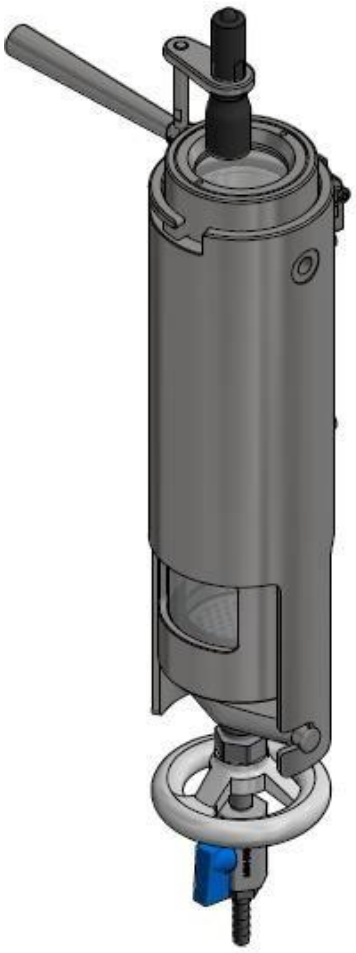
Tel: 704.845.1190; Fax: 704.845.1902
E-mail: info@bhs-filtration.com
Website: www.bhs-filtration.com

Operating instructions

BHS Pocket Leaf Filter (PLF)



950032765 - 600554251-002 - A

BHS-Sonthofen Inc.
14300 South Lakes Drive
Charlotte, North Carolina 28273

Page **1** of **18**

Tel: 704.845.1190; Fax: 704.845.1902
E-mail: info@bhs-filtration.com
Website: www.bhs-filtration.com

1 Example Installation

Pressure Test Installation

Sight glass Close-up

Vacuum Test Installation

CONTACT INFORMATION

Bruce M Glines
Senior Process Engineer
Office: 704 845-1190
Direct: 704 814-7664
Email: bruce.glines@bhs-filtration.com

David Bray
Process Engineer
Office: 704 845-1190
Direct: 980 335-2531
Email: david.bray@bhs-filtration.com

BHS-Sonthofen Inc.
14300 South Lakes Drive
Charlotte, North Carolina 28273

Page **2** of **18**

Tel: 704.845.1190; Fax: 704.845.1902
E-mail: info@bhs-filtration.com
Website: www.bhs-filtration.com

Safety instructions for the pocket leaf filter (PLF)

Please read the safety instructions before operating the device and follow them.

Keep these safety instructions for future users.

The operating personnel must have read and understood the operating instructions and in particular the following safety instructions completely.

In addition to the instructions provided here, the general safety regulations and statutory accident prevention regulations must be observed.

Failure to observe the safety instructions can create risks of personal injury, property damage and environmental damage. In addition, failure to observe the safety instructions leads to loss of any claims for damages.

The device may only be used by trained and qualified personnel.

The operator must use the device correctly. In particular where hazardous fluids and media are involved, improper use may result in serious injury or property damage.

Pay attention to third parties and your environment during use.

Before using the device, check the PLF and especially the seals for any damage.

Never leave the device unattended when it is in operation and under pressure.

Always use appropriate protective clothing such as gloves, goggles and protective clothing

BHS-Sonthofen Inc.
14300 South Lakes Drive
Charlotte, North Carolina 28273

Page **3** of **18**

Tel: 704.845.1190; Fax: 704.845.1902
E-mail: info@bhs-filtration.com
Website: www.bhs-filtration.com

Tel: 704.845.1190; Fax: 704.845.1902
E-mail: info@bhs-filtration.com
Website: www.bhs-filtration.com

When operating the device there is a risk of crushing injuries and malfunctions. Always ensure that the device is only opened and maintained when it is depressurised.

Contact with hot surfaces may cause burns.

There may be chemical hazards when filling and filtering the suspension and the washing liquid. Place the device in an exhaust hood to extract any vapours.

