Paste 2026 – AB Fourie, M Horta, M Oliveira & S Wilson (eds)

doi:10.36487/ACG_repo/2655_41

Big, bigger, high-performance disc filter: from idea to production

Jürgen Hahn [a,*], Timo Dobler [a], Halit Kilic [a]

[a] *BOKELA GmbH, Germany*

Abstract

The processing of minerals and ores produces tailings as an unavoidable residue. These tailings are either deposited in tailings storage facilities (TSF) or used as backfill in underground operations. In both cases, filtration technology plays an important role. Filtration technology in TSF operations is crucial due to the increasing sensitivity to safety, environment, real estate, water consumption and the cost for mine closure. In mine backfill, filtration technology helps to minimise the amount of cement/binder required, which is the major driver of operating cost.

Similar to many industries, the capacity per production line of minerals and ore processing is increasing from project to project. The major reason is that the cost for equipment with double capacity is just 50–70% more (not double). Therefore, the total capital expenditure (capex) for bigger projects is decreasing per tonne of product, and projects become more feasible with a higher chance of realisation.

The paper presents the four-year success story of the new high-performance disc filter giant BoVac Disc XL352 from the first idea to the commissioning and operation of the first unit in a European backfill plant. It will explain the design criteria to make sure that the upsizing is ensuring a reliable operation with regard to cake formation, solids distribution, cake moisture and complete cake discharge. It will highlight hurdles and the technical solutions developed to address the maintenance requirement of this filter size. Finally, the commissioning activities will be listed and discussed. The paper concludes with a comparison of the production results with the lab testing that was done to size the filter and to provide process guarantee figures.

Keywords: *tailings filtration, disc filter, high-performance disc filter, tailings storage facility, backfill, tailings stacking, moisture, filter press, capex, opex*

1 Introduction

The responsible treatment of tailings is expected from all mining operations. Only such a behaviour can minimise safety hazards and environmental risks, as well as consumption and real estate. One option for responsible treatment is filtration with tailings being stacked in a tailings storage facility (TSF) (Inci et al. 2023). For this treatment, it is important to dewater the tailings to a moisture level that ensures that liquefaction does not occur on the conveyor belt enroute to the TSF. In addition, the moisture must be low enough to meet all geotechnical requirements for stable and safe stacking (McKenna 2023). The moisture required for this is typically in the range of 13–17% w/w, with an average of 15% w/w. This is a moisture that can be reached with filter presses (pressure filtration) in most cases. However, many studies and projects, like Toquepala in Peru, have shown that filtration of tailings with filter presses is quite often the most expensive solution in terms of operational expenditure (opex) and capital expenditure (capex) compared to filtration with high-performance disc filters. Therefore, having alternative filtration equipment that would get similar moistures at lower cost will be beneficial to the industry.

[*] Corresponding author. Email address: jhahn@bokela.com

2 High-performance vacuum disc filters

In the 1980s, Werner Stahl (Stahl 1986) was part of the team that commercialised the so-called "big diameter disc filters". These filters had a disc diameter of 5.3 m in comparison to the standard design disc filters with a diameter of no more than 3.8 m. Furthermore, the number of segments was increased from typically 12 segments per disc to 30 segments per disc. These "big diameter" disc filters were mainly used in alumina refineries for the filtration of Al-hydrate as shown in Figure 1. The fines portion of this hydrate was returned to precipitation and the coarse portion was washed and calcined to alumina (Al_2O_3). This new design of disc filters was the consequent use of theoretical filtration know-how in the redesign of disc filters. This can be summarised in a simple guideline – increase the diameter of the disc rather than the number of discs. This improved big diameter design was using a maximum of 3 discs with a total filtration area of 112 m². Due to the high rotational speed of up to 5 rpm and the very efficient cake discharge, they achieved 50% more solids throughput compared to 200 m² disc filters with 10 discs and 3.8 m disc diameter. Subsequently, they were used in almost all new alumina projects in the following 2 decades.

Figure 1 Big diameter disc filter in an alumina refinery

The next development step happened in the early 2000s. The internal filtrate piping was changed from individual circular piping for each segment to a single pipe of trapezoidal shape which allowed for the use of a fourth disc. Additionally, the disc diameter was increased to 5.6 m. This resulted in a total filtration area of 176 m². Again, this design was used for the first time in an alumina refinery in Guinea, Africa. The first filter of this design was filtering Al-hydrate coarse seed and was replacing 3 standard design disc filters with a 200 m² filtration area, 10 discs and a 3.8 m disc diameter. The high-performance disc filter, as shown in Figure 2, was born and made its way into many alumina refineries in the last 25 years.

