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A versatile automatic filter design is used to process a wide variety of fluids, pastes and similar substances, ranging from coarse filtration to fine filtration or homogenization. By using various cleaning systems and filter materials, this compact design can be adapted to perform specific filtration tasks.

The variable configuration of this automatic filter system makes it possible to switch to a different cleaning system at very short notice, for example when operating parameters change.

Picture: Mahle Filtersysteme

Flexible automatic filter system can be adapted for specific needs

HEINZ GEISBAUER

If you want to be successful in Europe or world-wide, you have to take an innovative approach to the future. To remain competitive in the face of increasing cost pressure, companies are fully exploiting rationalization potential and automating more and more production processes. As a result, automatic filter systems for the filtration of fluids, pastes and similar substances are becoming increasingly important in industry. If machines and equipment are to run non-stop around the clock to achieve better capacity utilization, there are important conditions which must be met. Process fluids must be treated and regenerated, so that the high quality requirements placed on the work pieces can be fulfilled. Product media must conform exactly to specifications. High safety standards for equipment and processes must be adhered to. Required maintenance and disposal activities for disposable or consumable filter systems must no longer be disruptive or time-intensive, and they must not cause interruptions.

This makes automatic filter operation a compelling solution. At Mahle Filtersysteme GmbH in Öhringen, Germany, a consistent program of innovation has resulted in the development of a variable-configuration automatic filter series, which is protected by various patents. These products always provide the best solution to meet a wide variety of needs.

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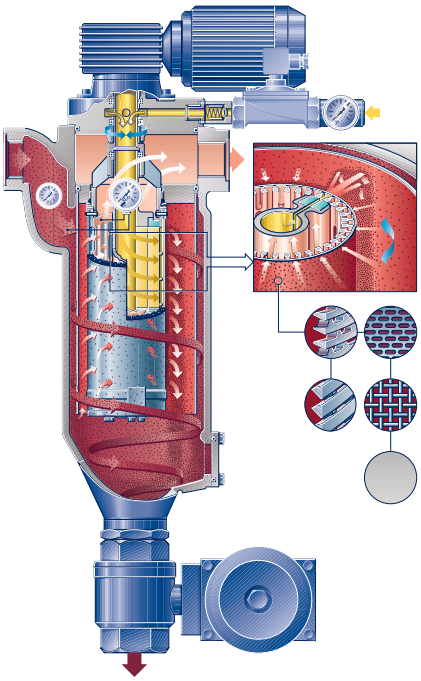
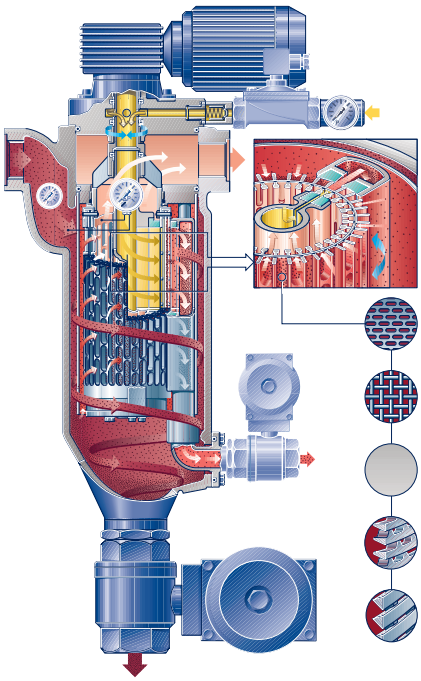
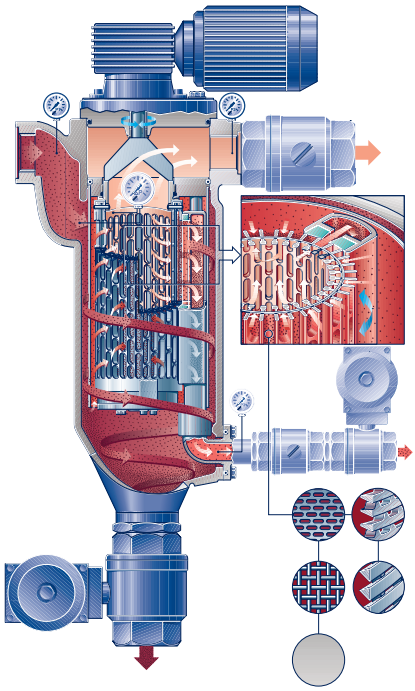


