

Design and Operation of Pan Filters at the Physical Cake Moisture Limit

Jürgen Hahn

Sales Director, BOKELA GmbH, Karlsruhe, Germany

Corresponding author: jhahn@bokela.com

Abstract



Pan filters are operated in alumina refineries for filtration and washing of Alumina Hydrate product. This vacuum rotary filter type is particularly suitable for filtration and washing of coarse particles. The main target of this separation duty is to achieve a filter cake that is dry and as free of soda as far as possible. BOKELA pan filters are operated in various alumina refineries where other OEMs' pan filters of the latest design are also operated. In such cases both technologies are processing identical feed slurries and are configured to satisfy the operator's demand for achieving soda-free product with minimum moisture content at maximum solids throughput with maximum availability. The paper discusses and reports on the pros and cons of these filters with respect to specific solids performance, wash liquor demand (cake wash efficiency and steam demand). Also examined is how filtrate solids can be minimised, and the interval between two wash cycles maximised.

Keywords: Product filtration, product washing, deliquoring, pan filter.

1. Product Filtration on Pan Filters

One of the last process steps in alumina production is the deliquoring and washing of the product hydrate. It is the aim of this filtration step to remove the liquor and the caustic which is a contaminant for the valuable alumina hydrate product. This process step is a basic prerequisite for achieving clean hydrate and a good product quality.

Filtration and washing of alumina hydrate product is usually performed on pan filters. With its horizontally arranged filtration area, the pan filter type is well adapted to the filtration and washing of coarse particles. The main objective of this operation is to achieve a filter cake that is free of leachable soda and as dry as possible. The single stage process of feeding the precipitation product (as first stage hydrocyclone underflow) directly onto a pan filter is a wide spread process design for alumina hydrate product washing. Another widespread process design is the use of disc filters for product deliquoring followed by washing of the discharged and re-slurried solids on pan filters. Product filtration on pan filters includes a two-step counter-current wash, although three counter-current wash stages can also be realised, and optional steaming of the filter cake.

The standard pan filter consists of 20 filter cells with a planar base and a flat bottom with a slope towards the filter centre. During filter operation, each filter cell passes through the separate wash stages of the pan filter. The control head in the pan centre divides the filtrate flows from the filtration zones to either two or three receiver vessels, where the liquid is separated from air. For optimal operation each cell should be completely empty before passing on to the following wash zone, to avoid direction of higher caustic liquors to clean wash areas/filtrates.

Pan filters have been operated for decades and in the last years have undergone various design modernization measures to improve operation and process performance. In modern Alumina refineries, pan filters are often operated at the physical limit of cake moisture removal.

2. BOKELA Pan Filter Design

In recent years BOKELA has steadily modernized the design of pan filters and introduced innovative features such as the forced feeding system, fast flow cells, a pre-separation control head with up to five process zones, an effective heel re-slurry system and BOKELA FrameTrak - a completely new filter cloth fixing system. These innovations have significantly improved capacity, operation and maintenance of pan filters [1].

The special design of the BOKELA pan filter (Figure 1) consists of the following features:

- The Forced Feeding System ensures a homogenous cake thickness over the whole filter surface by even slurry distribution. The motorized slurry distributor supplies equal slurry streams to equal areas on the filter surface.
- The cake wash system ensures an equal wash water distribution onto the filter cake. The free flow construction over a set of weirs distributes a homogenous water flow which ensures an equal washing of the cake and prevents the blocking which occurs with nozzles. Counter current washing on each pan filter minimizes wash water consumption.

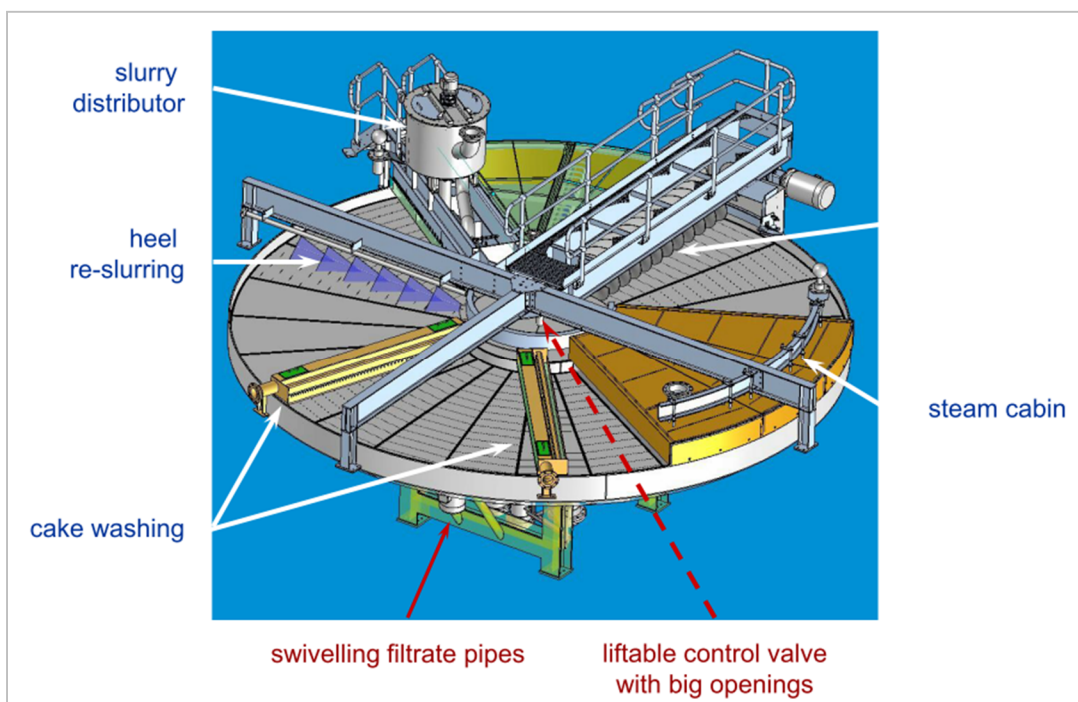


Figure 1. General arrangement of a BOKELA pan filter.

- A Pre-Separation Control Head provides for sharp splitting and fast drain of the filtrates and pre-separation of liquid and air. Thorough engineering of the main part of the hydraulic system minimizes scaling and leakages, and results in significantly lower pressure losses in the filtrate system.

The target of the modifications was:

- filter capacity increase of 30 %
- reduction in soluble soda below 0.02 % (no soda peaks)

The results after filter modification as presented in table 2 show that the optimized filter now runs with 60% higher throughput and lower soda content. The targets of the client were more than achieved for both solids throughput and for soda content. The cost for these optimization measures were only about 25% of the total cost of a new filter investment.

1. Acknowledgements

The authors would like to thank the clients for trusting in BOKELA's solid/liquid separation technologies and engineering services.

2. References

1. J. Hahn, R. Bott, T. Langeloh, Advances in hydrate filtration”, *Travaux No 31*. ICSOBA Conference 2013, Krasnoyarsk, Russia.