Filtration, Cake Washing & Drying: Lab Testing to Pilot Testing to Project Installation and Performance Guarantees

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Thin-Cake Solid-Liquid Separation, Cake Washing & Drying Technologies

- **Pressure & Vacuum Filtration**
- **Batch & Continuous Operation**
- **High Solids to Clarification**
- **Cake Washing & Drying**
- **Automatic Discharge of Wet Cake, Dry Cake or Concentrated Slurry**

PDS Process Development Symposium

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Thin-Cake Solid-Liquid Separation, Cake Washing & Drying Technologies

Candle Filter:	**Clarification**
Pressure Plate Filter:	**Clarification**
Vacuum Belt Filter:	**High Solids, Continuous**
Rotary Pressure Filter:	**High Solids, Continuous**
Autopress Filter:	**Full Containment, Pharma**

Main Applications: chemical, energy, environmental, mining & pharmaceutical

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Presentation Overview

- Generally, after the initial mixing - reactions, there is bulk separation to remove the larger product solids or unwanted solids.
- There is a trend to remove the residual particle fines from the slurries.
- These fines are very small, typically in the 1 – 5 micron range and smaller and are very low in concentration down to ppm levels.

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Presentation Overview

- Solving a filtration problem:
  - Lab testing, Pilot testing & Scale-Up,
  - Installation & Performance Guarantees
- The overall scheme can be used by process engineers to develop optimum filtration solutions for pressure or vacuum, batch or continuous and high-solids to clarification applications.

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Overview of Current Process

- The current process filters a specialty chemical in a filter press with paper filter media at 170 °C.
- Diatomaceous earth and/or activated carbon were used as a body feed and precoat.
- The process had typical problems associated with a filter press including bypass of slurry, manual operation, filter media plugging, non-reproducible quality plus the safety concerns of hot oil.

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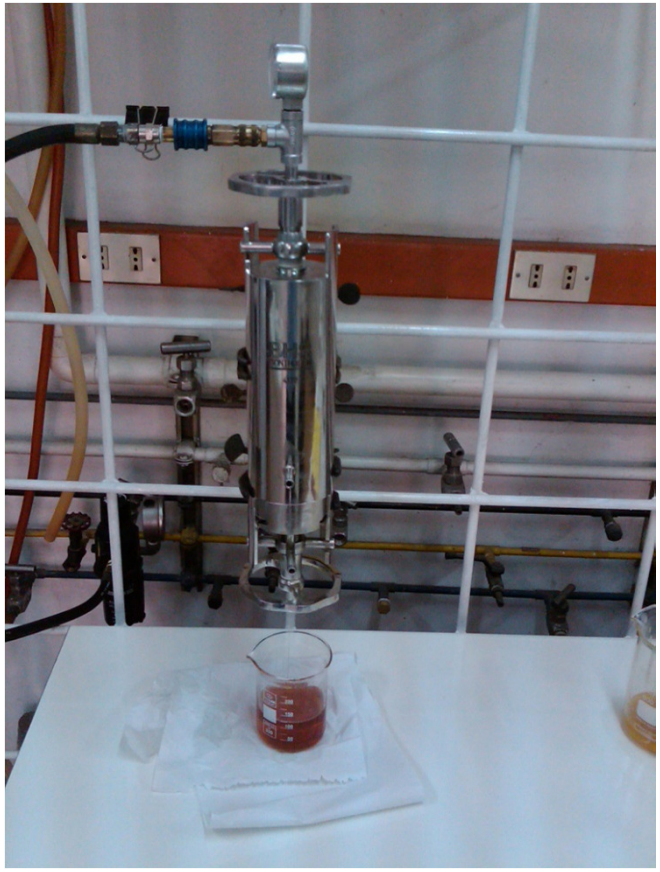
Laboratory Tests

