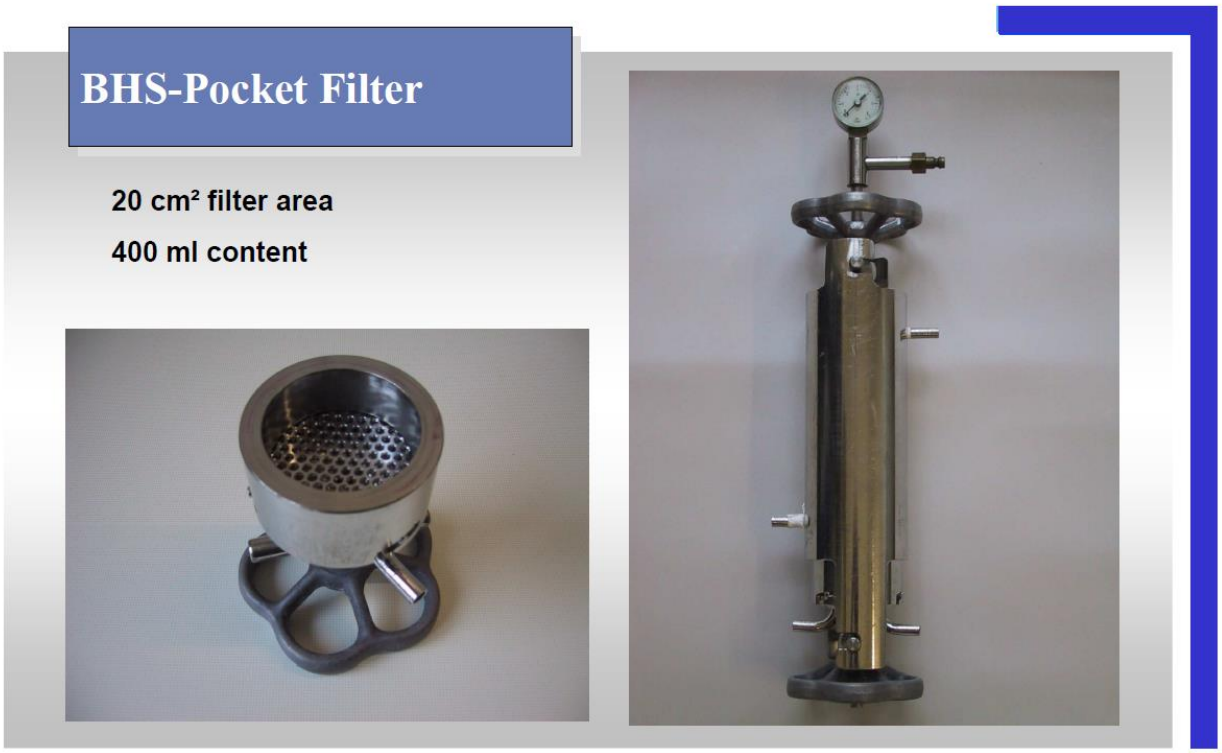
BHS Primer: Vacuum Filtration Testing & Technologies

Bruce Glines, BHS Senior Process Engineer
Garrett Bergquist, BHS Process Engineer

