

Filter Media Requirements in the Mineral and Mining Industry



Filter media for the mineral and mining industry

Ensure unparalleled product quality by using premium-grade filtration materials.

Table of contents

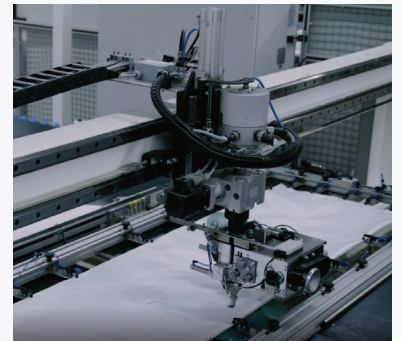
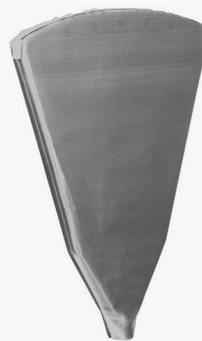
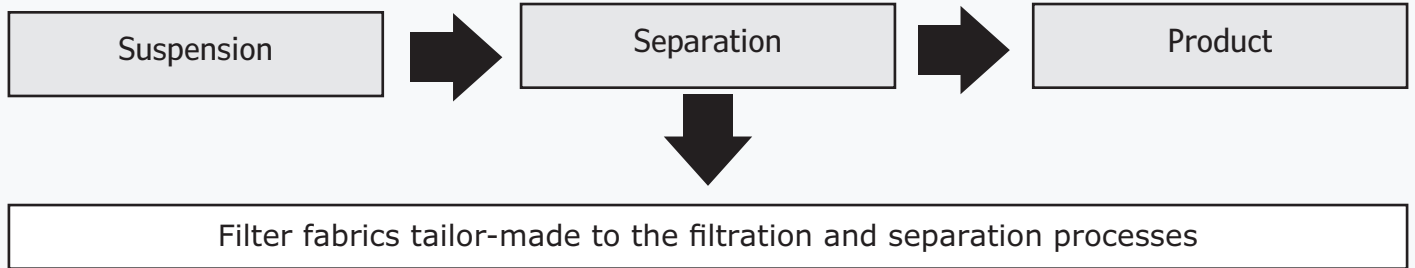
1. Markert Group & the Mining Industry
2. Concentrates Process
3. Filter Cloth Requirements for Concentrates
4. Clarification Process
5. Tailings Process
6. Mining Filter Press: Cloth Requirements
7. Vacuum Filtration
 - 7.1 Horizontal vacuum belt filters
 - 7.2 Horizontal pan filters
 - 7.3 Rotary drum filters
 - 7.4 Disc filters
 - 7.5 Disc filter steel sectors
8. Markert Customized Solutions



1. Markert in the Mining Industry

Markert - Advanced Textile Filter Cloths

For a century, our family business has stood for tradition and motivation to achieve maximum performance in our products. As specialists in textile filtration manufacturing, we thrive to serve our customers with customized products that are ideally suited to their operation's respective application. Markert is one of the market leaders in textile filtration. We operate close to our customers with dedicated sales engineers.



Mining Filter Fabrics for Tailings & Concentrates

Filtration technology is crucial in the mining industry, playing a key role in the processing of ores and minerals. Concentrates and tailings, need effective dewatering to reduce moisture content and manage waste. Efficient filtration improves the quality of concentrates, lowers transportation costs, and minimizes environmental impact.

Advanced filtration equipment such as filter presses or vacuum filters in combination with textile filter cloths that are well matched to the process are essential for handling the high demands of mining operations. These systems enhance operational efficiency, reduce energy consumption, and support sustainable practices.

This white paper explores the importance of filtration in mining, highlighting key technologies and best practices that drive performance and sustainability in mineral processing.



