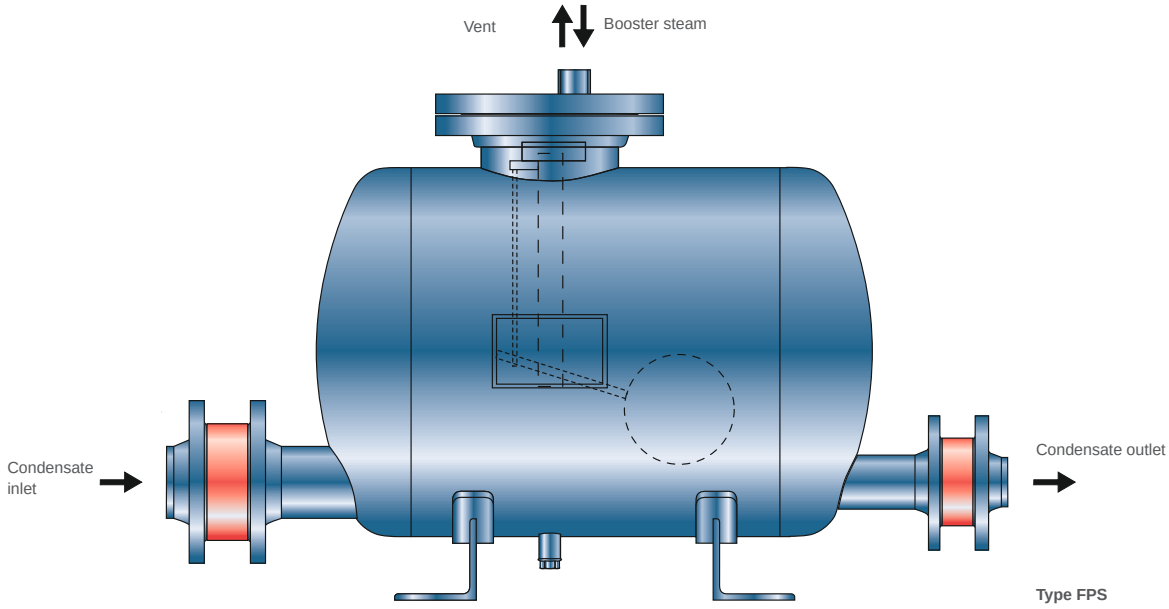
GESTRA steam powered condensate return units

Steam powered condensate return units type KH do not require pumps and are designed for condensate flowrates of up to 10 t/h and a max. operating pressure of 12 bar. They are fitted with the corresponding fittings, pressure gauge assemblies, solenoid valves for vent line and booster steam feed, level sensor for automatic control of the recirculation unit and check valves, and are supplied completely mounted and interconnected with counter-flanges, bolts and gaskets.

Condensate return units type FPS do not require electrically driven pumps to convey the condensate to the main condensate recovery tank, because they are powered by booster steam. The FPS units are designed for condensate flowrates up to 4.3 t/h and a max. operating pressure of 12 bar. They are fitted with the corresponding check valves and are supplied completely mounted and interconnected with counter-flanges, bolts and gaskets.



Type KH

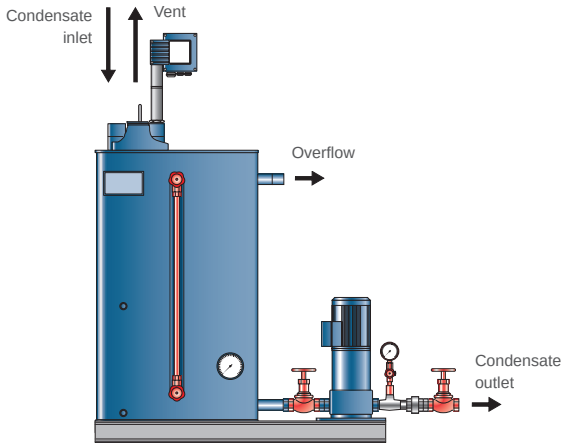


Type FPS

GESTRA open condensate recovery and return systems

Rectangular condensate tanks of the standard type SDR are designed for condensate flowrates up to 10 t/h and a max. operating pressure of 0.1 bar.

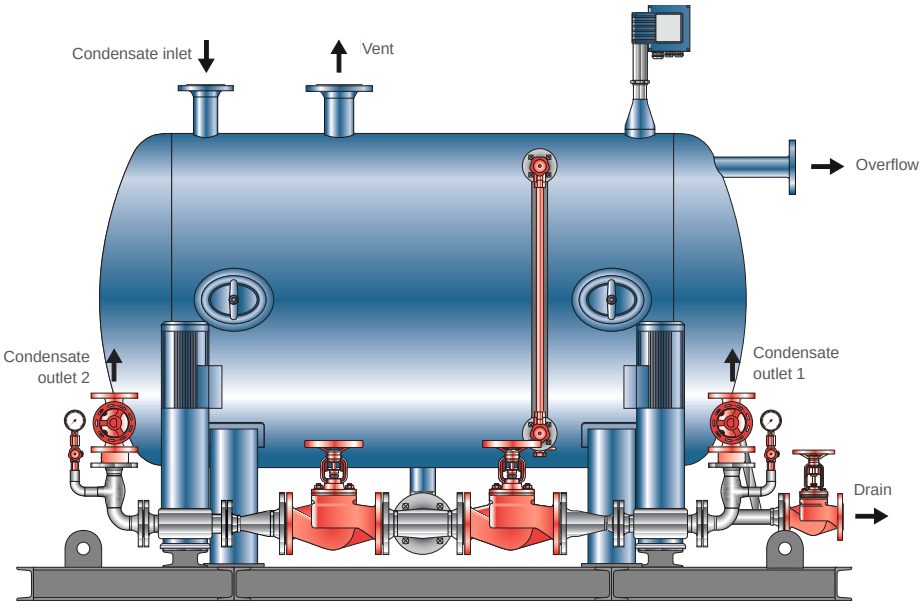
The condensate tanks are equipped with two externally mounted condensate pumps, bimetal dial thermometer, water level indicator, GESTRA level control equipment and level electrodes for automatic pump operation, check valves, stop valves, high-pressure centrifugal pumps and pressure gauge. They are supplied completely mounted and interconnected, together with the control cabinet for pump control.



GESTRA open cylindrical condensate tank, type SDL/SDS

Cylindrical condensate recovery tanks of the standard type are designed for condensate flowrates up to 30 t/h and a max. operating pressure of 0.5 bar. Systems for higher flowrates are available on request.

The condensate tank is supplied either as a horizontal or vertical type. It is equipped with two externally mounted condensate pumps, bimetal dial thermometer, water level indicator, GESTRA level control equipment and level electrodes for automatic pump operation, check valves, stop valves, high-pressure centrifugal pumps and pressure gauge. They are supplied completely mounted and interconnected, together with the control cabinet for pump control.

