The self-cleaning filter for continuous filtration.

F450

We filter, regulate and secure liquids and gases
The F450 self-cleaning filter.

Benchmark filter for industrial cooling water and process filtration.

The advantages of the F450 self-cleaning filter compared with conventional self-cleaning filter systems are grounded both in its simple design and also in the principle of non-contact filter insert cleaning.

The simple integration of the filter unit into cooling water and production processes allows ongoing operation of the plant without any significant investment in facility modification.

Since the filter, in contrast to backflush wash filters, does not use the pressure drop to atmosphere for the actual cleaning process, it is the only self-cleaning filter that can be used with working pressures as low as 0.4 bar.

Benchmark filter for industrial cooling water and process filtration.

Advantages at a glance:
- flow rate from 5 m³/h to 7,000 m³/h in one filter unit.
- self-cleaning of the filter.
- continuous filtration during the self-cleaning process.
- minimal pressure drop.
- filtration sizes from 0.1 mm to 10 mm.*
- can be installed in any orientation.
- low weight.
- reliable functionality under all operating conditions.
- can be used with system pressures as low as 0.4 bar, pressure levels up to PN 25.
- effortless management of high levels of contamination.
- low washing flow rates and moderate losses.
- energy cost savings as a result of low Δp (pressure drop).

*depending upon filtersize and application.
Automatic filtration duties.

Protect plants – minimise maintenance – prevent damage.

Duties at a glance:

- protect large cooling water systems, plants and processes from contaminants.
- minimise maintenance resource requirements for filters.
- prevent damage to heat exchangers and plants.
- avoid production downtimes and failures.

Two F450 DN 200/ANSI 8" providing heat exchanger protection in a cement factory.

Filtration of highly loaded slurry. 500 m³/h per filter.

Heat exchanger in operation.

Typical contamination in heat exchangers that have been operated without the protection of an F450.
In the 18th century Daniel Bernoulli, a Swiss scientist, discovered the basic principles of hydrodynamics.

He studied the flow of fluids and amongst other achievements formulated the principles that the pressure exerted by a fluid is inversely proportional to its flow velocity, and that the sum of the velocity and pressure in flowing fluids is constant.

This is referred to as the »Bernoulli principle«.

The »Hydrodynamica« of 1738.

Physics intelligently utilised.
This principle is used in the design of the F450 self-cleaning filter. The movable washing disk generates a fall in static pressure in the filter insert and a large local increase in flow velocity between the washing disk, as it moves into the filter insert, and the insert liner. The fall in pressure thereby generated cleans the filter insert with no surface to surface contact, and the particles escape via the washing valve, which in the opened state generates a pressure drop to atmospheric pressure.

Because of its excellent fluid mechanical design the filter generates only a very small pressure drop in the system. The result is a large saving in energy compared with conventional backflush filters. The washing water flow rates are so low that the systems as a rule can be operated without the need for further investment in plant modifications.

The filter is supplied with an electronic control system, which monitors all functions and enables adjustment of operating parameters. Integration and control of the system via the customer’s own control facilities and monitoring systems is also possible without any difficulty.
The cleaning principle of the F450.

1) Filtration
The filter is in the normal filtration phase. The particles are deposited in the filter insert in accordance with the laws of fluid mechanics, starting at the top and continuing towards the bottom. The duration of this filtration phase is dependent upon the level of contamination of the medium.

Because of the design and the fluid mechanical conditions no particles are deposited in the filter entry region in this phase.

2) Filtration and first washing phase
In this washing phase the washing valve opens and generates a pressure drop relative to the system pressure prevailing in the pipework system. By means of this pressure drop the coarser and easily cleanable particles are flushed out of the insert liner. The filtration continues throughout this process, while the washing flow rate is defined and limited by means of a throttle valve that is located in the washing outlet pipe.

The washing process is triggered either by monitoring of the differential pressure, or by a time-based control algorithm.
3) Filtration and second washing phase

The washing valve is open. The pneumatically driven piston, together with the washing disk, travels into the filter insert region. The large local increase in velocity in the gap between the washing disk and the filter insert generates a drop in static pressure (the Bernoulli effect). Only in part of the region of the washing disk is the external pressure on the clean side of the filter higher than in the region between the washing disk and the filter insert. Together with the much increased flow velocity this generates a »suction effect« in the filter element.

By means of the washing valve that is open at the same time, and the pressure drop thereby generated, the contamination is flushed out of the filter.

4) Filtration and last washing phase

While the washing disk is reaching its initial position the washing valve remains open. This enables the remaining particles to leave the filter unit. During the upwards movement of the washing disk the lower region of the filter liner is also cleaned by means of a self-cleaning effect produced by the flow conditions generated in accordance with the Bernoulli principle.