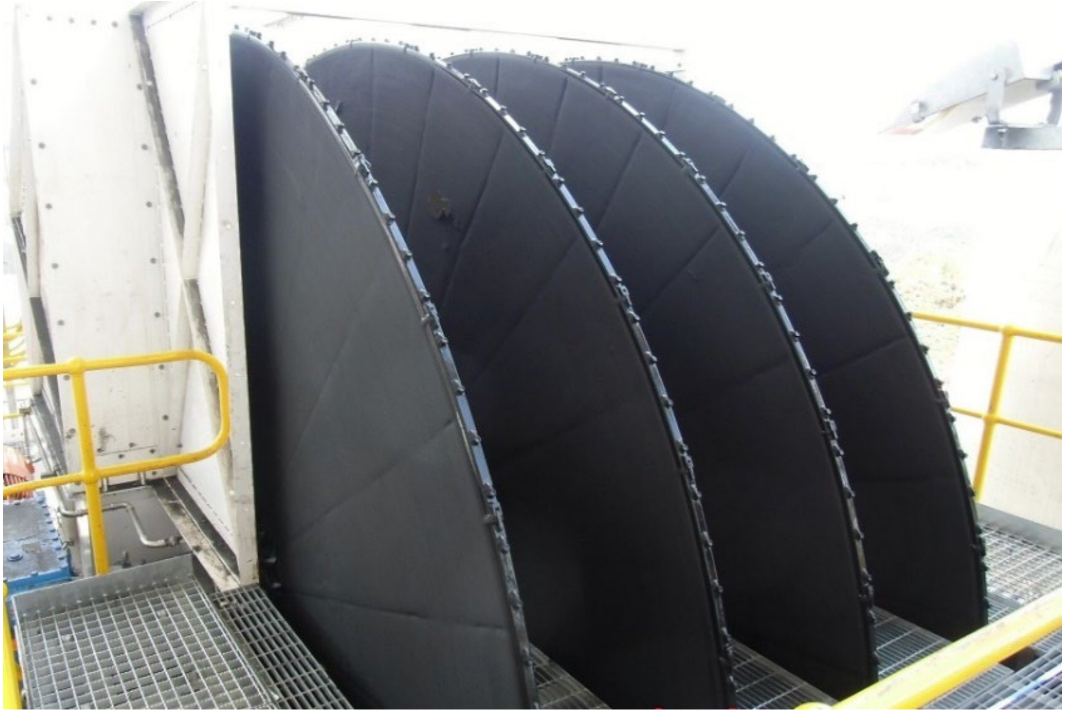


Figure 2 A high-performance vacuum disc filter

The major characteristics of the high-performance vacuum disc filter design are:

- diameter of disc to be 5.6 m
- 50% slurry level – half of the disc can be used for cake formation
- maximum number of discs to be 4
- maximum rotational speed to be 4–6 rpm
- pre-separation control head
- trapezoidal shape of filtrate pipes
- joint single trough design.

These design features were targeting maximum solids throughput. With 50% slurry level in the bath/trough as shown in Figure 3, half of the filtration area is submerged in the slurry and can be used for cake formation while the other half remains for cake drying (Hahn 2023).

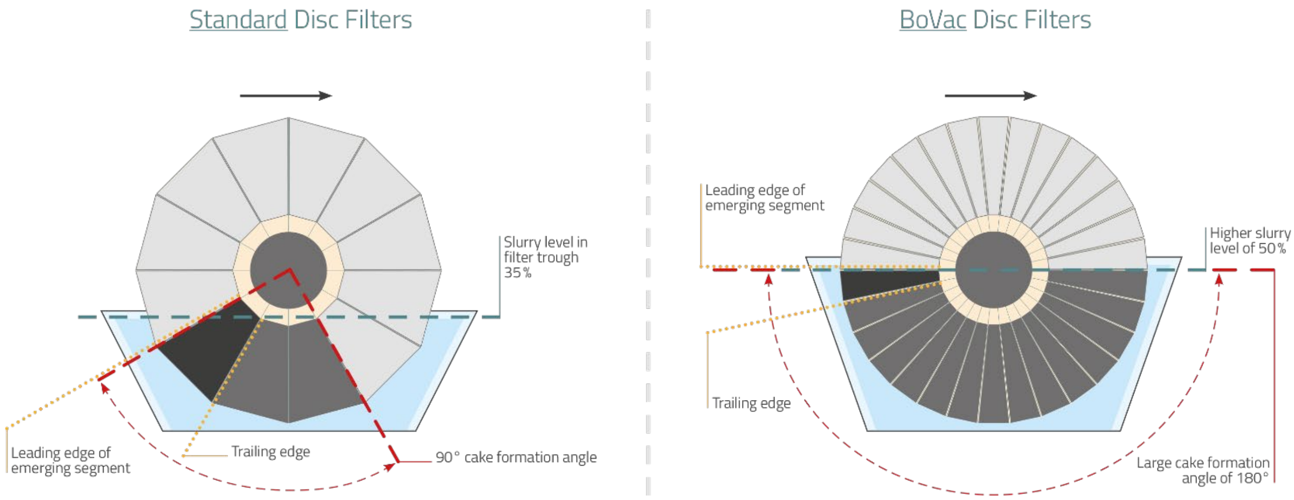


Figure 3 Slurry level and cake formation angle for a standard and a high-performance disc filter (BoVac) (Hahn 2023)

In addition, the cake became more homogenous. With the standard disc filter design, the angle for cake formation varies from 35° at the leading edge inner radius to 105° at the trailing edge outer radius. This results in a 73% thicker cake at the trailing edge outer radius as can be seen in Figure 4. Subsequently, the resistance increases, less air is going through this part of the cake and the moisture content is higher.