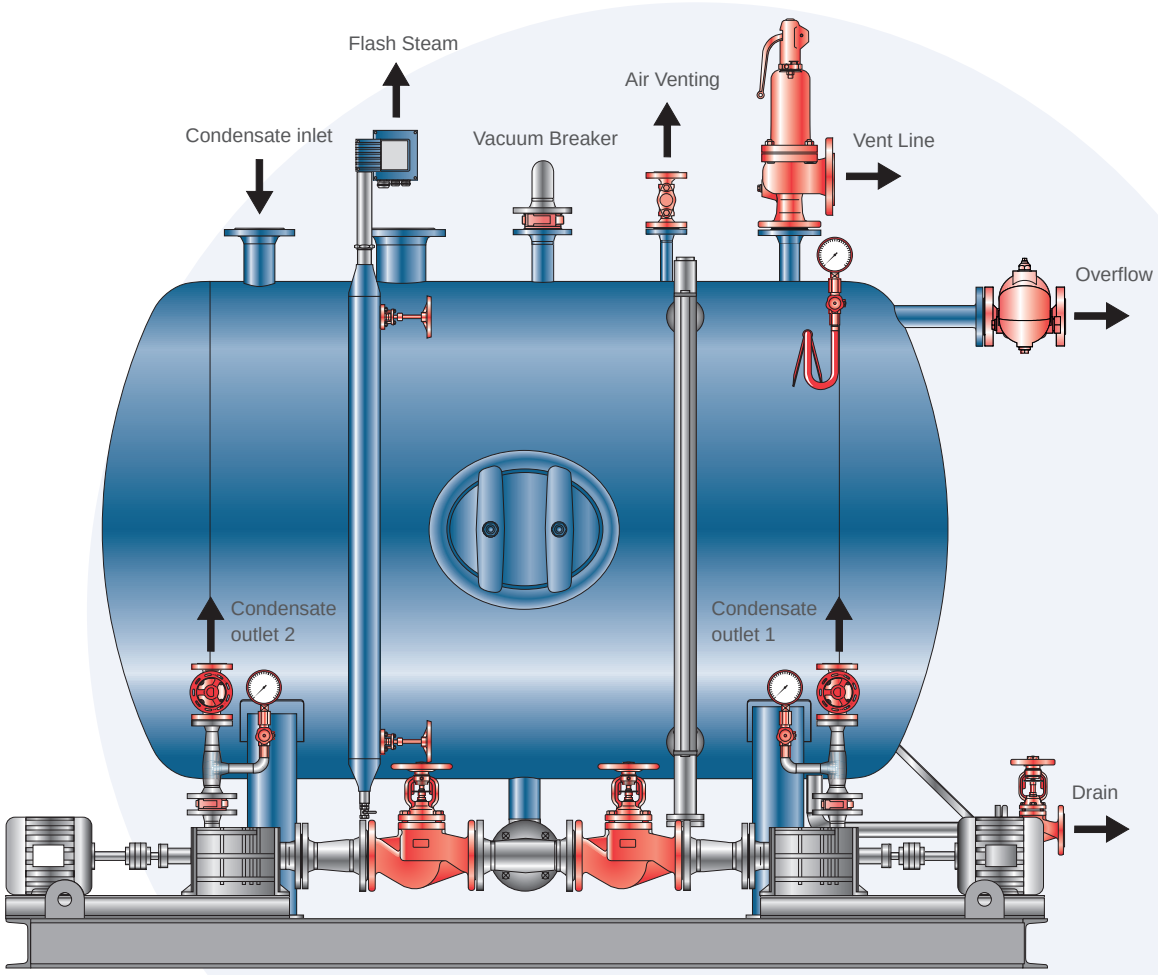


GESTRA closed condensate recovery and return systems

Closed cylindrical condensate tank, type SDL/SDS

Cylindrical condensate recovery tanks of the standard type are designed for condensate flowrates up to 30 t/h and a max. operating pressure of 4 bar. Systems for higher pressures and flowrates are available on request.

The tanks are supplied either as a horizontal or vertical type. They are equipped with two externally mounted condensate pumps, bimetal dial thermometer, water level indicator, GESTRA level control equipment and level electrodes for automatic pump operation, check valves, safety valve, vacuum breaker, air vent, stop valves, high-pressure centrifugal pumps and pressure gauge. They are supplied completely mounted and interconnected, together with the control cabinet for pump control.



Steam quality made by GESTRA

In modern plants involving process technology, the properties of steam as an energy carrier for the process are subject to increasingly stringent requirements. This is known as steam quality.

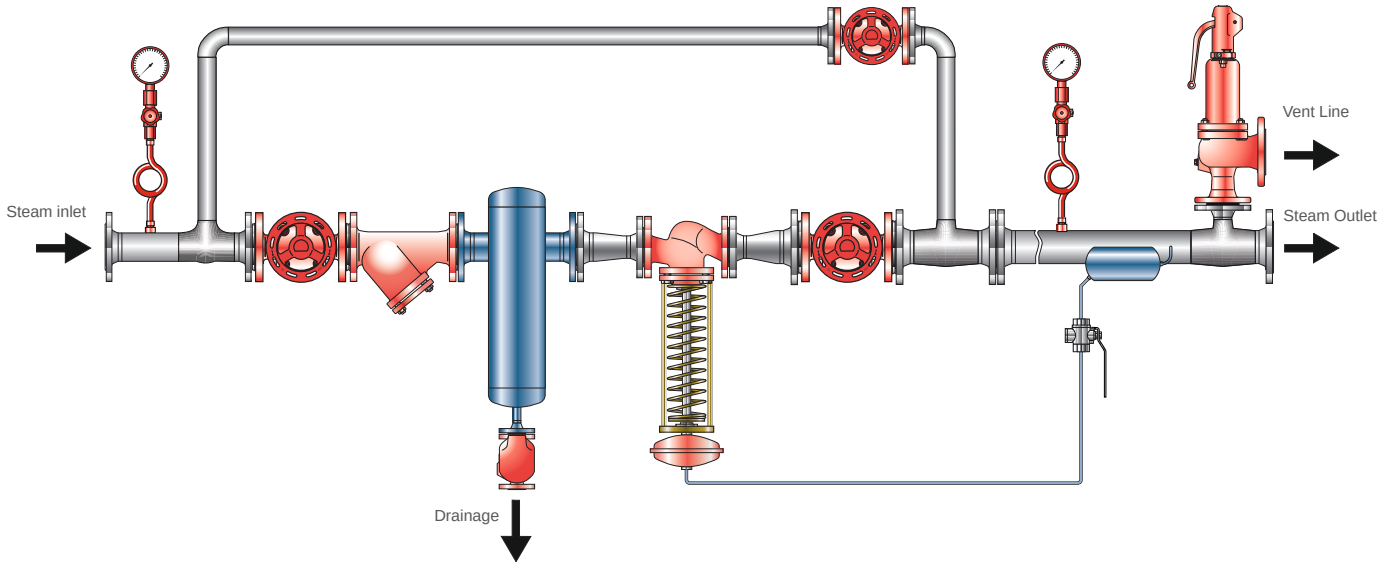
Here are a few application examples:

- In hospitals, a control accuracy of +/- 100 mbar is required for sterilisers with sudden steam consumption.
- The operation of steam turbines requires a guaranteed residual steam moisture of <1%.
- Many areas of the textile industry require highly precise steam temperature. A deviation of just 1 Kelvin can mean that the colours are no longer clear and the goods must be discarded.

GESTRA offers compact pressure-reducing stations, along with pressure-reducing and cooling units for superheated steam, providing the perfect solution to most requirements. Depending on the demands, steam pressure reductions can be achieved through self-acting pressure-reducing valves without auxiliary energy, or through electrical, pneumatic or electro-pneumatic control valves.

GESTRA steam driers ensure that the steam is conveyed to the consumer with a residual moisture much lower than 1%. In GESTRA desuperheaters, the required steam temperature is obtained through the addition of cooling water. Here, the various requirements determine whether the water bath desuperheaters type KD or injection coolers are used.

GESTRA pressure-reducing station



Steam systems frequently require different steam pressures, in order to supply the correct pressure to the different consumers. As these steam pressures often have to remain constant, steam pressure-reducing stations are used. There are various ways of reducing the steam pressure. The simplest method is mechanical (self acting) pressure reduction without outside energy. The pressure-reducing valves are balanced, single-seated valves that function as proportional controllers without outside energy. Mechanical steam pressure-reducing devices can only be used to a limited extent, however.

If supercritical pressure differences have to be dissipated, if major fluctuations in flowrate may occur, if the accuracy of the secondary pressure is subject to very stringent requirements or the sound pressure level of the valve is problematic with these requirements, pressure controls with electric, pneumatic or electro-pneumatic actuators are used.

