RPF Rotary Pressure Filter
Precise separation of suspensions

Continuous . Versatile . Highly efficient

BHS Sonthofen
Cake filtration
BHS has specialized in cake filtration for more than 50 years. We supply a broad range of pressure and vacuum filters for both batch and continuous operation. There is a diverse spectrum of applications and we have accumulated a wealth of experience. A common feature of all BHS filters is that they work with a comparatively thin cake.

High process versatility
The rotary pressure filter makes a large number of process steps possible during one drum revolution. After the suspension has been precisely separated into filtrate and filter cake, the rotary pressure filter additionally enables the following operations: single- or multi-stage cake washing, displacement washing, counter-current washing, closed-cycle washing, reslurrying, solvent exchange, steaming, extraction and mechanical or thermal cake drying. All process steps are performed in separate segment chambers inside the filter. This allows filtrates and other fluids to be drained off separately.

Process-optimized pressure generation
The rotary pressure filter operates at a pressure of up to 7 bar (g). In all process steps, pressure is generated hydraulically by feeding suspension, wash liquids or extraction agents and not pneumatically by gas layers. This allows an individual process optimization of each operation step.

Atmospheric cake discharge
Since each process step is sealed off as an independent segment chamber inside the rotary pressure filter by means of pressure-tight separating elements, the cake can be discharged directly at atmospheric pressure. Discharge of the filter cake can be assisted by a scraper if required.

Self-contained, gas-tight operation
The rotary pressure filter is a completely self-contained unit allowing gas-tight integration into a production process. This enables the rotary pressure filter to be implemented even in operating environments subject to strict safety or hygiene regulations.

Filtration tests
BHS has a range of pilot and lab filters available for customer-specific filtration tests. They are available for rent, BHS will advise you in all application related matters.

Worldwide service
BHS provides quick and reliable service worldwide with its technical customer support and a large stock of spare parts for all standard machine types, also for older machines.
More than 1,000 installations
Functional principle & process steps

Description of the individual process steps in the rotary pressure filter

Suspension feed & filtration
The suspension is fed continuously and under pressure to the filter from below. In the filter cells, the filter cake forms on the filter elements and is carried into the following segment chambers by drum rotation. The filtrate drains off the cells through the pipe systems to the control head.

Cake washing
Depending on the specific requirements, washing, extraction or steaming can take place in one or more stages. As the segment chambers are completely filled with pure, unmixed treatment agents, an ideal single-phase displacement flow through the cake is ensured. The washing fluid is drained through the pipe system to the control head, where it can be collected in unmixed form.
**Cake discharge**

In the non-pressurized discharge zone – which can be provided with a gas-tight hood if required – the cake is discharged by backblowing and optionally by a moveable scraper. The filter cloth can then be washed.

**Cake drying**

In the next step, the filter cake is dried. Targeted drying is accomplished by means of compressed air, nitrogen or steam.

The filter drum 1 rotates continuously in a pressure-sealed housing 2 at infinitely variable speed. The annular space between drum and housing is sealed to the sides by specially designed stuffing boxes and divided into pressure-tight segment chambers by separating elements. The surface of the drum consists of filter cells 3 connected to the control head 5 via drainage pipes 4.
1 **Housing**
The housing is divided into segment chambers to which the individual treatment agents are pressure-fed from the outside. The maximum operating pressure is 3 bar in normal applications or 7 bar for high-performance filters.

2 **Drum**
The drum surface is divided by separating ledges and drum rings into individual filter cells in which the filter cake is formed. The filter cells accommodate the cell inserts, covered with the filter medium and fastened to the drum. The cake thickness can normally be set in a range of 6 to 30 mm and varied by inserting spacers beneath the inserts; larger cake thicknesses up to 175 mm are possible in special cases. The drum can be equipped with a double jacket for heating or cooling.

3 **Control head**
The control head is responsible for separately draining the individual filtrates and controlling the backblow process for discharging the cake and cleaning the cloth. The control head consists of the rotating core with the filtrate tube outlets and a stationary ring, which is divided by exchangeable separating plugs to match the segment chambers of the housing. Lateral sealing is assured by stuffing boxes.