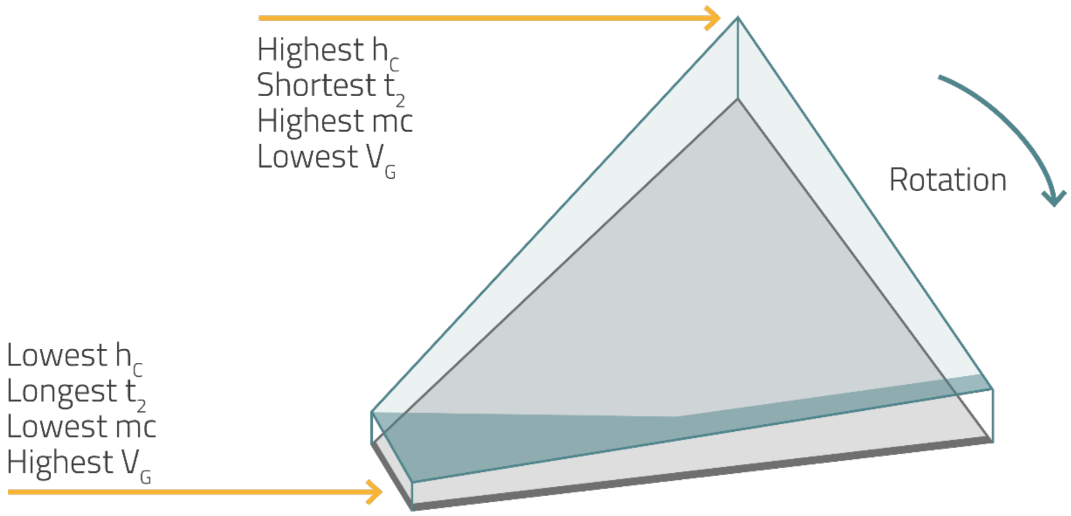


Figure 4 Cake thickness on a segment of a standard disc filter

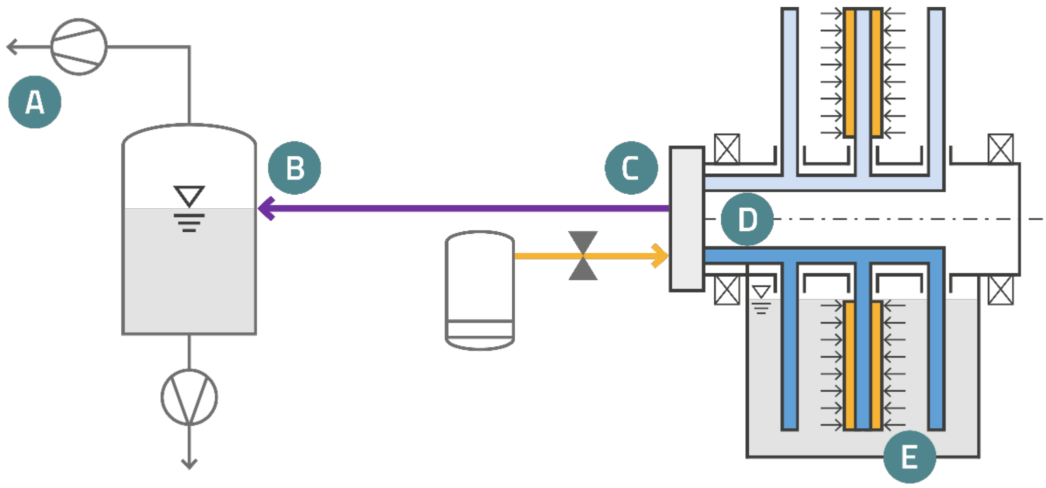
In comparison, the high-performance disc filter has no differences in cake thickness between the inner radius and the outer radius as they emerge from the slurry simultaneously. Furthermore, the high-performance disc filter has 30 segments per disc which results in a segment angle of only 12°, while the standard disc filters have 30 or 36°. With the 12° segment angle, the difference in cake thickness between the trailing edge and the leading edge is only 4%. The difference in cake thickness and moisture is almost undetectable.

Furthermore, design features such as the following minimise pressure losses inside of the high-performance disc filters:

- trapezoidal filtrate pipes (more cross-section area = less flow velocity)
- pre-separation control heads (minimising two-phase flow which creates high pressure losses)
- highly perforated filter segments (minimum pressure loss for liquid and air to pass)
- online cloth wash (reduces cloth blinding and thus minimises pressure loss in the filter cloth).

Trapezoidal filtrate pipes allow for up to 3 times the cross-section area compared to circular pipes. This reduces the flow velocity, which is important because the pressure loss increases with the square of the flow velocity. Thus, the triple cross-section area results in a third of velocity and a ninth of pressure loss compared to that of circular pipes.