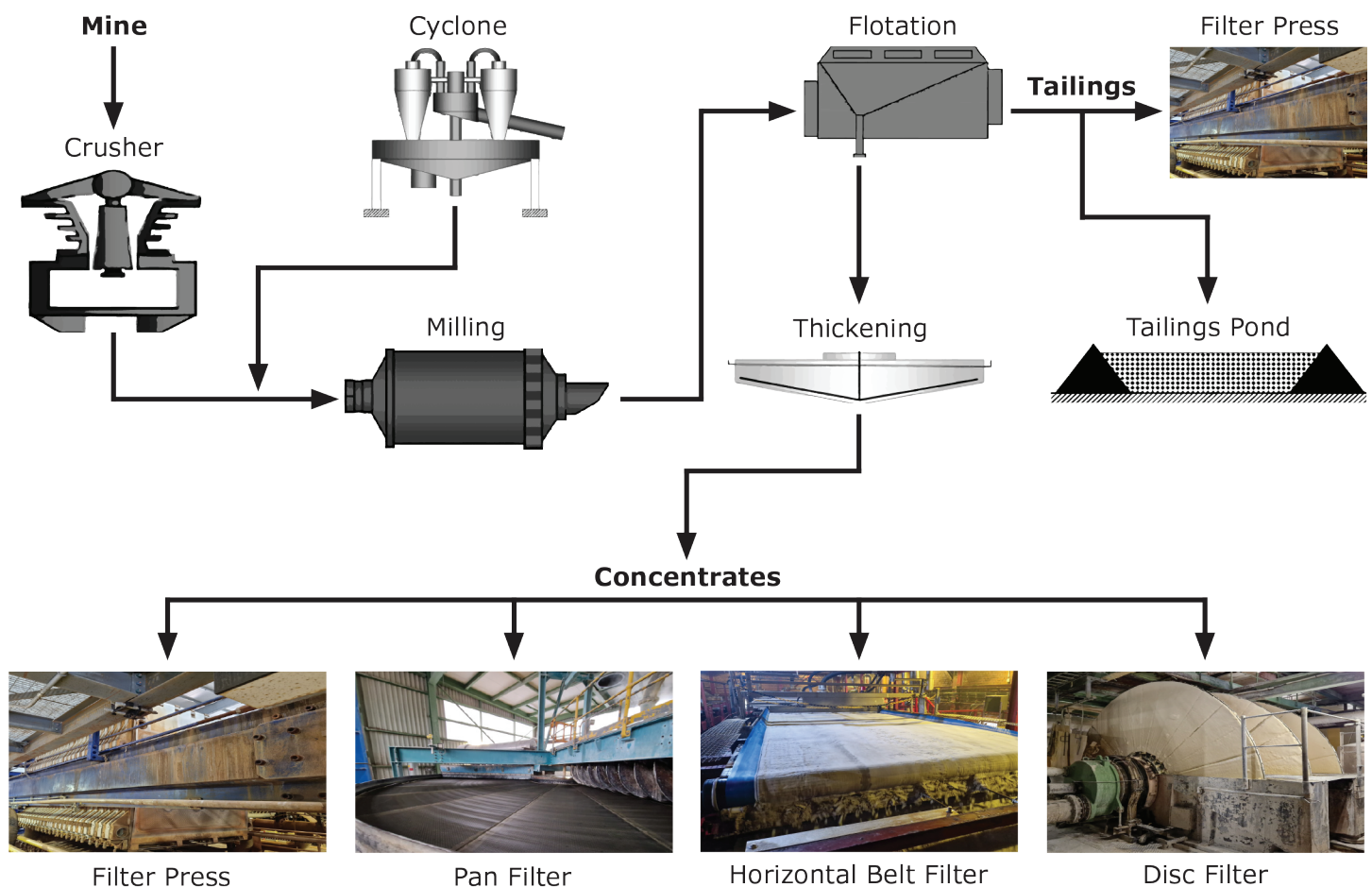
Where is filtration heading in Mining?

Concentrates & Tailing in the mining industry

Mining involves several steps of filtration:

- **Exploration and Development:** Searching for and confirming mineral deposits.
- **Extraction:** Removing ore from the ground, either through open-pit or underground mining.
- **Crushing and Grinding:** The extracted ore is crushed and ground to reduce particle size and liberate mineral content.
- **Concentration:** The primary process to separate valuable minerals from non-valuable materials.
- **Tailings Management:** Managing the leftover materials (tailings) after concentration

In mineral processing, liquid solid filtration mainly occurs in the dewatering/accumulation of concentrates and tailings.