Make sure that there are no pressure-increasing reactions in the pocket leaf filter.

Use the pressure regulator in the supply line. The maximum pressure specified in the data sheet must not be exceeded. Exceeding such maximum may destroy the device and cause serious injury.

Exceeding the operating temperature can result in reduced mechanical strength of the material and increase the risk of bursting.

Make sure that both sight glasses are undamaged and in perfect condition before each experiment.

Strong acids, alkalis and solvents can cause corrosion and damage to the materials used. Check the chemical resistance especially of the sealing material when using acids, alkalis and solvents.

Reliable and safe operation is only possible if used as intended and in compliance with the operating instructions. The limit values specified in the data sheet must not be exceeded under any circumstances.

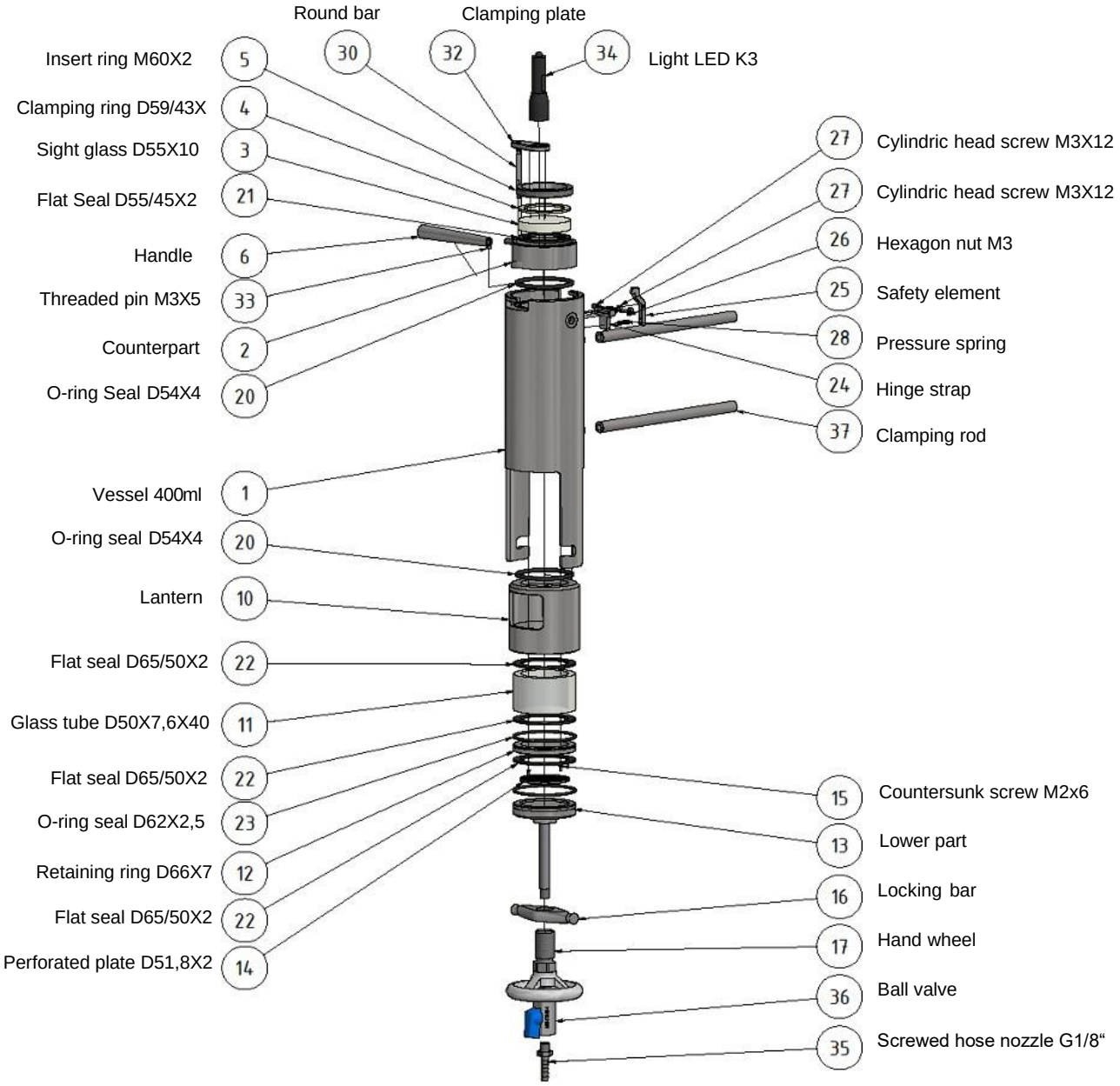
The operator is responsible for ensuring safety when implementing modifications or changes to the PLF. Such changes cause the warranty of BHS-Sonthofen GmbH to be voided.
Safety can be ensured only by using original spare parts and approved accessories.

