sera Industry Solutions

sera®
Excellence in Fluid Technology

Brewery Technology

Dosing stations and -systems
Dosing- and Feeding pumps
Packaged Dosing Units

- Dosing of Brewing gypsum
- Dosing of Calcium chloride
- CIP-Cleaning
- Filtrations
- Bottle Filling
- Waste Water Treatment

Well-dosed is almost brewed

To create a tasty beer from water, malt and hop requires more than a sophisticated brewing porcess: measures for the disinfection and cleaning of the industrial production equipment as well as the treatment of the water sources required for the brewing process are necessary.

It is exactly for this purpose that **sera** pumps and dosing systems have been used as imprtant and reliable modules for decades in the production equipment of many breweries worldwide.

Where is dosing required in the beer brewing process?

1.) Brewing gypsum for water treatment

To achieve optimal brewing results, the brewing water must have a specific hardness. A so-called brewing gypsum must therefore be added as ultra-pure gypsum mineral to increase the hardness of water. This calcium sulphate must be added to the brewing process as a suspension with up to 10 % concentration via a dosing system.

The abrasive properties of these suspensions and their tendency for sedimentation thereby present highest requirements on the dosing system. A relatively high flow rate must be maintained in the system to prevent sedimentation of the solids during the dosing process; this velocity, in turn can lead to high wear in the pumps and fittings because of the abrasive medium employed.

In regard to the preparation tank for the suspension, it is important here that, on the one hand, complete drainage of the tank is possible and, on the other hand, the agitator, which is constantly driven, always remains submerged in the liquid and the solids thereby remain suspended. This task is normally solved through tanks – made of thermoplastics (PP or PE) – with an inclined bottom and an agitator equipped with a stripping agitator mechanism.

The latter is positioned only a few millimetres above the tank bottom thereby ensuring that the tank can be emptied almost completely even during the dosing process.

In addition, ultrasonic level measuring ensures that the actual filling level is always reliably recorded preventing the system from running dry. Filling the preparation tank with brewing gypsum is normally a manual process and takes place via a filling device. Common preparation volumes for the suspensions are 1 or 2 m^3.

While the management of wear and the tendency to sedimentation in the tank can be handled relatively easily, dosing requires a clearly greater effort to ensure the operational reliability and availability of the entire system in the long term.

The dosing pump is clearly the centre of considerations in this process. Piston diaphragm pumps equipped with valves that were especially designed to deliver liquids with high-wearing properties have proven successful. The common hard seat of the valve ball is thereby replaced by an elastic seat.

Ansetz- und Dosieranlage aus PP für $CaSO_4$ oder $CaCl_2$

As a result of this measure, the solids from the suspension located between ball and seat during the closing of the valve no longer impact the tightness of the valve and thereby the dosing accuracy.

Furthermore, the seat manufactured of a special elastomer, exhibits clearly more positive wear properties than a hard seat which – due to erosion – is no longer usable after some time.

Another essential advantage of the piston diaphragm pumps consists of the fact that they are already equipped with an integrated pressure relieve device in the hydraulic area of the machine.
This means that the pump does not require excess pressure protection through external pressure relief valves. This avoids the need for regular flushing of return lines (=bypasses), etc. of pressure relief valves.

The issue of flushing is naturally a key item in the operation of dosing systems for suspensions. These dosing systems have been constructed so that the complete system, starting from the pump intake side, is automatically flushed after the dosing pump is switched off.

Deposits and interim obstructions of the pipelines are thereby effectively prevented – a principle requirement for the operational reliability of the entire production process.

On the pressure side of the dosing pump, a hose pulsation damper ensures a uniform low-pulsation flow and takes care that pressure peaks, resulting from the delivery characteristics of oscillating displacement pumps, are reduced. This also simplifies flow rate measuring (usually handled by magnetic-inductive flow meters).

2.) Calcium chloride

Preparation and dosing systems similar to those used for brewing gypsum are also used for calcium chloride which is used in the malt mill and the wort copper in solutions up to 40 %. However, the key difference to $CaSo_4$-systems is that much less effort is required for flushing and the design of the dosing pump since the calcium chloride is completely dissolved.

For this purpose, the preparation containers are equipped with a dissolving basket from which the salt is washed into the flow created by the agitator and is evenly dissolved. For dosing, diaphragm pumps are used here together with external pressure relief protection.

The corrosiveness of the $CaCl_2$ – solution is offset by using only plastics (PVC, PP, PVDF) to be in contact with the chemical thus preventing damages to the system through chemical aggression. In general, all **sera** dosing pumps and systems can be integrated into fully automatic systems. It does not matter thereby whether the dosing unit is controlled analogue or digital (BUS).

Piston diaphragm pump R410.2KM

Which applications are necessary for auxiliary processes?

The dosing of cleaning agents, acids, alkaline solutions and lubricants is an essential part of auxiliary processes of actual brewing. Dosing technology by **sera** is widely used in this segment as well.

