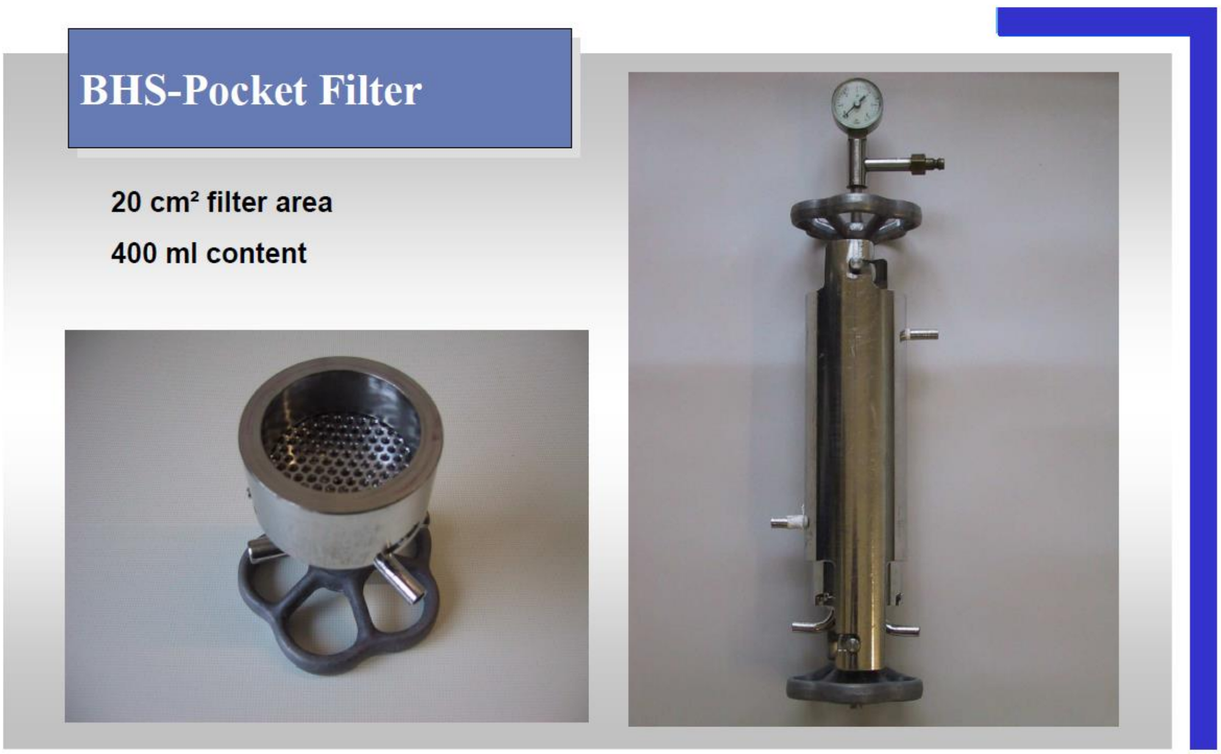
BHS Primer: Pressure Filtration Testing & Technologies (Part 1: Constant Pressure)

Bruce Glines, Senior Process & Applications Engineer, bruce.glines@bhs-filtration.com
Garrett Bergquist, Process & Applications Engineer, garrett.bergquist@bhs-filtration.com