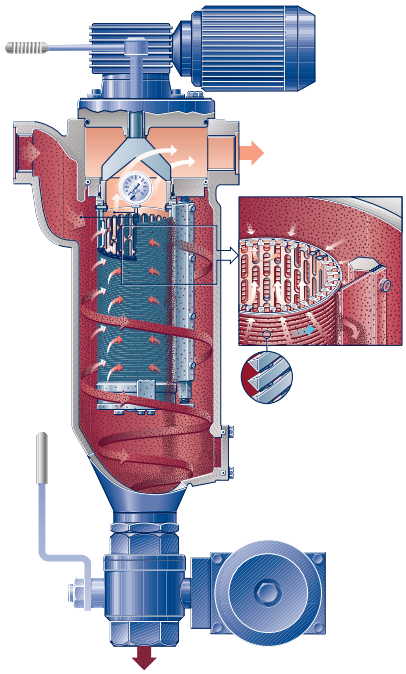
Picture 1: Pulsating external pressure surge segment cleaning with integrated cyclone effect.



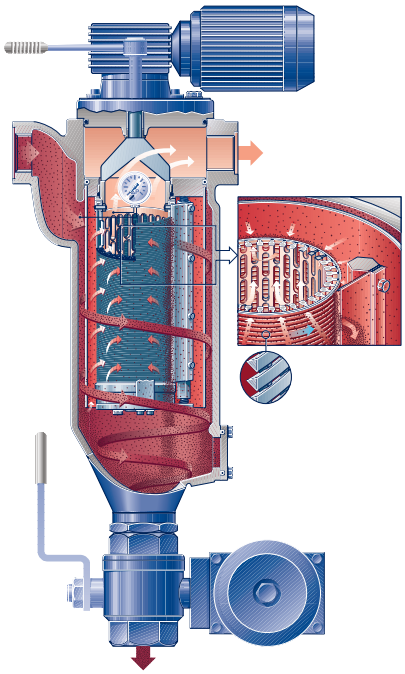
Picture 2: Pulsating external pressure surge segment cleaning with cyclone effect during constant filtrate flow.



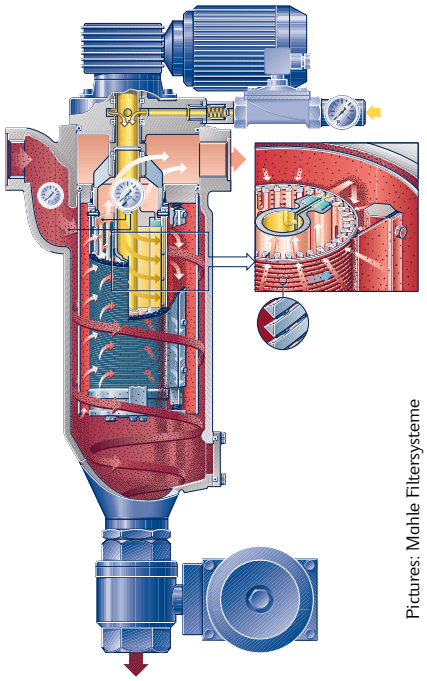
Picture 3: Inherent segment cleaning with integrated cyclone effect.



Picture 4a: Metal edge filter with scraper cleaning.



Picture 4b: Metal edge filter with scraper cleaning and integrated cyclone effect.



Picture 5: Scraper and pulsating external pressure surge segment cleaning with cyclone effect.

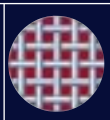
Pictures: Mahle Filtersysteme

Variable-configuration inline pressure filters, which use modern technology and can be cleaned during on-going operation, require no maintenance or disposal measures as opposed to consumable filter material, for example. Using a variety of cleaning systems, filter materials and combination options, these compact automatic filters are designed to be highly adaptable to filtration requirements, and they can be used in applications ranging from fine filtration to coarse filtration or homogenization. Applications include for example:

- Cooling lubricants for metal cutting and metal forming in machine building and car manufacturing
- Fluids used in washing systems for industrial components and cars
- Fluids used in ship building, for example motor oil and fuel
- Products used in production and processing in the lacquer, paint, grease, paste and adhesive industries
- Other fluids or products used or manufactured, for example in the chemical or food industries

The variable-configuration system provides the capability to react in a highly flexible manner to the most diverse filtration tasks by using a basic filter design. If necessary, for example, it is possible to switch to another cleaning method at short notice, should the operating conditions change.