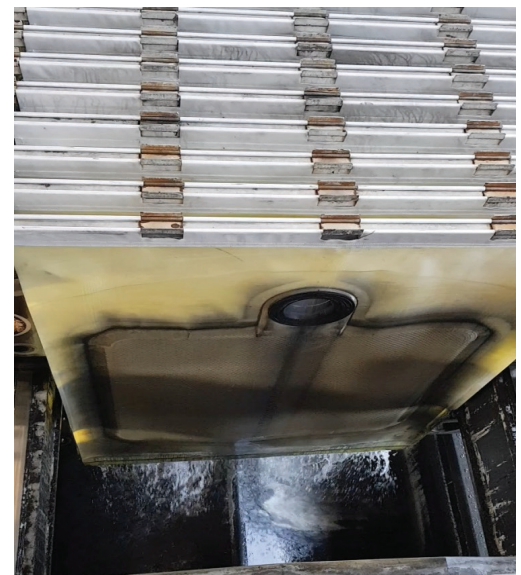
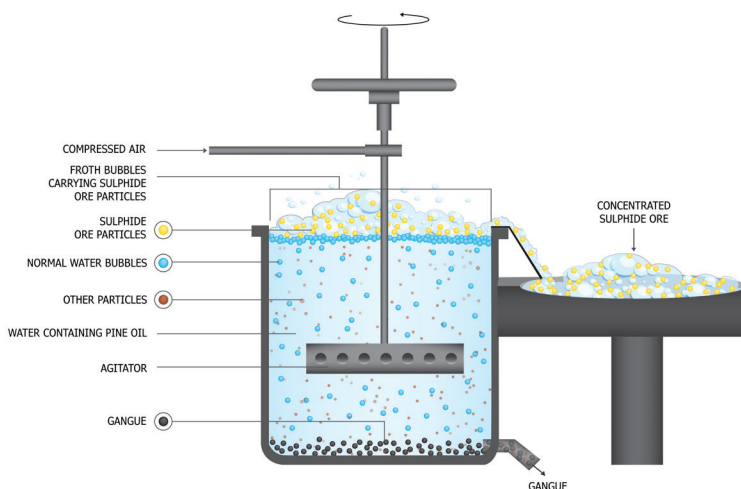


2. Concentration Process

The concentration process aims to separate valuable minerals from unwanted gangue materials (non-minerals). This process involves several methods depending on the type of mineral:

- **Flotation:** One of the most common methods for separating metal sulfides. In the flotation method, the ore particles are treated with reagents in a water tank, making specific minerals hydrophobic. These minerals attach to rising air bubbles and form a froth at the top of the water tank, which is then skimmed off to remove the minerals.
 - **Nowadays, this method is most often used alongside filter presses with woven fabrics made of polypropylene multi/multi filaments, like our PP 90328 and PP 24800. To achieve maximum cake drying for very fine particles, our non-woven filter cloths made of PPV 90296 are the preferred choice to due its sealing ability.**
- **Magnetic Separation:** This method is used for separating magnetic minerals like in iron ore mining magnetite. A magnetic field attracts the magnetic particles and separates them from non-magnetic material.
 - **Primarily used with continuous filters like vacuum or pressure disc filters. Our ferrutex® fabric uses advanced multifilaments for vacuum filtration and advanced monofilaments for pressure filtration.**
- **Leaching:** Used for specific ores like gold and copper. Chemicals (e.g., cyanide for gold) are used to dissolve the ore, from which the metal can then be extracted.
 - **Mainly in use with horizontal vacuum belt filters where our advanced non-woven needle felt filter belts made of PPV 50391 or TV 50374 with a heavy monofilament scrim are the perfect choice.**

The output of these processes are **concentrates**, which contain a high percentage of the desired metal. These concentrates are sent for further processing or refining steps, such as smelting and refining.



3. Filter Cloth Requirements & Solution for Concentrates

Filter cloth requirements within the Mining Industry:

- Resistance to mechanical abrasion and dimensional stability (i.e. drape over cloths)
- Easy installation of filter cloths
- Good cake release
- Non-blinding structure & high capacity
- Clear filtrate
- Long service life ($\geq 8,000$ cycles)

Particularly in mining applications, there are sharp particles in the suspension that can damage the filter cloth. Friction occurs during each cycle through the cake discharge and filling processes, which results in chafing of the cloth.

