



# DAHLMAN

## Debottlenecking HCGO Filtration

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

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### Agenda

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

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### Dahlman world wide I

- Head offices in Maassluis, The Netherlands
  - Management
  - Sales
  - Engineering
  - Production



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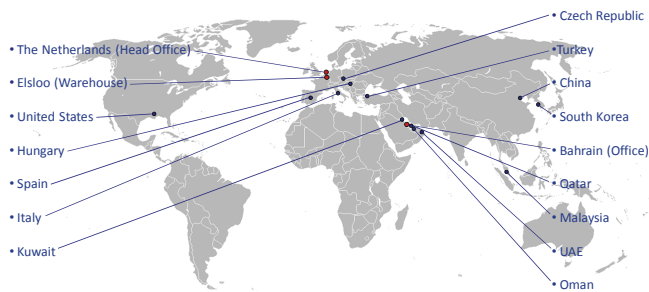
## Dahlman world wide II

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



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## Dahlman world wide III



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## 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



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## 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*

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## 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)**

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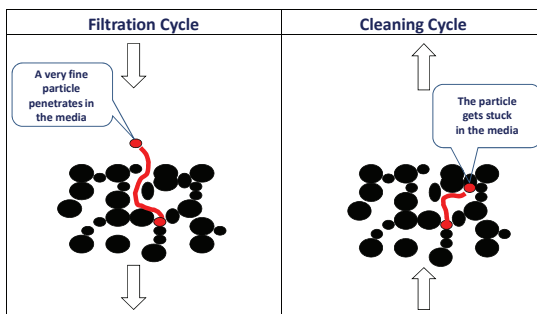
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## Minimize penetration of contaminants in filter medium

### Not depth filtration ...



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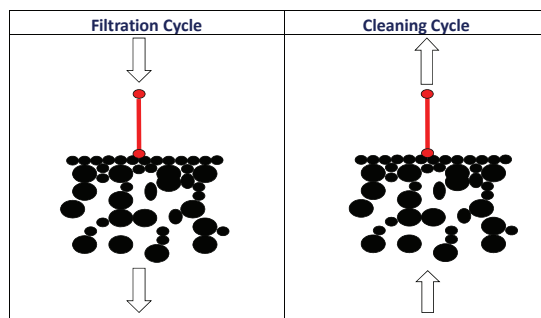
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Minimize penetration of contaminants in filter medium

**But surface filtration!**



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**Filter media used for pilot testing**

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

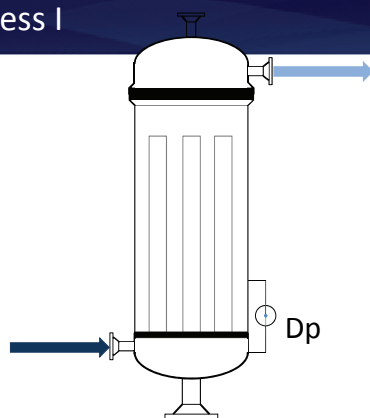
- Surface filtration
- Shape stability
- Suitable for high differential pressure
- Easily cleanable using gas assisted back flush technology
- Wide variety of sizes and materials
- High permeability with low pressure drop
- Chemical and heat stability, also for ex situ cleaning

**Demonstrated technology for HCGO filtration**

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**Filtration Process I**

- Filling



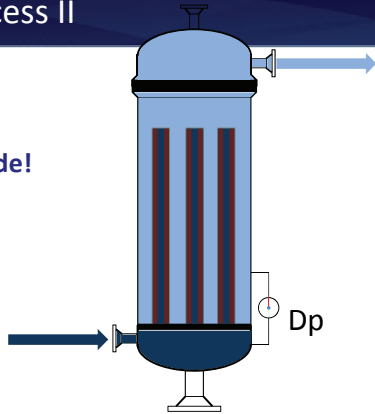
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## Filtration Process II

- Filtering

**Inside to outside!**

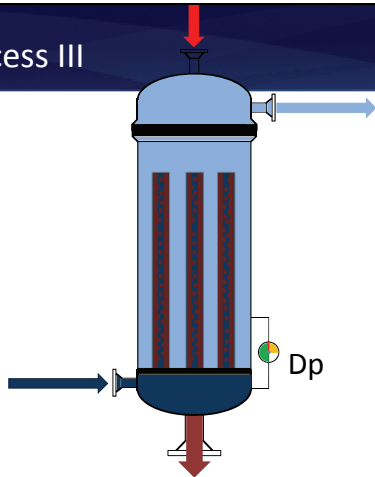


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## Filtration Process III

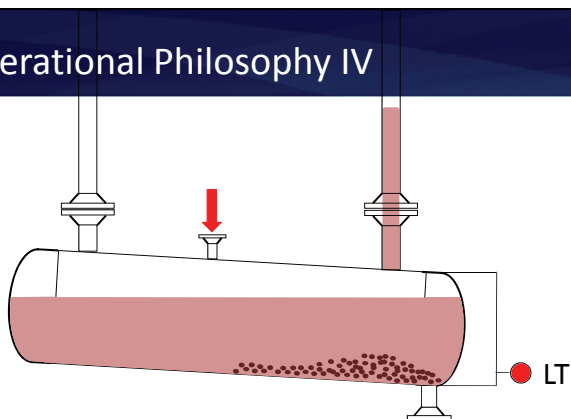
- Cleaning  
**Gas-driven**

- Close inlet/outlet
- Pressurize
- Open bottom valve



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## Operational Philosophy IV