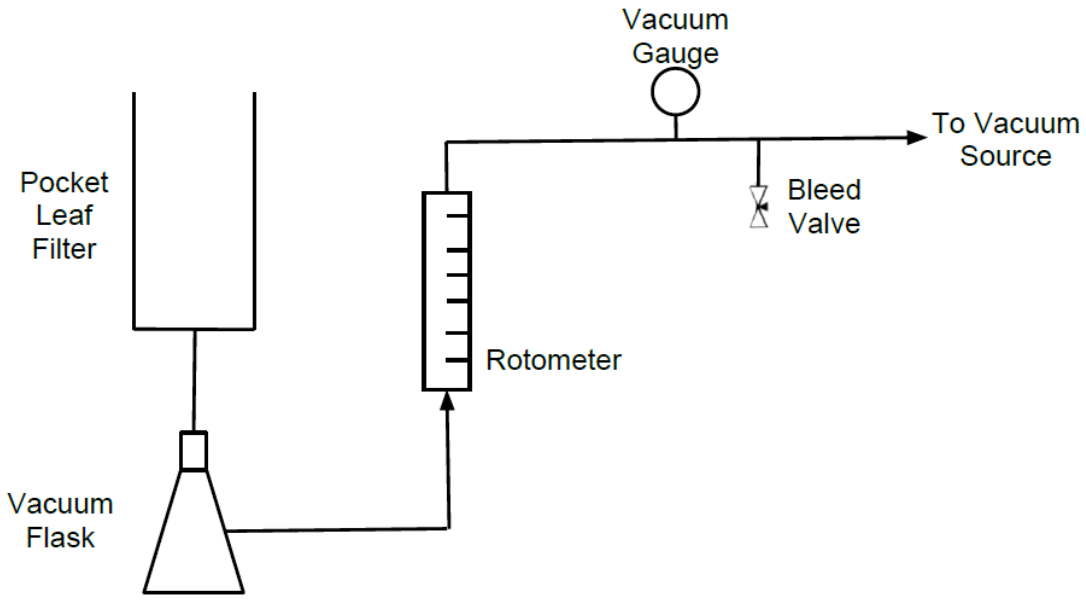
1. BHS POCKET LEAF FILTER DESCRIPTION

The BHS Pocket Leaf Filter (PLF) shown below is used for pressure and vacuum filtration tests to determine filtration rates, filtrate clarity, filter media, cake thickness, washing and drying efficiencies, cycle times, quality parameters and qualitative cake discharge. It is jacketed for heating or cooling and is rated from 90 psig/full vacuum. The scale-up to the BHS Continuous-Indexing Vacuum Belt filter or the BHS Rubber Belt Filter is directed by the BHS process engineers. With accurate PLF testing, BHS can provide process guarantees.



2. BHS POCKET LEAF FILTER SET-UP

The set-up for vacuum testing is shown below using a vacuum rated flask and a laboratory vacuum pump with a flow rate of 1.1 cfm and a maximum vacuum of 25.5 inches Hg. Below is a picture and a diagram of the recommended components for vacuum filtration.



Vacuum Filtration Equipment Setup

Equipment needed:

1.) Pocket Leaf Filter (PLF)
2.) 500 – 1000 ml vacuum flask
3.) Gas Rotameter
    a. Measurement range 0 – 15 l/min
    b. Includes needle valve
4.) Vacuum source
5.) Vacuum control
    a. Vacuum gauge
    b. Bleed line with needle valve to control vacuum level
6.) Glassware

Note: Make sure the lines used for vacuum connections will not collapse under vacuum. Use proper clamps or vacuum grease on hose connections to eliminate leaks. Use PTFE tape on all threaded NPT connections.

3. BHS POCKET LEAF FILTER OPERATION

A) Filtration

1.) The top for the PLF can be used to set the maximum vacuum the pump can achieve to 18 " Hg. During actual testing the top is not required.
2.) Place a receiver under the unit for collecting the filtrate.
3.) Measure out enough feed material to make the desired cake thickness.
4.) Slowly pour the measured feed material into the unit.
5.) Apply vacuum to the unit.
6.) Start the stop watch and measure the amount of time for the free liquid in the PLF to just expose the cake surface or with thick slurries for the glossy sheen to turn dull.
7.) Turn off vacuum to the unit and record the data (Data Sheet - Appendix A).

B) Washing (This step may be repeated as needed)

1) Place a receiver under the unit for collecting the wash filtrate.
2) Measure out the wash liquid.
3) Slowly pour the measured wash liquid down the inner wall of the unit. Try not to disturb the cake when pouring the wash liquid into the unit
4) Apply vacuum to the unit.
5) Start the stop watch and measure the amount of time it takes for the first bubble of gas to come out of the bottom outlet piece.
6) Turn off vacuum to the unit and record the data (Data Sheet - Appendix A).

