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**BHS-Filtration Inc.**  
Solid-Liquid Separation,  
Cake Washing & Drying  
Technologies

## **BHS CANDLE FILTER APPLICATIONS FOR CLARIFICATION / RECOVERY OF SOLIDS FROM CHEMICAL SLURRIES**

### **TABLE OF CONTENTS**

<b>1. FINE CATALYST RECOVERY AT A REFINERY</b>	<b>Pages 2 – 4</b>
<b>2. FINE SOLIDS REMOVAL &amp; CLARIFICATION OF A SPECIALIZED ACIDIC SOLVENT AT A METAL GALVANIZING PLANT</b>	<b>Pages 5 – 6</b>
<b>3. WASTEWATER POWDER RECOVERY PLANT</b>	<b>Page 7</b>
<b>4. FINE SOLIDS REMOVAL/CLARIFICATION OF A LIQUID SPECIALTY CHEMICAL</b>	<b>Pages 8-10</b>
<b>5. SPECIALTY CHEMICAL RECOVERY/CONCENTRATOR WITH INTEGRATED MIXING TANK FOR RESLURRY OPERATIONS</b>	<b>Pages 11-12</b>

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## BHS CANDLE FILTER APPLICATIONS

### FINE CATALYST RECOVERY AT A REFINERY



### BHS CANDLE FILTER SKID (KF 37-19) WITH PLC PACKAGE

The Candle Filters are installed for clarification and recovery applications from liquids with low solids content. They are an ideal replacement for manual pressure filters and other equipment where solids, solvents and hazardous materials are being handled.

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## **BHS CANDLE FILTER APPLICATIONS**

### **FINE CATALYST RECOVERY AT A REFINERY (continued)**

#### **A. SPECIFICATIONS**

- Two KF 37-19 with 19 m<sup>2</sup> of filtration area each
- PLC controlled for completely automatic operation
- Communication to the refinery DCS
- Skid is fully pre-piped and pre-wired for a turnkey installation

#### **B. PROCESS BENEFITS**

- Automatic operation which eliminates the need for operator attention; estimated savings per year is approximately \$600,000 (assuming two operators per shift)
- Full containment of solids, liquids and vapors, which improves worker safety and eliminates environmental concerns.
- Improved filtration results with patented coated-membrane / polyester media. The design is a continuous sock design; removal efficiency is 1 –3 micron range.
- Candle and sock design is a positive seal, which eliminates bleed-through of solids, liquids or gases.
- Improved washing which may be beneficial for landfill purposes.
- Improved drying, which will reduce landfill costs.
- Discharge is automatic and 100% (no residual heel) and is from a 16-inch flange. Solids handling is easy as there is a chute from the discharge flange to the hopper or tote. The hopper / tote can easily be picked up by forklift or drive-in truck.
- Installation is easy as the candle filters are completely skid-mounted including piping, valves, instruments and PLC controls. Units can sit in an open structure and hard-piped to slurry, liquid and gas feed lines and filtrate and cake-discharge lines.
- There are no moving parts so the units are low maintenance and require a small inventory of spare parts.

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## **BHS CANDLE FILTER APPLICATIONS**

### **FINE CATALYST RECOVERY AT A REFINERY (continued)**

#### **C. DESCRIPTION**

The BHS Candle Filter provides for pressure filtration as well as heel filtration in an enclosed and pressure tight housing. ASME housings can be constructed of various materials. They can also be jacketed for heating/cooling or drying. The filter media can be any type of cloth with a clean removal efficiency in the 1-5 micron range. As the cake builds up on the candles, the efficiency improves to less than 1 micron. Cake washing follows which produces a uniform cake for drying. Drying can be by vacuum or gas blowing. Finally, cake discharge via gas blowback is automatic and contained and is accomplished with minimal gas requirements. Slurry discharge of the cake by filling the vessel with liquid and then initiating gas blowback can also be accomplished. After discharge, the cycle begins again.

The Candle Filter provides operational/process flexibility and can incorporate different filter media. Finally, the units can be used with a pre-coat of diatomaceous earth, activated carbon or other media depending upon the filtration characteristics of the solids. BHS, then, completes the installation tanks, pumps, instrumentation, full PLC controls, all skid-mounted with piping, valves, electrical, etc.

#### **D. TESTING & RENTAL PILOT FILTERS**

BHS has two filter laboratories in Charlotte. One facility is used for filtration, washing and drying studies using a 400 ml bench-top unit. The second lab is used for wet reaction and filtration studies. Finally, we can conduct these preliminary or pilot tests at the existing installation. In all cases, we can gather the data for filter sizing and process guarantees.

BHS also provides pilot-scale candle filter rental units, KF 3/1, with 1 square meter of filter area (3 candles). The rental unit can be installed on a slip or side stream to run the actual process. The KF 3/1 is automated by pneumatic control so it can be easily installed without the concern of electrical classifications.