Our Solution: PP 24800

- Yarn type: Multi/Multi twisted
- Basis weight: 800 g/m²
- Material: Polypropylene
- Weave: Twill



PP 24800



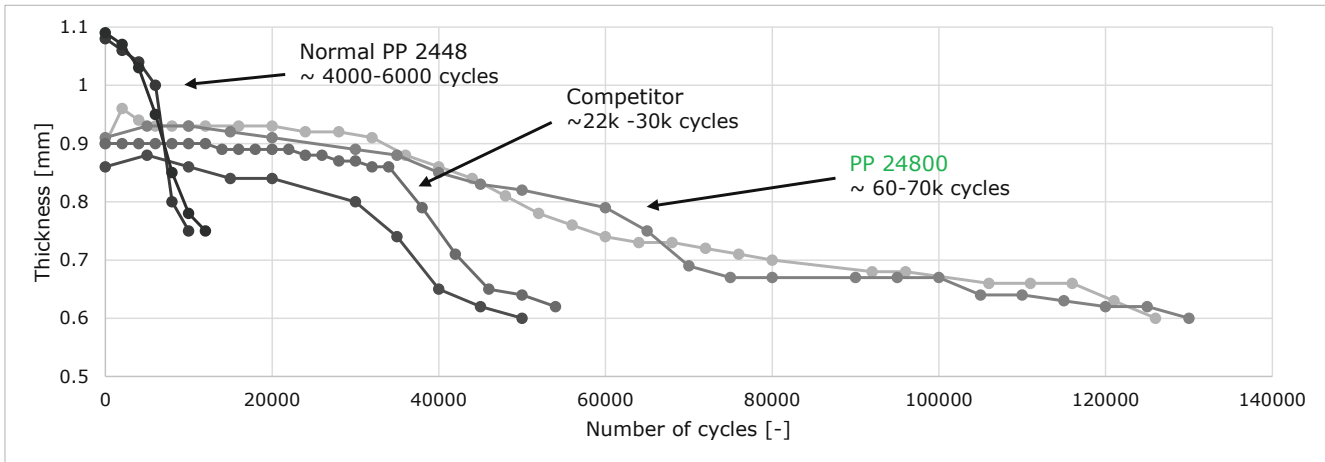
Abrasion Resistance Testing for Long Lifespan

Abrasion resistance was tested with various cloths by tracking the quantity of cycles performed in the cloths lifespan and how the the cloths' thickness and air permeability was effected throughout the course of that lifespan.

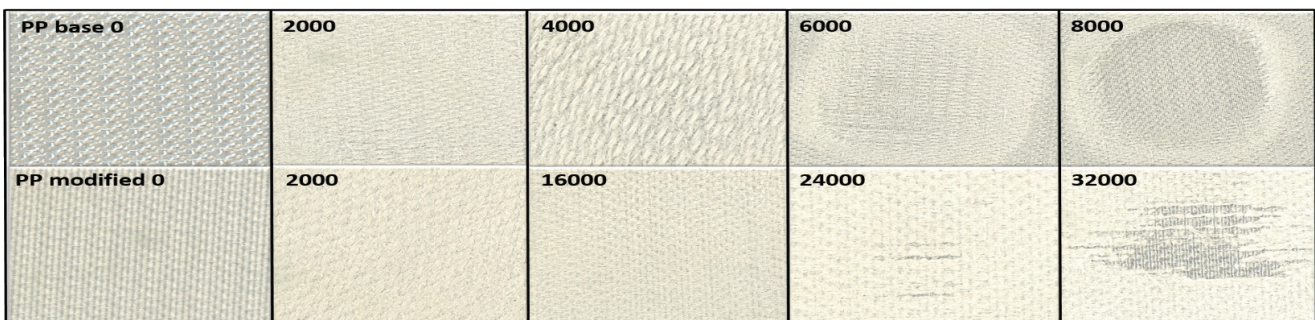
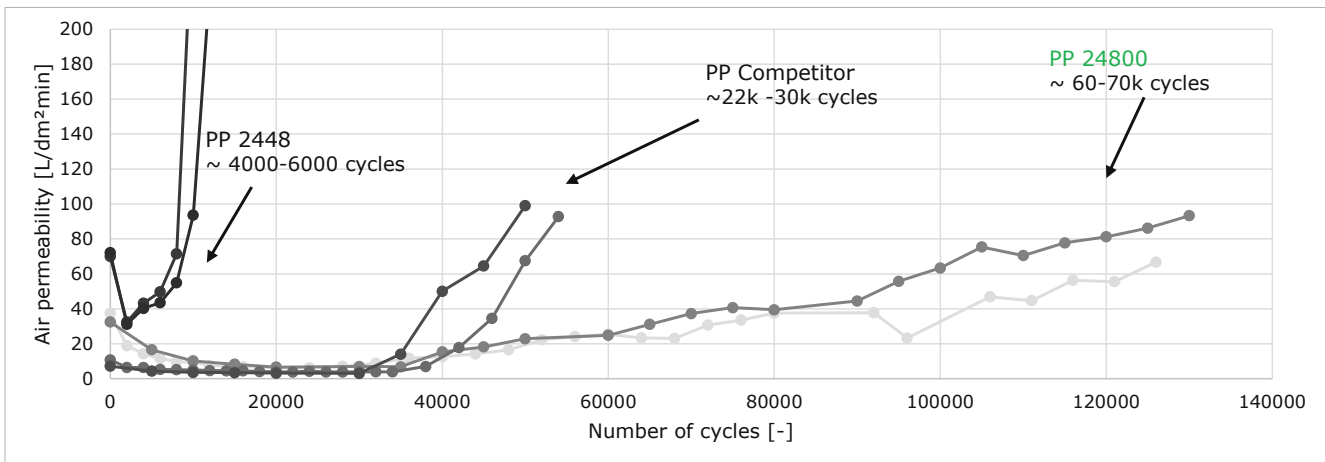
See next page for abrasion test results.