Tel: 704.845.1190; Fax: 704.845.1902
E-mail: info@bhs-filtration.com
Website: www.bhs-filtration.com

Please read the operating instructions before use and adhere strictly to the safety instructions.

Content

2 Assembly drawing



Tel: 704.845.1190; Fax: 704.845.1902
E-mail: info@bhs-filtration.com
Website: www.bhs-filtration.com

Technical specifications

Filter surface	20 cm²
Volume	400 mL
Double jacket volume	200 mL
Max. operating pressure filtration chamber	6 bar gauge pressure
Max. operating pressure double jacket	4 bar gauge pressure
Max. cake height	60 mm
Material	1.4571 (316Ti)
Design temperature	200°C
Design temperature double jacket	200°C
Dimensions	505 mm x 190 mm
Weight	5.8 kg

Tel: 704.845.1190; Fax: 704.845.1902
E-mail: info@bhs-filtration.com
Website: www.bhs-filtration.com

3 BHS pocket leaf filter (PLF)

The filtration performance of a solid-liquid separation process is influenced by a large number of parameters.

These include, for example, particle size and shape, density, concentrations, viscosity of the suspension, cake height, pressure or vacuum and the filter medium.

Laboratory tests can be used to determine the specific filtration performance and select an appropriate filter system. In addition, on the basis of experimental data, a filter adapted to the production capacities can be designed.

The BHS PLF complies with the recommendations of VDI Standard 2762 “Mechanical solid-liquid separation by cake filtration”.

The PLF consists of a double-jacket tube with pressure gauge, manual valve with compressed gas connection and a closure lid with sight glass and lighting as well as a lower part with a cake forming ring with sight glass ring, a closure and ball valve. The pocket leaf filter can either be heated or cooled via the double jacket.

With the support of BHS-Sonthofen Inc. and correctly recorded test data, an appropriate filter can be selected and designed. Existing filters can also be optimized.

The following sections provide helpful information on how to operate the PLF properly.

Tel: 704.845.1190; Fax: 704.845.1902
E-mail: info@bhs-filtration.com
Website: www.bhs-filtration.com

4 Preparing the trial

An optimal test preparation is the most important requirement for reliable and reproducible test results. The following section provides helpful information for choosing the right equipment for pressure and vacuum testing.

4.1 Required equipment

The following parts are necessary to carry out the filtration test optimally:

- **Safety data sheet** for all substances used (MSDS)
- **Personal protective equipment** (PPE)
- **Representative suspension** for each product to be tested
- **Heating thermostat** with tempering fluid (optional)
- **Beaker with stirrer** for the suspension to be filtered (optional)
- Sufficient quantity of **washing liquid** (optional)
- Various **measuring cylinders** and **beakers** for the suspension, washing liquids and filtrates
- **Container** for the filter cake
- **Scales** with gram scale
- **Vacuum furnace** or **rapid determination device** for determining the solid matter content in the liquids and the residual moisture in the filter cake
- **Laboratory spoon**, **spatula** and **ruler**, etc.
- Devices for **measuring pH**, **conductivity**, **particle size**, etc.
- **Timer**