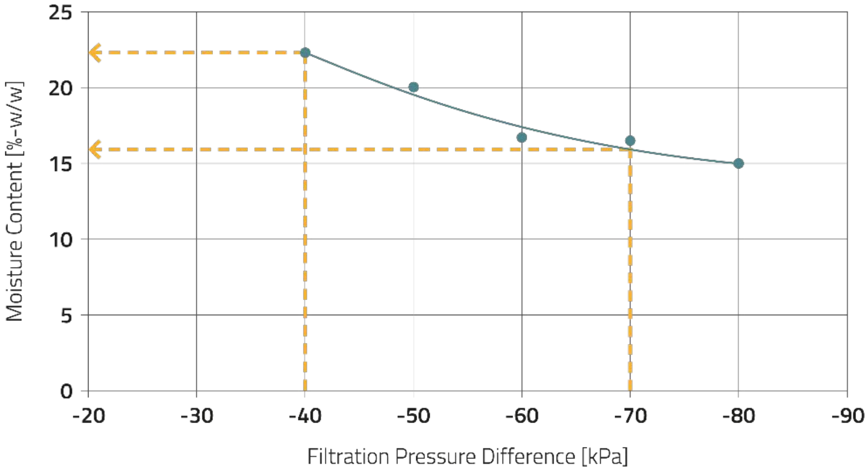
The pre-separation control head separates about 90% of liquid and air already. This is crucial as two-phase flow can generate a pressure loss up to 10 times greater when compared to a single-phase flow. The real impact of these design features on the reduction of pressure losses can be seen in Figure 5.



	A	B	C	D	E
Vacuum at	Vacuum Pump	Receiver Inlet	Control Head	Segment Outlet	Filter Cloth
Standard	-80 kPa	-70 ... -75 kPa	-55 ... -65 kPa	-45 ... -55 kPa	-30 ... -50 kPa
High-Performance	-80 kPa	-78 ... -79 kPa	-74 ... -78 kPa	-70 ... -76 kPa	-65 ... -75 kPa

Figure 5 Pressure drop on standard disc filters and on high-performance vacuum disc filters

Vacuum measurements are an integral part of filter retrofitting projects. Standard design disc filters running in alumina, coal or tailings operations have been retrofitted using high-performance design features such as highly perforated segments, trapezoidal filtrate pipes, pre-separation control head and cloth wash. The original vacuum pump with a suction pressure of −80 kPa was used with no changes. On more than 90% of the filters subject to retrofit, the vacuum measurement before the retrofit showed a pressure difference of only −30 to −50 kPa at the filter cake (with some worse than this). After the retrofit, with all the high-performance design parts being installed, the pressure difference at the cake increased to −65 to −75 kPa. This subsequently has a major impact on cake moisture. Figure 6 shows the moisture of a tailings sample that was filtered at different vacuum levels.



Feed Temperature	20°C
Dewatering Ratio	1
Flocculant Dosage	0 g/t
Feed Solids Content	50%-w/w
Cake Thickness	10 mm

Figure 6 Moisture versus active pressure difference at the filter cake

Due to the pressure losses indicated above, the acting pressure difference at the filter cake of a standard vacuum disc filter is about −40 kPa, which correlates with a moisture of 22.5% w/w from the above tests conducted. Due to the reduced pressure losses of the high-performance vacuum disc filters, about −70 kPa pressure difference is reached at the cake and thus a moisture of 16.5% w/w was achieved. This is 6% w/w points less moisture than the standard design disc filters. Therefore, it is recommended to consider high-performance vacuum disc filters as an option for tailings filtration for dry stacking.

Apart from the reduction in moisture, the high-performance design with reduced pressure losses results in a high solids throughput as well. The solids throughput of a rotational filter can be determined using the following equation (Bott 1985):

$$M_s = m_s \times A_f = \rho_s \,(1-\varepsilon) \times \sqrt{\frac{2}{\eta_L r_C}} \times \sqrt{\kappa} \times \sqrt{\Delta p} \times \sqrt{\frac{n}{60}} \times \sqrt{\frac{\alpha_1}{360°}} \times A_f \times 3{,}600 \qquad (1)$$

where:

M_s = solids throughput of the filter (on dry solids basis) in kg/h

m_s = specific solids throughput (on dry solids basis) per 1 m² filtration area in kg/m²/h

A_f = filtration area of the filter in m²

ρ_s = specific gravity of the solids in the slurry in kg/m³

ε = porosity of the filter cake in vol/vol

η_L = dynamic viscosity of the liquid in the slurry in kg/m/s

r_C = relative resistance of the filter cake in 1/m²

κ = solids content coefficient defined as $k = c_v / (1 - \varepsilon - c_v)$

c_v = %volume/volume of the solids in the slurry

Δp = filtration pressure difference at the filter cake in kg/m/s²

n = rotational speed of the filter in 1/min

α_1 = cake formation angle in degrees.

Table 1 highlights the parameters to be used in Equation 1 for both disc filter types.

Table 1 Differences between a standard vacuum disc filter and a high-performance disc filter

	Unit	Standard disc filter	High-performance disc filter
Maximum cake formation angle	°	90	180
Pressure difference at the cake	kPa	40	70
Typical rotational speed range	rpm	0.2–1.0	1.0–2.5

With a given maximum cake formation angle of 90° and a typical pressure difference of −40 kPa at the cake, the standard disc filter reaches its maximum solids throughput at its maximum rotational speed of 1.0 rpm. This solids throughput is now considered as 100% for comparison with the high-performance design. According to filtration theory, the pressure difference at the filter cake, the rotational speed of the filter and the cake formation angle all increase the solids throughput in relation to their square root.

If the values of Table 1 for the high-performance vacuum disc filter design are used, the maximum solids throughput of the high-performance vacuum disc filter design will be 296% compared to the 100% of the standard vacuum disc filter design as shown in Figure 7. In other words, a project needs only a third of the filtration area if high-performance vacuum disc filters are used instead of standard vacuum disc filters.