The self-acting reduction of steam pressure functions as follows:

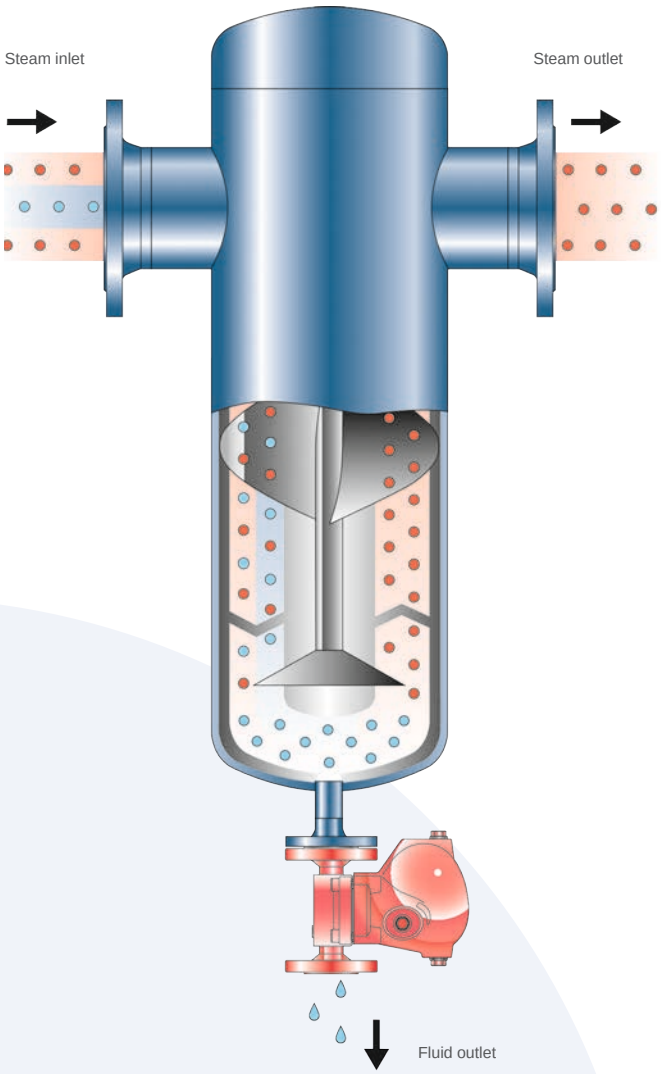
The fluid flows through the valve. This produces a drop in pressure, leading to a reduced pressure downstream of the valve. This pressure level is transmitted into the diaphragm chamber via a pilot line and acts on the actuating membranes. The force produced by the diaphragm opposes the force of the spring. As long as the two forces are balanced, the valve cone remains in position. Deviations and downstream pressure move the cone until the two forces are again in equilibrium. The required reduced pressure is set by adjusting a handwheel. The spindle is sealed by a metal bellows that also balances the upstream pressure.

GESTRA steam driers

Moisture and impurities in steam cause increased wear in steam systems. These can be water droplets or dirt particles floating in the steam.

GESTRA steam driers remove moisture and impurities from the steam line, thus extending the service life of control valves, heat exchangers and other steam consumers, increasing the reliability of the entire plant in the process.

GESTRA steam driers have no moving parts. The guide element, a two-start helix, is permanently mounted in the housing. The wet, unpurified steam enters the drier and flows down the guide element in a spiral motion. The resulting centrifugal forces separate out the particles and water droplets with a heavier specific gravity. In the lower section of the steam drier, steam flow is deflected by 180°, which provides an additional separation effect. The dirt particles flow into the lower sump of the steam drier and are discharged via a UNA ball-float steam trap.



GESTRA air driers and purifiers

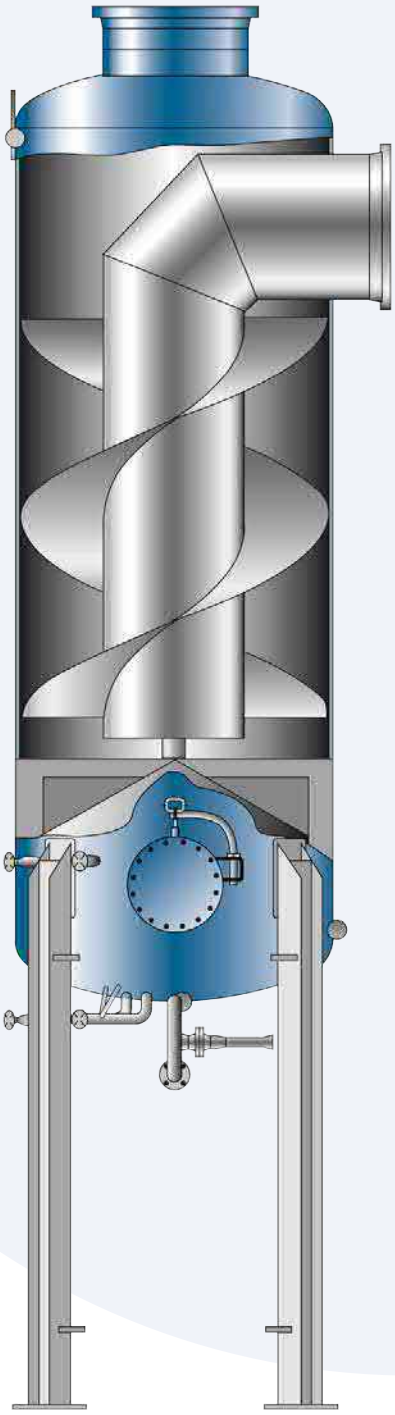
GESTRA air driers dry and purify compressed air and gas by mechanically separating liquids, mists and contaminants.

They are installed in pipelines immediately downstream of the compressor aftercooler, or upstream of the first air distributor in the compressed air ring line, as well as in branch lines leading to special separators (such as water absorbers or oil absorbers), or immediately upstream of the compressed air consumer (compressed air tool).

The air drier can dry and clean the air simultaneously. It is compact, has a very high separation effect and requires no maintenance.

The humid, impure gas flows through the guide helix in a downward spiral. When it is above the separator cap, the flow is reversed 180 degrees. The resulting centrifugal forces, impact and deflection effects separate specific heavy particles such as liquid, suspended moisture, dirt, scale, etc. from the lighter medium (air or gas), and convey them to the sump. The abrupt reversal of the flow of gas from one helix thread to another prevents the unwanted separated particles from rejoining the flow.
GESTRA steam/air driers are available for a wide range of applications. Here is one application example:

- Process steam/low-pressure steam is used in turbines to drive air compressors. The low steam pressures occurring in some cases, together with large quantities of steam, necessitate structures with diameters exceeding 3 m and heights of more than 11 m. Here too, GESTRA employs highly effective cyclone separation with special internals and proven drainage techniques using ball-float steam traps or electrically controlled systems.