Pressure filtration tests also require the following items:

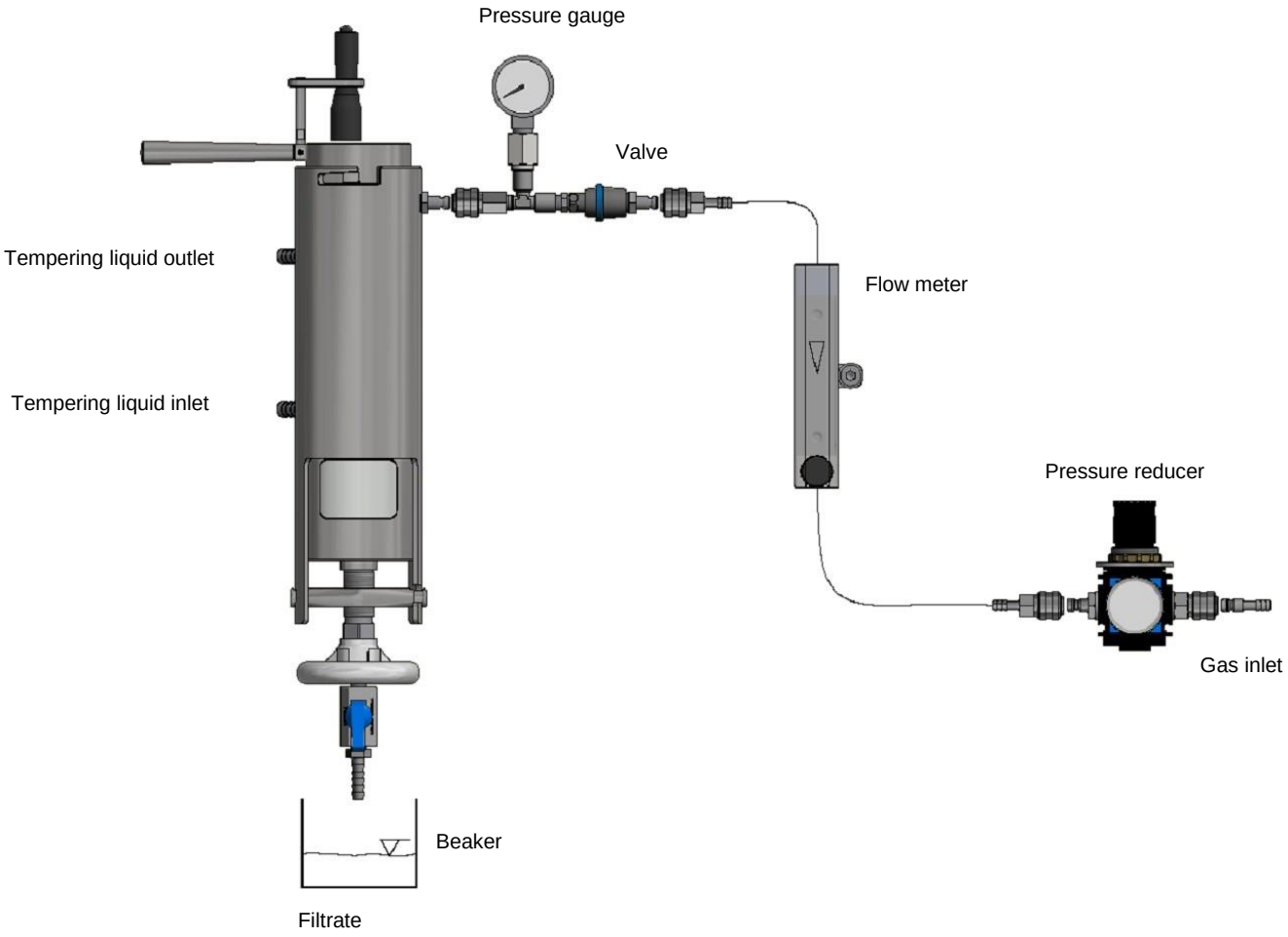
- **Compressed gas supply** with pressure regulator adjustable to max. 6 bar gauge pressure
- **Flow meter** for compressed gas to measure the flow during dehumidification

