Giant steps forward in the scale of pressure filtration available

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Introduction

• With greater demands for water recovery and declining grades in concentrators there has been an increasing demand for much larger pressure filters.

• Several companies have worked to increase the scale of their equipment to meet this challenge

• Clean water generation (RO & pumping) and recovery (thickening & filtration) are expensive technologies
Historical view on filtration

Vertical plate filters are a product of the European chemical industry needs

- The company Hoesch began development of filter presses in 1947 and supplied the first filter press in 1950.

Chamber filter press
Size 1000 X 1000
60 Chambers
Spindle/Hydraulic closing
In the beginning........................

The Larox PF started out looking something like this!
Plate and Frame Filter Plates

Early filters had plate and frame filter elements. Polypropylene recessed chambers replaced plate and frames. Major driver in development has been the increases in the size, pressure and the chamber depth of filter elements. This has led to higher capacities per unit. The designs are however suited to difficult material and long filtration cycles.
Plate development for mining

Plate comparison 1500mm DIN

Conventional PP filter plates with corner filtrate and internal feeding are designed for low flow conditions and are not suitable for short cycle heavy duty operation.

Hoesch 2500mm FFP plate

Significantly larger plates are required for high capacity mining applications.

- Simplify the structure to reduce maintenance.
- Designed to reduce velocities, turbulence and abrasion.
- Overhead supported cloth for better cake discharge, cloth washing and easier replacement.
Machine function

• For slurries with high (relative) filtration rates the machine function can represent 40 to 60% of the total batch time.
• Hence the large improvements in machine design available today.
• Harsh environments and short cycle times require different structures and components to meet reliability requirements.
Frame and machine development Fast Opening System

• High capacity filtration requires
  – short machine times
  – Improved reliability
  – Larger pressure plates
Testing & Scale-up

• Test equipment should simulate full scale equipment
  – Vertical filtration surfaces
  – Chamber areas of > 0.01m²
  – Cake behaviour

• Results should be scaled to suit the design equipment
Energy / moisture

Typical Cycle vs. Energy Consumption in Tailings Dewatering

- Solids: 85%
- Cake Air Blowing: 80%
- Diaphragm Pressing: 70%
- Filtration: 60%
- Technical Time: 15%
- Energy: 70%
Why pressure filtration?

- Where Dry stackable tailings are required the technology must shift from sedimentation to filtration.
- Where there is a large portion of clays or the particle size is small the filterability decreases and vacuum filtration is unable to achieve acceptable results.
- The only remaining alternative is pressure filtration
- Test case is for tails with a p80 of 45μm and a p40 of 20 μm
Vacuum filtration

- The first choice where it works but increasing amounts of sub 20 μm material decreases capacity and increases moisture.
- With 40% passing 20 μm vacuum filtration does not achieve a reasonable moisture.
Tailings filtration for fine material or clays

Pressure filter capacities are lower than for vacuum filtration
Moisture can be 5% to 10% lower
Gas displacement is essential for low moisture
Low moisture means high energy
Filter presses for tailings

- **MFP1500**
  - Base case of copper concentrate tailings from a 50mt/a concentrator (80% -45μm, 40% -20μm)
  - Test filtration rate 235 kg/m²h. De-rated to 75 kg/m²h
  - Cake thickness 40mm
  - Cycle time 30 min
  - Cake moisture 15.5%
  - 160 units required
  - 90 units of 2000mm
Filter press Revised case

- **FFP2512**
- Base case of copper concentrate tailings from a 50mt/a concentrator (80% -45μm, 40% -20μm)
- Test filtration rate 400 kg/m²h. (Graph 3)
- Cake thickness 60mm
- Cycle time 8 min
- Cake moisture 15.5%
- Filter selection 15 units
- Outotec Larox FFP2512 70 T(60)
Tower filters for fine concentrates

• PF25 M1 45
• Iron ore concentrator with 8 mt/a magnetite with high Blaine index
• In 1990 at 420kg/m² h required 97 PF25 M1 (45) filters
• Cake thickness 30 mm
• Cycle time 10 min
• Cake moisture 9%
The current standard

- **PF144**
  - Iron ore concentrator with 8 mt/a magnetite with high Blaine index
  - In 2000 at 950 kg/m2h required 8 PF144 M1 (60) filters
  - Cake thickness 50 mm
  - Cycle time 9 min
  - Cake moisture 9%
The future for fine concentrates

- **PF234**
  - Iron ore concentrator with 8 mt/a magnetite with high Blaine index
  - Today at 1070kg/m² h requires 4 PF234 M1 (75) filters
  - Cake thickness 62 mm
  - Cycle time 9 min
  - Cake moisture 9%

- [Animation]
• Thank you