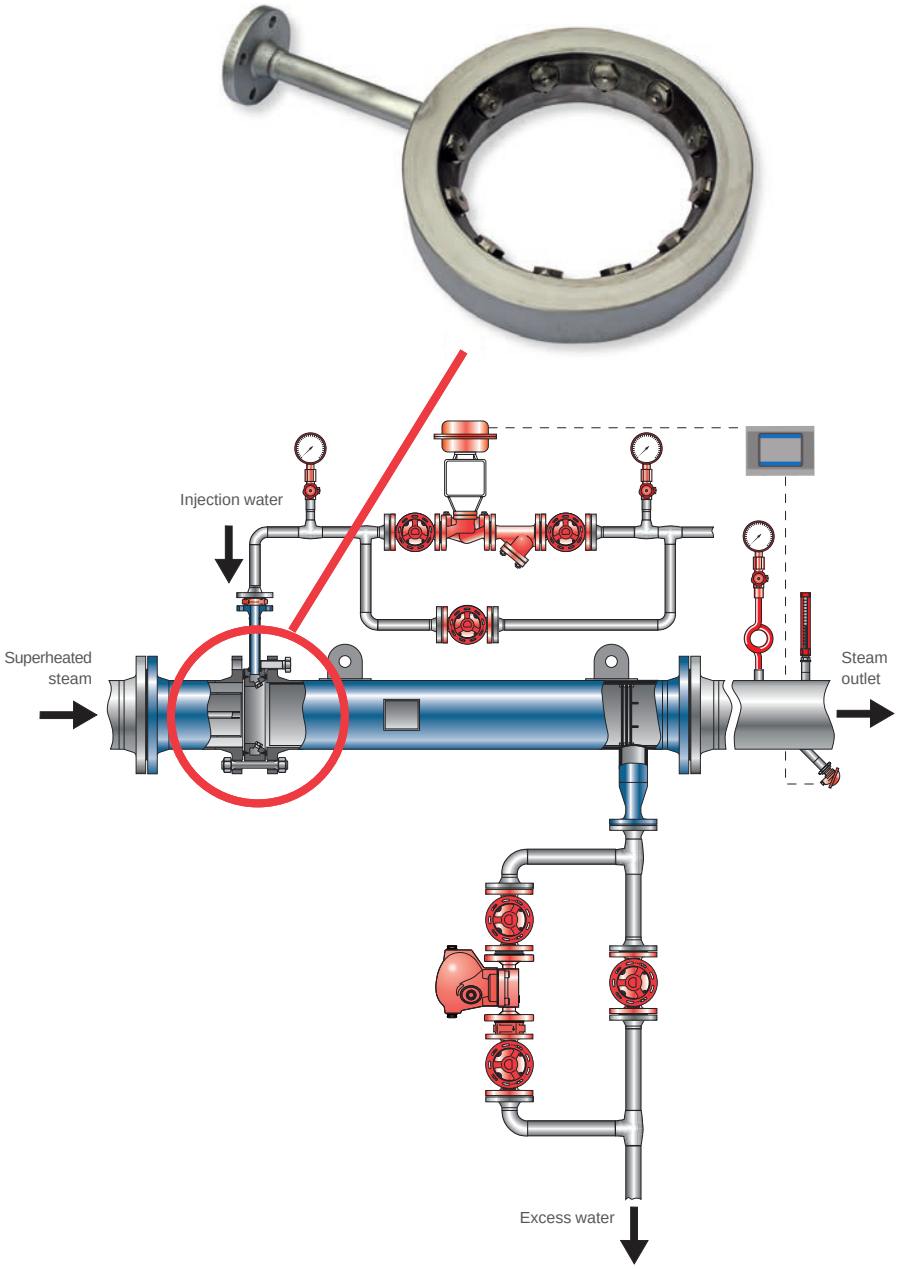


GESTRA desuperheating systems

Injection coolers

GESTRA injection coolers are used wherever there is a need for desuperheating without having to reach the saturation temperature.

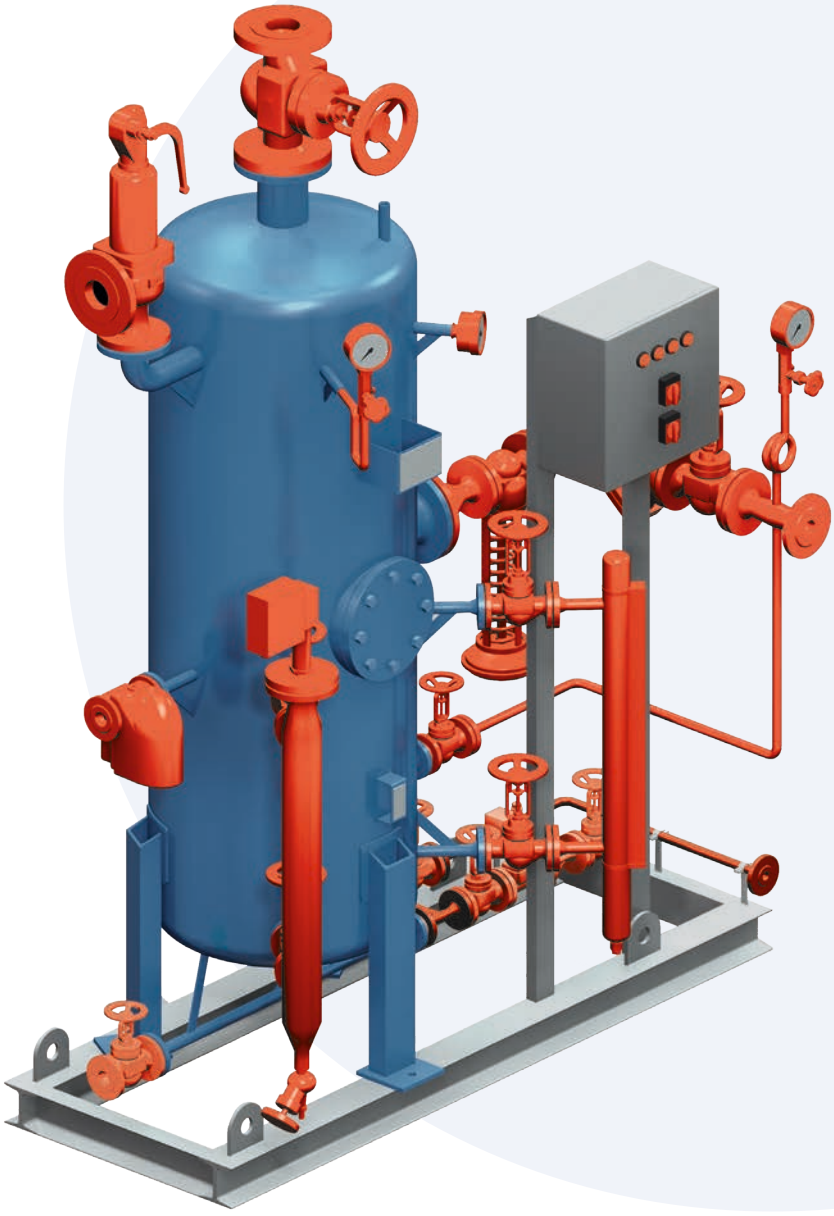
Cooling takes place by the direct injection of water. The desired steam temperature or required quantity of cooling water (condensate) is set by means of a temperature-controlled condensate injection valve, whose temperature sensor is arranged downstream of the cooler and obliquely to the flow. The atomisation process is performed by fine nozzles producing very small droplets.
Depending on the required volume flow of injection water, the cooler is designed with one or two cooling stages. The special arrangement of the nozzles and internal parts of the cooler allow optimum mixing of the nebulised water in the steam, so that the desired steam temperature is obtained within the subsequent pipe section. An inner protective tube in the pipe section eliminates the danger of thermal shock and the resulting stress cracks in the steam line. Excess water is discharged through special parts at the end of the tube section to a drainage point. This ensures that dry steam is available at the outlet of the injection cooler.



GESTRA water bath desuperheaters

The KD 13 desuperheater consists of a tank with an integrated nozzle device for distributing and cooling hot steam in a water bath. It is used wherever hot steam that arises must be reliably converted into saturated steam. The system is available for various operating loads as the vertical type (KDS 13) or horizontal type (KDL 13). We custom design each system in terms of size and thermodynamics to suit the customer's requirements.