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## **BHS CANDLE FILTER APPLICATIONS**

### **FINE SOLIDS REMOVAL & CLARIFICATION OF A SPECIALIZED ACIDIC SOLVENT AT A METAL GALVANIZING PLANT**

The BHS Candle Filters are installed for clarification and recovery applications from liquids with low solids content where the final product is the cake or the liquid. They are an ideal replacement for manual Sparkler filters, filter presses and other equipment where solids, solvents and hazardous materials are being handled.

#### **A. SPECIFICATIONS**

- Three (3) x KF 125 – 74 (125 candles with 74 m<sup>2</sup> of filtration area each)
- PLC Controls by BHS for a completely automatic operation
- Skid is fully pre-piped and pre-wired for a turnkey installation

#### **B. PROCESS BENEFITS**

1. This customer produces steel sheets for automotive use in thickness from 0.4 – 2.5 mm
2. It is an electro - galvanizing process with Zn + 10% Ni in H<sub>2</sub>SO<sub>4</sub>
3. The slurry flow is 220 m<sup>3</sup>/hour (968 gpm)
4. The particle sizes distribution is an average at 20 um
5. The BHS candle filters removed the particle contamination (metals, salts, etc.) from the H<sub>2</sub>SO<sub>4</sub> slurry, which is recirculated back to the process. There is no turbid flow. The candle filters must produce clean fluid within one pass. Any residual particles in the H<sub>2</sub>SO<sub>4</sub> that is recirculated will damage the galvanizing process and steel sheets leading to a rejection of the sheets.
6. Cake discharge into totes for disposal
7. The units were installed in 1995 and run 24/7.
8. Filter media socks are removed every 12 months for a routine shutdown. The socks are inspected and cleaned and reused. There have been no unscheduled shutdowns. The socks most likely would last longer but this is a critical application so a once/year turnaround is always planned.
9. The customer has one complete set of registers / candles / socks so change out time is one shift or 8 hours. There is a crane which lifts the registers out of the vessel and then are lowered to a “candle trolley” for transporting to a clean area where the candles can be cleaned and the socks inspected / cleaned / or changed.
10. Cycle time is one hour for filtration, draining, blowing and cake discharge.
11. Slurry feed is by centrifugal pumps.
12. Overall, the customer is pleased with the unit operation, reliability and performance. They require no operator intervention and have led to an improvement in their quality of the metal sheets for their customers.

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## BHS CANDLE FILTER APPLICATIONS

### FINE SOLIDS REMOVAL & CLARIFICATION OF A SPECIALIZED ACIDIC SOLVENT AT A METAL GALVANIZING PLANT



## SPECIFICATIONS

- Three (3) x KF 125-74 with 125 candles and 74 m<sup>2</sup> of filtration area each (Third Filter-not shown)
- PLC controlled for completely automatic operation
- BHS candle filters remove contaminants from H<sub>2</sub>SO<sub>4</sub> slurry
- Cake discharge into totes for disposal
- Filtrate is sent back into the galvanizing process
- Skid is fully pre-piped and pre-wired for a turnkey installation

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## **BHS CANDLE FILTER APPLICATIONS**

### **WASTE WATER POWDER RECOVERY PLANT**

**A. Installation: 2 x KF 91-46**

**B. Overview**

- 1. Two BHS candle filters replaced three filter presses**
- 2. Candle Filters produced a solid cake with excellent handling properties**
- 3. Filter cone design modifications will ensure good solids flow for discharge**

**C. Benefits**

- 1. Reduced filter press maintenance costs at \$150,000 / year**
- 2. Reduction in building size which saves capital costs**
- 3. Reduced the complexity of the project**
  - a. Eliminated pre-thickening tank**
  - b. Eliminated clarifier**
  - c. Eliminated polymer system**
  - d. Eliminated sludge tank**
  - e. Total overall savings for capital costs = \$1,700,000.00**

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## BHS CANDLE FILTER APPLICATIONS

### FINE SOLIDS REMOVAL/CLARIFICATION OF A LIQUID SPECIALTY CHEMICAL

The BHS Candle Filters are installed for clarification and recovery applications from liquids with low solids content where the final product is the cake or the liquid. They are an ideal replacement for manual Sparkler filters, filter presses and other equipment where solids, solvents and hazardous materials are being handled.

#### A. SPECIFICATIONS

- One KF 37-19 with 19 m<sup>2</sup> of filtration area
- Jacketed to maintain 100 degrees C operating temperature
- DCS controlled for completely automatic operation; controls engineering by BHS
- Skid is fully pre-piped and pre-wired for a turnkey installation