BHS-Pocket Filter

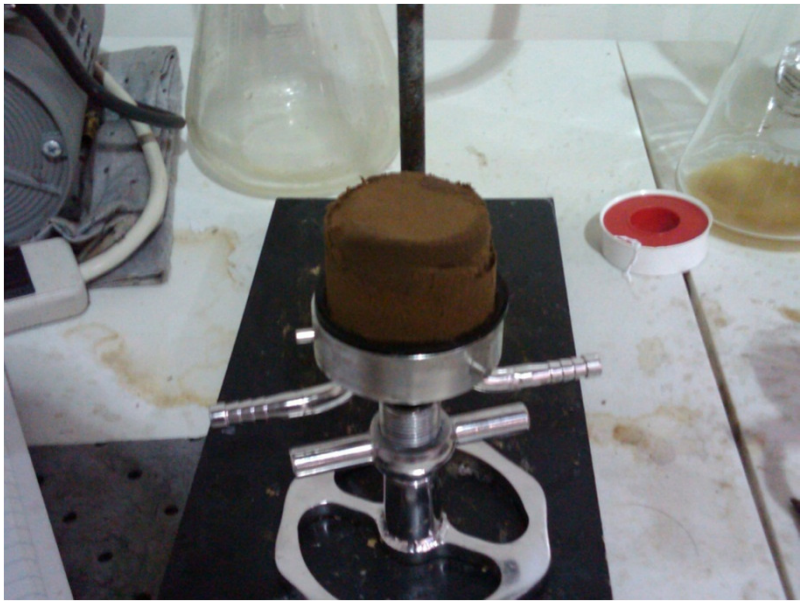
20 cm² filter area

400 ml content

Laboratory Tests: Pressure



Cracking/Shrinking & Optimum Cakes



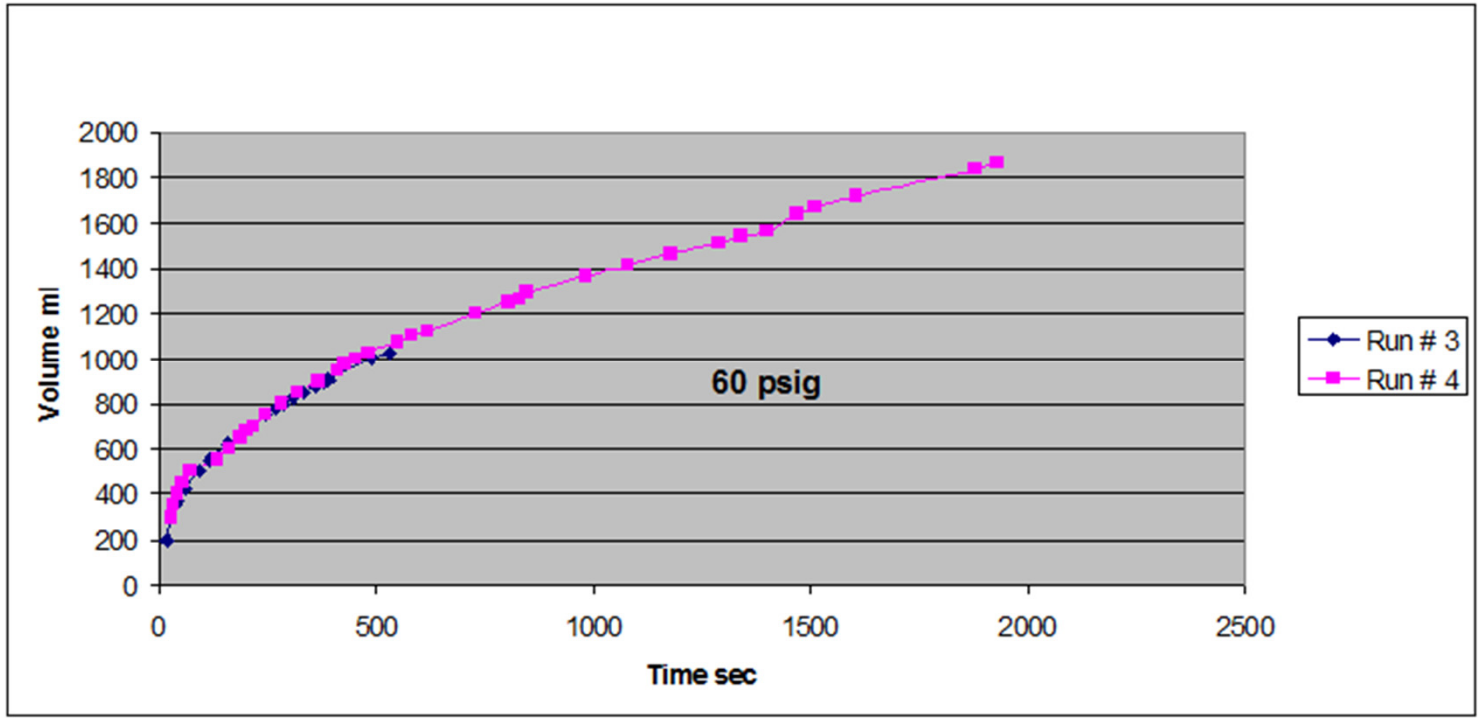
SELECTION OF FILTRATION TECHNOLOGY

CAKE STRUCTURE /PROCESS PARAMETERS FROM LAB TESTING

- **Cake Thickness and Filtration:**
- **Filter Media**
- **Cake Washing**
- **Precoat / Body Feed**
- **Cake Drying**
- **Cake Discharge**
- **CIP/SIP**

SELECTION OF FILTRATION TECHNOLOGY

Run 4: Filter Media Polypropylene (8 um) with DE precoat



SCALE-UP & SELECTION OF FILTRATION TECHNOLOGY

Filling	**5 Minutes**
Pre-coating	**10 Minutes**
Filtration	**110 Minutes**
Draining	**5 Minutes**
Drying	**15 Minutes**
Discharge	**10 Minutes**
Total Processing Time	**155 Minutes (Required Rate: 5677 liters/3 hours)**

- **Test Filter Performance:**
  (1.865 l / 20 cm^2)/√32 min x 10000 cm^2 / m^2 = 164.3 l /m^2 √min
- **Specific Rate Test Filter: 164.3 l /m^2 √min x √110 min. = 1723 l/ m^2**
- **Filter Area = Required Rate / Specific Test: 5677.5 l / 1723 l/ m^2 =3.3 m^2**
- **BHS Candle Filter: CF 18-007 provides a filtration area of 3.56 m^2**

Batch/Continuous Candle Filters for Low Solids Concentrations

- Applications include water & amine scrubbers, chlor-alkali, chemical, biodiesel, gasification / grey water, activated carbon, catalysts, heavy metals, PTA fines and pharmaceutical
- Replaces filter presses, manual plate filters, bag, cartridge, metal filters and centrifuges
- Filtration to 0.5 um, cake washing and drying
- Precoat of the filter media is possible, if required
- Complete containment and Automatic discharge