Abrasion Resistance Testing Results

Cloth Thickness (mm) vs. Number of Filtration Cycles



Cloth Air Permeability (L/dm²min) vs. Number of Filtration Cycles



4. Clarification Process

The extraction of gold in mining poses a special challenge to filtration due to the addition of chemicals. This process is widely known as **Merrill-Crowe process** and a used method for the recovery of gold and silver from cyanide solutions. The process involves removing precious metals from cyanide leach solutions through a series of steps, including filtration.

Leaching Process

The ore containing gold and silver is ground and mixed with a cyanide solution, which dissolves the precious metals. This creates a “pregnant” solution containing dissolved gold and silver.

The pregnant solution often contains fine suspended solids such as clay, silt, and other particulates. These solids must be removed, as they can interfere with the process and reduce efficiency.

Clarifiers like pressure leaf filters are used for this purpose. The pregnant solution is passed through clarifiers—typically large tanks where flocculants (chemicals that promote the clumping of fine particles) are added. This helps to settle out the suspended solids.

Clarifiers work through sedimentation, allowing the clear solution to overflow while the solids settle to the bottom. The clarified solution is then passed through filters (such as leaf filters) to remove any remaining fine particles, resulting in a clean, clarified solution.



4.1 Filtration requirements & solutions for clarification

Requirements for the filter bags:

- high number of pores = high flow (pore size: 21µm)
- excellent filtration efficiency = lesser amount of fine particles passing at the start
- very good resistance against wear and tear
- excellent cleaning properties

Our Solution for Clarification: PPD 11293

Woven and reinforced with a high amount of heat resistant threads

5. Tailing Process

Tailings are the leftover materials after extracting valuable minerals. They primarily consist of fine slurry, rock dust, chemicals, and residual minerals. Tailings are a byproduct that must be properly managed to minimize environmental and safety risks.

Key Aspects of Tailings Management:

- **Tailings Ponds:** A common method for storing tailings is the creation of large, enclosed ponds. These ponds allow solids to settle and water to clarify, which can be reused or treated and released back into the environment.
- **Dry Stacking:** In water-scarce regions, tailings can be dry-stacked, where water is removed from the tailings, and the solids are compacted into “dry stacks.” This method reduces the risk of dam failures and environmental disasters.
- **Environmental Monitoring and Rehabilitation:** Continuous monitoring of tailings storage facilities to ensure stability and safety. After mining operations cease, tailings facilities are rehabilitated to prepare the land for safe reuse or natural restoration.



5.1 Filtration requirements & solutions for tailings

Filter cloths in mining applications are exposed to extremely high mechanical load, causing abrasion mainly in feeding areas. Increasing the lifetime of filter cloths is important for reducing OPEX costs. Our filter cloths improve your production by offering a longer lifetime, perfect dewatering and cake separation. We also use a special rubber material to minimize abrasion in feeding areas, extending lifetime of our filter cloths significantly.