C) Types of Cakes That Can Be Formed

Cracked Cake

Well-Formed Cake

D) Drying

Drying on the PLF is generally accomplished by vacuum, if liquid can be extracted by squeezing the cake then vacuum with mechanical pressing and blowing can be used. The drying design on the PLF is directly scalable to the BHS production technologies.

It is important to correctly set up the PLF for drying such that the airflow for the vacuum pump sizing can be correctly determined. The installation drawing (section 2) above illustrates the installation and measurement range details. With this information, the liquid ring vacuum pump can be sized.

Mechanical pressing/blowing provides the benefit of additional dryness when the cake is compressible. The pressing blowing device shown below is inserted into the PLF and used to define operating requirements. It is imperative to select a filter cloth to place between the pressing device and the filter cake. This cloth will be used in the pressing device design for scaled up filters and must release cleanly.

Pressing Ram & Blowing Cap

E) Cake Discharge

1) Remove the inlet cover from the unit.
2) Remove the bottom outlet piece.
3) Measure the cake thickness.
4) Remove cake.
5) Weigh the cake and carry out any desired lab tests (% moisture, etc.).
6) Inspect the cake for cracking as well as the cake removal from the filter media

4. BHS VACUUM BELT FILTER TECHNOLOGIES

BHS manufactures two types of vacuum belt filters to meet various process requirements: the continuous-indexing vacuum belt filter and the rubber belt filter. A summary of the technologies is below. Please refer to the BHS website at www.bhs-filtration.com for further information.

Continuous Indexing Vacuum Belt Filter

Continuous slurry feed
Indexing belt movement
Up to 75 m² filter area
High solid slurries
Electric or pneumatic drive
Multi-stage cake washing
Drying by vacuum, steaming, pressing
No sealing media (water/air)

Rubber Belt Filter

Continuous slurry feed
Continuous belt movement
Up to 200 m² filter area
Electric drive
Multi-stage cake washing
Drying by vacuum or steaming
Belt supported by rollers (no water/air)

5. SUMMARY

This BHS Primer provides information for pressure testing. The PLF testing can be conducted in the BHS laboratory or on-site in your facility. The PLF can also be rented or purchased for use and is always supported by the BHS process engineers. Good luck with your testing and we look forward to being of assistance to you as a resource for testing help, data analysis, and future pilot rental units. The PLF is also a useful tool for troubleshooting BHS installations or installations from our competitors.

Appendix A: PLF Data Sheet

Customer:			**Project #:**					
Date :			**Test Unit:**					
* 1 = good, 3 = bad		Units	Run #	Run #	Run #	Run #	Run #	Run #
Basic Info								
Material	Media Type							
	Slurry Name							
	% Solids	%						
	Wash 1							
	Wash 2							
Temperature	Slurry	C						
	Wash 1	C						
	Wash 2	C						
	Drying	C						
Feed Amount	Slurry	g						
	Wash 1	g						
	Wash 2	g						
Process Data								
Pressure	Filtration	bar						
	Wash 1	bar						
	Wash 2	bar						
	Drying	bar						
Time	Filtration	sec						
	Wash 1	sec						
	Wash 2	sec						
	Drying	sec						
Filtrate Amount	Filtrate	mL						
	Wash 1	mL						
	Wash 2	mL						
Flow Rate	Drying Air	SCFH						
Analysis								
Filtrate/Solids Quality	% Solids in Filtrate	%						
	Washing Condition 1							
	Washing Condition 2							
Cake	Thickness	mm						
	Formation	1-3 *						
	Wet Weight	g						
	Dry Weight	g						
	% Moisture	%						
Media	Cake Discharge	1-3 *						
	Cleaning	1-3 *						