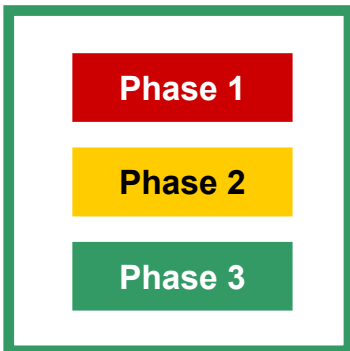
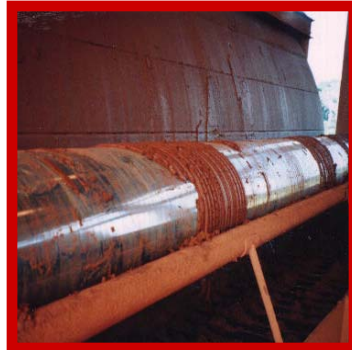


Filter Revamping



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What is Filter Revamping?



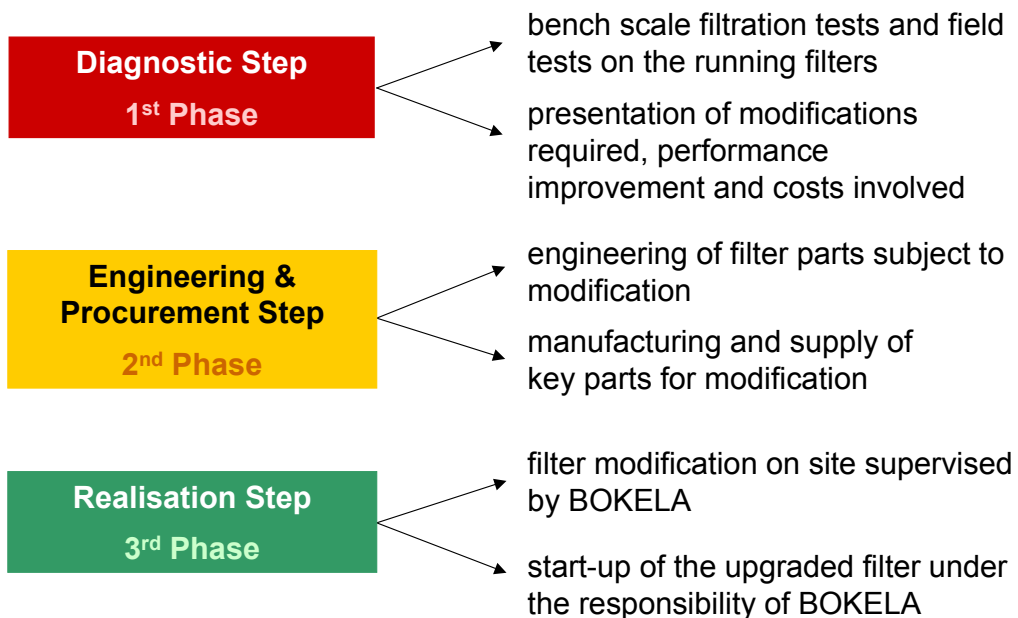
Filter revamping ...

... means the modification and upgrading of running disc, drum, pan, belt and Kelly filters at the site leading to:

- **30 % up to 135 % performance increase**
- **cost savings (only 10% - 25% of new filter investment costs are necessary)**
- **short-termed and fast realisation covered by maintenance budget and no new investment.**

Filter revamping is the simplest, straightest and most economic way to realize new production targets.

BOKELA Filter Revamping Programme



Revamping of Disc Filters

Al-Hydrate Seed Filtration



Targets of the Client

➤ For the plant:

- increase of the total plant capacity
- de-bottlenecking of the running seed disc filters instead of new investment

➤ For the disc filters:

- throughput increase
- no increase of moisture content
- secure and complete (100%) cake discharge
- improved filter availability
- more spare capacity
- reduced filter operation costs

...

Revamping of Disc Filters

Al-Hydrate Seed Filtration



Cake discharge before ...