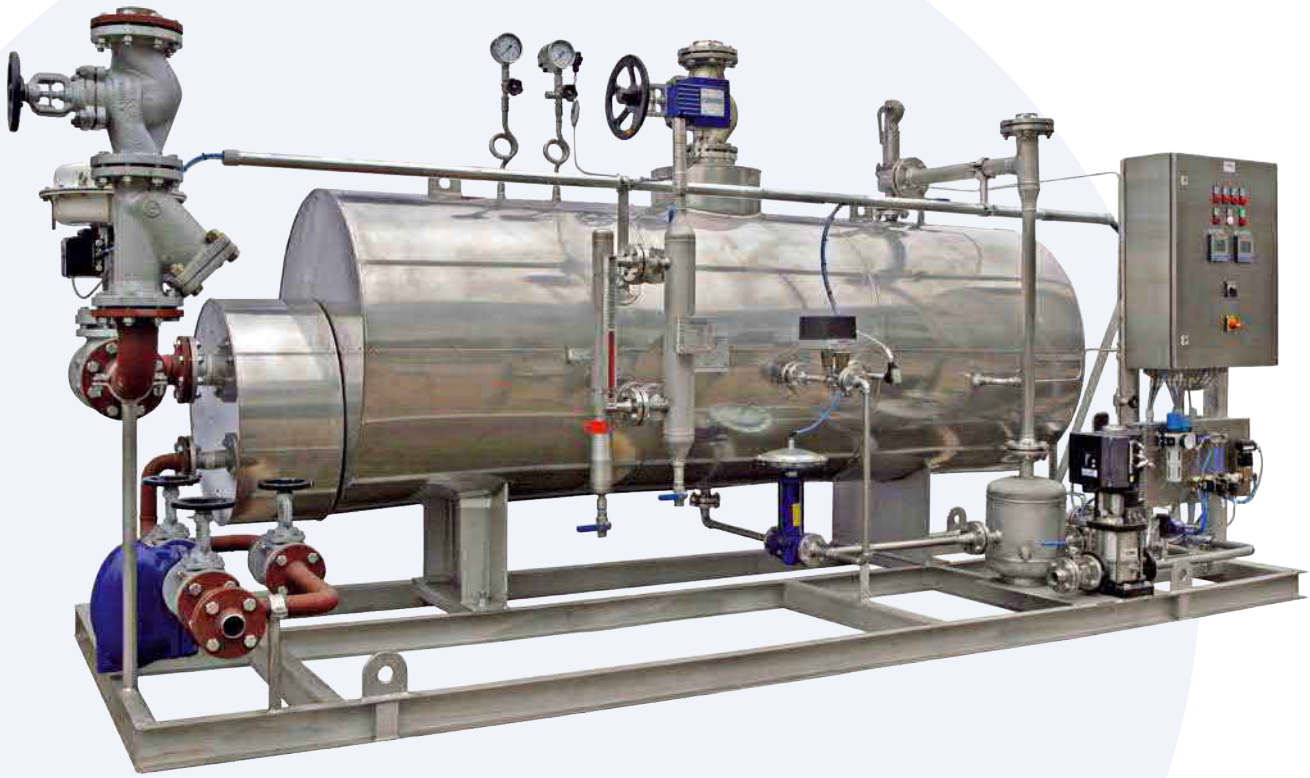
Superheated steam with a maximum temperature of 470 °C is introduced into a control system and injected through a nozzle into a water bath, where it is cooled down to the temperature of the saturated steam. In passing through the water, the thermal energy of the steam is given up to the cooling water, with some of the cooling water being vaporised and drained as saturated steam. The steam content after the cooling process is 98%. The desuperheater features an integral water separator that prevents the cooling water from being carried along into the steam line during peak loads. The NRG or NRGT level electrode detects the cooling water level and an electronic control unit ensures that the vaporised cooling water is replaced by make-up water. The cooling water at the required upsteam pressure is fed into the lower part of the desuperheater by a control valve or solenoid valve. If the temperature of the steam is very high, the cooling water must be heated up first. The water bath desuperheater is the only steam cooling system that supplies saturated steam over a control range of 0–100%.

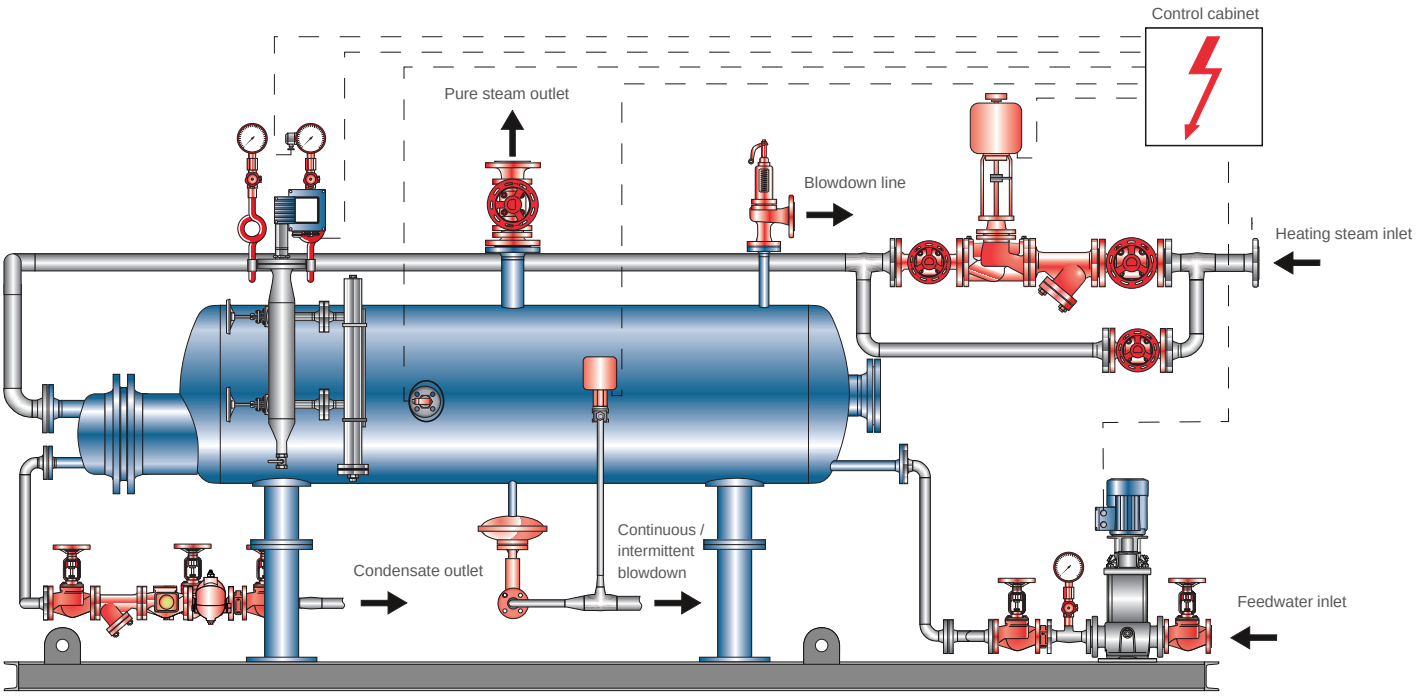


GESTRA steam regenerators

GESTRA steam regenerators supply process steam in the form of pure steam that does not contain substances such as hydrazine or ammoniac, which are hazardous to health. For technical reasons, these substances must be fed to the boiler feedwater during normal boiler operation. As they are steam-volatile, they are also present in the process steam. Pure steam is necessary for operating sterilisation systems in hospitals, for drying chambers in the foodstuff industry, for air humidification in air-conditioning systems, and wherever the process steam has to be absolutely free from unwanted additional substances that are harmful to health, chemically reactive or impair flavour.

GESTRA steam regenerators are available in compact designs as horizontal or vertical units, and are delivered completely equipped.





The GESTRA horizontal version of the steam regenerator consists of a cylindrical vessel, in which a heating tube bundle with head is installed in the lower part through a standpipe. The heating fluid (steam, pressurised hot water or thermal oil) flows through a control valve into the tube bundle, where it transfers its thermal energy to the surrounding water. Depending on the quantity of heat applied, the water evaporates and can be extracted by steam-separating internals. If the accuracy of the steam pressure is not a critical factor, a self-acting pressure controller may be used.