Vacuum filtration tests also require the following items:

- **Vacuum pump**
- **Suction flask** as filtrate separator
- **Flow meter** in the vacuum line for measuring the air volume flow during dehumidification
- **Vacuum manometer**
- **Ball valve** for adjusting the negative pressure

4.2 Test set-up for pressure filtration experiments

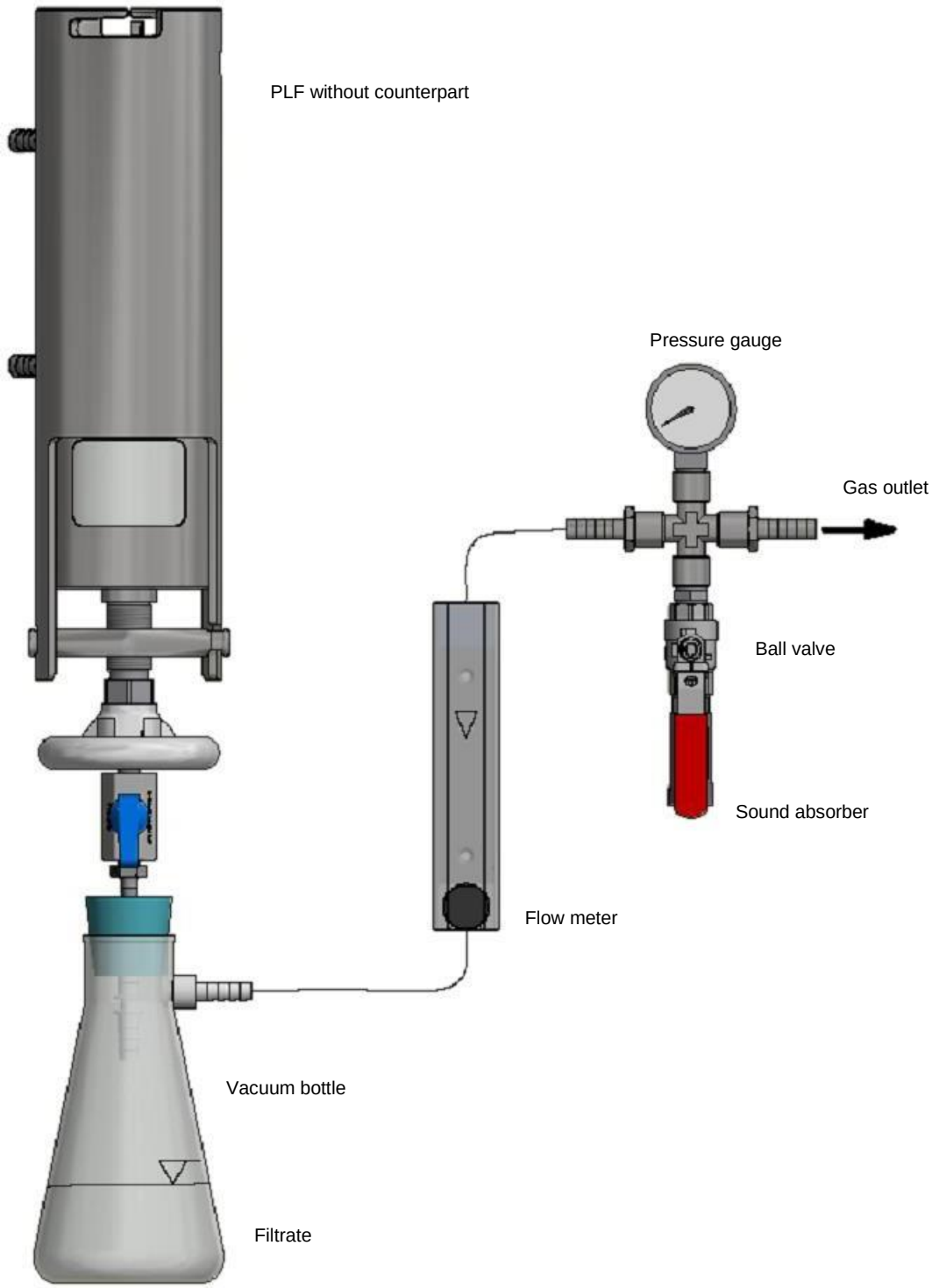
The following diagram shows the recommended test set-up for pressure filtration experiments:



Tel: 704.845.1190; Fax: 704.845.1902
E-mail: info@bhs-filtration.com
Website: www.bhs-filtration.com

4.3 Test set-up for vacuum filtration experiments

The following diagram shows the recommended test set-up for vacuum filtration experiments:



4.4 Selection of filter medium

The filter medium serves as a particle-impermeable barrier. At the beginning of a filtration process, the filter medium must retain the particles. Once a thin cake has formed, it helps with particle retention, with the filter medium providing support.

The filter media used in the PLF can be either plastic (cloth, tape, felt) or metals (single-layer, multi-layer sintered).

The following aspects should be considered when selecting the filter medium:

- Chemical resistance
- Mechanical strength
- Thermal resistance
- Mesh size

Not only the material affects the selection of the filter medium but also its constructive properties such as:

- Type of fiber
- Thread diameter
- Type of mesh
- Finishing

In addition, in selecting the filter medium, it is important to ensure the following:

- The filtrate is visibly clear and free of solids (if necessary)
- The filter medium is not clogged even after several tests
- The cake can be detached from the filter medium easily and without too much residue
- The filter medium has only a minor effect on the flow.

Consider using the filter cloths supplied for testing purposes.

Tel: 704.845.1190; Fax: 704.845.1902
E-mail: info@bhs-filtration.com
Website: www.bhs-filtration.com

4.5 Installation of the filter medium

Insert the filter medium as described in the following three steps:

1.

- Place flat seal (FKM ring 58 x 52 x 3) in the cake forming ring.
- Place the filter medium on the flat seal. The filter cake side (smooth) of the filter medium must be installed facing down.

2.

- Attach the perforated plate on the lower part using the screws (M2x6).
- Insert O-ring (FKM 54x2.5) in the radial groove on the lower part.

3.

- Place the cake forming ring on a flat surface.
- Place the lower part vertically from above on top of the cake forming ring and press straight in until it stops.
- Make sure that the O-ring is not pinched or sheared (danger of leakage).

4.6 Temperature control of the pocket leaf filter

The housing has a double-jacket design and can thus be heated or cooled. To do this, connect the thermostat to the inlets and outlets of the PLF.

4.7 Test preparation

The process of suspension preparation and sampling requires special attention. The comparability of the sample with the suspensions from current or future processes must be guaranteed. This also applies to the particle size and particle size distribution, density, temperature, solid matter content and chemical composition.

Please note that especially organic suspensions tend to change their properties due to longer storage times. These changes can significantly affect filtration performance.

Tel: 704.845.1190; Fax: 704.845.1902
E-mail: info@bhs-filtration.com
Website: www.bhs-filtration.com

5 Test procedure

In order to obtain representative test results, it is necessary to work accurately and under constant conditions. For the comparability of the experiments, it is important that at least two tests are carried out with the same parameters. If the test data differ greatly, the tests should be repeated.

All data and observations should be systematically documented in a trial protocol.

The procedure for running the test is explained step by step in the next section.

5.1 Filtration

A pressure filter can be operated with constant volume or constant pressure. These operating instructions describe the most commonly used approach, the pressure-constant method.

In pressure-constant filtration, the pressure is kept constant as the driving force responsible for the filtration. This results in a decreasing filtrate flow rate with increasing cake height.

