



# Basic knowledge Mechanical water treatment

Solids can easily lead to blockages in plant components such as pipes, valves and fittings. In multistage water treatment plants the first stage is usually to remove solids by mechanical means for this reason. In mechanical processes, the solids are not altered either physically or chemically. Only separation of the solids from the liquid phase (water) takes place. This can be implemented according to the following three principles:



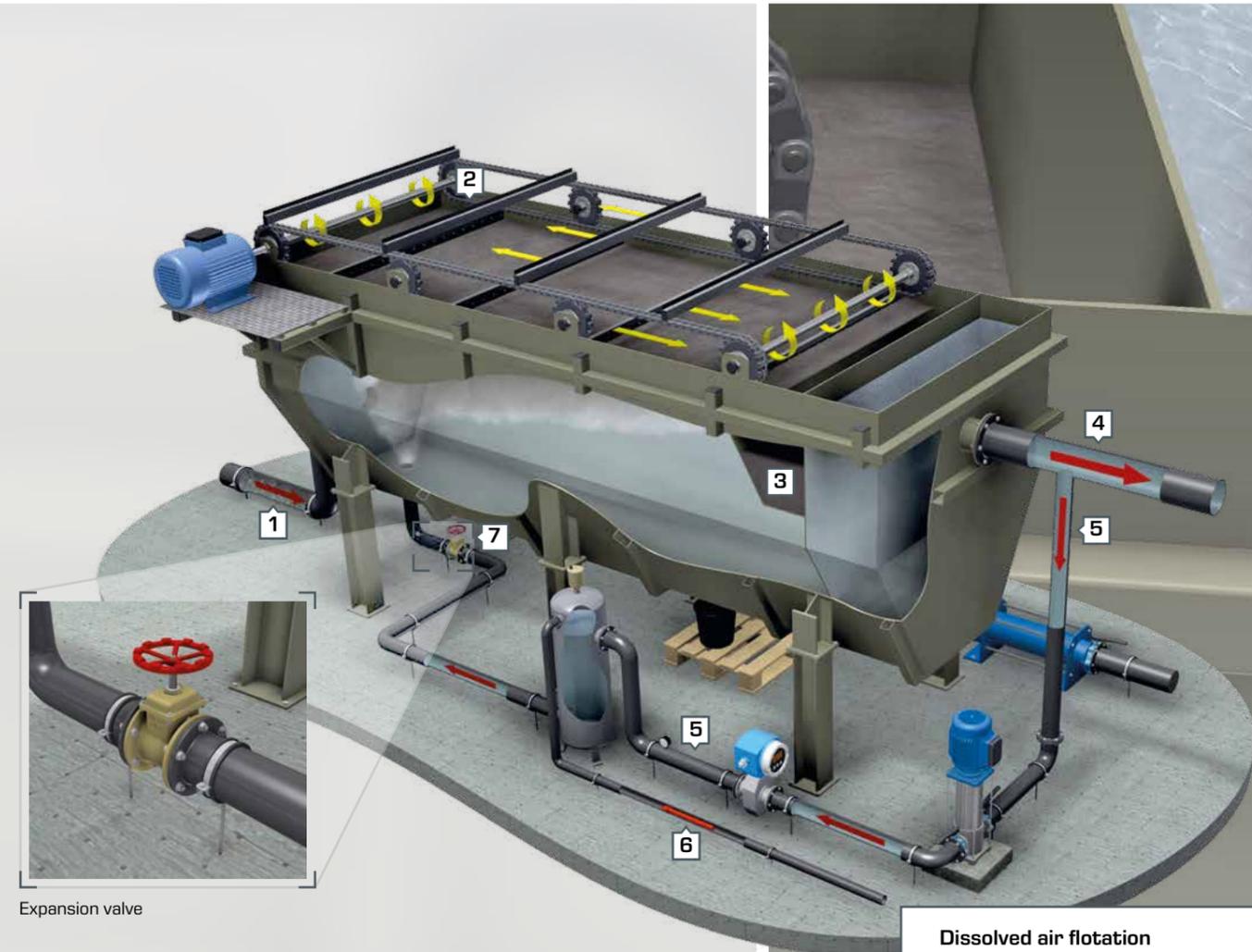
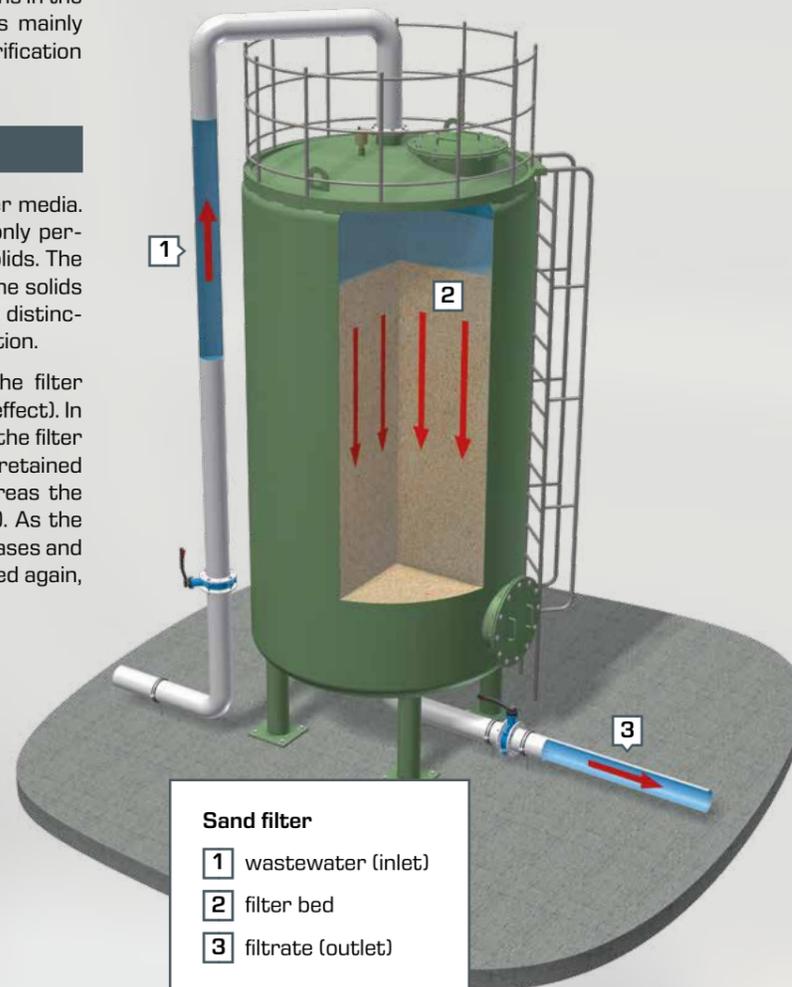
### Sedimentation