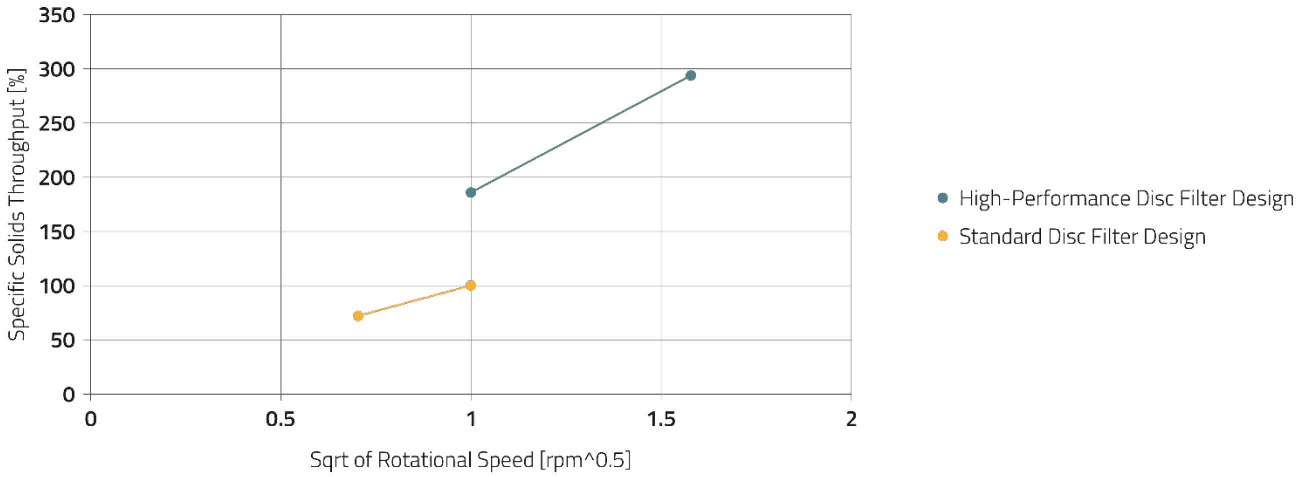


Figure 7 Specific solids throughput in % versus rotational speed

All the above design features were suitable for fast-filtering products like Al-hydrate or products with a combination of high liquid flow and high airflow like coal. But how will this design help the filtration of tailings which are typically slower filtering and have very little or even no airflow through the cake?

The internals of the high-performance disc filters were designed to allow for:

- specific solids throughput up to 15 t/m²/h
- specific liquid throughput of up to 10 m³/m²/h
- specific airflow of up to 150 m³/m²/h.

Tailings do not typically reach the above design parameters and, therefore, it was a consequent decision to keep the internals of the high-performance disc filter design as they are. An increase of capacity with tailings can only be reached with an increase in filtration area. Therefore, in a first step, the length of each segment was increased by 400 mm to a length of 2.5 m. This was considered the maximum length that can be handled without using a crane. This resulted in an additional area of 33%.

The second step was the addition of 2 more discs to a maximum of 6 discs. This could be safely done, because the maximum speed was reduced to 2 rpm (Kern & Stahl 1986). If the original design can completely discharge the cake at a speed of 4 rpm, then this design can discharge the double area at half of the speed still safely. Fluid dynamics simulation was used to confirm the flow dynamics inside the pipes and contributed further to the sound engineering of the XL352 filter.

Finally, the distance between the discs was reduced from 700 to 500 mm. This could be done because the high-performance disc filter has permanent walkways between the discs, as can be seen in Figure 2. Therefore, the access for cloth and segment change is already satisfactory. However, the main reason for the reduction was to ensure that the increase of the total length of the shaft was less than 10% in order to avoid significant reinforcement. Figure 8 shows the first filter after the shop assembly and the dry test run.

Figure 8 XL352 filter after the shop assembly and the dry test run

In addition, small cake thicknesses of 4–25 mm are expected in tailing operations compared to cake thickness of up to 80 mm in Al-hydrate filtration. This reduces the operational load and torque. All of the above finally resulted in a small increase in the footprint of the XL352 filter compared to the L176 filter (previously the biggest high-performance disc filter size), as Figure 9 shows.