For the ongoing sequence see: 1) Filtration.
The operating states of the F450 in detail.

Filtration in the upper 2/3 region
- In the lower third reverse flow of the filter insert takes place as a result of high flow velocities in the filter insert entry region – this does not cause any deposits.

Filtration in progress
- The filter insert starts to clog up from the top to the bottom.
- Filtration also begins in the lower third of the filter insert.
- Reverse flow in the filter entry region still takes place.

Filtration and triggering of the self-cleaning mechanism
- 2/3 occupation of the filter insert is reached.
- Filtration starts to take place over the whole of the filter surface.
- The self-cleaning mechanism is triggered, controlled by differential pressure.
Cleaning and filtration
- The washing valve is opened.
- The washing disk still remains in its initial position.
- The coarse particles that can easily be washed out are released.
- The lower third of the filter insert also takes part in the filtration.

Cleaning and filtration, ongoing
- The washing disk travels into the filter insert liner (up to 2/3).
- Cleaning takes place in accordance with the Bernoulli principle.

Filtration and cleaning of the lower third of the filter insert
- The washing disk travels upwards.
- Reverse flow and cleaning of the lower third of the filter insert.
- Particles are extracted through the open washing valve.
Materials and areas of use.

**Housing materials.**
The many and diverse areas of use for the filter demand a large spectrum of housing materials. The filter is manufactured in steel, rubberlined carbon steel, stainless steels, special stainless steels, bronze, glass fibre reinforced plastics/polyesters GRP, PVDF, and PE, as well as other special materials.

The use of high quality composites such as glass fibre reinforced plastics strengthens the advantages of the filter system in terms of material durability and very large weight savings.

In particular this material is very suitable for use in salt water cooling systems, or in cooling water systems into which chemicals have been added.

**Materials that can be supplied:**
- steel
- stainless steel
- glass fibre reinforced plastic
- plastic
- marine bronze (aluminium bronzes)

**F450 areas of use:**
- chemical industry
- petrochemicals
- plastics industry
- automotive industry
- power stations
- cooling water circuits
- processes in industry
- food industry
- reverse osmosis plant protection
- demineralised water filtration
- desalination plant protection
- sewage treatment plants
- surface water filtration
- cement factories
- steel foundries
- aluminium industry
- mineral oil filtration
- shipbuilding
- protection against mussel larvae in cooling water circuits
- ballast water filtration
- marine

*F450 made of special "marine bronze" used in exhaust cooling system of the new German corvette/K130.*
Installation of a stainless steel filter 1.4571 on the Schünemann site.

This company is certified to DIN ISO 9001.

Examples of dimensions:

\[ Q = 2,000 \text{ m}^3/\text{h} \]

Filter size selected: DN 500/ANSI 20"

Maximum pressure drop at 200 µ: 0.1 bar.

Installation of a stainless steel filter 1.4571 on the Schünemann site.
Application examples.

The F450 filter system has been in use worldwide for many years in industry.

BASF

F450 stainless steel
- 200 µm
- DN 250/ANSI 10”
- 500 m³/h
- 5 bar
- 40 °C
- time/differential pressure controlled

Production of formic acid
Filtration of flowing water for the protection of heat exchangers and prevention of mussel growth.

Petrotank

F450 stainless steel
- 1.5 – 3 mm
- DN 100/ANSI 5”
- 30 – 90 m³/h
- 4 – 6 bar
- up to 80 °C
- time/differential pressure controlled

Mineral oil industry
Filtration of waste oil and crude oil in a refinery and protection of the tanks and transport vehicles.
**BASF**

**F450 stainless steel**
- 200 µm
- DN 500/ANSI 20"
- 3,500 m³/h
- 1.5 bar
- 80 °C
- time/differential pressure controlled

**Production of propionic acid**
Filtration of flowing water for industrial water utilisation and prevention of mussel growth.

**Mobil Lesum**

**F450 glass fibre reinforced plastic**
- 200 µm
- DN 200/ANSI 8"
- 300 m³/h
- 5 bar
- °C = ambient
- time/differential pressure controlled

**Further processing of oil and natural gas**
Filtration of flowing water for the solution mining of an underground reservoir and protection of a high-pressure pump from damage.
Further application examples.

**Mettmann sewage treatment plant**

- **F450 glass fibre reinforced plastic**
  - 1 mm
  - DN 400/ANSI 16"
  - 1,100 m³/h
  - 0.4 bar *
  - °C = ambient
  - time/differential pressure controlled

*special feature: pressure of 0.4 bar sufficient as operating pressure.

