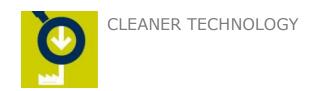


by Henrik Vittrup Pedersen Air pollution control solutions





Contents

- DuoClean™ filter
 - A proven technology
 - Innovative modular design
- Research & Development activities
 - Full scale pilot test
 - Computational Fluid Dynamic analysis
- A popular design
 - Cases and results
- Conversion of ESP to Fabric Filter.





New modular filter design to reduce CAPEX

"The goal was to develop a compact filter which is simple to manufacture, transport and install while still delivering low operational costs, high performance and low emission. With the new, modular DuoClean filters the extensive focus on manufacturability and constructability also means that the filters minimize environmental footprint."

Mr. Lars Gamborg, Global Product Manager, Fabric filters



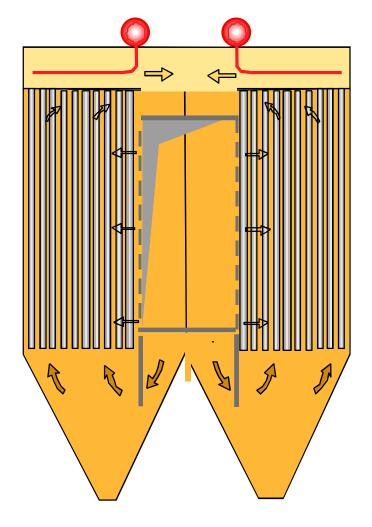
cleaner technology

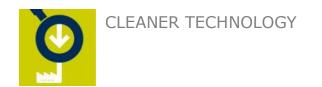




DuoClean fabric filter technology

- One compartment filter
- Dual gas flow approach, from side and bottom of the bags
- Unique gas distribution screens
- Long filter bags up to 12m
- Low can velocity and dust re-entrainment
- Pre-separation of dust before the bags

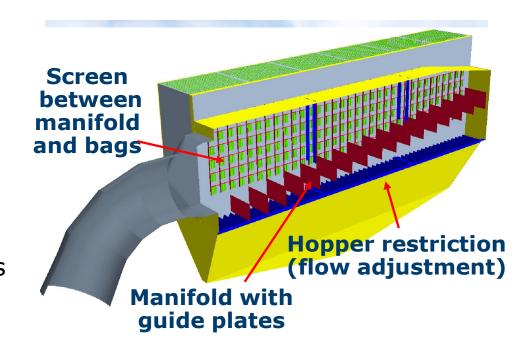


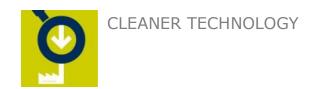




DuoClean fabric filter technology

- Ideal for processes with high dust load or when on-line maintenance is not required
- > 50 filters installed worldwide between 2007 and 2014 all with outstanding performances







Perspectives in design principles

1. Technology development

- FLSmidth on-line cleaning system
- Unique gas distribution system
- FLSmidth long bag technology

2. Modular design

- Standard engineering
- Reduced number of components

3. Cost-effectiveness

- Casing design reduces steelwork usage
- Small footprint, best fit

4. Optimization from workshop to site

- Manufacturing easy production
- Transportation panels fit the container size
- Installation cost-effective assembly

→ Reduce OPEX

→ Reduce CAPEX

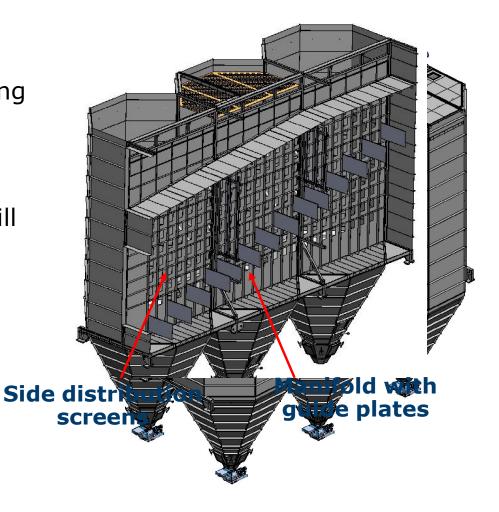
- → Low weight & Reduce CAPEX
- → Manufacturability & Constructability

