

## **Filter press operating with recessed filter plates**

Filter presses were introduced in the early 20<sup>th</sup> century and have been around for many years mainly for de-watering waste sludges.

Each plate is dressed with filter cloth on both sides and, once pressed together, they form a series of chambers that depend on the number of plates. The entire pack of plates is supported by side or overhead beams.

The plates are pressed together during the filtration cycle by a hydraulic or mechanical mechanism.

### **Operational Sequence**

1. Slurry is pumped and fills the chambers at a high flow rate and low pressure which gradually builds-up as the cake gets thicker. The drip trays which are positioned below the filter press for the collection of drippings closed.
2. When pressure reaches 6-7 bars wash water is pumped through the filter cake at a predetermined wash ratio to displace the adhering mother solution.
3. In case of membrane plates: Air blowing is applied to reduce cake moisture or water is pumped in from the backside of the flexible membrane, squeezing the filter cake and releasing more moisture.
4. The wet core that remains in the feed port is blown back with air for 20-30 seconds to ensure that the discharged cake is completely dry.
5. The drip trays open and are ready for cake discharge.
6. The hydraulic plate closing piston retracts together with the follower.
7. The shuttle shifter moves the plates one by one towards the follower and the cake discharges.
8. The drip trays close and are ready for the next cycle.
9. The shuttle shifter moves the plates back one by one towards the fixed header. When each plate parks the cloth is washed at 100 bar with a mechanism that lowers and lifts a pair of symmetrical manifolds with high impact nozzles.

## Design

The plates have generally a centered feed port that passes through the entire length of the filter press so that all the chambers of the plate pack are connected together. Likewise, four corner ports connect all the plates and collect the mother and wash filtrates in a "closed discharge" towards outlets that are located on the same side as the feed inlet.

Present recess depths are 16, 20 and 25 mm so the corresponding cake thicknesses are 32, 40 and 50 mm at maximum filling. Filter presses are built for operating pressures of 7, 10 and 15 bar for cake squeezing. Sometimes pressures go up to 50 bar.

Filter press plates are available in various materials of construction such as cast iron, aluminium alloys, high-density polypropylene and PVDF.

Effective filtration area has gone up since with the largest available plates of 2 by 2 meters, having a 20 mm recess and 150 chambers, the area is about 1'000 m<sup>2</sup> with a cake capacity of 20 m<sup>3</sup>. The introduction of water, or air to a lesser extent, from the backside of flexible membranes reduces chamber volume and squeezes the cake yielding a further lowering of the moisture content.

For many years filter presses, named plate and frame, have used flush plates with separate frames to contain the cake. These plate and frame filter presses had many sealing surfaces which were the main cause for leakages so the introduction of recessed plates has cut the number of surfaces in half and reduced the problem of drippings. The development of recessed plates has gone hand in hand with advances in cloth technology which enabled 3-dimensional stretching as opposed to plate and frame where the cloth remains in one plain.

## Washing

When efficient washing is required since with a chamber filled with cake the wash water may not reach all its surface causing an uneven displacement.

## Cake Disposal

Cakes may be discharged into bins that are trucked away or transported with a belt conveyor. With very large filter presses a well formed cake may weigh 200-300 kgs per chamber and when it falls into a bin or onto a belt conveyor in one solid piece the impact is very high.

## Enhancing Filtration

Filter presses provide a good alternative for processing solids with poor de-watering characteristics. Pressure filtration allows many types of solids to be de-watered to a solids content above 40%.

In such case, often special measures are taken to ease cake discharge and enhance filtration.

The measures are:

- Pre-coating
- Addition of body feed

Pre-coating the plates prior to introducing the feed is done only in the following cases:

1. When the contaminants are gelatinous and sticky it forms a barrier that avoids cloth blinding. Likewise the interface between the pre-coat and the cloth departs readily so the cake discharges leaving a clean cloth.
2. When a clear filtrate is required immediately after the filtration cycle commences otherwise re-circulation must be employed until a clear filtrate is obtained.

When the solids are fine and slow to filter a body-aid is added to the feed slurry in order to enhance cake permeability. However, it should be kept in mind that the addition of body-aid increases the solids concentration in the feed so it occupies additional volume between the plates and increases the amount of cake for disposal.