On the secondary side, the GESTRA steam regenerator is protected against excessive pressure by a safety valve. The condensate formed in the tube bundle is discharged by a GESTRA UNA ball-float steam trap. The feedwater evaporating during the production of pure steam is made up continuously by a feedwater supply control. GESTRA supplies suitable components from its product range for this purpose.

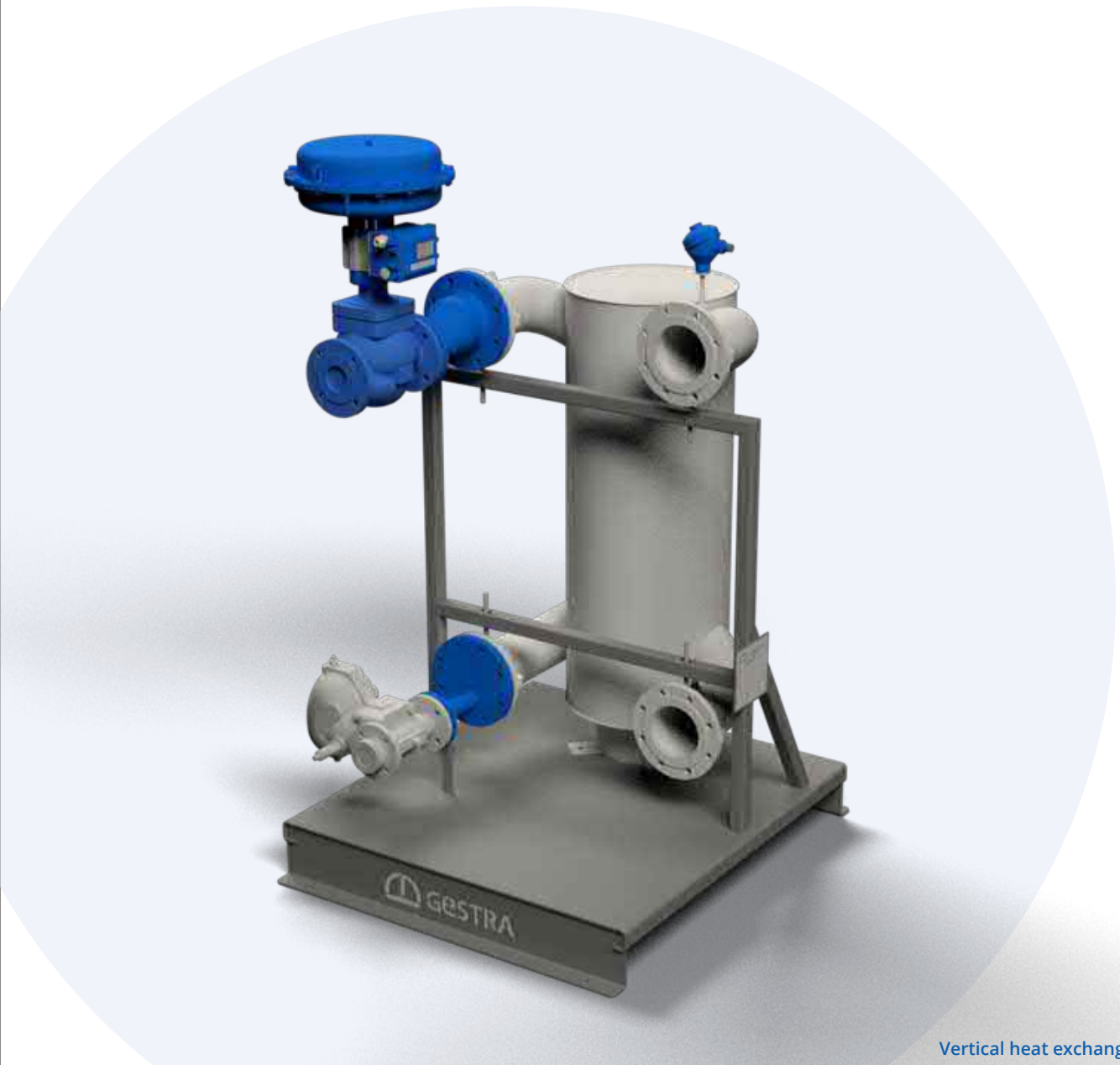
As a result of the continuous evaporation process and feedwater make-up, the concentration of salts dissolved in the boiler water increases steadily, even if the feedwater is partially desalinated. If there is a high steam demand, the admissible limit for the salt content may be exceeded after only a few hours. For this reason, the steam regenerator must be fitted with a continuous and intermittent blowdown unit operating automatically. For this special application, the GESTRA product range for process control offers proven conductivity electrodes and controllers, continuous blowdown valves, and automatic intermittent blowdown valves and controllers. This is the only way to ensure the production of the very highest quality pure steam with the use of demineralised feedwater and fully controlled continuous boiler blowdown. This also prevents the dangerous salt concentration and sludge formation that may lead to corrosion in the steam regenerator.

GESTRA heat exchangers

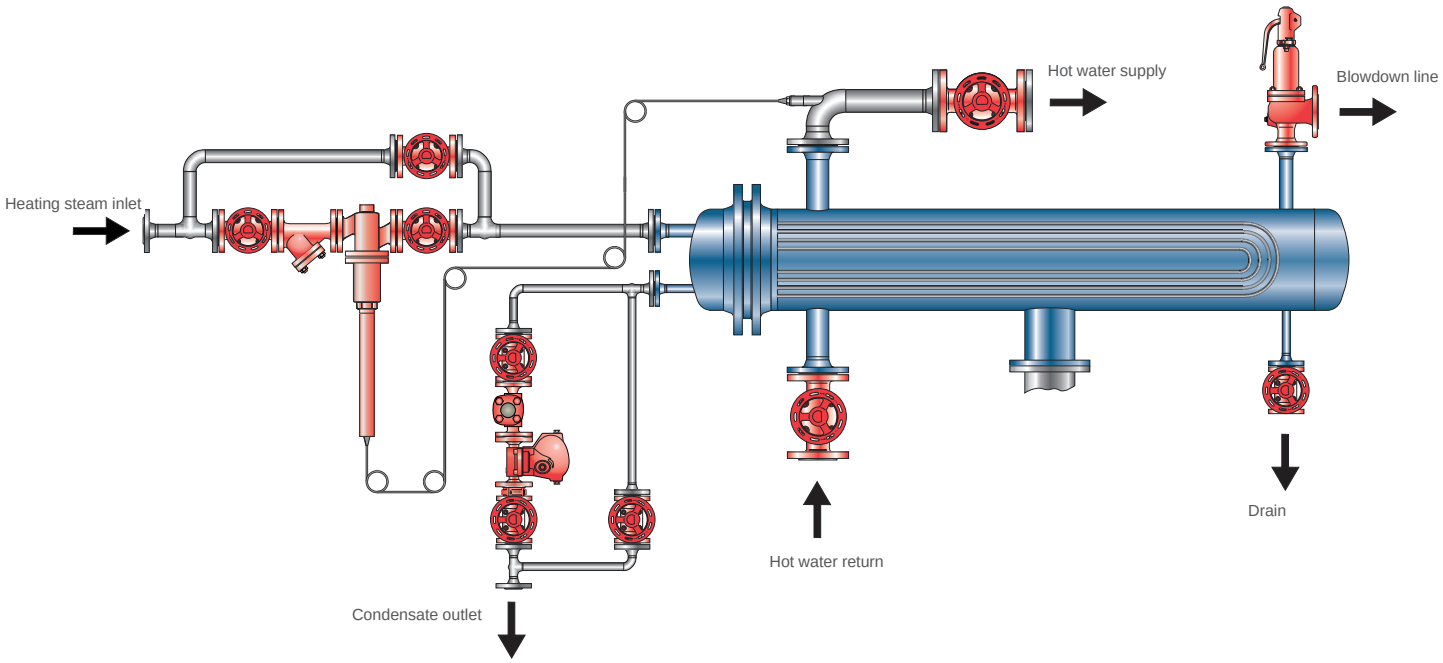
Various types of heat exchanger are available. In addition to the classic horizontal or vertical tube bundle heat exchanger, bolted and welded plate-type versions are also used in steam and condensate systems.