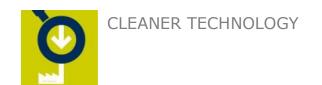




Matching larger needs **DuoClean DC2**

- Multi-octagonal shaped casing
- Medium to large gas flows (150.000 – over 1.000.000 Am³/h)
- Ideal for cement kiln and mill filters
- Bag length up to 12 m
- Up to 15% reduction in steelwork thanks to casing design

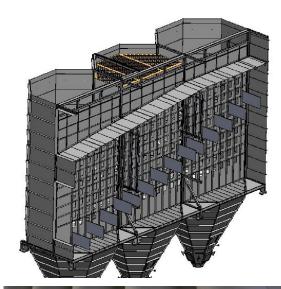




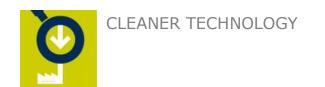


Reduced operational costs

- Unique gas distribution ensures a uniform gas velocity and minimized wear of the filter bags
- The optimized pulse jet system and the possibility to clean with low pressure (P ≤ 2.0bar) reduces compressed air consumptions and the stress of the bags thus increasing bag lifetime
- The absence of dampers means reduced pressure drops leading to reduced energy consumption of the ID fan









Optimized fabrication and transportation

- Casing plate span is reduced by 30-40% allowing to use simple reinforcement profiles - reduces the fabrication time
- Concept of standardization makes it easy to manufacture filter parts - reduces the risk of errors
- Steel parts are designed for maximizing loading of standard containers – ensures optimized transportation at reduced cost

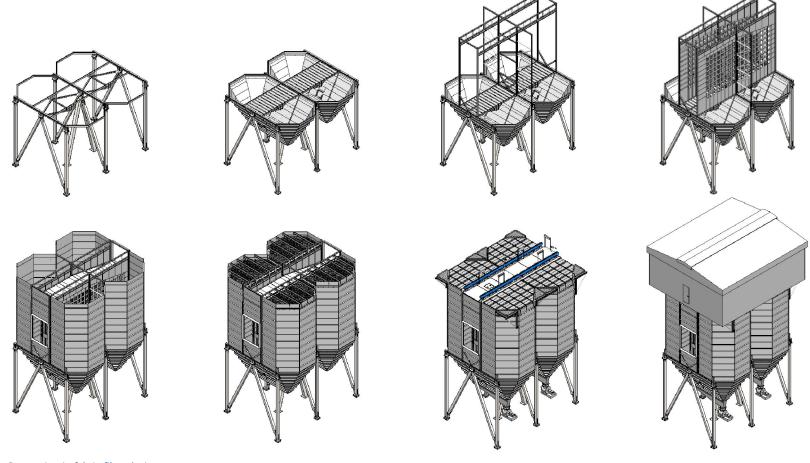








Easy assembly of identical modules



AFCM - 2015 - Innovation in fabric filter design

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DuoClean vs. DuoClean DC2

Weights	DuoClean	DuoClean DC2	Comparison
Supports (tons)	16,1	18,2	+13%
Casing, hoppers, top boxes (tons)	84,1	71,6	-14,9%
Access (tons)	6	6	0%
Penthouse (tons)	9,6	8,2	-14,6%
Insulation (tons)	22,2	21,9	-1,4%
Components (tons)	40,1	34,5	-14%
Total	178	160,4	-9,9%
Footprint			
Supporting structures (m2)	117,5	87	-26%





Full scale testing facilities at FLSmidth R&D Center, Dania

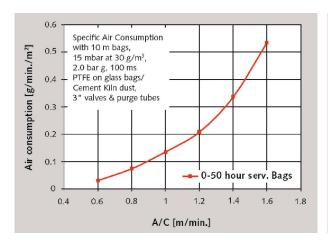
- Pilot filter with 10m long bags
- Testing at different process conditions
- Testing of different type of purge valves
- Testing of low pressure cleaning system