- **Sewage treatment plant**
  Filtration of sewage treatment plant waste water and protection of entrainment filters.

---

**Kolbenschmidt**

- **F450 glass fibre reinforced plastic**
  - 500 µm
  - DN 150/ANSI 6"
  - 150 – 170 m³/h
  - 3 bar
  - 80 °C
  - time/differential pressure controlled

- **Automotive supplier**
  Filtration of flowing water for the protection of heat exchangers and motors.
F450 stainless steel
- 100 – 200 µm
- DN 100/ANSI 4"
- 110 m³/h
- 1.8 bar
- 80 °C
- time/differential pressure controlled

Artificial snow production
Filtration of surface water at a height of 1,800 m and protection of the snow cannons.

F450 glass fibre reinforced plastic
- 200 µm
- DN 150/ANSI 6"
- 115 m³/h
- 7 bar
- °C = ambient
- time/differential pressure controlled

Plastics production
Saving of demineralised water by means of filtration and recycling of the granulation plant water.

Ski Run at St. Moritz

Bayer Dormagen

F450 stainless steel
- 100 – 200 µm
- DN 100/ANSI 4"
- 110 m³/h
- 1.8 bar
- 80 °C
- time/differential pressure controlled
The mussel larvae phenomenon.

Using the example of the zebra mussel.

The F450 self-cleaning filter was originally designed for the protection of cooling water systems (plate heat exchangers and tube bundle heat exchangers) from particulate contaminants.

After the filter had been in use for some time, many operators observed a phenomenon – there was no longer any growth of mussel larvae in the downstream system of pipework, even though in many cases the larvae are smaller in size than the nominal size of the filter insert in use.

The phenomenon of mussel larvae mortality has aroused great interest in industry, since the growth of the familiar zebra mussel, in particular, has posed enormous problems for plant operators.

The mortality phenomenon is occurring across a much wider spectrum than originally supposed – it is being explained primarily in terms of the level of turbulence and fluid shear stresses, and has been defined in terms of a so-called dissipation rate. The dissipation rate enables statements to be made concerning the required turbulence levels that are necessary to kill the living organisms.*

According to the latest findings plankton and other small organisms are also killed by this effect in the filter system.**

*cf. Rehmann, C.R. »Effect of turbulence on the mortality of zebra mussel«.
**Ongoing study, for more information please contact us.

Growth of the mussel larvae within a few days.

The zebra mussel (Latin: Dreissena Polymorpha).

Time-consuming manual cleaning of a plate heat exchanger.
Research project.
In an extensive research and development project the phenomenon of the mussel larvae mortality has been investigated and scientifically explained in a comprehensive study. The results are aiding the selection of types of edge gap profiles and filter design.

Computer-based simulation of the behaviour of fluids in the insert clearance for different filter insert sizes and flow velocities (horizontal section).

Section through the filter. View on the edge of the insert. Simulated flow conditions.
Research and development.
We are working together with our customers to integrate our filter system into the customer’s process, and our engineers are supporting the optimisation of the filter system on-site in the customer’s own process plant.

Test filter design.
In the company test filter units are always available for installation at the customer’s site to verify the level of optimisation in the customer’s own systems, preferably by means of extended experimental tests.

Design and manufacture in-house.
In the Schünemann company in-house manufacture and design are important for process integration and provision of service. Customer care and attention is always provided, from replacement parts through to on-site support.
Publications in the specialist press.

A selection of publications from the specialist press.

Fairs and exhibitions.

SAB Georg Schünemann GmbH has a worldwide presence in specialist fairs and exhibitions as an exhibitor and participant.
Partner for your requirements.
Since 1937 we have been supplying our products and services to all sectors of industry. As a result of our long-term commitment to research and development we are able to develop benchmark products for virtually all fields of application. We are the specialists for the manufacture of bespoke individual designs and low production runs.

Service and support – worldwide.
Service signifies for us the provision of advice and care to our customers worldwide; from design and development, through instruction and training, to joint commissioning of equipment and after sales support.

SAB worldwide

Schünemann valves.

Schünemann filters.

Schünemann plant construction.

Schünemann filters are in use worldwide.

Georg Schünemann GmbH
Buntentorsdeich 1
28201 Bremen
Germany

Phone: +49 421 55 90 9-0
Fax: +49 421 55 90 9-40
E-Mail: sales@sabfilter.de
Internet: www.sabfilter.de

We filter, regulate and secure liquids and gases

Your contact

Edelflex S.A.
Av. Gral. Belgrano 2487 8161DVD - Don Torcuato
Provincia de Buenos Aires - Argentina
Tel.: +54 11 4727-2000 - Fax: +54 11 4727-2200
www.edelflex.com - info@edelflex.com