- Sludge discharge

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## Testing Facility

### Semi Automatic Backflush Test Filter with FCV



Test unit in place



Different elements are tested



Convincing results

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## Process Specifications

|                                     |   |                         |
|-------------------------------------|---|-------------------------|
| ▪ Fluid                             | : | HCGO                    |
| ▪ Particles                         | : | Coke fines              |
| ▪ Flow rate                         |   |                         |
| – Normal                            | : | 70 m <sup>3</sup> /hr   |
| – Maximum (design)                  | : | 76,6 m <sup>3</sup> /hr |
| ▪ Temperature                       |   |                         |
| – Operating                         | : | 240 °C                  |
| – Design (mechanical)               | : | 310 °C                  |
| ▪ Density                           | : | 801,5 kg/m <sup>3</sup> |
| ▪ Viscosity @ operating temperature | : | 0,22 cP                 |
| ▪ Pressure                          |   |                         |
| – Operating                         | : | 8,5 bar                 |
| – Design                            | : | 35 bar                  |
| ▪ Maximum allowable pressure drop   | : | 3 bar                   |

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## Testing

### Questions:

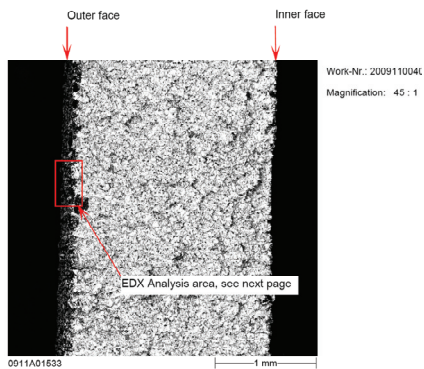
- Which filter media is best able to filter HCGO?
- Will these filter elements be cleaned effectively?
- What are the expected cycle times?
- What is the effect of gas assisted backwashing, can we reach initial clean delta P?



Dahlman Test Rig

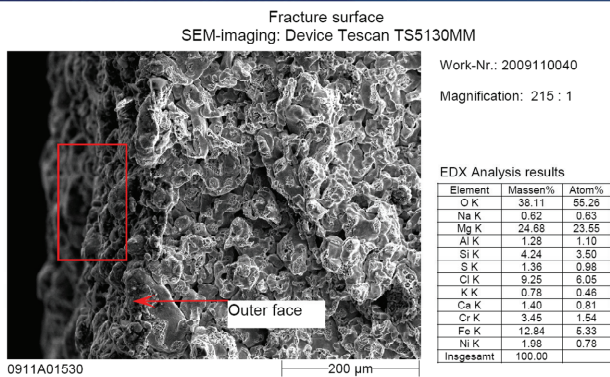
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## Problem Analyses Sintered Powder



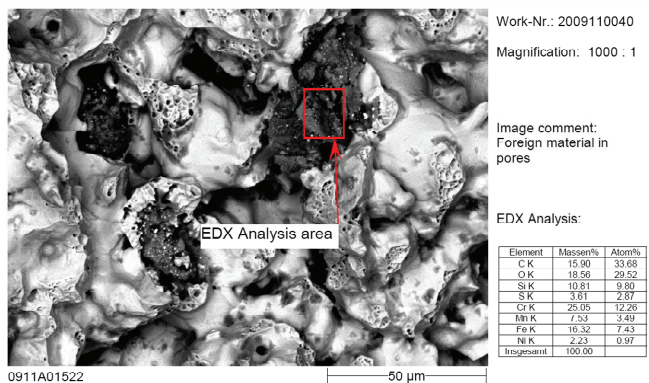
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## Problem Analyses Sintered Powder



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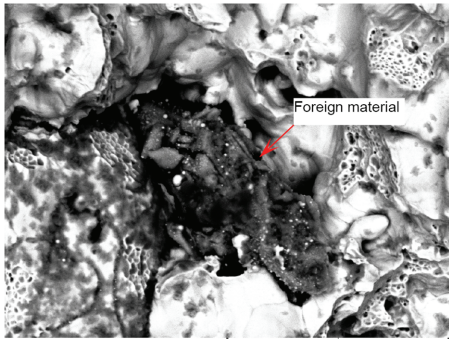
## Problem Analyses Sintered Powder



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## Problem Analyses Sintered Powder

Fracture surface with foreign material in pores  
SEM-imaging: Device Tescan TS5130MM



