GEMÜ®

VENTIL-, MESS- UND REGELSYSTEME

Deionization of boiler feed water
using an ion exchanger

In steam boiler systems, salts that have dissolved in the water lead to corrosion and deposits. To avoid corrosion and deposits, depending on the operational mode and design of the steam generator, there are important requirements regarding the quality of the boiler feed water.
In a deionization system, the salts that have dissolved in the water are removed using ion-exchange resins. These salts are dissociated, i.e. in positive (cations) and negative particles (anions), and as a result, a so-called desalination line is set up as follows: cations exchanger – CO_2 degasifier – anions exchanger – mixed-bed filter. Moreover, for the installation to operate properly, a regeneration station and neutralization are required.

GEMÜ solution

To dose acids and alkalis, and to distribute the water, the GEMÜ R690 and GEMÜ R677 diaphragm valves are used, which have nominal sizes of DN20 – DN50, EPDM as diaphragm material and a GEMÜ 805 variable area flowmeter. The valves are equipped with GEMÜ 1235 electrical position indicators.

GEMÜ R690 with GEMÜ 1235

GEMÜ 805

GEMÜ R677

Construction and function of an ion exchanger

- *First, the water that is to be desalinated flows through the acid resin bed of the cations exchanger. Here, the water's cations (e.g. calcium (Ca^{2+}), magnesium (Mg^{2+}), sodium (Na^{+})) are replaced by H^{+} ions, which have been adsorbed onto the resin.*
  During this process, carbon dioxide (H_2CO_3), among other things, is produced, which dissociates to free CO_2 and dissolved H_3O^{+} and HCO_3^{-} in the water.

Cations exchanger

- *CO_2 degasifier*
  The free CO_2 is dissolved in a secondary CO_2 degasifier. Due to the expansion element located in the degasifier, there is a high level of recirculation on the water's surface, and as a result, the gaseous CO_2 is released. Fewer HCO_3^- ions are now generated, and therefore the secondary anions exchanger is discharged and the chemical and regeneration water consumption is lowered.
- *Anions exchanger*
  Here, the anions (e.g. hydrocarbonate (HCO_3^-), sulphate (SO_4^{2-}) or chloride (Cl^-)) are replaced with hydroxide ions (OH^-), which have been adsorbed on the alkaline resin bed of the anions exchanger.
- *Mixed-bed filter*
  The secondary mixed-bed filter, also called a polisher, removes the residual ions from the water. It contains both highly acidic and highly alkaline ion exchanger resins. By mixing the two resins, the residual ions can be completely removed.

Regeneration

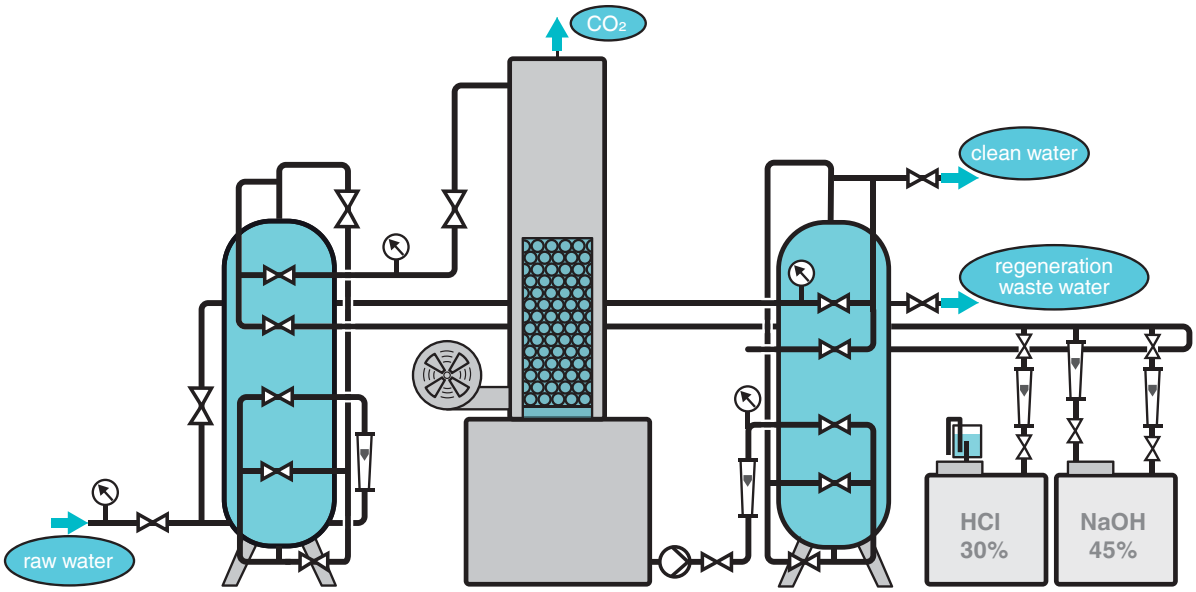
When the ion exchanger resins are completely depleted, they are regenerated. During this process, the acidic resin from the cations exchanger is flushed with hydrochloric acid (HCl) and the alkaline resin from the anions exchanger is flushed with sodium hydroxide (NaOH). If there is still residual acid or residual alkali in the regeneration waste water, it must be neutralized before it drains off into the sewage system.

So that pure water can be generated continuously, two desalination lines are required – one is in operation and the other is part of the regeneration phase.

Dosierstation

Operational mode

The ion exchanger resins are available as a suspended or fixed bed, or also as a combined suspended bed with a fixed bed section. Most commonly, regeneration takes place in counter current, i.e. charging occurs in one direction and regeneration occurs in the other. Generally, charging occurs from bottom to top and flushing occurs from top to bottom. Compared with the direct current method, a significantly higher product quality is achieved and fewer regeneration agents are consumed.



Construction: ion exchanger

Operating parameters

Output:	*0,5 to 300 m^3/h*	*Downtime:*	*6 to 24 hrs*
Raw water pressure system, abs:	*2 to 10 bar*	*DI water quality:*	*up to 0.1 µS/cm*
Water temperature:	*8 to 50 °C*	*Pipe material:*	*PVC, PP, steel (coated, stainless steel)*

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