... and after optimisation

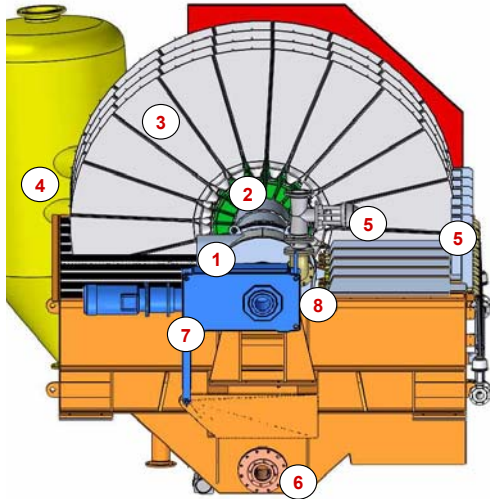
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Revamping of Disc Filters

Al-Hydrate Seed Filtration



Typical Modifications and Improvements



	Modification of:	Throughput increase Δ ms	Moisture reduction Δ mc	Ease of maintenance
1	control valve + control plate	10 - 15 [%]	1 - 2 [%]	x
2	individual and collecting filtrate pipes + barrel	10 - 20 [%]	-	
3	segments	10 - 20 [%]	1 [%]	x
4	filtrate pipes + receivers	10 - 20 [%]	1 [%]	
5	cake discharge	20 - 30 [%]	1 [%]	x
6	feeding + agitator	up to 10 [%]	-	x
7	filter drive	up to 10 [%]	-	x
8	barrel sealing/ immersion ratio	up to 10 [%]	-	x

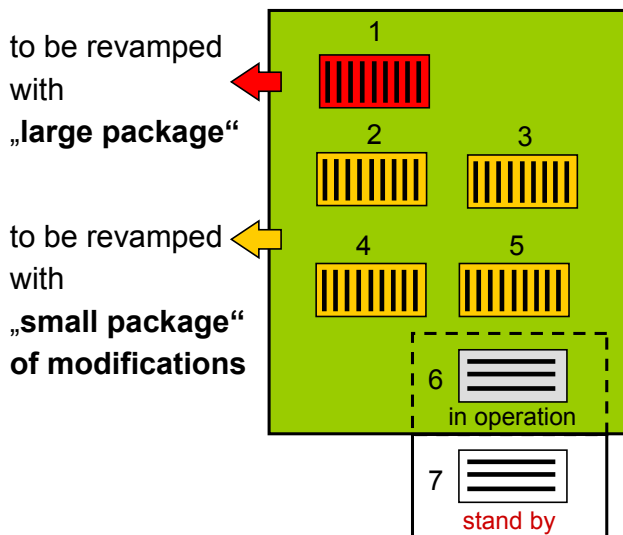
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Revamping of Disc Filters

Al-Hydrate Seed Filtration



Disc Filters for Seed Filtration - Situation Prior to Modernisation



5 disc filters:
 - 9 discs each
 - 160 m² per filter

2 disc filters:
 - 3 discs each
 - 112 m² per filter

...

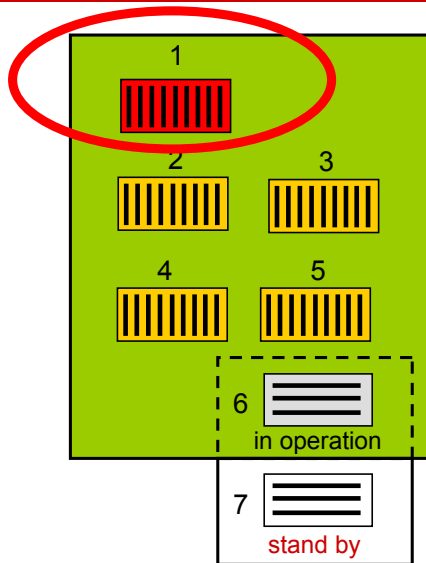
Revamping of Disc Filters

Al-Hydrate Seed Filtration



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Modification of 1 Filter – Large Package of Modifications



- new filter barrel (9 discs)
- new high performance segments (20 per disc)
- higher trough level
- modifications to control head
- new control plate
- new filter drive
- new snap blow system for cake discharge
- filter operation without overflow
- new slurry feeding system (no more agitator required in the trough)

...