The easiest way to separate solids is by sedimentation. In the sedimentation tank, the solid particles fall to the bottom due to gravity and can then easily be removed with sludge scrapers. Effective sedimentation requires calm flow conditions in the sedimentation tank (no turbulence). Sedimentation is mainly used in wastewater treatment plants in primary clarification and secondary clarification.

### Filtration

During filtration, the solids are retained by porous filter media. Effective filtration requires that the filter medium is only permeable for the liquid phases (water), but not for the solids. The success of treatment depends on the particle size of the solids in relation to the pore size of the filter medium. A basic distinction is made between surface filtration and depth filtration.

In **surface filtration**, the solids do not penetrate the filter medium, but instead are retained on its surface (sieve effect). In **depth filtration**, however, the wastewater penetrates the filter medium (e.g. fixed bed of sand or gravel). The solids are retained in the pores between the individual sand grains, whereas the water flows through the fixed bed unimpeded (filtrate). As the load of the fixed bed increases, the pressure drop increases and the flow rate decreases. A backwash cleans the fixed bed again, so that the pressure drop decreases.



### Flotation

Solids with low settling velocities cannot be effectively separated by sedimentation because this would require very large sedimentation tanks. In this case, flotation processes provide a sensible alternative. The basic principle is still the same. Gas bubbles attach themselves to the bottom of the solids and drive the solids to the surface. Once there, the floated solids can be removed with special scrapers. Flotation processes differ mainly in the way the gas bubbles are produced.

In water treatment, the most commonly used method is dissolved air flotation. In this process, a partial flow of the treated water is saturated with air under pressure. The air-saturated water is then passed back to the inlet region of the flotation tank (circulation). An expansion valve is located just before the inlet to the flotation tank, which causes the water to suddenly re-expand to atmospheric pressure. This expansion causes the dissolved air to form fine bubbles.

### Dissolved air flotation

- 1 wastewater
- 2 sludge scraper
- 3 separated sludge
- 4 treated water
- 5 circulation
- 6 compressed air
- 7 expansion valve