#### B. PROCESS BENEFITS

- Replaced a manual Sparkler Filter, which is downstream of a decanter centrifuge.
- BHS Candle Filter is an automatic operation which eliminates the need for operator attention for the Sparkler filter; estimated savings per year is approximately \$600,000 (assuming two operators per shift)
- BHS Candle Filter provides for full containment of solids, liquids and vapors, which improves worker safety and eliminates environmental concerns.
  1. Application is a formaldehyde resin process at over 100 degrees C
  2. Current Sparkler operation is in a vented room
  3. Operators are required to wear a breathing apparatus
  4. BHS produced a waste cake at 90% below the OSHA exposure limit
- Reproducible and improved filtration results meeting a "Quality" specification of equal to or less than 1 for a higher quality final product.
- Candle and sock design is a positive seal, which eliminates bleed-through of solids, liquids or gases. The sock design is a continuous sock, which further eliminates the chance of bypass.
- Discharge is automatic and 100% (no residual heel) and is from a 16-inch flange. Solids handling is easy as there is a chute from the discharge flange to the hopper or tote. The hopper / tote can easily be picked up by forklift.
- Installation is easy as the candle filters are completely skid-mounted including piping, valves, instruments and all prewired to a junction box and pre-piped with pneumatic tubing to an air header. Units can sit in an open structure and be hard-piped to slurry, liquid and gas feed lines and filtrate and cake-discharge lines.
- There are no moving parts so the units are low maintenance and require a small inventory of spare parts.

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## **BHS CANDLE FILTER APPLICATIONS**

### **FINE SOLIDS REMOVAL/CLARIFICATION OF A LIQUID SPECIALTY CHEMICAL**

#### **C. DESCRIPTION**

The BHS Candle Filter provides for pressure filtration as well as heel filtration in an enclosed and pressure tight housing. ASME housings can be constructed of various materials. They can also be jacketed for heating/cooling or drying. The filter media can be any type of cloth with a clean removal efficiency in the 1-5 micron range. As the cake builds up on the candles, the efficiency improves to less than 1 micron. Cake washing follows which produces a uniform cake for drying. Drying can be by vacuum or gas blowing. Finally, cake discharge via gas blowback is automatic and contained and is accomplished with minimal gas requirements. Slurry discharge of the cake by filling the vessel with liquid and then initiating gas blowback can also be accomplished. After discharge, the cycle begins again.

The Candle Filter provides operational/process flexibility and can incorporate different filter media. Finally, the units can be used with a pre-coat of diatomaceous earth, activated carbon or other media depending upon the filtration characteristics of the solids. BHS, then, completes the installation tanks, pumps, instrumentation, full PLC controls, all skid-mounted with piping, valves, electrical, etc.

#### **D. TESTING & RENTAL PILOT FILTERS**

BHS has two filter laboratories in Charlotte, NC. One facility conducts filtration, washing and drying studies using a bench-top pocket-leaf filter (PLF). The second lab is used for wet/glassware reaction studies combined with filtration, washing and drying. Finally, these preliminary tests can also be done on-site. In all cases, BHS gathers the data for filter sizing and process guarantees.

BHS also provides pilot-scale candle filter rental units, KF 3/1, with 1 square meter of filter area (3 candles). The rental unit can be installed on a slip or side stream to run the actual process. The KF 3/1 is automated by pneumatic control so it can be easily installed without the concern of electrical classifications.

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## BHS CANDLE FILTER APPLICATIONS

### FINE SOLIDS REMOVAL/CLARIFICATION OF A LIQUID SPECIALTY CHEMICAL

#### E. SIMILAR LIQUID CLARIFICATION APPLICATIONS

In one application for a high molecular weight aqueous cation guar, the current process uses a filter press followed by a 1 um sintered metal filter. The BHS candle filter replaces the existing filters and can meet the NTU clarity specification of less than 1.0.

In a second application for an aqueous resin, the current process uses an inverting centrifuge to a filter press. The BHS candle filter replaces the filter press and can meet the NTU clarity specification of less than 0.4.



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## **BHS CANDLE FILTER APPLICATIONS**

### **SPECIALTY CHEMICAL RECOVERY AND CONCENTRATOR WITH INTEGRATED MIXING TANK FOR RESLURRY OPERATIONS**

The Candle Filters are installed for clarification and recovery applications from liquids with low solids content. They are an ideal replacement for manual pressure filters and other equipment where solids, solvents and hazardous materials are being handled.

#### **A. SPECIFICATIONS**

- KF 3-1 with 1.5 m<sup>2</sup> of filtration area
- PLC controlled for completely automatic operation
- Skid is fully pre-piped and pre-wired for a turnkey installation

#### **B. PROCESS BENEFITS**

- Automatic operation which eliminates the need for operator attention
- Full containment of solids, liquids and vapors, which improves worker safety and eliminates environmental concerns.
- Candle and sock design is a positive seal, which eliminates bleed-through of solids, liquids or gases.
- Discharge is automatic and is from a 4-inch flange directly into a mix tank for reslurry. Slurry is then pumped to the next stage of the process.
- Installation is easy as the candle filters are completely skid-mounted including piping, valves, instruments and PLC controls. Unit sits in an integrated skid-frame in an open structure and hard-piped to slurry, liquid and gas feed lines and filtrate and cake-discharge lines.
- There are no moving parts so the units are low maintenance and require a small inventory of spare parts.

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### SPECIALTY CHEMICAL RECOVERY AND CONCENTRATOR WITH INTEGRATED MIXING TANK FOR RESLURRY OPERATIONS