4 **Cake discharge hopper**
The cake is discharged in a non-pressurized zone of the filter by means of a backblow of air, steam or nitrogen. Cake discharge can optionally be assisted by an independently operating scraper. If required, this zone is provided with a gas-tight hood. A device for cleaning the filter cloth either continuously or on demand follows the cake discharge.
5 Separating elements
Separating elements pressed pneumatically against the drum provide a dependable and pressure-tight seal between the individual segment chambers. The sealing effect is reliably achieved by means of high-grade, chemical-resistant plastics, such as PE or PEEK. The exchangeable sealing plates (red in the detail graphic) are mounted on dimensionally stable supports.

6 Cell inserts in the drum
The filter cells incorporate the cell inserts, the actual filter elements. The filter inserts separate the solids from the suspension. They are bolted to the drum and contain the filtrate drain, backing fabric and filter cloth (yellow in the detail graphic). The filter cloth can be made of plastic fabric or metal fabric, as required by the application. Tests are carried out in advance to determine the appropriate filter cloth for the task.

7 Drive
The filter is equipped with a variable-speed drive enabling adaption to changing throughput rates and filtration properties. This drive consists of a reduction gear unit, an optional coupling and a frequency-controlled drive motor.

8 Spur gear drive
The drum is driven by an open spur gear drive on the drive side with a reduction gear unit and frequency-controlled electric motor.

9 CenterDrive
The CenterDrive is an enclosed drive on the control head side with a planetary reduction gear unit, coupling and frequency-controlled drive motor.

10 TwinDrive
The TwinDrive variant comprises an enclosed spur gear drive featuring two reduction gear units and two drive motors with common frequency control.
Applications

Cellulose products
The production of cellulose and cellulose derivatives requires special expertise in the field of solid-liquid separation as well as appropriately optimized machines and plant components. Our rotary pressure filters have been used successfully in this application around the world for many years. Whether for single or multiple cake washing (including counter-current), steam drying or reslurrying – our systems are equipped for all requirements and also meet the criteria for pharmaceutical-grade production.

Examples: MC, HEC, HMEC, CMC, etc.

Intermediate plastic products
When used in the manufacture of intermediate plastic products, the BHS rotary pressure filter meets the requirement for high throughput, assuring top product quality at the same time. Excellent cost-effectiveness, especially with regard to energy consumption and maintenance, as well as high reliability are additional parameters favoring the implementation of these systems in production facilities. Working pressures of up to 7 bar (g) and operating temperatures of up to 160 °C are key factors in ensuring efficient production with our high-performance filters.

Examples: TA, PTA, ABS, HDPE, PVC, bisphenol A

Organic chemicals
A wide variety of other intermediate and final organic products are processed by BHS rotary pressure filters. These substances are often characterized by moderate filtration properties, and/or a closed, absolutely leak-tight and continuous production system is required. If there is also an additional demand to wash, extract, steam or dry, this filter system is the number one choice.

Examples: vulcanization derivatives, sodium hydrosulfite, phenyls, amines, paraffins, raw materials for detergents

Dyes and pigments
The production of dyes and pigments requires efficient filter systems that ensure reliable execution of the necessary process steps such as filtration, washing and pre-drying in a continuous mode. Thin-cake thickness, high purity and cleanability of the filter are typical requirements that are dependably fulfilled by BHS rotary pressure filters.

Examples: pearlescent pigments, aniline dyes, silicate pigments
Agrochemicals
For decades, this filter system has been successfully used in the production of crop protectants, fertilizers and other agrochemicals. Multiple cake treatment stages are implemented in a closed system, with high throughput rates being achieved in continuous operation. Filter systems from BHS-Sonthofen meet the strict standards for workplace hygiene and occupational health and safety that apply in particular to the processing of toxic products.

Examples: phosphates, molluscicides, fertilizers, herbicides, insecticides, fungicides

Coffee
Coffee extraction for the production of instant coffee encompasses various process steps in which multi-stage counter-current washing is required in order to optimize the yield. The unique technology of the BHS rotary pressure filter enables the finely ground coffee to be extracted without any foreign substances impairing the quality ($N_2$, air, etc.). An optimal extraction yield is achieved in first-rate quality.