6. Mining Filter Presses: Cloth Requirements

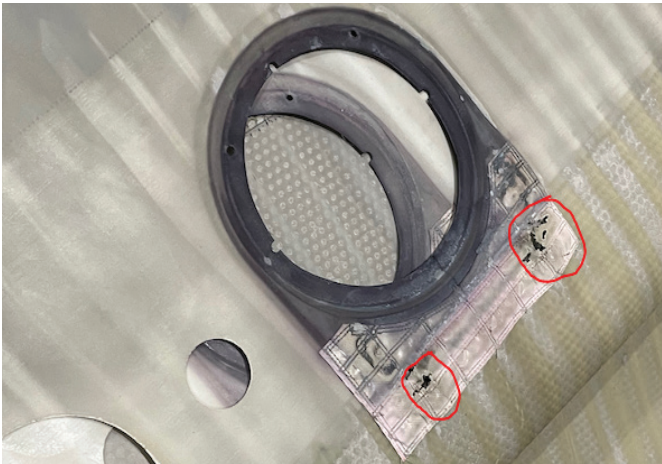
In addition to the selecting the perfect fabric, a perfect design and strategic reinforcements are decisive for the durability of the filter cloth. See the picture of a poor feed reinforcement (page 12). The feeding shoes made of rubber and metal tend to rub through the cloth material:

- Customer: silver mine with 2x FFP 3512 with 100 Plates and cloths size: 2.420x3.982mm
- Application: Silver Tailings, with a high content on flocculants, PSD 30-40 μ m and cycle time 15-16 min.
- Issues: sticky cake, clogging
- Cloths in use: Multifilament with 20cfm

Our Solution: NKD 11299 Nylon Monofilament with 60cfm

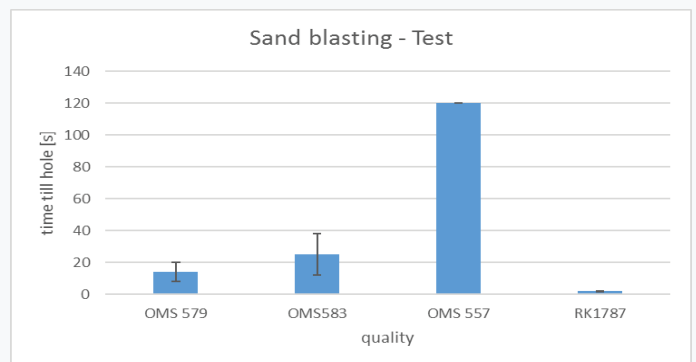
- Conclusion: Provides lifespan of 8,290 cycles against the previous 4,000 cycles. It also provides benefit for the filter press as less shaking of the cake is required.





Most frequent damages occur in the area of the feeding shoes.

! Under a sand blasting test, our production material OMS 557 has far exceeded expectations and demonstrated outstanding tenacity under the most extreme conditions.



! Black reinforcement called OMS 557 sewed on our sewing robot provides extreme protection from the feeding shoe.

7. Vacuum Filtration

General

- Vacuum belt filters are continuously operating filters.
- Application: Phosphoric acid for fertilizer industry and filtration of copper concentrates.

7.1 Horizontal vacuum belt filters



Success Story: Phosphoric acid

Di-Hydrate Conditions:

- Calcium sulfate hemihydrate and phosphoric acid extraction
- Components $\text{CaSO}_4 \cdot 0,5 \text{H}_2\text{O}$, Na_2SiF_6 , AlPO_4 , SrSO_4 , FePO_4
- Weight of solid content 22 – 30%
- Medium particle size 47,7 (10; 100) μm
- Operation temperature 86-93°C
- Chemistry: pH 1

Our Solution: DID 11137

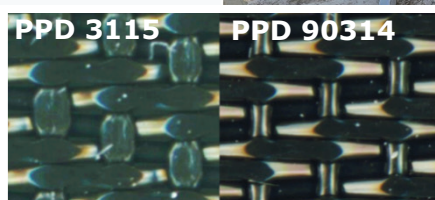
- Improved service lifetime up to 40%
- Increased filtration throughput up to 25%
- Better residual moisture possible
- Higher separation efficiency and less solids in the filtrate
- Test against two competitors on the same plant
- Belt width up to 4.5m

7.2 Horizontal pan filters



Our Solution: PPD 3115 and PPD 90314

- PPD 3115: our standard solution for hemi-hydrate
- PPD 90314: premium grade solution for hemi-hydrate
 - Longer service life due to:
 - Greater thickness (+0.2mm)
 - Higher tensile strength (+1100 N/5cm)
 - Thicker yarns (+0.1mm in warp and weft)
 - Heat resistant PP yarns



7.3 Rotary drum filters

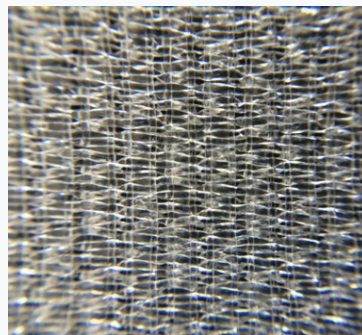


Success Story: Copper Concentrates

→ This method uses a drum with a small tension roll covered with one filter belt. The belt is endless via use of a clipper seam, overlapped with a combination of a zipper and velcro. Additionally, it uses a rubber profile along both sides of the belt to guarantee a proper guideline.

