PF
Pressure Plate Filter

Recovery of clear filtrates
The company
BHS-Sonthofen, headquartered in Sonthofen, Germany, is an owner-operated group of companies in the field of machine and plant engineering. We offer technical solutions in the field of mechanical process engineering, with a focus on mixing, crushing, recycling and filtration. With over 300 employees and a number of subsidiaries, BHS-Sonthofen has a global presence.

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. We have accumulated a great wealth of experience. The number of applications that have been implemented is in four figures. All BHS filters are characterized by the fact that they work with a comparatively thin cake.

System solutions
BHS has experienced project engineers at its disposal for planning and implementing complete filtration solutions. Numerous references all over the world testify to our broad expertise and experience. We are well-versed in all customary standards, including country-specific norms such as API, CSA, ASME etc.

Worldwide service
BHS offers quick and reliable service worldwide with its technical customer support and a large stock of spare parts for all standard machine types and also for older machines.

www.bhs-sonthofen.com
BHS pressure plate filter (PF)

The BHS pressure plate filter is a batch-operated filter with plate-shaped filter elements arranged one above the other inside a pressure vessel. The filter cake builds up on the filter plates. The clear filtrate is discharged inwards through the hollow shaft. All the process steps are carried out under pressure. Cake discharge is accomplished by vibration of the filter elements.

The filter is used primarily for cake-forming solid-liquid separation of suspensions with a low solids content that are moderately or extremely difficult to filter. It is also suitable for adsorptive filtration (as a deep bed or precoat filter). The BHS pressure plate filter is frequently used for clarifying filtration. It is a compact unit, operates fully automatically and allows high throughput rates.
High process versatility
A variety of options are available for treating the filter cake, enabling the individual process requirements to be met. The cake can be washed in one or more stages. Air, nitrogen or other gases can be passed through the filter cake to achieve a greater degree of dewatering. If required, precoat filtration by means of filter aids is possible.

Vibration discharge
The filter cake can be removed by means of either slurry discharge or dry discharge. The complete set of plates with hollow shaft and drive head is placed on a flexible elastomer ring that is not in contact with the product. Two unbalance motors subject the entire set of plates to defined horizontal and vertical vibrations, causing the filter cake to break up and fall off the filter plate in a spiral pattern.

Safe pressure filtration system
The entire filtration process takes place under pressure – up to a pressure differential of 10 bar g – in a closed, gastight system. This enables a BHS pressure plate filter to be implemented even where strict safety or hygiene regulations apply. It is also possible for products to be processed in an inerted or sterile environment. Sealing between the filter vessel and the vibrating plate stack is carried out using a static sealing collar made of elastomer or PTFE.

Fully automatic operation
The pressure plate filter operates fully automatically. Once a process cycle has been completed, the filter cake is discharged by vibrating the plate stack. Following cake discharge, the next cycle begins.

GMP and ATEX
For applications in the pharmaceutical, food and bioprocess industries, we make specially equipped, GMP-compliant filter plants incorporating CIP equipment if necessary. We are also ATEX certified.

Modular, turnkey filtration skids
On the basis of the pressure plate filters, BHS has developed a modular system of turnkey filtration skids. The advantages of these tried-and-tested system solutions are their short delivery times and low installation requirements on site. The modules are designed to allow cost-effective transport to the construction site in ISO containers.

Energy-efficient and low-maintenance
Unbalance motors are required for cake discharge with only low drive power (0.3 to max 2.0 kW depending on size). This is an advantage over alternative design principles, which require a higher energy to generate a rotation of the set of plates. In addition, there is no need for a rotating shaft feedthrough including sealing against the pressure vessel. The uncomplicated design leads to savings in energy and maintenance costs.

Pressure plate filter of type PF 1019 with 14.9 m² filter area
STRUCTURE OF A PRESSURE PLATE FILTER

**FUNCTIONAL DESCRIPTION**

### Set of plates and cake formation

The individual filter plates consist of slightly conical stainless steel plates. On the surface is a coarse-mesh backing screen that supports the actual filter cloth. The filter cake builds up on the filter cloth. The prevailing pressure differential causes the clear filtrate to flow into the backing screen area and from there to the central collecting pipe. The filter plates are connected to each other via hubs with special toothing and tie rods to produce a form fitting connection. The filter cloth is fastened to the shaft side by means of the hub seal and to the plate rim by a clamping ring.

### Shaft seal

Sealing between the hollow shaft and the filter vessel is carried out in the BHS pressure plate filter using a radially acting static sealing collar. Compared with dynamic solutions, this static sealing of the process space offers very high system reliability, even in challenging operating conditions.

### Heel filtration

After a filtration cycle, the heel volume in the lower part of the vessel is forced out through the vessel discharge pipe by means of compressed gas. Additional filter plates with a reduced diameter can be used to reduce the heel volume in the vessel cone. For further, virtually complete heel filtration, an additional filter cylinder can be flange-mounted at the bottom of the vessel.
CAKE FORMATION AND CAKE DISCHARGE

Cake formation
During the filtration cycle, the solid particles are deposited as a filter cake on the surface of the slightly conical plates due to the applied pressure differential. The filtrate is discharged through the backing screen, the plate hub and the hollow shaft (blue arrow).