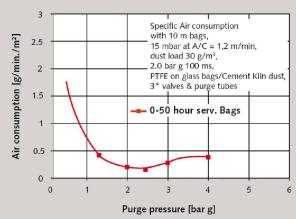


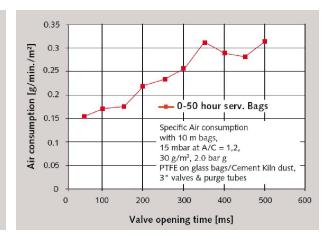




Low pressure cleaning – Fine tuning of parameters

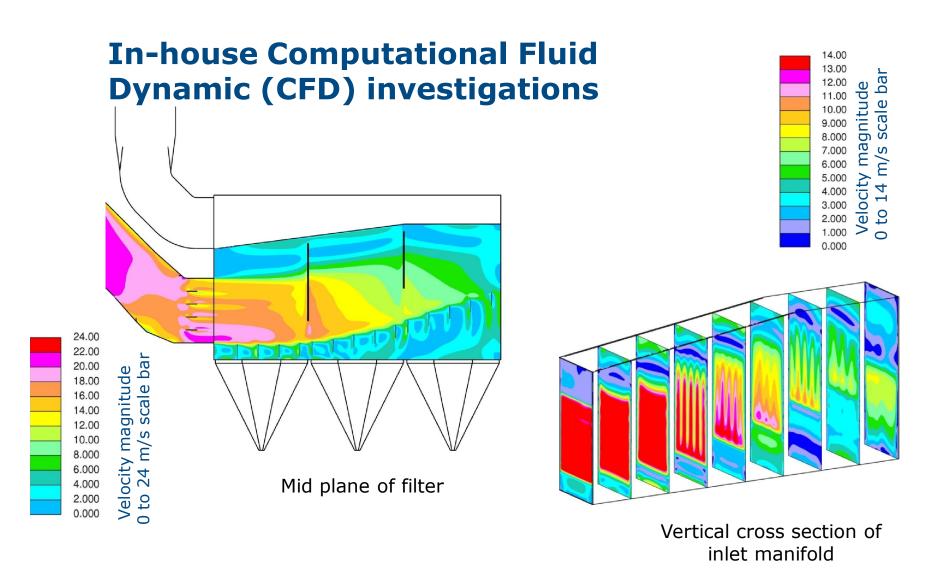






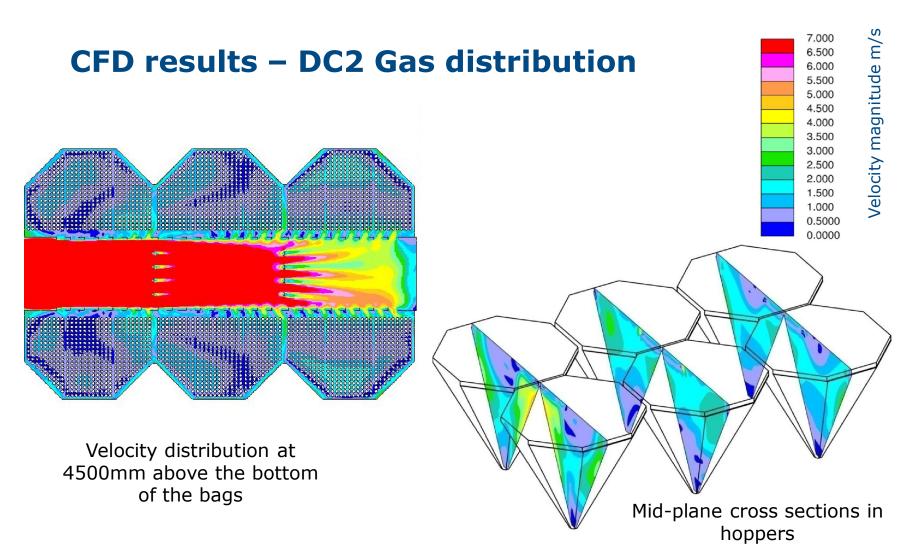








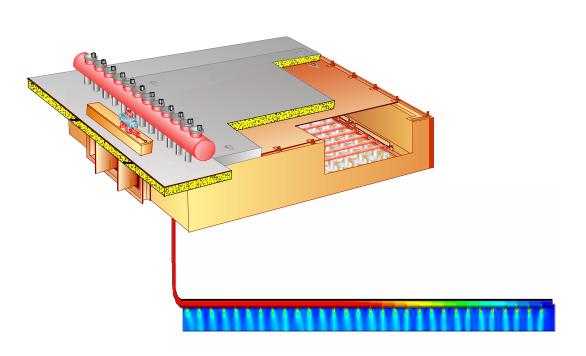




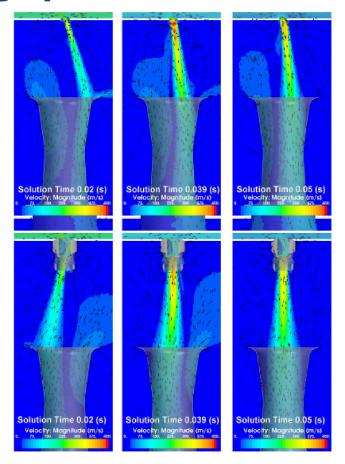




CFD developments – Cleaning system



Pulse jet cleaning system

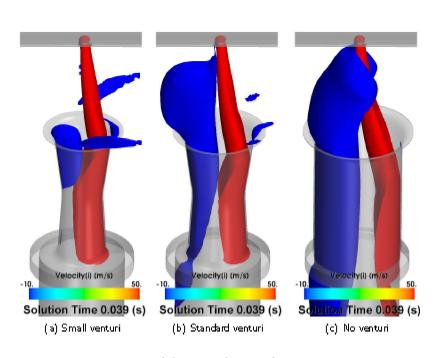


Nozzles testing

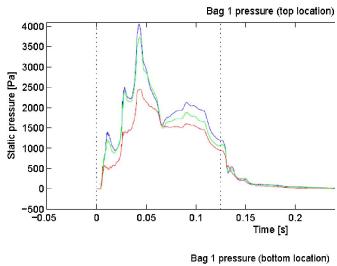


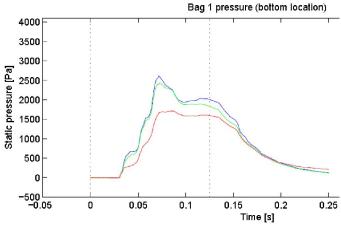


CFD developments – Cleaning system



Venturi testing









Lafarge Medgidia, Cement, Romania DuoClean DC2

- Turnkey supply of DuoClean DC2 filter for kiln/raw mill process
- Cement production knowledge, extensive R&D and compact design were key drivers for Lafarge to select FLSmidth as supplier
- Performance test show emission level well below the guarantee at 2.25 mg/Nm³

"FLSmidth is a well known supplier in the cement industry. When we selected the DuoClean DC2 filter we knew that we could expect high quality, a high performing installation and professional service during the project execution"

Emmanuel Ollivier, Project Manager Lafarge Technical Center







Lafarge Rezina, Cement, Moldova DuoClean DC2

- Turnkey supply of DuoClean DC2 filter for kiln/raw mill process
- Maintenance and stocking of spare parts is simplified as the filter is identical to the filter at Medgidia
- Performance test show emission level well below the guarantee at 1.24 mg/Nm³