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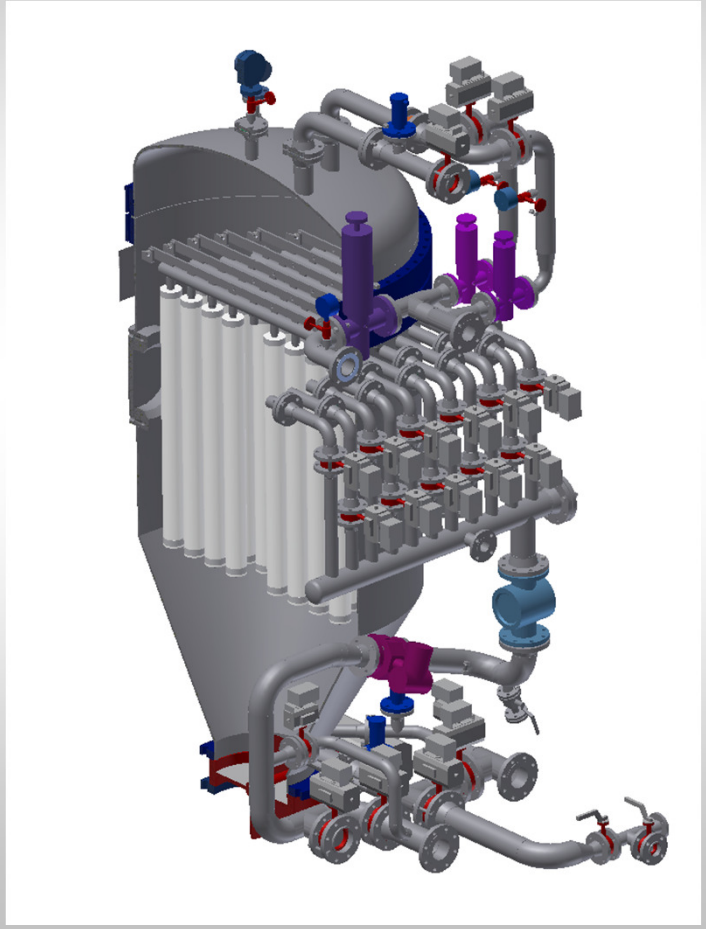
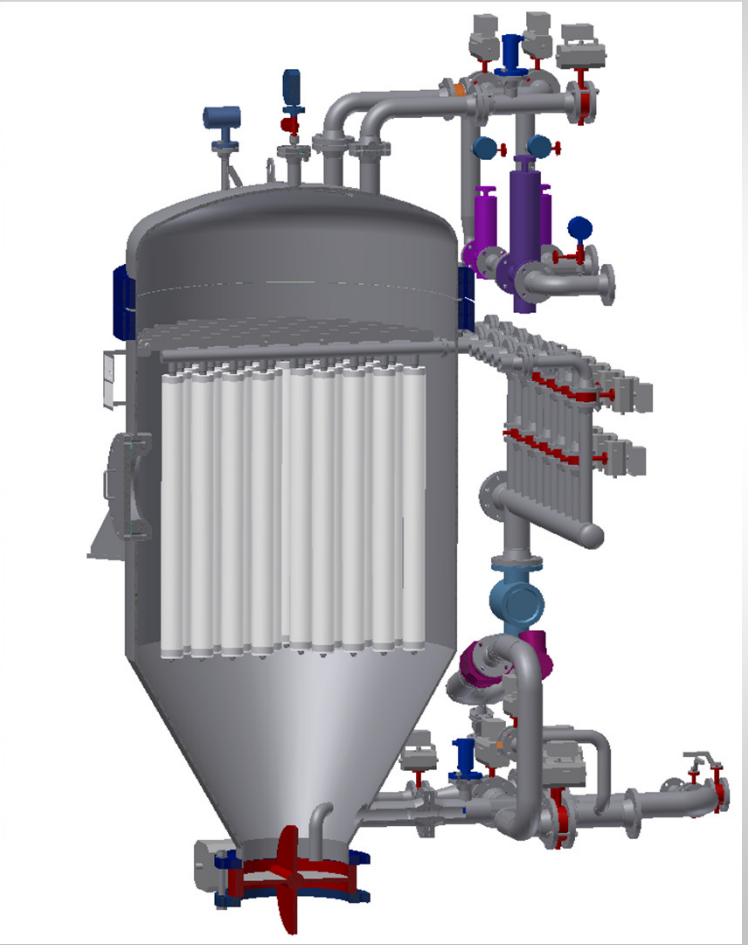
Candle Filter Technology