Comparison of filter materials

Filter material	 V-profile pile winding	 Triangular profile winding	 Stainless steel foil	 Top mesh	 Fleece reinforced stainless steel
Filter fineness/ gap width in µm – nominal	Open filter surface %	Open filter surface %	Open filter surface %	Open filter surface %	Porosity %
3	–	–	–	–	65
5	–	–	–	4	77
10	–	–	5	6	72
20	5	–	10	32	70
30	8	6	14	39	–
40	10	7	19	40	–
60	14	11	28	40	–
100	22	17	–	44	–
500	48	38	–	44	–
Filtration effect	••••	•••	••••	•••••	••••••
Cleaning behavior	•••••	••••••	•••••	••••	•••
Resistance to differential pressure	••••••	••••••	••	••••	••••

Relative assessment: •••••• = very good • = poor.

The basic filtration principle makes use of the cyclone effect

Material flows from the outside towards the inside through the segment elements, filter spools or split tubes located in the variable-configuration housing. The filtrate flows upwards across from the intake connection and out of the filter. Solids, particles or similar substances are deposited on the surface of the filter material. There is a downwards tangential flow around the immersion pipe via the outer intake chamber. This reduces the load on the segment element or filter spool, and particularly with low-viscosity fluids this results in the pre-deposition of coarse and heavy particles through settling in the collection cone. As mentioned above, cross flow and precision residual separation take place on the filter material via the inner intake chamber.

Segment cleaning by pulsating external pressure surge

The „segment cleaning with external pressure surge“ system is used for a wide variety of low-viscosity fluids for fine or very fine filtration (see picture 1). It delivers excellent cleaning performance, and its outstanding characteristics include robustness and a lack of sensitivity to very coarse particles or high differential pressure.

After a differential pressure threshold has been reached or after a pre-determined interval, the segment element is turned in the opposite direction for brief cleaning with compressed air or filtered fluid, and both the external pressure valve and the drain valve are opened. The segments pass the external pressure nozzle in sequence, and the nozzle is alternately opened and sealed. When the nozzle is sealed, the integrated external pressure reservoir is pre-loaded, so that when the nozzle is opened, an outward pressure surge causes the deposited particles to be cleaned off the filter material in each individual segment. One revolution is sufficient to clean all of the segments. During this brief cleaning period, the residue in the collection cone and particles that have been cleaned off the element are transported out through the drain valve. The cleaning process can be triggered by setting a limit on the differential pressure contact using time intervals or machine cycles. Various filter material are used for different applications and filtration requirements (see table).

Pressure surge segment cleaning during continuous filtrate flow

The external pressure surge segment cleaning system is also used during continuous filtrate flow with low-viscosity fluids for very fine and fine filtration (see picture 2). However, with this method, the filtrate flow is not interrupted or noticeably reduced during the cleaning process. Rotation of the filter elements causes the segments to sequentially pass the external pressure nozzle on the inside and the rinsing channel on the outside. The particles are cleaned off by the external pressure surge, collected on the outside in the rinsing channel and transported away in a medium made up almost exclusively of foreign matter. The same filter materials described above are used with this method.

Inherent pressure segment cleaning

In a manner similar to the external pressure principle, the inherent pressure principle is also used for very fine and fine filtration (see picture 3). In this case, however, the inherent pressure or a low partial flow of the filtrate itself in the opposite direction is used instead. The segment element is rotated briefly and the cleaning valve is opened. The segments are sequentially moved past the cleaning channel. Differential pressure between

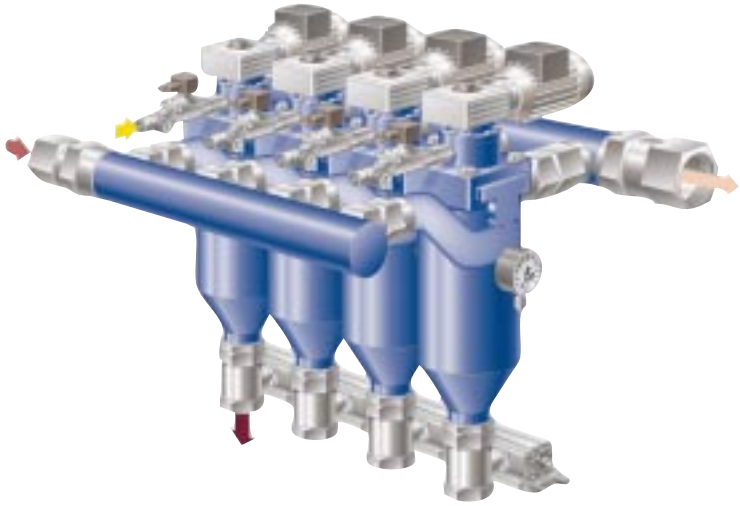
the filtrate side and the cleaning channel causes particles to be cleaned off and transported out via the cleaning channel. The inherent pressure segment cleaning principle requires a pressure of at least 2 bar in front of the filter, so that a cleaning pressure of approximately 1 bar can be created on the filtrate side using a regulating choke. Residue in the collection cone can be emptied via the drain valve during process stoppage phases or ongoing operation. The same filters are used as with the external pressure system.