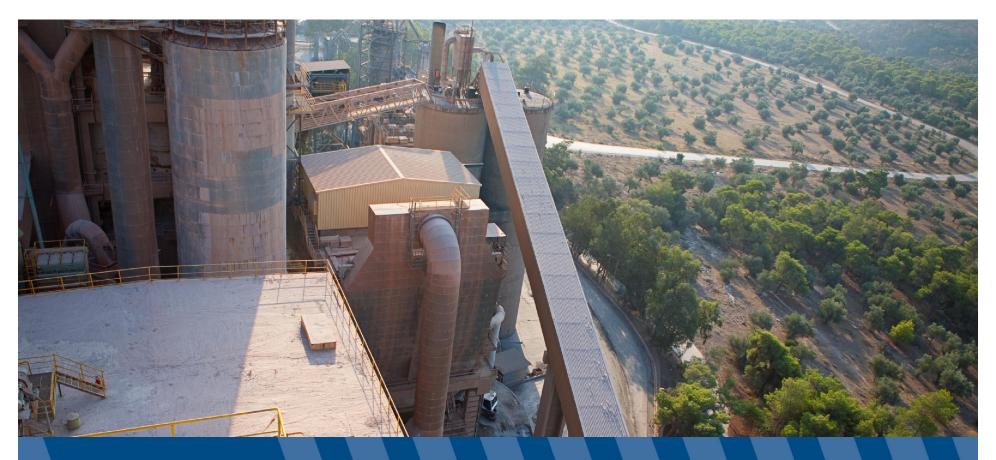
Askale Gumushane, Turkey DuoClean DC2

- Supply of DuoClean DC2 filter for cement mill process
- The DC2 filter was selected thanks to its compact design and optimised performance handling large gas flow





Air Pollution Control solutions Conversion of ESP to fabric filter



One Source







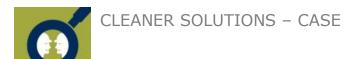
Conversion from ESP to fabric filters

Why convert?

- Mechanical or electrical equipment is worn out
- Production has increased
- New emission requirements
- Change in fuel or raw material

Advantages

- Short plant stop time
- Low investment cost
- Reduced delivery time
- Reuse of existing equipment (supporting structure, dust transport, fan, etc.)
- Flexible design for all makes of ESP's
- Reuse of existing control system for auxiliary equipment

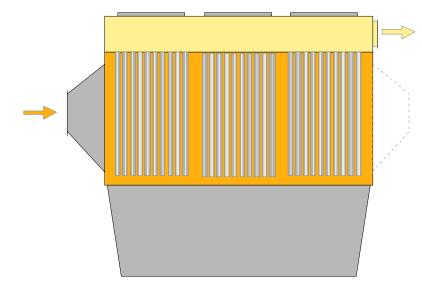




Configuration examples

Example A On

One dirty gas chamber. One clean gas chamber. No dampers.



Cleaning:

Online

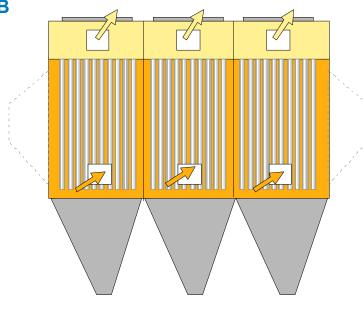
Maintenance:

Offline

Many clean gas chambers.
With inlet and outlet dampers.

Example B

Many dirty gas chambers.



Cleaning:

Online or Offline

Maintenance:

Online



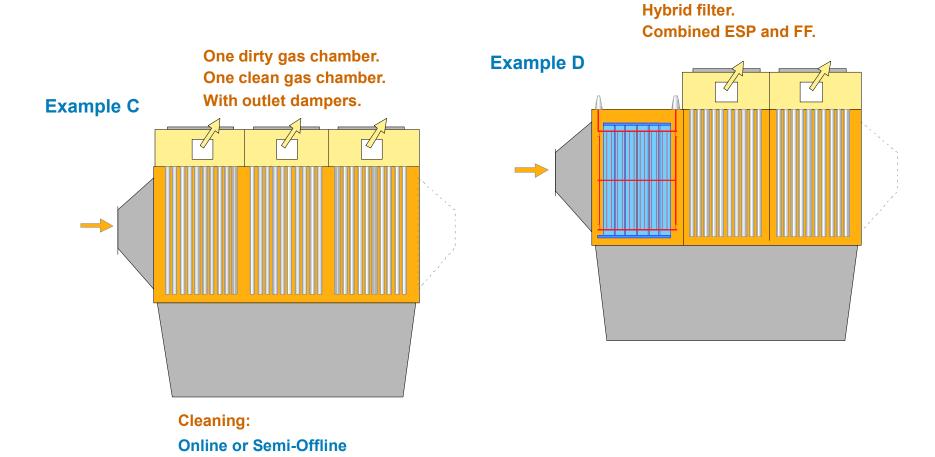


Configuration examples

Maintenance:

taken out)