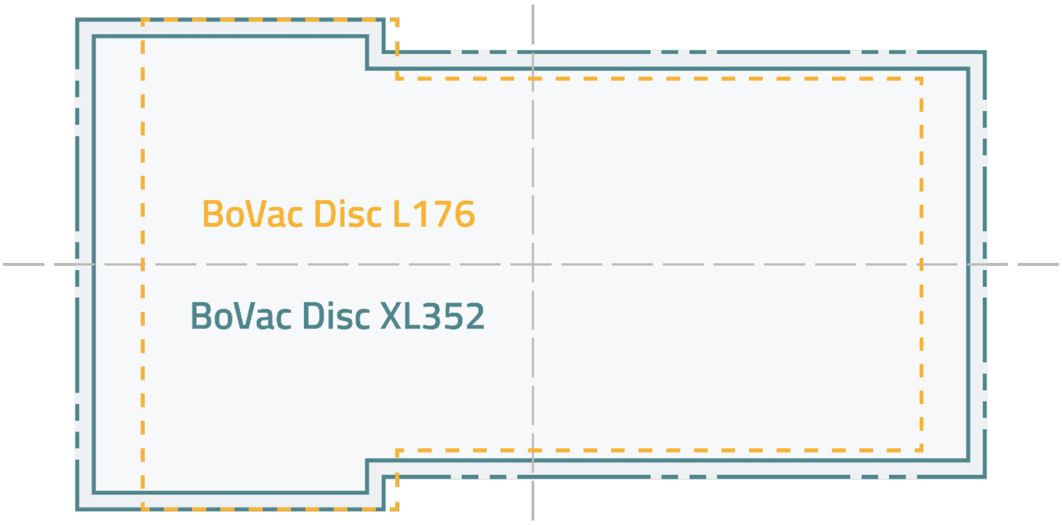


Figure 9 Footprint of the L176 filter and XL352 filter

With small changes to the steel structure, an L176 filter can be replaced with an XL352 filter. This means a doubling of the performance can be achieved with a small investment.

3 First project and its challenges

The first order for an XL352 disc filter came from a copper and zinc mine in Portugal. This mine is either producing zinc concentrate or copper concentrate, depending on market price. It is an underground mine with a backfill plant. The tailings feeding the backfill plant are thickened with hydrocyclones. The coarse underflow is feeding a 14-disc standard vacuum disc filter. The fines overflow is pumped to the tailings dam.

In 2023, the decision was made to double the production of the plant. This included the parallel processing of copper and zinc concentrate, and building a second backfill plant. Furthermore, the hydrocyclones were planned to be decommissioned and a thickener was to be used to increase the solids content prior to filtration. This meant that the filters would get more fines compared to the existing feed of the backfill plant. It was expected that the D_{50} will drop to about 10 µm because of the decommissioning of the cyclones. Furthermore, there were calculations indicating that the tailings from the processing plant may not be enough for the backfill requirement. Therefore, parts of the existing tailings dam would be reclaimed and added to the feed of the backfill plant. This resulted in challenge 1 for the filter which is the range of different feed materials the filter has to cope with. In the extreme, it can be either:

- 100% tailings from copper concentrate production
- 100% tailings from zinc concentrate production
- a mix of the 2 above
- any mix plus a portion of dredged tailings from the dam.

Based on the above, the expected maximum filtration rate of a vacuum disc filter with the design as used in the existing backfill plant was 800 kg/m²/h. For the new tailings capacity of 300 t/h, this would be a minimum filtration area of 375 m² or one more 14-disc filter of the existing design.

A sample of the new tailings composition was not available. Therefore, the sizing of the high-performance disc filter was done on the principles of the design improvements as described in the previous section. This means that the high-performance filter design with double cake formation angle/area would run at the same cake thickness as the standard design. At the same cake thickness, the high-performance filter would run at double speed and thus require only half of the filtration area which would be at least 188 m². The next size for this area requirement was the XL352 with a 352 m² filtration area. This sizing includes a lot of spare capacity that might be required depending on the many uncertainties as described above.

3.1 Further issues and challenges to deal with

Two operational issues with the existing filter were reported prior to the filter sizing and the final decision for the XL352. First, there are sometimes coarse particles with a >1 mm diameter in the filter feed that directly settle in the trough/bath of the existing filter. Second, every now and then there are cracks appearing on the cake of the existing filter. These cracks allow for a bypass of air into the filtrate system and reduce the acting vacuum. As a consequence, the cake thickness deteriorates, the solids throughput reduces, the cake moisture increases, the cake discharge is incomplete, and the solids throughput significantly decrease.

3.2 Coarse particles >1 mm

The design of the high-performance disc filter trough differs completely from the standard disc filter trough design, as Figure 10 shows.