1. BHS POCKET LEAF FILTER DESCRIPTION

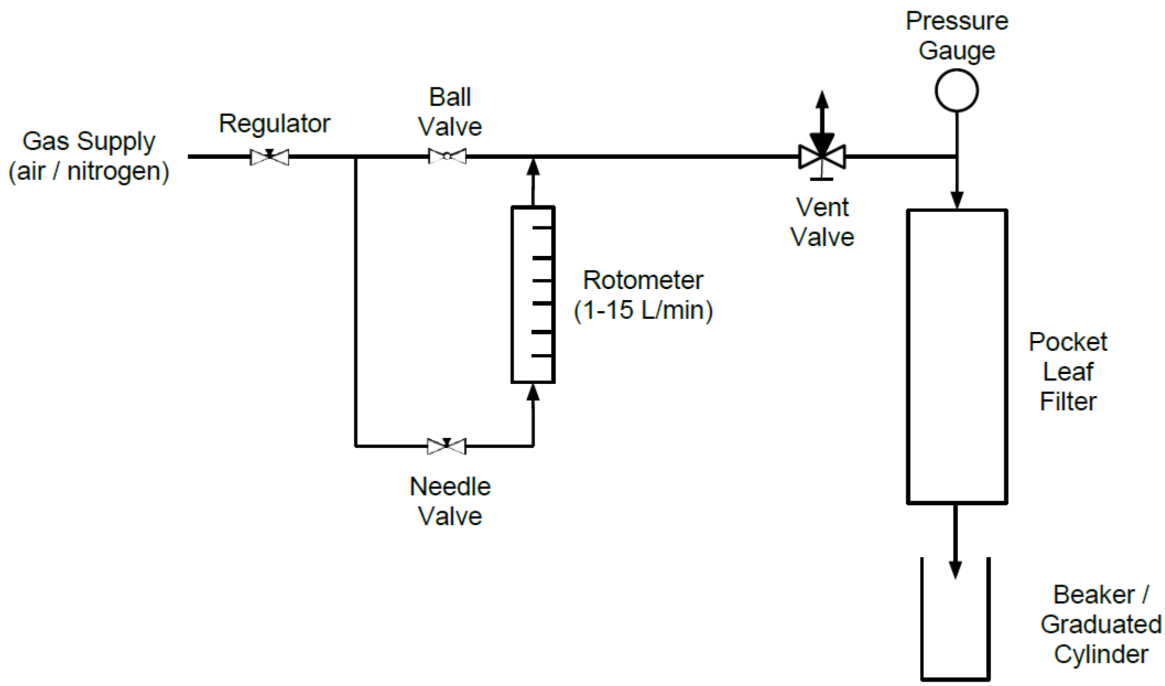
The BHS Pocket Leaf Filter (PLF) shown below is used for pressure and vacuum filtration testing to determine filtration rates, filtrate clarity, filter media, cake thickness, washing and drying efficiencies, cycle times, quality parameters and qualitative cake discharge. It is jacketed for heating or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



2. BHS POCKET LEAF FILTER SET-UP

The ideal set-up for constant pressure testing is shown in the flow diagram below and will be the focus of this article. An alternative testing setup can be used to evaluate a constant flow process.

A compressed air/nitrogen supply is used to apply a constant pressure to the vessel through the ball valve for the filtration and washing stages. Ideally, the rotameter and needle valve can be used to reduce the flow and control the drying conditions separately from the filtration/washing conditions. The photo shown here also illustrates the use of the jacketing for heating the PLF.



Pressure Filtration Equipment Setup

Equipment Required:

1.) Pocket Leaf Filter (PLF)
    a. Includes pressure gauge
    b. Includes gas quick connect with safety vent valve
2.) Gas Rotameter
    a. Measurement range 0 – 15 l/min
    b. Includes needle valve
3.) Source of air/nitrogen (up to 6 bar)
4.) Regulator to control pressure accurately

Note: Make sure the lines used for pressure connections are properly rated for 6 bar pressure. Ensure clamps are used on all hose connections and PTFE tape on all threaded connections. Close off the PLF and check for leaks.

