Debottlenecking HCGO Filtration

Niels van der Horst, Calgary, Alberta, September 13-17 2010

Agenda

- Company Profile
- HCGO Filtration
  - the problem
  - design principles
  - operations
- Testing facilities
- Reference project
- Questions

Dahlman world wide I

- Head offices in Maassluis, The Netherlands
  - Management
  - Sales
  - Engineering
  - Production
Dahlman world wide II

- **Riffa (Bahrain)**
  - Sales ME, Gulf Area
  - Consultancy
- **Elsloo (The Netherlands)**
  - Spare Parts & Consumables
  - Total Supply Frame Agreements
  - Maintenance
  - After Sales Services

Dahlman world wide III

- The Netherlands (Head Office)
- Elsloo (Warehouse)
- United States
- Hungary
- Spain
- Italy
- Kuwait
- China
- South Korea
- Bahrain (Office)
- Qatar
- Malaysia
- UAE
- Oman
- Czech Republic
- Kuwait

Dahlman Capabilities

**Pre Order**
- Consultancy
- Laboratory Testing
- On Site Pilot Testing

**Order**
- Project Management
- Process Engineering
- Mechanical Engineering
- Production & Assembly

**After Sales**
- Start-up & Commissioning
- Training
- Technical Services
- Spare parts
The problem with filtration

- Penetration of contaminants in filter medium
  - Short cycle times

- Element cleaning not powerful and effective
  - Backwashing with filtered product shows bad results

Result:
- High backwash frequency -> excessive product loss
- Ex situ cleaning required -> downtime causing production losses

HCGO Filtration Design Principles

- Minimize penetration of contaminants in filter medium
  - Surface filtration

- Optimal use of filter area at high solids content
  - Filtration from inside-to-outside

- Element cleaning needs to be powerful and effective
  - Gas-assisted backwash (steam, nitrogen or (sweet) fuel gas)

- Effective way of sludge disposal
  - Sludge removal gas-driven or by pump(s)

Minimize penetration of contaminants in filter medium

Not depth filtration ...

<table>
<thead>
<tr>
<th>Filtration Cycle</th>
<th>Cleaning Cycle</th>
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<tbody>
<tr>
<td><img src="image1" alt="Diagram" /></td>
<td><img src="image2" alt="Diagram" /></td>
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Minimize penetration of contaminants in filter medium

**But surface filtration!**

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**DAHLMAN CLASSIC SINTERED POWDER, WIRE MESH & DAHLMAN (NEW DEVELOPED) WEDGED WIRE ELEMENTS**

- Surface filtration
- Shape stability
- Suitable for high differential pressure
- Easily cleanable using gas assisted back flush technology
- Wide variety of sizes and materials
- High permeability with low pressure drop
- Chemical and heat stability, also for ex situ cleaning

**Demonstrated technology for HCGO filtration**

**Filtration Process I**

- Filling

![Filtration Process Diagram](image3)
Filtration Process II

- Filtering
  
  Inside to outside!

Filtration Process III

- Cleaning
  Gas-driven
  
  - Close inlet/outlet
  - Pressurize
  - Open bottom valve

Operational Philosophy IV

- Sludge discharge
Testing Facility

Semi Automatic Backflush Test Filter with FCV

Test unit in place
Different elements are tested
Convincing results

Process Specifications

- Fluid: HCGO
- Particles: Coke fines
- Flow rate
  - Normal: 70 m³/hr
  - Maximum (design): 76.6 m³/hr
- Temperature
  - Operating: 240 °C
  - Design (mechanical): 310 °C
- Density: 801.5 kg/m³
- Viscosity @ operating temperature: 0.22 cP
- Pressure
  - Operating: 8.5 bar
  - Design: 35 bar
- Maximum allowable pressure drop: 3 bar

Testing

Questions:
- Which filter media is best able to filter HCGO?
- Will these filter elements be cleaned effectively?
- What are the expected cycle times?
- What is the effect of gas assisted backwashing, can we reach initial clean delta P?
Problem Analyses Sintered Powder

Fracture surface with foreign material in pores
SEM-imaging: Device: Tescan TS51020M

Foreign material

Analyses of Sintered Wire Mesh

Cut section
Microscopic detail
Analyses of Sintered Wire Mesh

Before cleaning After cleaning

Filtration Test Results

Conclusion of the testing

- A significant amount of very small coke particles is present
- Lower operational temperatures than indicated; temperature drops during drum switch (8h-16h operation)
- Improved back flush results using LCGO
- Some filter media is not useful for HCGO filtration
DAHLMAN Scope of Supply

- Complete Engineering Package
- Manufacturing
- Assembly
- Testing & Inspection
- Project management
- Start-up & Commissioning

Today’s performance

- Gas assisted backwash cleaning is today a demonstrated and proven technology for HCGO filtration
- Wear resistant, use of the best components
- Easy operation, no operator intervention required
- Lower use of utilities compared to other technologies resulting in lower operational costs
- Demonstrated in the field, up and running today
Dahlman Company – Your Advantages

- More than 100 years of filtration experience
- Hands-on supplier cooperating with our clients
- World wide sales network
- Complete, assembled delivery with competitive pricing
- Equipment based on client specific requirements
- Commitment to performance
- Ongoing cost engineering practices on HCGO filtration design

Thank you!
Questions?

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