Revamping of Disc Filters

Al-Hydrate Seed Filtration



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Performance after Large Package of Modifications

Operating Data of Filter 1 Before and After Modification

	old filter	modified filter	
filter speed [rpm]	1.0	2.0	
cake moisture content [%]	20.5	14.5	
specific slurry flow [m ³ /m ² h]	1.7	3.0	Increase: 175 %
specific solids rate [t/m ² h]	3.1	5.4	
cake discharge [%]	80	95	

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Revamping of Disc Filters

Al-Hydrate Seed Filtration



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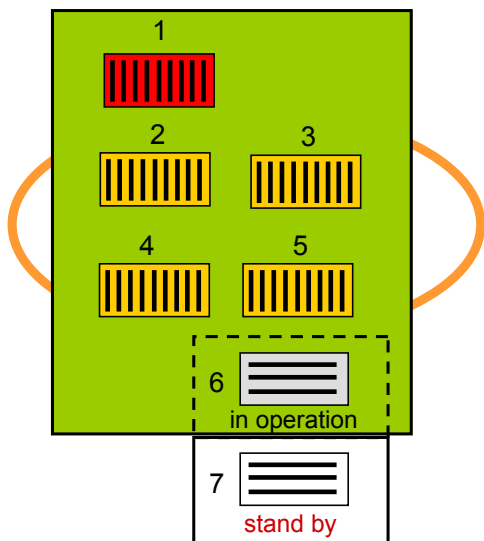
Revamping of Disc Filters

Al-Hydrate Seed Filtration



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Revamping of 4 Filters with Small Package of Modifications



- higher trough level
- new control and wear plate
- new snap blow system for cake discharge
- new slurry feeding system (no more agitator required in the trough)

...

Revamping of Disc Filters

Al-Hydrate Seed Filtration



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Performance after Partial Modification

Operating Data of Filters 2, 3, 4 and 5 Before and After Modification

		old filters	modified filters
filter speed	[rpm]	1.0	1.35
cake moisture content	[%]	20.5	19.5
specific slurry flow	[m ³ /m ² h]	1.7	2.2
specific solids rate	[t/m ² h]	3.1	4.0
cake discharge	[%]	80	95

**Increase:
30 %**

...

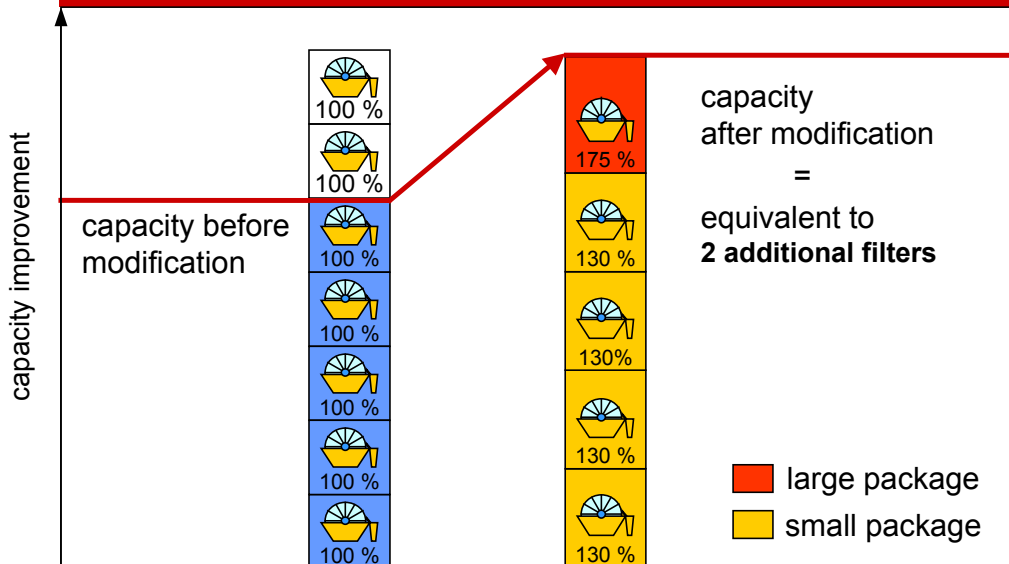
Revamping of Disc Filters

Al-Hydrate Seed Filtration



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Capacity improvement



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Revamping of Disc Filters

Al-Hydrate Seed Filtration



Typical Costs Example: Revamping of Disc Filters for Al-Hydrate Seed Filtration

	Modification Measures	Throughput Increase [%]	Costs of Filter Modification vs New Filter [%]
small package	1, (4), 5, 6	30 – 50	5 – 10
large package	1 – 8	60 – 135	15 – 25

The costs calculation includes costs for building, piping, auxiliary units and engineering necessary for new filters.