Work-Nr.: 2009110040

Magnification: 1500 : 1

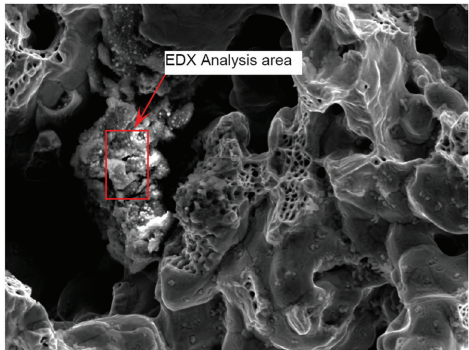
Image comment:  
BSE contrast

0911A01527

20 µm

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## Problem Analyses Sintered Powder



Work-Nr.: 2009110040

Magnification: 1500 : 1

EDX Analysis:

| Element   | Massen% | Atom% |
|-----------|---------|-------|
| C K       | 21.62   | 37.09 |
| O K       | 29.61   | 38.14 |
| Si K      | 14.86   | 10.90 |
| S K       | 2.84    | 1.82  |
| Cr K      | 20.43   | 6.10  |
| Mn K      | 4.18    | 1.57  |
| Fe K      | 6.00    | 2.21  |
| Ni K      | 0.45    | 0.16  |
| Insgesamt | 100.00  |       |

0911A01528

20 µm

Page 6

Date:

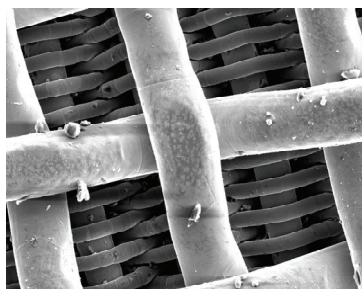
18.11.2009

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## Analyses of Sintered Wire Mesh



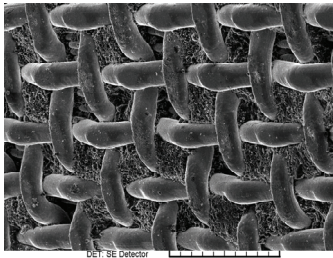
Cut section



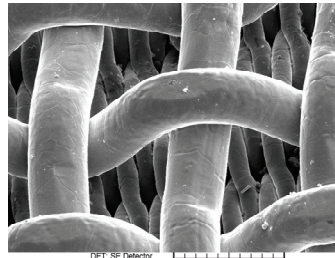
Microscopic detail

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## Analyses of Sintered Wire Mesh



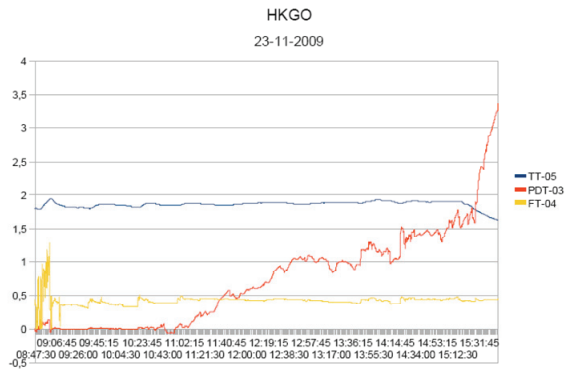
Before cleaning



After cleaning

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## Filtration Test Results



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## Conclusion of the testing

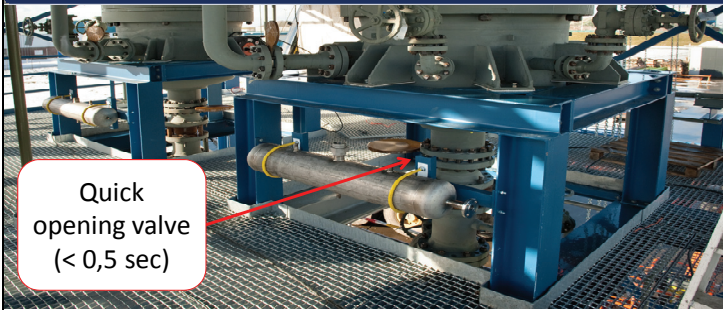
- A significant amount of very small coke particles is present
- Lower operational temperatures than indicated; temperature drops during drum switch (8h-16h operation)
- Improved back flush results using LCGO
- Some filter media is not useful for HCGO filtration

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## Dahlman HCGO Reference Project

Detailed picture of the special discharge valve



Quick  
opening valve  
( $< 0,5$  sec)

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## Dahlman HCGO Reference Project

HCGO Back Flush Receiver Vessel



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## Dahlman HCGO Reference Project



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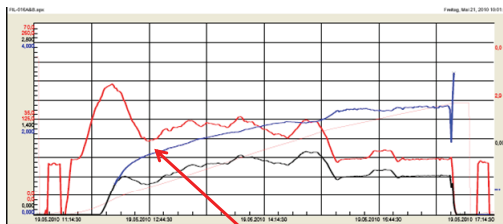
## DAHLMAN Scope of Supply

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



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## Today's performance



Corrected  
delta P curve  
for flow  
fluctuations

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## Conclusion

- 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

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## 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

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**Thank you!  
Questions?**

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