Heat exchangers can be manufactured from a wide range of materials to suit requirements.

Applications include steam-heated heat exchangers for production purposes or for the heating of buildings. Furthermore, a wide variety of applications can be found in the area of heat recovery. Here, heat exchangers can be used as residual blowdown coolers, flash steam coolers or as economisers.



Vertical heat exchanger



GESTRA offers various systems for controlling heat exchangers. Control on the steam side can be performed using self-acting temperature regulators (Clorius system), or controllers with electrical, pneumatic or electro-pneumatic actuation. For building heating systems, vertical heat exchangers with electrical controllers are frequently used on the condensate side.

In addition, there are various customer requirements regarding control accuracy or system speed, for which GESTRA process control is able to offer customised complete solutions.

The diagram shows a horizontal GESTRA heat exchanger with steam-side control. In this example, the heating system is controlled by a self-acting Clorius-type temperature regulator. Depending on the requirements regarding the safety technology, these temperature regulators can also be fitted with a self-monitoring safety temperature limiter. During start-up operation or fluctuating operational conditions, it is necessary to prevent water hammer. This requires the condensate to be discharged without any banking up. To ensure this, GESTRA uses a UNA ball-float steam trap. The other valves shown also belong to the GESTRA product range and round off the scope of supply.

GESTRA VDM mixing coolers (blowdown receivers)

Mixing coolers (a type of blowdown receiver) cool hot effluent that can no longer be used for heat recovery and must therefore be conveyed into bodies of water, pits or sewers.

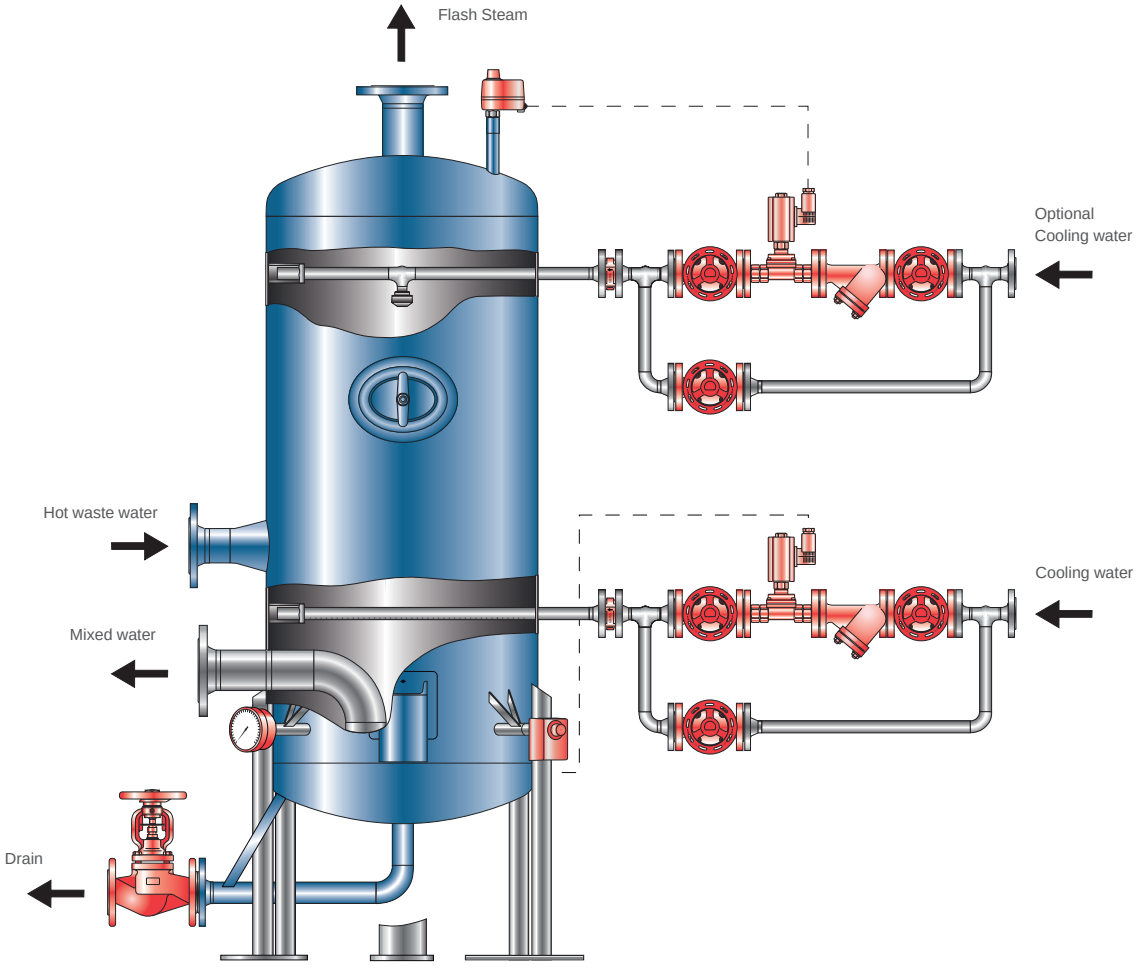
Typical applications for mixing coolers are, for example:

- Production systems in which hot, contaminated effluent is produced
- Steam plants in which intermittent or continuous blowdown has to be cooled with raw water
- Use as a blowdown receiver for flash steam

The hot waste water is discharged into the mixing cooler, which is at atmospheric pressure, and passes over the rod feeler of the thermostat. The cooling water enters via a solenoid valve, the amount depending on the temperature setting of the thermostat.

Flash steam is formed if the waste water is discharged from the system under pressure with a temperature above 100 °C, as is the case for intermittent boiler blowdown.

If the flash steam can neither be recovered nor discharged to the atmosphere (because of the inconvenience caused by the condensing steam), the flash steam can be condensed inside the mixing cooler. This is performed by a second cooling water spray nozzle.