A previously measured amount of the suspension is poured into the PLF and the lid closed. Filtration starts upon pressurization. At the same time the filtration time and the amount of filtrate must be measured.

The filtration process is considered complete when the filter cake is saturated with liquid and no gas has penetrated the filter cake yet.

The first optimization involves the cake height relative to the filtration time. If the filtration takes too long, the cake height can be reduced and vice versa. Other parameters that can be used to optimize the process are:

- Filtration pressure
- Filter medium

In order to determine an appropriate cake height, it is necessary to perform several experiments with different amounts of suspension.

Please note the maximum cake heights for the different BHS filter types:

▪ Rotary pressure filter	≤	150 mm
▪ Indexing belt filter/rubber belt filter	≤	40 mm
▪ Plate filter	≤	60 mm
▪ Candle filter	≤	20 mm
▪ Autopress	≤	15 mm

5.2 Displacement washing

The (optional) displacement washing is carried out after filtration. A certain amount of washing liquid is carefully poured on the filter cake. During the washing process, the washing time and pressure are measured. There may be various washes with different detergents and ratios being carried out in succession, for example. The washing is considered finished when the filter cake is saturated with liquid and no gas has penetrated the filter cake.

5.3 Dehumidification

The filter cake is dehumidified by applying pressure or vacuum. Pressure is kept constant in the process. Both the gas flow and the dehumidification time are measured. The saturated filter cake becomes more and more undersaturated as dehumidification progresses.

5.4 Cake discharge

After a specified dehumidification time, the filter cake is carefully removed from the filter medium. When discharging the filter cake, special attention must be paid to its removal behavior. The filter cake can be pushed out of the cake forming ring using the punch supplied.

The cake height and mass of the wet filter cake should be measured and, if necessary, further cake analyses should be conducted.

The filter media should be rinsed after each test according to the process instructions and reused for the next test.

Tel: 704.845.1190; Fax: 704.845.1902
E-mail: info@bhs-filtration.com
Website: www.bhs-filtration.com

6 Quick operating instructions

6.1 Filtration

- Remove the top part.
- Place a container under the outlet to catch the filtrate.
- Close the ball valve.
- Pour a quantity of suspension commensurate with the desired cake height into the pocket leaf filter.
- Quickly close the top part (only in case of pressure filtration).
- Apply the previously set pressure or vacuum to the PLF.
- Open the ball valve at the filtrate outlet.
- At the same time, time the filtration time until the cake is just saturated.
- Close the ball valve.
- Depressurize the device (only in case of pressure filtration).

6.2 Displacement washing

The following steps can be repeated several times

- Open the top part (only in case of pressure filtration).
- Place a container under the filtrate outlet to catch the washing filtrate.
- Close the ball valve.
- Measure the desired quantity of washing liquid and carefully pour it into the PLF. Make sure not to damage the filter cake.
- Quickly close the lid (only in case of pressure filtration) and apply the previously set pressure or vacuum to the device.
- Open the ball valve, then measure the time required for the cake washing, with the cake still being saturated.
- Close the ball valve.
- Depressurize the device (only in case of pressure filtration).

6.3 Dehumidification

- Apply the previously set pressure or vacuum to the device.
- Measure the drying time and the required gas volume flow.
- Depressurize the device.

6.4 Cake discharge

- Open the top part (in case of pressure filtration).
- Carefully remove the bottom part with the cake forming ring.
- Measure the cake height.
- Inspect and asses the cake surface (cracks, smooth surface, etc.) and cake removal from the filter medium.
- Weigh the moist cake and if necessary carry out further analyses of the cake.

7 For any Questions Please Contact

Bruce M Glines
Senior Process Engineer
Office: 704 845-1190
Direct: 704 814-7664
Email: bruce.glines@bhs-filtration.com

David Bray
Process Engineer
Office: 704 845-1190
Direct: 980 335-2531

Email: david.bray@bhs-filtration.com