Our Solution: PPPD 3146

- Double layer fabric
- No need of drainage fabric/backing cloth
- Better residual moisture possible
- Higher throughput
- Belt width up to 8m x 25m



7.4 Disc filters

General

- Disc filters are continuously operating pressure filters.
- They can be described as a combination of a drum and plan filter
- Filter segments/bags are placed horizontally
- Filtration principle as for the drum filter
- Emptying:
 - Mechanically via scraper
 - Via pressure surge

Reasons for fabric failure

- Mechanical stress at cake discharge
 - Pressure shocks can cause the welding to tear
 - Mechanical scrapers rip the fabric open
- Insufficient filtration performance



Success Story: Ferrutex® elastic filter bags

- Elastic stretch Nylon bags (multifilament)
- “Self cleaning” bag
- High capacity all the time
- Durable = long life
- Clear filtrate
- Dry cake

7.5 Disc filter steel sectors

A newly designed steel sector with the following benefits:

- Very light segment weight of only 18 kg instead 28kg
- Fast and easy segment change due to the special bayonet shape of the segment foot (just one operator)



- Optimized hydraulics ensure fast filtrate drainage and efficient compressed air blow-back for cake discharge
 - No need for a backing cloth
- Shape of segments helps to seal the filter bag and prevents product loss
 - special groove and no need to use screws anymore

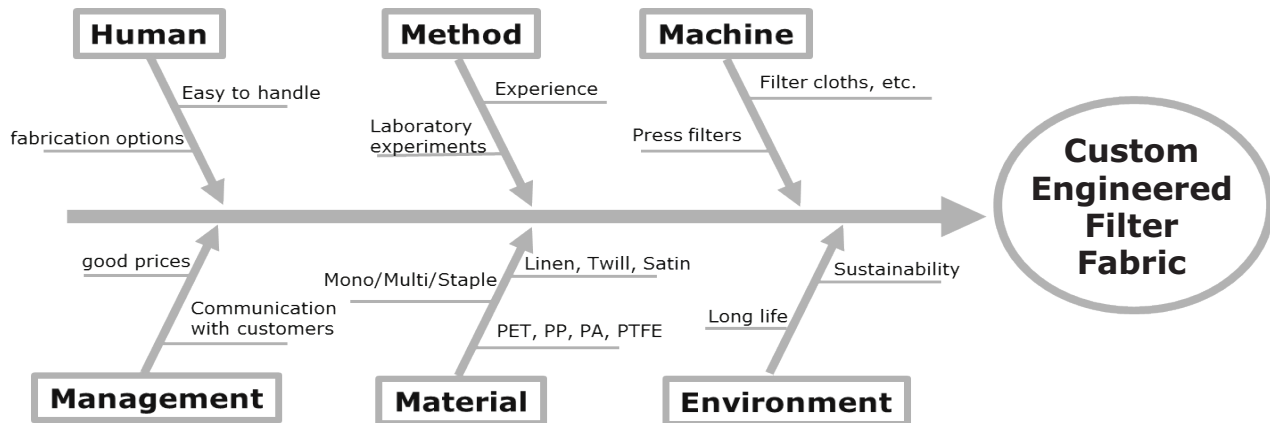


Sectors are compatible with the following vacuum disc filter OEM's:

- Bokela → FLSmidth → Gaudfrin → Krauss Maffei
- Eimco → Dorr Oliver → Andritz

8. Markert Customized Solutions

Development process for a custom engineered filter fabric



Laboratory Testing

Markert runs a laboratory analysis of the filter cloth with subsequent analysis of the results. This includes determination of:

- Filtration test and fabric screening with our pressure nutsche
- Electric resistance through and along the fabric
- Air permeability
- Water permeability
- Pore size through microscope
- Weight
- Binding type
- Fabric material
- Thickness
- Yarn type
- Abrasion behavior
- Chemical resistance