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Candles and Registers

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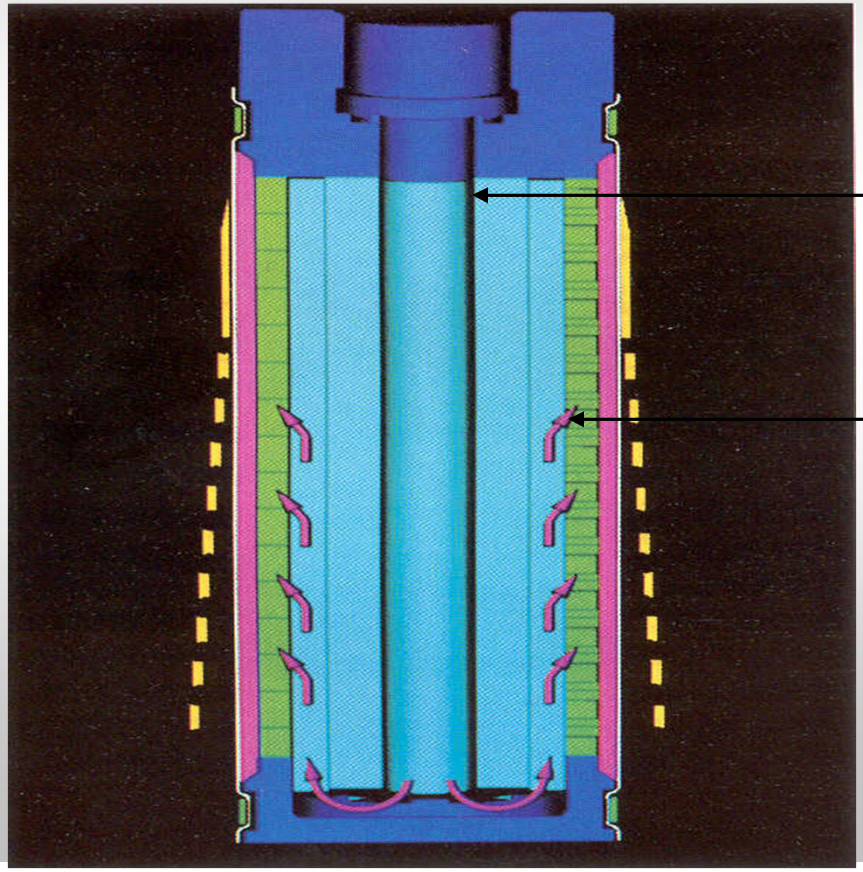
Detail of the BHS Candle



Filtrate Pipe

Gas Flow Shown in Purple

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BHS Candle – Filter Media Sock

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BHS Rental Candle Filter CF012-3 (1.0 m^2) of filter area

Test device: Candle Filter CF 012-3 with 1 m^2 of area
Filter cloths: Teflon material: 5 um pore size
PEEK: 22 um pore size
Temperature: Heated slurries, 150 degrees C (max)
Drying: Compressed air at ambient temp
Blowback: Compressed air at ambient temp