Cake discharge
After the filtration cycle, the discharge valve opens. The filter cake is located on the filter plates. The set of plates is subjected to defined vertical and horizontal vibrations by unbalance motors. Spring isolators on the vessel prevent the vibrations from being transferred to the foundation. Additionally, gas is blown back from the filtrate side under a slight overpressure (orange arrow). This causes the filter cake on the plates to resonate. The cake begins to crack and the solids are moving outward over the rim of the plates. From here the filter cake falls into the vessel cone and is discharged through the discharge valve.
BHS manufactures pressure plate filters and corresponding skids for diverse applications. These are based on a range of standardized modules for skids from 0.33 m² to 45 m² filter area. BHS also makes individually engineered filter skids to customer specifications.

The BHS plate filter skid consists of the following four main components:

- Pressure plate filter
- Piping with fittings and measuring instruments
- Steel structure
- PLC Controls

The skid can be supplemented and expanded with further accessories.

Process solution

Besides the machinery itself, BHS also offers complete process solutions in the area of solid-liquid separation. Upstream and downstream process steps can be planned and integrated in addition to the actual filtration.

Modularization

All BHS plate filter skids are of modular design which reduces the planning effort and allows preassembly at the factory as well as comprehensive testing prior to shipment (FAT). On-site installation time is thus reduced and short overall delivery periods are possible. The modules can be combined to meet the individual process requirements.

ISO containerization

The modules installed in the skid can be shipped in ISO containers. This permits cost-effective and uncomplicated transport worldwide.

Interfaces

Timely and complete clarification of interfaces is an integral part of our project planning. We create foundation plans and detailed isometric drawings for the piping. All connection points are precisely defined.

Documentation

BHS has extensive experience in the production of engineering documentation conforming to international standards.
Heel filtration device
The heel filtration device enables the residual volume to be processed on completion of the filtration cycle by means of an internally filtering cylinder at the vessel cone. This ensures complete heel filtration with a minimum of compressed gas.

Precoat or body feed
In certain cases a precoat or body feed is required to help with filtration. They are used to suspend powdery filter aid. The precoat operates in batch mode, whereas the body feed runs continuously. BHS provides the precoat or body feed system including tanks, pumps, agitators, automated feeding etc. which is fully integrated with the filtration package.

Further accessories
We can integrate additional accessories into the plate filter skids as required by the application, e.g. polishing filters or activated carbon filters.
Tests give certainty

We perform initial tests with our pocket leaf filters. These tests can be performed quickly and easily at your location or in any of BHS locations worldwide. Basic data can thus be obtained about the filterability of a suspension and the general design of a production filter.

For more extensive tests, even spanning several weeks, we can rent out pilot and lab filters for all BHS filter types. Filters made of different materials are also available. If necessary, the filters can be equipped to meet specific customer requirements.

These filters can be used to examine filter behavior methodically and reliably. Machine parameters can be varied and alternative materials can be explored. The test results provide a sound basis for the layout of a production machine and for determining the ideal mode of operation.
Performance data and dimensions

<table>
<thead>
<tr>
<th>Type</th>
<th>Plate diameter</th>
<th>Filter area/plate</th>
<th>Number of plates</th>
<th>Active filter area</th>
<th>Vessel diameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>PF 04</td>
<td>400 mm</td>
<td>0.11 m²</td>
<td>3 - 6</td>
<td>0.33 - 0.67 m²</td>
<td>550 mm</td>
</tr>
<tr>
<td>PF 07</td>
<td>760 mm</td>
<td>0.42 m²</td>
<td>4 - 15</td>
<td>1.7 - 6.3 m²</td>
<td>1,000 mm</td>
</tr>
<tr>
<td>PF 10</td>
<td>1,010 mm</td>
<td>0.78 m²</td>
<td>7 - 30</td>
<td>5.5 - 23.4 m²</td>
<td>1,300 mm</td>
</tr>
<tr>
<td>PF 14</td>
<td>1,440 mm</td>
<td>1.5 m²</td>
<td>16 - 30</td>
<td>24 - 45 m²</td>
<td>1,800 mm</td>
</tr>
</tbody>
</table>

Process criteria

<table>
<thead>
<tr>
<th></th>
<th>batch</th>
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</thead>
<tbody>
<tr>
<td>Operating pressure</td>
<td>up to 10 bar (g)</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>up to 250 °C</td>
</tr>
<tr>
<td>Solids content (suspension)</td>
<td>up to 10% (weight)</td>
</tr>
<tr>
<td>Cake thickness</td>
<td>up to 60 mm</td>
</tr>
<tr>
<td>Particle size</td>
<td>starting from 0.5 µm</td>
</tr>
<tr>
<td>Filtration capacity – suspension</td>
<td>up to 4 m³/m² h</td>
</tr>
<tr>
<td>Filtration capacity – dry solid</td>
<td>–</td>
</tr>
<tr>
<td>Active filter area</td>
<td>0.35 - 45 m²</td>
</tr>
</tbody>
</table>

All specifications apply to the standard design. Technical data for customized designs may differ from the specified data. All technical data may change due to development. Subject to modification without notice.