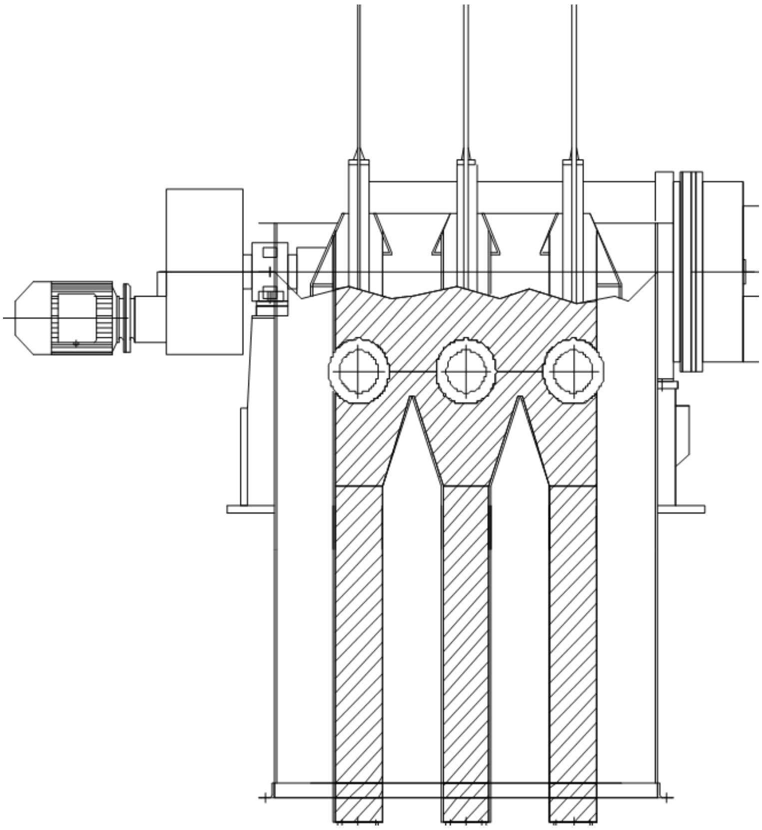


Figure 10 Joint single trough design of the high-performance disc filter

Each disc is positioned in a single trough compartment with a width of no more than 130 mm. The movement of the disc gives a good agitation effect which is why this filter design does not need an agitator in the trough. This system has been successfully used for 25 years in all applications with solids specific gravity of up to 5 t/m³. Over time, there has been a small layer of solids building up in the 50 mm gap between the disc and the trough bottom. This layer gets released once a day by opening the dump valve for 3–4 seconds before it gets hard. Therefore, it was expected that even the >1 mm particles will not cause issues during the filter operation.

3.3 Crack formation with fine tailings

Crack formation happens mainly with small particles of <20 µm. The surface charges of these particles can lead to situations in which there is no particle contact in the cake anymore due to the electrical repulsion. On the existing standard disc filter, cracks could already be seen. Furthermore, the filter feed was expected to become even finer which increases the risk of crack formation.

What is the mechanism of crack formation? The cake formation ends when the cake emerges from the slurry and the cake dewatering starts. In that moment, the cake is fully saturated with filtrate. All void volume between the particles is filled with filtrate and the saturation is 100%. Due to the applied vacuum, air is pulled into the voids and replaces filtrate. This process finally forms filtrate bridges between the particles. The surface tension of the liquid is pulling the particles together while the surface charge is keeping the particles apart, but there is a particle pulling, and sooner or later, one liquid bridge will break and a crack starts forming. According to the filtration science literature (Anlauf et al. 1985), the tension between the particles reaches a maximum at a saturation of 85% at which the probability for cack formation is highest. Therefore, it is even more likely that in future the crack formation will happen even more frequently because the tailings are expected to become finer.

The high-performance filter design was historically already adapted to address this specific issue about 10 years ago when the first high-performance disc filter was installed in a copper and gold mine. At the beginning of the cake dewatering, the saturation is 100% and there is little risk of crack formation. To reach the 85% saturation, it takes a time equal to about 50% of the cake formation time. As cake formation time and cake dewatering/dry time are equal on a high-performance disc filter, the first half of the cake dewatering area has very little risk of crack formation. However, the second half of the dewatering area has a high risk of crack formation. Therefore, the control head of a high-performance disc filter has 2 separate ports for cake dewatering/drying, as Figure 11 shows.

Figure 11 Two dewatering ports on a high-performance disc filter separating tailings

The airflow of the second port connected to the high-risk area of crack formation can be throttled with a valve. If cracks appear in the cake and air is bypassing the cake, then the amount of air going to the filtrate separator is rapidly increasing and the vacuum is deteriorating because vacuum pumps are volumetric pumps. The pressure cell on the filtrate separator will detect the vacuum reduction. If the vacuum is dropping below the minimum set point, the control will start closing the valve to keep the vacuum at the given minimum set point. This system ensures the minimum required vacuum for the filter to keep the nominal solids throughput. This system does not require operator input and reacts on cracks whenever they appear.

Therefore, the production of the filter is safe with this system, even in situations where the filter feed changes and cracks appear more often and at unexpected times and under unexpected conditions.

4 Samples tested prior to commissioning of the first filter

Before the manufacturing of the filter was finished, there were samples made available for lab testing. The determination of the particle size distribution confirmed the movement to more fines, as Table 2 shows.

Table 2 Updated particle size distribution for copper and zinc tailings

	Unit	D_{10}	D_{50}	D_{90}
Copper concentrate tailings	µm	2.0	10.1	53.4
Zinc concentrate tailings	µm	1.8	8.5	31.4

Filtration tests were conducted with both samples to confirm the filter sizing. The vacuum used was −70 kPa because a standard vacuum pump with a suction pressure of 20 kPa was intended to be used. Furthermore, the plant elevation was only a few hundred metres above sea level with an ambient pressure of >96 kPa, and that allows for a pressure loss of 5–10 kPa in the filter (see Section 2).

The tests showed that the XL352 filter would treat the 300 t/h of copper tailings at a rotational speed of 1.1 rpm with a cake thickness of about 8 mm and a cake moisture of 21.5% w/w. The filter still has a spare capacity of another 60 t/h if pushed to the maximum speed with the minimum permitted cake thickness.

With the zinc tailings, the XL352 filter would also run at a rotational speed of 1.1 rpm; however, the cake thickness would be just 6.5 mm with a cake moisture of 17.5% w/w. In this case, there is almost no spare capacity as the cake thickness does not allow for significant further increase of the rotational speed. However, with both tailings, there was no need for additional flocculant dosage. This is another option to increase the solids throughput; although additional flocculant typically increases the moisture as well. However, in case of the zinc tailings, this is not an issue, as the 17.5% w/w moisture is still by far lower than the maximum permitted moisture of 22% w/w.