3.) CIP-Cleaning

Brew vessels, yeast and fermentation tanks as well as filtration systems must be cleaned during the brewing processes to ensure sterility. To avoid disassembly, the cleaning of the entire pipeline system is regularly done in place (Cleaning In Place).

The treatment agents for the flushing processes include caustic soda and various acids (usually phosphoric acid, nitric acid) with their respective additives; disinfectants such as hydrogen peroxide or peracetic acid are also used. The use of tenside free detergents in modern flushing processes can help save time and water.

The process is largely fully automatic exerting equally high requirements on the dosing system.

Standardized vertical Dosing System (CVD 2)

Transfusing station for caustic soda with screw conveyor for caustic soda flakes

The structure of the system is marked by absolute corrosion resistance, leak-tightness and reliability in handling the very aggressive chemicals. Last not least, economy ensured by the great dosing accuracy and durability of the pumps is also an important factor.

The design of the dosing equipment used for CIP cleaning often requires the pumps and the necessary accessories to be wall-mounted on respective mounting panels. The pumps then suck the chemicals directly from the supply containers erected next to or below the dosing system. To further enhance the safety standard, the dosing systems can be equipped with additional splash guards.

4.) Filtrations

a) Enzymes:
ß-glucanase is used as so-called filtering yeast helping to "clarify" the beer. Small dosing systems with 40 to 1,000 litre tanks are available for this purpose. Suction lances, electric mixers, diaphragm pumps, dosing valves and seeding site as well as the appropriate fittings contribute to operational reliability.

b) Diatomite:
After the end of the storage time, the beer runs through a filter system to preserve the bear and improve it optically – consumers prefer crystal-clear beer.

Among others, the filter is charged with diatomite, a porous rock that retaines smallest particles (yeast, protein or hops residues). Piston diaphragm pumps are especially suitable for the dosing of diatomite as filtering additive in the standard form of a suspension.

Standardized compact dosing unit type CTD

Because of the abrasive effect of the solids, the diaphragm is made of resistant CSM (Hypalon). For these applications, elastomers have the advantage – in contrast to PTFE or PTFE-coated diaphragms – that they are subject to much lower wear because of their elasticity. The machines utilized are similar to those used for $CaSO_4$ dosing.

5.) Bottle Filling

Before the beer is filled, returned empty bottles must be cleaned from the inside and outside. Innovative multicomponent cleaning agents are used here and cold water rinsing is often followed by the use of caustic soda with low concentration (up to NaOH 5 %). Dosing systems and pumps similar to those utilized with CIP cleaning are used.

Chlorine dioxide is currently often used in the preparation and disinfection of the service water. Ready-foruse solutions of this chemical are generated on site from a low-concentration hydrochloric acid and a sodium chlorite solution and directly added to the water to be treated.

For greater throughputs, the chlorine dioxide solution is generated from concentrated hydrochloric acid and sodium chlorite solutions. During this process, it must always be remembered that a third dosing pump feeds water into the reactor to prevent the formation of explosive mixtures. A key criterion with the chlorine dioxide generating plants is the dosing of the chemicals (and the diluting water) in equal portions in the reactor.

The dosing pumps by **sera** guarantee this requirement in conjunction with the respective downstream flow monitors.

6.) Waste water Treatment

The acid regeneration waters primarily generated from flushing processes, sometimes containing solids, of the brewing water preparation can also be directed to a neutralization system. Breweries generate a relatively large volume of waste water which is usually evened out by buffering.

The adjustment to a neutral pH value is required before directing the waste water to the municipal waste water treatment. Depending on the requirement, nitric acid or caustic soda, e.g. are added. **sera** pH electrodes with flow or immersion fittings as well as the necessary measuring transducers are used here for controlled dosing with diaphragm pumps.

To increase the process quality and breakdown rate, biological and chemical processes with dosing of precipitating agents and flocculents such as iron III chloride solutions are used.

Modern brewery waste watersystems are designed as multi-stage processes (among others, with aerobic process water treatment and anaerobic fermentation).

Chlordioxid-Generator (CDG)

7.) Summary and Preview

In the beverage industry, especially breweries offer a broad range of dosing applications with a wide variety of requirements on the pumps and dosing systems used.

However, it is no longer sufficient nowadays to only deliver solid, accurately-dosing, material-resistant and reliable products but rather total solutions, technically and economically geared to the customer and his application scenarios in an optimal manner regarding the dosing-technology.

sera offers these solutions and now also individual service contracts for all pump and dosing systems for breweries, beverage bottling facilities and equipment operators.

Excellence in Fluid Technology

Locally present for our global customers

With local offices in England and South Africa and a worldwide sales and service network with more than 30 foreign representatives in more than 80 countries across all continents, **sera** guarantees optimum support for customers locally.

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