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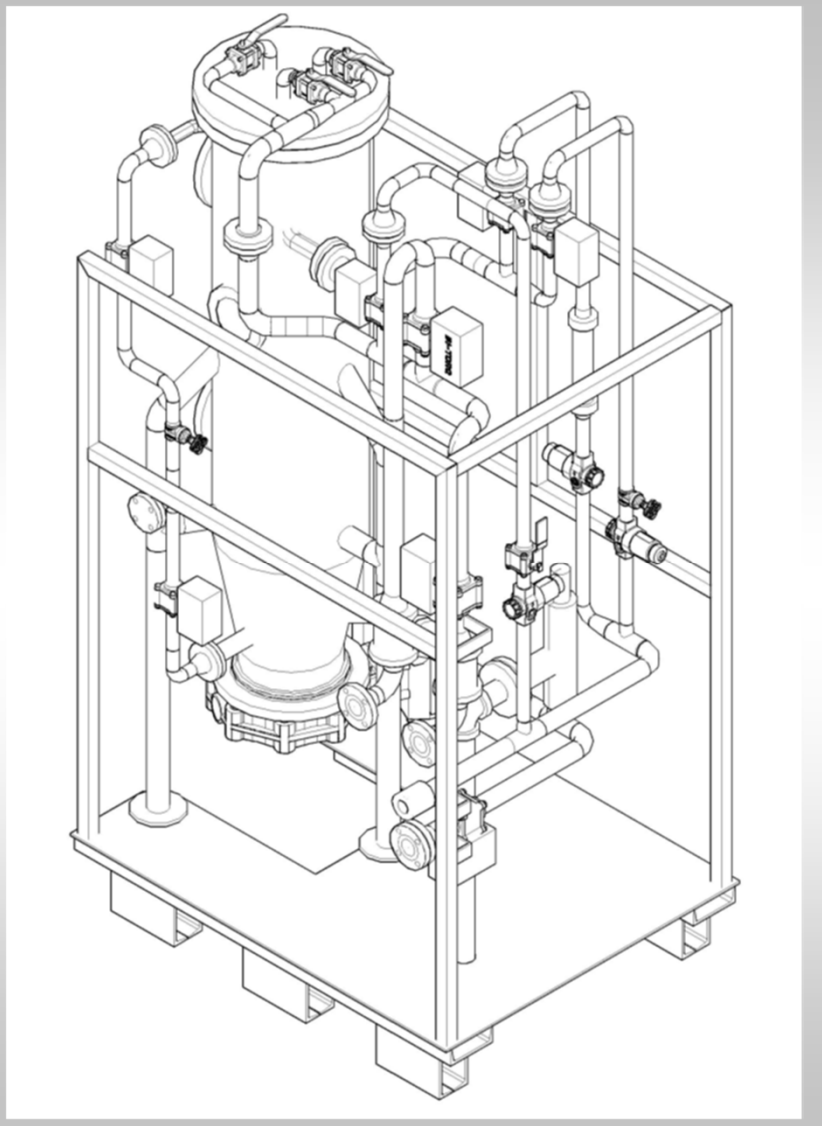
BHS Rental Candle Filter CF012-3 (1.0 m^2) of filter area



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PILOT TEST SCALE-UP

Filling	**5 Minutes**
Pre-coating	**10 Minutes**
Filtration	**87 Minutes**
Draining	**10 Minutes**
Drying	**5 Minutes**
Discharge	**10 Minutes**

Total Processing Time: 137 Minutes

Required Rate: 5677 liters/3 hours

- **BHS Candle Filter:**
- **CF 18-019 provides a filtration area of 10 m^2**

BHS CANDLE FILTER, CF 18-019 WITH PLC CONTROLS

BHS CANDLE FILTER PERFORMANCE GUARANTEE

A) BHS conducted tests using the BHS CF 12-003. The specific test report is the basis for the scale-up and process guarantee.

B) Based upon the above referenced, mutually agreed test results, BHS will supply one candle filter system consisting of a CF 18-019 with PTFE socks.

C) MECHANICAL GUARANTEE:

D) QUALITY GUARANTEE:

E) VOLUME PERFORMANCE GUARANTEE:

F) FILTER SOCK PERFORMANCE GUARANTEE:

G) FINAL PRODUCT QUALITY SPECIFICATIONS:

Product	Color Spec	Sediment mg/L	Sediment Ash, mg/L	Sebacic Sediment, mg/L	Filter Time min/L	Ash wt%
600						
CW						
F						
FABP						
J						
7H						
22H						
32H						
68H						

Summary

- There are many choices for filtration in a process.
- Technical evaluation, laboratory and pilot testing are critical for successful decisions and projects.
- Engineers must evaluate all outcomes to make an informed and successful decision
- The take-away is that close collaboration between the operating company and the vendor will allow for creative problem-solving and process filtration solutions to achieve the desired quality and production requirements

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THANK YOU!

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