...

Revamping of Disc Filters

Al-Hydrate Seed Filtration



Costs for revamping	
engineering	17 %
modification with small package (filter 2, 3, 4 and 5)	32 % (8 % per filter)
modification with large package (filter 1)	29 %
additional costs of client (project management, site contractors, hardware procured by client)	22 %
total revamping costs	100 %
Alternative: Costs for new investment	
2 additional filters	150 %
additional costs for building, piping, auxiliary units & engineering (2 x the costs as for new filter):	300 %
total costs for new filters	450 %

Revamping of Drum Filters

Titanium Dioxide Filtration



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Targets of Client

- **Reasons for upgrading**
 - unsatisfactory product quality due to poor cake washing
- **Filter equipment**
 - two vacuum drum filters in a row with intermediate re-slurring of the filter cake
- **Objectives of the client**
 - clean product and reduced wash liquor consumption

Revamping of Drum Filters

Titanium Dioxide Filtration



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BOKELA's laboratory and field tests indicated a good cake washing by:

- preventing of filter cake cracking and
- preventing of cake remoistening at cake discharge

Modifications for Improving the Cake Wash

- Prevention of cake cracks by changing of the pressure difference in the cake dewatering zone
- Prevention of cake remoistening at cake discharge by modification of the filter segments

Revamping of Drum Filters

Titanium Dioxide Filtration



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Cake formation and cake washing ...



before ...



... and after optimisation by
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Revamping of Drum Filters

Red Mud Drum Filter with Roller Discharge



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Performance Data Before and After Modification

	original filter	predicted value	modified filter	improvement
filter speed [rpm]	2.1	-	2.7 – 3	
slurry throughput [m ³ /h]	41	60	62	50% increase
soluble soda content [g/l]	6.8	≤ 6.8	4.5	33% less soda

Revamping of Drum Filters

Red Mud Drum Filter with Roller Discharge



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Roller cake discharge before ...



and after modification by
BOKELA

Revamping of Pan Filters

Filtration of Al-Hydrate Product



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Filter equipment

- three vacuum pan filters of 50 m² each

Target of the client

- increase of filter capacity by 30 % to achieve plant capacity increase from 1.0 to 1.3 Mio. tonnes alumina per year
- reduction of soluble soda level below 0.02 % (no soda peaks)

Modifications

- increase of filter speed
- modification of the control head (filter setting)
- adaptations to the filter segments
- adaptation of the feeding system
- modification of cake wash

Revamping of Pan Filters

Filtration of Al-Hydrate Product



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Filter Operation Before and After Optimisation

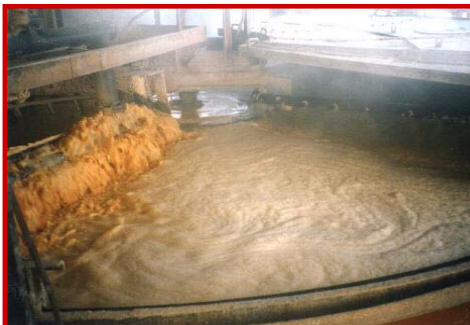
	original filter	modified filter
slurry feed	130 m ³ /h	185 m ³ /h
soluble soda content	0.03 wt.-%	0.02 wt.-%

Revamping of Pan Filters

Filtration of Al-Hydrate Product



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Cake formation before ...



... and after modification

References



Filter Types

- vacuum disc filters
- vacuum drum filters
- vacuum pan filters
- press filter tower
- sieve belt press
- pressure candle filter
- horizontal leaf filter
- vertical leaf filter

...

References



Products

- | | |
|-----------------------|-------------------------|
| - FGD gypsum | - Al-Hydrate |
| - pulp & paper fibres | - coal |
| - colour pigments | - copper concentrates |
| - potassium chloride | - iron ore concentrates |
| - sodium bicarbonate | - lead concentrates |
| - sodium chloride | - pyrite paste |
| - starch | - red mud |
| - titanium dioxide | - zinc sulphate |
| - ... | - ... |



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