# Three Steps to Improved Filtration Performance and Reduced Cost in Times of Limited Capital

**Jurgen Hahn[1] and Christelle Viet[2]**
1. Director Global Sales,
2. Senior Sales Engineer
BOKELA GmbH, Karlsruhe, Germany
Corresponding author: jhahn@bokela.com



**Abstract**

The optimization of the existing filters in an alumina refinery is a very economically attractive alternative to investment in new equipment, particularly in times of where available capital is limited. With the BOKELA filter revamping program, insufficient filter performance, excessive maintenance and the high operating costs of existing filters can be corrected quickly and at a reasonable price. The benefits of filter revamping include: increased filtration capacity by between 30 % to 135 % (as per assessment), improved cake moistures, improved filter operation, reduced maintenance, and a typical cost range between 20% to 40% of the cost of a new filter. The BOKELA filter revamping program comprises three steps: Diagnostic, Engineering and Realization. The program starts with laboratory and/or plant trials performed by BOKELA to assess the potential to increase filter capacity and to make proposals for modifications to the filter design. If the test results and the proposed design modifications are suitably attractive, the revamping project typically starts with the upgrading of a first filter in a step by step collaborative process involving BOKELA and the equipment owner.

**Keywords:** disc filter; pan filter; drum filter; filter revamping; filter capacity, filter cost reduction.

## 1. New Investment or Revamping?

The first step in choosing between a new filter installation and an existing filter plant optimisation is to verify the current performance and capability of the existing plant, and its improvement potential.

In many cases the revamping of running filtration plants improves the filter capability to such an extent that the required targets can be achieved as effectively and reliably as with new equipment. This requires that the revamping is informed by deep know-how and experience concerning the filtration process and filtration equipment. The upgrading of operating filter plants is realised much quicker and impairs the whole production process significantly less than the planning and implementation of new equipment. Capacity increases of 30 % up to 135 % can be achieved by revamping.

Investing in new equipment usually means a prolonged multistage procedure including;

- a time consuming pre-engineering phase to specify and pre-plan rebuilding measures, to work out a specification of the new technology, etc.
- technology screening to identify the best suited technology available on the market, which often demands the performance of tests or trials
- OEM screening, calling for bids, to compare and evaluate the competitive offers with respect to technical and economic criteria, and to carry out negotiations

- complex engineering, since new equipment often requires modifications to the filter building or even a new building, both of which means comprehensive modifications to, or installation of completely new, piping, wiring, instruments, etc.
- potential for schedule slip in the installation of the new equipment through unforeseen delays, e. g. delayed delivery of one or more components
- overcoming of acceptance barriers by the operators and maintenance staff who also need a training and familiarisation period (with increased risk of malfunctions) to learn how to operate the new equipment well
- costs for additional peripheral equipment
- Applications and authorisations for financing the new investment.

Compared to this comprehensive and administratively heavy procedure, revamping existing filter equipment proceeds much more simply and directly, as numerous revamping projects have proven. The modernisation and upgrading measures of a filter revamping project normally cause less or no changes to the building, and the repercussions on the periphery of the filter plant are significantly reduced. The existing equipment is upgraded at the site and stays in place, so, the effort of pre-engineering, logistical planning, inquiring and ordering of supplementary peripheral equipment etc. are minimal compared to the installation of new equipment.

In summary, the main advantages of a revamping process are;

- reduced planning and engineering effort
- compressed-schedule, fast realisation
- step-by-step engineering
- involvement of the owner's know-how and plant technical knowledge
- use of well-understood and operator-accepted equipment
- minimal costs for peripheral & supplementary equipment
- coverage of costs by the maintenance budget

The optimisation of existing processes and equipment however, demands a fundamental understanding of the dependencies between the product to be filtered, the applied filtration process and the filter equipment used. Only substantial filtration know-how and expertise and the understanding of these dependencies allow the engineering of optimal solutions, and finally guarantee the improved performance. Against this background BOKELA has developed a successful concept to de-bottleneck and revamp existing filtration plants.

## 2. BOKELA Filter revamping programme - filter optimisation in three steps

On the basis of numerous filter revamping projects in nearly all industries, BOKELA has developed a special program for filter optimisation in three steps. The three phases allows rigorous cost control, involvement of own plant technology and minimising risk. It is carried out with the know-how and the experience gained by upgrading of the drum, belt, disc and plate filters, filter presses, Niagara filters, Kelly filters etc. of nearly all OEMs.

## 4.2 Revamping of pan filters for product filtration

In an Alumina refinery, 3 pan filters of 50 m² filtration area each are operated for separation and washing of Al-hydrate product. To ensure that these filters can handle the increased plant capacity BOKELA was requested to optimize all three (3) pan filters by a filter revamping.

Targets of the modifications were:

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

Laboratory tests and plant trials indicated an improvement potential of 40 % increased filter capacity with a soluble soda level constant below 0.02 %. Accordingly, the following modifications were proposed by BOKELA and carried out after approval of the customer:

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

The performance data before and after modifications are shown in table 3.

**Table 3. Performance data of pan filters before and after modifications**

| performance data | | before | after modifications |
|---|---|---|---|
| slurry feed | [m³/h] | 130 | 185 |
| soluble soda content | [wt.-%] | 0.03 | 0.02 |

The data in Table 3 show that the targeted improvements could be achieved with the modified filters. The throughput capacity even increased by some 42%.

**Conclusion**

The BOKELA filter revamping programme enables quick optimization of existing filters at a reasonable price. Filter revamping is a very economically attractive alternative to investment in new equipment. Increasing the filter capacity is not the only benefit of filter re-vamping, an optimised filter design also improves the product quality and reduces operating and maintenance costs. Furthermore, an optimised filter design increases the filter flexibility and filter availability and leads to a significant improvement in filter operational control. Last but not least, the operators can work with familiar equipment.