The lab tests further confirmed the appearance of cracks. Almost all tests did show crack formation with resulting air bypass. Therefore, it is essential to have the special design of the control head in combination with the control system to minimise the negative effect of crack formation and limit the air bypass to an acceptable level, as shown in Section 3.

All the design changes have already proven their effectiveness on the BoVac Disc L176 filters. The commissioning of the first BoVac Disc XL352 started in November 2025 and shall confirm the trade-off between increase in filtration area and limitation of the rotational speed. If the commissioning confirms the performance of this filter size, this can be used as a duplicate design for other backfill plants, allowing a significant size reduction and thus a significant reduction in capex.

5 First feedback from commissioning

Commissioning finally started in December 2025 with the first slurry on the filter. Unfortunately, this first run had to be stopped after some minutes, because the deflection of the trough wall caused by the hydrostatic pressure of the slurry inside was more than calculated and was moving the cam disc so much that the proximity switch could not detect. The snap-blow valve did not get a signal and did not open, and the filter cake did not come off. The commissioning was stopped, the deflection was recalculated and additional re-enforcement profiles were welded to the trough. This was a simple fix of the issue. However, it did delay the commissioning to the beginning of February 2026.

On the first day of commissioning in February 2026, the filter was operated for periods of about 10–20 minutes. The cake discharge was only 50–70%, with a typical discharge pressure of 25–35 kPa. The next day, the pressure was increased to 50–60 kPa and the cake discharge improved to >95% – issue fixed.

On the second day of commissioning, the filter was running at a speed of 0.5–1.0 rpm. The solids throughput at that speed was already 170–250 t/h. The performance and the speed could not be increased, because this was the maximum feed to the filter possible on that day. Therefore, it is expected that at a rotational speed of 1.5 rpm the solids throughput will exceed the 300 t/h required by the project. It is intended to present a follow up paper at Paste 2027 to show the outcomes of the unit versus the design.

6 Outlook

The development of the BoVac Disc XL352 is in line with the worldwide trend of increasing equipment sizes and increasing capacities of production lines. It is important to incorporate the theoretical know-how, as well as to calculate and identify the bottlenecks that are going to appear with the upsizing. Only then the double size will give the double performance or get at least close to it. If this target can be realised, the reduced manufacturing cost of the large unit will result in a cost reduction per tonne of tailings filtered. Reaching this final target will lead to a successful commercialisation of the new filter size. Therefore, this XL352 may not be the end of the development. But it surely is the biggest high-performance filter in tailings operations at the moment and for the next few years, with a very good prospect to be lower in opex and capex in backfill plants compared to all other vacuum filters on the market.

References

Anlauf, H, Bott, R, Stahl, W & Krebber, A 1985, 'Die bildung von schrumpfrissen im filterkuchen bei der entwässerung feinkörniger erze (The formation of shrinkage cracks in the filter cake during the dewatering of fine-grained ores)', *Aufbereitungstechnik* (Processing Technology), vol. 26, pp. 188–196.

Bott, R 1985, *Zur Kontinuierlichen Druckfiltration (About Continuous Pressure Filtration)*, PhD thesis, Institute of Mechanische Verfahrenstechnik und Mechanik of the University Fridericana Karlsruhe, Clausthal-Zellerfeld.

Hahn, J 2023, 'Vacuum disc filters go beyond', in GW Wilson, NA Beier, DC Sego, AB Fourie & D Reid (eds), *Paste 2023: Proceedings of the 25th International Conference on Paste, Thickened and Filtered Tailings*, Australian Centre for Geomechanics, Perth, pp. 853–858, https://doi.org/10.36487/ACG_repo/2355_68

Inci, YS, Uzunçelebi, G, Ürkmez, H, Ennis, S, Kimball, P & Ruiz Castro, E 2023, 'Application of risk-based tailings management at Tüprag Efemçukuru Gold Mine', in GW Wilson, NA Beier, DC Sego, AB Fourie & D Reid (eds), *Paste 2023: Proceedings of the 25th International Conference on Paste, Thickened and Filtered Tailings*, Australian Centre for Geomechanics, Perth, pp. 776–786, https://doi.org/10.36487/ACG_repo/2355_61

Kern, R & Stahl, W 1986, 'The discharge of filter cake by air blow back: a mathematical simulation to improve design and operation of disc filters', *Proceedings of the 4th World Filtration Congress*, Institut für Mechanische Verfahrenstechnik und Mechanik, Ostende.

McKenna, G 2023, 'How to compact filtered tailings', in GW Wilson, NA Beier, DC Sego, AB Fourie & D Reid (eds), *Paste 2023: Proceedings of the 25th International Conference on Paste, Thickened and Filtered Tailings*, Australian Centre for Geomechanics, Perth, pp. 440–454, https://doi.org/10.36487/ACG_repo/2355_33

Stahl, W 1986, 'The influence of disc filter design parameters on cake formation, air consumption and residual moisture', *Proceedings of the 4th World Filtration Congress*, Institut für Mechanische Verfahrenstechnik und Mechanik, Ostende.