Offline (one top box can be









Overview of options

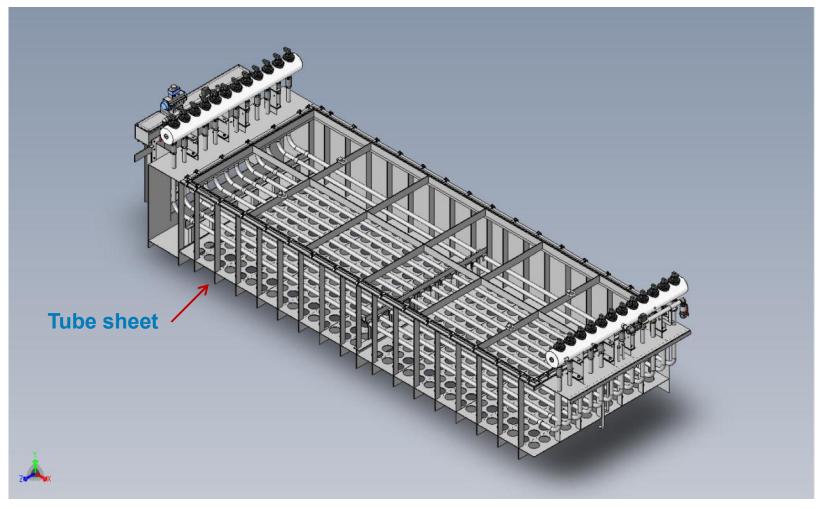
	Fabric filter Online	Fabric filter Semi-online	Fabric filter Offline	Hybrid
Compartments	Yes	Yes	No	Yes, if semi-offline
Hopper modification required	Yes	No	No	No
Maintenance in operation	Yes	No	No	No
Pressure drop (mmWg)	130 - 150	130 - 150	120 - 150	100 - 120
Sensitive to CO	No	No	No	Yes
Compressed air consumption index	100	100	100	70
Bags replacement time (estimate)	2 years (felt bags) 5 years (fiberglass)	2 years (felt bags) 5 years (fiberglass)	2 years (felt bags) 5 years (fiberglass)	3 years (felt bags) 6 years (fiberglass)
Cost index	100	95	75	60







Main equipment, Top Box







ESP plates/electrodes dismantling - day 3-5



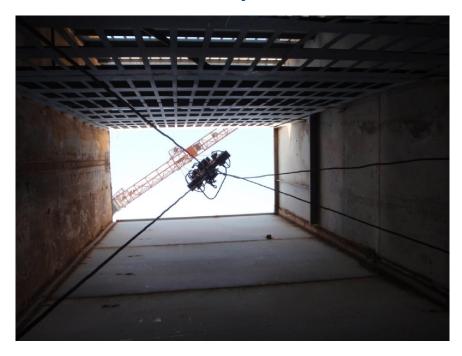
Empty casing - day 7







Gas distribution screens - Day 16-19



Gas distribution screens - Day 16-19









Top boxes installed - Day 23



Bags & cages installation – Day 23-25









Site pictures Siam Cement Thung Song

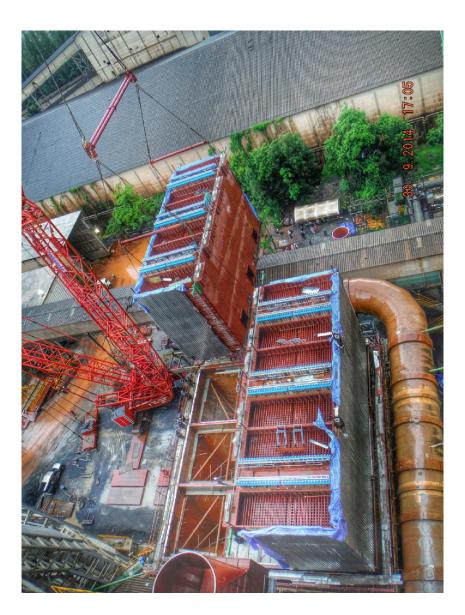








Siam Cement Thung Song





Thank you for your attention

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