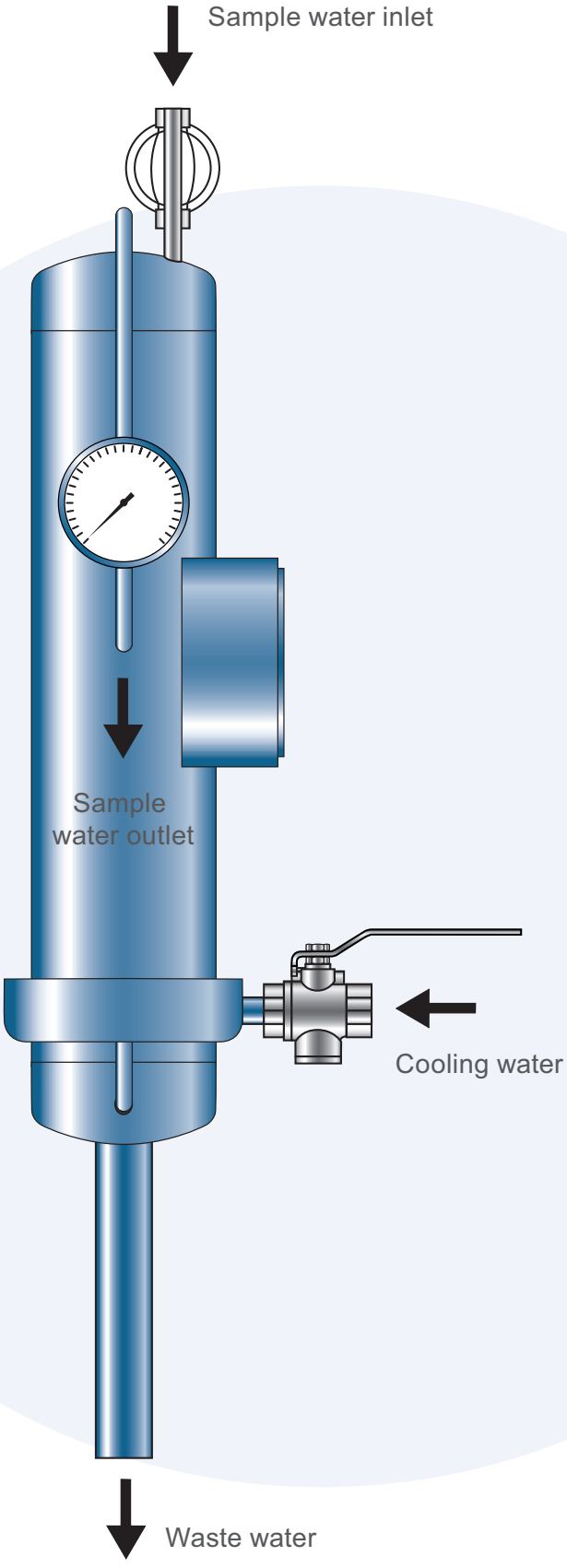


GESTRA sample coolers

Sampling is of special importance for the operation of steam generating units. However, accurate and uncorrupted analysis requires correct sampling and correctly functioning analysing instruments.

The direct sampling of hot boiler water from pressurised lines always entails a danger of scalding, and the results of analysis are inevitably falsified, as the flash losses in the sampling line or the sample vessel cause the density of the remaining boiler water sample to increase. The removed samples therefore do not reflect the true dissolved solids content.

The GESTRA sample cooler PK offers the perfect solution. The boiler water sample is cooled to the reference temperature of 25 °C, therefore satisfying the prerequisites for precise water analysis.

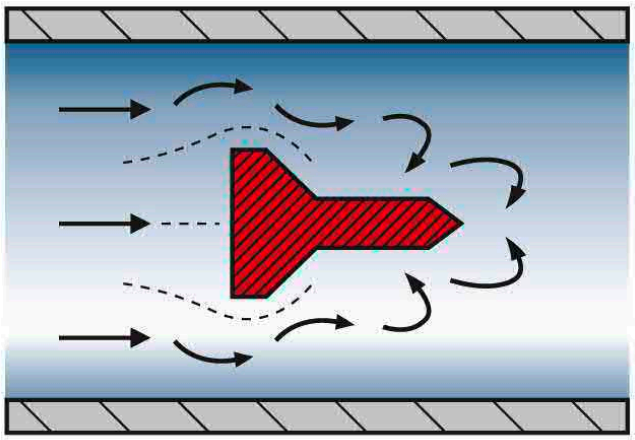


GESTRA steam flowrate measurement

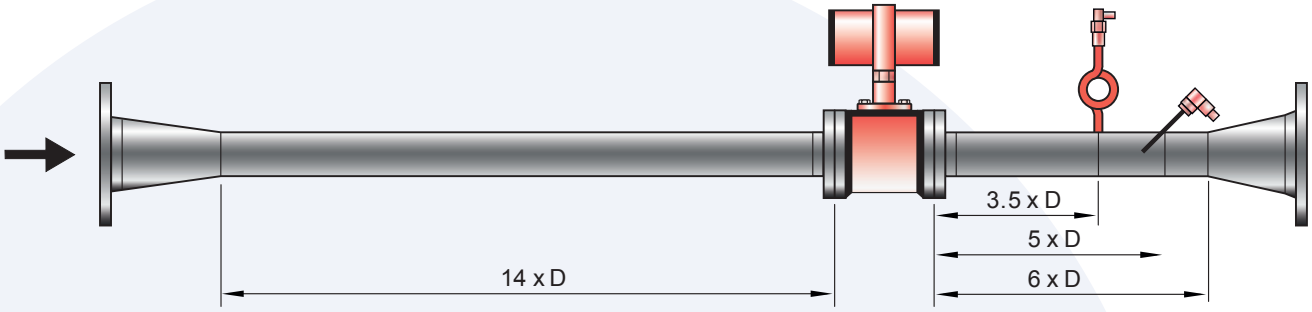
The measurement is based on the Kármán vortex street principle. The process uses a body installed perpendicular to the axis of the pipe. Eddies are shed continuously from either side of the body, forming rows of vortices in its wake. The alternate shedding of vortices creates periodic lateral forces on the body and causes the baffle located in the vortex stream to vibrate. An advantage of the vortex shredder is that it produces a low pressure loss compared to other measuring processes. The pressure oscillations are transformed into electrical signals by a sensor and converted into a standard output signal. This is then evaluated in the flow computer.

The measurement system is very reliable, as it does not have any moving parts. The sensor is not in direct contact with the process fluid. At 1% of the actual measurement value, the measurement accuracy is very high. The system is very easy to install and put into operation.

The GESTRA steam flowrate measurement package includes all the components needed for a measuring point. A vortex flow meter is used as a measuring transducer. The measurement signal is evaluated by a microprocessor-controlled flow computer and, in the event of fluctuating steam conditions, compensation can be applied with the aid of a resistance thermometer and a pressure transducer.



Vortex body with integrated baffle



GESTRA compact systems

GESTRA equipment and vessels are also available as package solutions with all the necessary accessories. For further optimisation of the heat recovery equipment, GESTRA also offers control systems adapted to the corresponding application. With these complete solutions, the customer only needs to connect the supply and discharge lines, and parametrise the controller.

To uphold our high quality standard, we use the same sensors for heat recovery equipment as for boiler plants. Here too, we apply only proven technology and make no compromises.

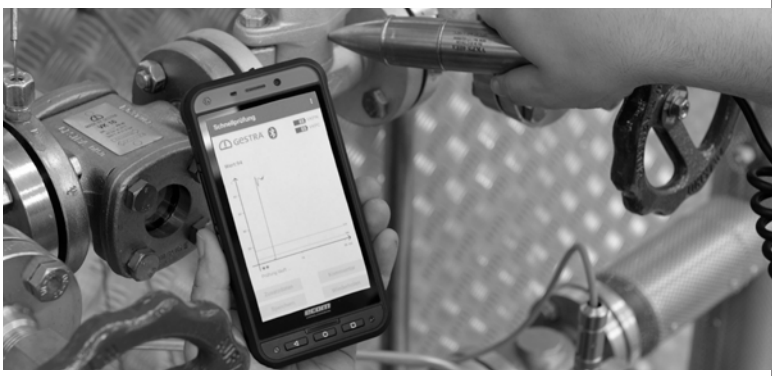
For the controls, we have developed a suite of customised solutions over the years. These are offered with autonomous control units or with complete PLCs (programmable logic controllers) of the type S7-300. In complex plants, it is often very useful to visualise the actual values dynamically in the mimic diagram. The possibility of data transfer (Profibus DP) to the central control room is another benefit. Thanks this comprehensive concept of heat recovery equipment plus control technology, we combine the wide-ranging expertise of our process and software engineers.

GESTRA service

All as an international leader in the manufacture of valves, traps and control technology for the steam energy industry, GESTRA offers its customers many decades of experience and the technical service to match. This gives you a decisive competitive advantage.

To make the GESTRA support even more direct and tailored, the technical service was developed further and subdivided into GESTRA valves and steam traps and GESTRA electronic equipment for steam boilers. This makes it possible for our customers to obtain rapid and effective assistance.

You too can benefit from this expertise - get in touch. We will be happy to advise you.



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SB-GCM-06-EN-ISS1