3. BHS POCKET LEAF FILTER OPERATION

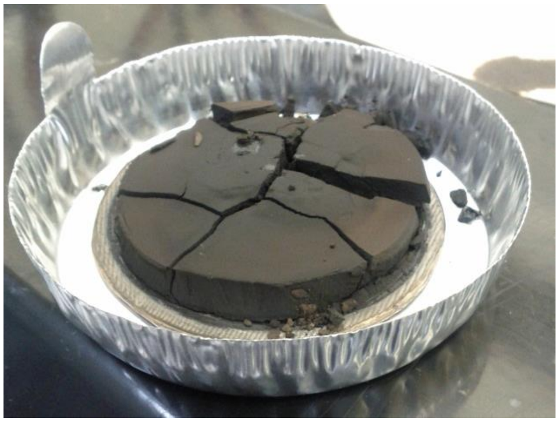
A) Filtration

1.) Attach the gas disconnect to the top assembly.
2.) Place a receiver (graduated cylinder) 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.) Attach the top assembly to the PLF.
6.) Close the vent valve to apply pressure to the vessel.
7.) Start the stop watch and measure the amount of time until gas is passed through the cake. This is usually indicated by a bubble forming on the outlet of the filter instead of a normal drip/stream.
8.) Open the vent to stop the filtration and release the pressure from the PLF. Record the data (Data Sheet - Appendix A). In addition to total filtration time and total filtrate volume, it is helpful to take incremental time vs. volume measurements to construct a filtration curve.

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

1) Place a receiver under the unit for collecting the wash filtrate.
9.) Place a receiver (graduated cylinder) under the unit for collecting the filtrate.
10.) Measure out enough wash material
11.) Slowly pour the measured wash material into the unit. The wash should be poured slowly down the sidewall or sprinkled on the surface to avoid disturbing the cake.
12.) Attach the top assembly to the PLF.
13.) Close the vent valve to apply pressure to the vessel.
14.) Start the stop watch and measure the amount of time until gas is passed through the cake. This is usually indicated by a bubble forming on the outlet of the filter instead of a normal drip/stream.
15.) Open the vent to stop the wash and release the pressure from the PLF. Record the data (Data Sheet - Appendix A). In addition to total wash time and total wash volume, it is helpful to take incremental time vs. volume measurements to construct a wash curve.

C) Cake Formation



Cracked Cake

Well-Formed Cake

D) Drying

Drying on the PLF is accomplished using compressed air/nitrogen. The drying design on the PLF is directly scalable to the BHS production technologies as long as proper flow rates are used in the lab. Using too much air in the lab can lead to optimistic targets and uneconomical air assumptions on commercial equipment.

The three important variables for drying cake are pressure, air flow, and time. Pressure can vary from the filtration pressure in order to achieve the desired result. Higher pressures typically provide better drying.

Air flow should be maintained below 10 SCFH with 4-6 SCFH being a good starting range for initial testing. Air flow that is too high in the lab can lead to uneconomical air requirements on a full scale system. The other risk is obtaining better drying results than are possible in full scale systems.

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 PRESSURE FILTER TECHNOLOGIES

BHS manufactures three types of pressure filters to meet various process requirements: the candle filter, the pressure plate filter, and the rotary pressure filter. A summary of the technologies is below. Please refer to the BHS website at www.bhs-filtration.com for further information.

Rotary Pressure Filter

- Continuous slurry feed
- Pressure up to 6 bar
- Up to 8.8 m² filter area
- High solid slurries
- Multi-stage cake washing
- Cake discharge under atmosphere
- ATEX certified explosion proof

Candle Filter

- Batch operation
- Pressure up to 6 bar
- Up to 150 m² filter area
- Low solids slurries (clarification)
- Full washing and drying capability
- Precoat and body feed filter aid options
- Dry or slurry discharge options
- < 20 mm cake

Pressure Plate Filter

- Batch operation
- Pressure up to 6 bar
- Up to 50 m² filter area
- Low solids slurries (clarification)
- Full washing and drying capability
- Precoat and body feed filter aid options
- Vibratory assisted cake release
- > 20 mm cake

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.

14300 South Lakes Drive Charlotte, NC 28273-6794
Tel: 704.845.1190 Fax: 704.845.1902 E-Mail info@bhs-filtration.com Website: www.bhs-filtration.com

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 *						