Starch
Modified starch can be efficiently filtered, washed and dewatered with the BHS rotary pressure filter. The combination of a 6 bar pressure differential, thin filter cake and continuous production makes high throughput and minimum energy consumption possible despite the moderate filtration characteristics of the starch. Integrated CIP cleaning and a manufacturing process complying with the highest quality standards translate into high availability of these filter systems in production.

Pharmaceuticals
The production of active pharmaceutical ingredients with the BHS rotary pressure filter conforms to the latest state of the art and meets GMP, CIP and ATEX requirements. The filter can be validated and is manufactured under the strictest quality guidelines. Product suspensions are processed by the filter in a closed and inerted system. The absolute leak-tightness of the filter and the CIP cleaning option ensure consistent and continuous product quality. For inerted processes, the BHS nitrogen circuit is available as an optional accessory. This assures the continuous supply of inert gas to the filter while minimizing consumption.

Examples: antibiotics, natural extracts, hormone derivatives, statins, antiviral drugs
Versions

1 Standard filter
Standard filters are designed for a continuous suspension throughput of up to 25 m³/h with a cake thickness of up to 30 mm. For standard filters, rotary pressure filters with spur gear drive are normally used. The maximum operating pressure is 3 bar (g).

2 High-performance filter
High-performance filters are suitable for a continuous suspension throughput of up to 250 m³/h and a cake thickness of up to 175 mm with operating pressures of up to 7 bar (g) and a pressure-tight filtrate discharge of up to 6 bar (g).

3 Rotary pressure filter with second containment
Additional, pressure-tight sealing of the working spaces from the environment – known as a “second containment” – increases the safety of the rotary pressure filter in the event of possible failure of the primary sealing arrangement. Any liquids or gases that escape are systematically detected in the second sealing chamber on the housing and control head and selectively discharged – without the risk of contaminating the environment with highly toxic and/or volatile substances.

Special materials for compliance with particular requirements
The metallic parts of the filter unit in contact with the product are made of the material DIN 1.4301 (ASTM 304) or DIN 1.4571 (ASTM 316 Ti) as standard. Different materials to meet specific product requirements are possible – a range of materials from DIN 1.4547 (ASTM S31254) to DIN 2.4610 (ASTM B366) can be provided.

Accessories

N₂ circuit
The N₂ circuit is implemented to enable the nitrogen employed in inerted processes to be re-used. In this equipment, the nitrogen needed for drying and discharging the filter cake is separated from entrained solvent and compressed to the required process pressure. The central component is a liquid ring compressor with an operating fluid corresponding to the solvent of the last cake wash in the rotary pressure filter (RPF). Depending on the application, the N₂ circuit can be rated at 3 bar (g) or up to 7 bar (g). Twin units for serving two or more RPFs are also possible. The overall nitrogen consumption can thus be considerably reduced.
### Performance data and dimensions