Metal edge filters with scraper cleaning

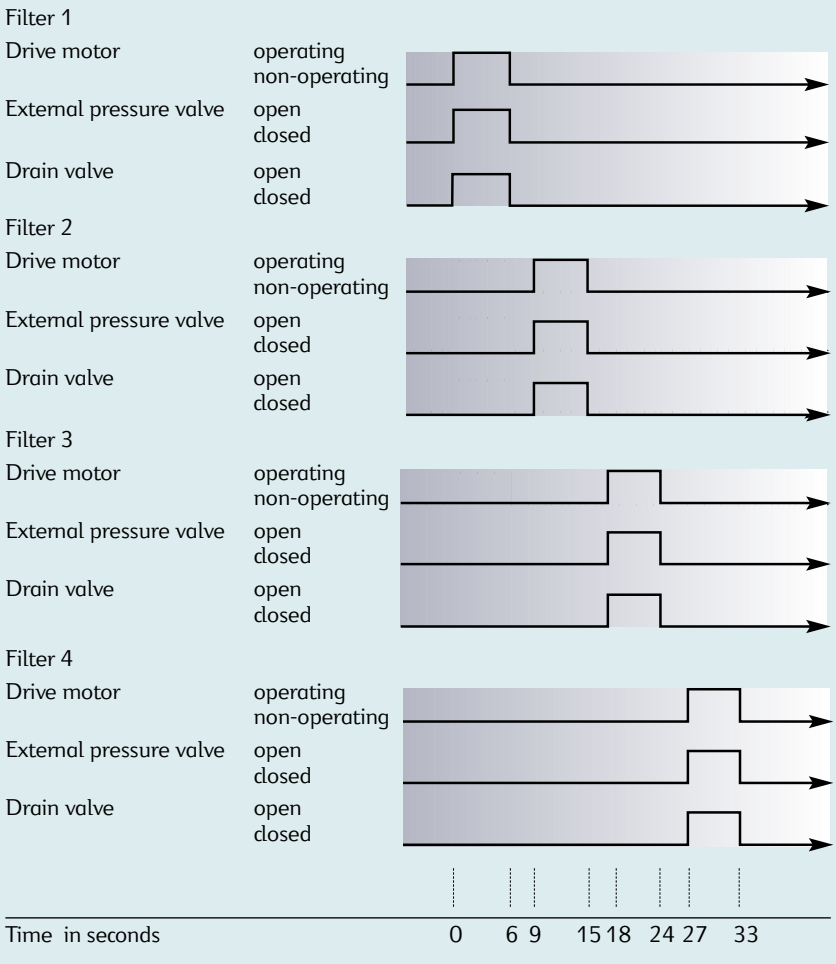
The mechanical principle of metal edge filters with scrapers covers, with various limitations, a wide spectrum of applications for low to high viscosity fluids, pastes and similar substances ranging from fine right up to coarse filtration (see picture 4 a/b). It enables a continuous flow of filtrate in the pressure and suction area when cleaning is performed during ongoing operation.

The filter spools or split tubes with triangular radial or V-shaped profile windings rotate against the spring-mounted moveable scrapers. The scrapers collect particles or substances on the edge gaps and strip them lengthways off the gaps, which widen towards the inside.

Windings with gap widths ranging between 30 and 2000 µm are used. The drain valve can be opened during the cleaning process or when cleaning is not taking place.



Cleaning process



Scraper and pressure surge combined for special cases

The combination of scraper and pulsating external pressure surge (see picture 5). is used in special circumstances when complementary mechanical stripping and subsequent non-contact external pressure cleaning are both required to achieve a satisfactory cleaning effect. Filter elements with radial gaps or with triangular or V-shaped profile windings are suitable for this application.

Operating conditions influence the selection of the most suitable filter variation. Filter size as well as filtration and cleaning behavior of the suspensions are evaluated depending on the characteristics, viscosity, composition, magnitude and concentration of the existing solids or other substances. If reliable evaluation criteria are lacking, basic or practical tests must be conducted.

Automatic filters in a parallel unit

For higher volume flows or corresponding filtration requirements, the external pressure variant can, for example, be assembled into a compact parallel unit. A continuous filtrate flow can be guaranteed during ongoing operation through the use of regulated filter cleaning.