<table>
<thead>
<tr>
<th>Type</th>
<th>Drum diameter</th>
<th>Effective drum length</th>
<th>Active filter area</th>
<th>Dimensions (L x W x H)</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPF T01</td>
<td>0.5 m</td>
<td>0.1 m</td>
<td>0.12 m²</td>
<td>1 x 0.9 x 1.6 m</td>
<td>900 kg</td>
</tr>
<tr>
<td>RPF P01</td>
<td>0.75 m</td>
<td>0.1 m</td>
<td>0.18 m²</td>
<td>2 x 1.2 x 2 m</td>
<td>2000 kg</td>
</tr>
<tr>
<td>RPF P02</td>
<td>0.75 m</td>
<td>0.25 m</td>
<td>0.45 m²</td>
<td>2.1 x 1.2 x 2 m</td>
<td>3000 kg</td>
</tr>
<tr>
<td>RPF A03</td>
<td>1 m</td>
<td>0.3 m</td>
<td>0.72 m²</td>
<td>2.2 x 2.1 x 2.2 m</td>
<td>4500 kg</td>
</tr>
<tr>
<td>RPF A06</td>
<td>1 m</td>
<td>0.6 m</td>
<td>1.44 m²</td>
<td>2.5 x 2.1 x 2.2 m</td>
<td>5900 kg</td>
</tr>
<tr>
<td>RPF A09</td>
<td>1 m</td>
<td>0.9 m</td>
<td>2.16 m²</td>
<td>2.7 x 2.3 x 2.2 m</td>
<td>7300 kg</td>
</tr>
<tr>
<td>RPF A12</td>
<td>1 m</td>
<td>1.2 m</td>
<td>2.88 m²</td>
<td>3.3 x 2.4 x 2.5 m</td>
<td>8500 kg</td>
</tr>
<tr>
<td>RPF B09</td>
<td>1.5 m</td>
<td>0.9 m</td>
<td>3.2 m²</td>
<td>3.1 x 2.9 x 3.2 m</td>
<td>11500 kg</td>
</tr>
<tr>
<td>RPF B12</td>
<td>1.5 m</td>
<td>1.2 m</td>
<td>4.32 m²</td>
<td>3.7 x 3 x 3.2 m</td>
<td>14000 kg</td>
</tr>
<tr>
<td>RPF B16</td>
<td>1.5 m</td>
<td>1.6 m</td>
<td>5.76 m²</td>
<td>4 x 3 x 3.2 m</td>
<td>17500 kg</td>
</tr>
<tr>
<td>RPF X16</td>
<td>1.8 m</td>
<td>1.6 m</td>
<td>6.87 m²</td>
<td>4.2 x 3.3 x 3.6 m</td>
<td>30000 kg</td>
</tr>
<tr>
<td>RPF X20</td>
<td>1.8 m</td>
<td>2 m</td>
<td>8.6 m²</td>
<td>4.6 x 3.3 x 3.6 m</td>
<td>38000 kg</td>
</tr>
</tbody>
</table>

All specifications apply to a rotary pressure filter of standard design with base frame, spur gear drive, 3 bar working pressure and a maximum cake thickness of 24 mm. Technical data for customized designs, high-performance filters (high temperature and working pressure up to 7 bar) or other drives may differ from the specified data. All technical data may change due to development. Subject to modification without notice.

### Process criteria

The BHS rotary pressure filter works on the principle of cake filtration and can fulfill the following process criteria:

<table>
<thead>
<tr>
<th>Mode of operation</th>
<th>continuous</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating pressure</td>
<td>up to 7 bar (g)</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>up to 160 °C</td>
</tr>
<tr>
<td>Solids content (suspension)</td>
<td>up to 60% (weight)</td>
</tr>
<tr>
<td>Cake thickness</td>
<td>up to 175 mm</td>
</tr>
<tr>
<td>Particle size</td>
<td>10 - 500 µm</td>
</tr>
<tr>
<td>Filtration capacity – suspension</td>
<td>up to 15 m³/m² h</td>
</tr>
<tr>
<td>Filtration capacity – dry solid</td>
<td>up to 15,000 kg/m² h</td>
</tr>
<tr>
<td>Active filter area</td>
<td>0.12 - 8.6 m²</td>
</tr>
</tbody>
</table>
BHS product and service range:

Mixing technology
- Twin-shaft batch mixer
- Twin-shaft continuous mixer
- Single-shaft continuous mixer
- Laboratory mixer
- Mobile concrete mixing plants
- Continuous concrete mixing plants
- Retrofitting concrete mixing plants
- Mixing plants for the waste disposal sector

Crushing technology
- Impact crusher & impact mills
- Rotor impact mill
- Rotor centrifugal crusher
- Mobile crushing plants
- Stationary aggregates plants

Recycling technology
- Impact crusher & impact mills
- Rotor impact mill
- Rotor centrifugal crusher
- Rotorshredder
- Biogrinder
- Recycling plants

Filtration technology
- Rotary pressure filter
- Indexing belt filter
- Rubber belt filter
- Autopress
- Candle filter
- Pressure plate filter
- Lab filters & pilot filters
- N2 circuit for filters
- Filtration plants

Worldwide service
- Tests in our BHS technical center
- Engineering – process engineering & consulting
- Spare parts & service