

DIFFERENTIAL OUT OF BALANCE PRESSURE – FILTER PLATES

Damaging out of balance pressure is determined when thick and thin cakes are discharging from the filter plate pack. This condition should be corrected as soon as possible to prevent filter plate damage. Normal low pressure differentials occur regularly and will flex the plate web within the design parameters. This flexing does not overstress the plate web and is normally not detected by operations.

Causes

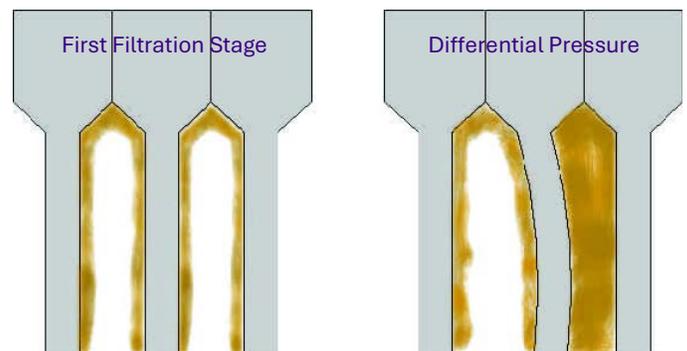
- i. Different permeability and separation characteristics of the filter cloths used inside the same plate stack
- ii. Blocked slurry feed holes
- iii. Plugged filtrate porting
- iv. Bridging of the feed hole between plates (fast filtering slurries)
- v. Too high feed velocity
- vi. Different chamber depths (cake thicknesses) inside the same stack

Damaging Differential Pressure

Filter press chambers fill in two stages:

Build up of two separate cakes on both filter surfaces inside the chamber. Growth of the two separated cakes into one single cake.

Out of balance pressure starts when the two separate “face” cakes become one. Once a chamber fills up completely with dry solids the feed pressure can no longer spread evenly from the feed channel to all the filter area. A rapid pressure loss through the cake to the inside of this chamber takes place. If the neighboring chamber still has two “face” cakes then a dangerously high out of balance pressure is exerted on the plate web which separates the chambers. This pressure can be as much as the feed pressure that is being generated at that time.



The web will be bent towards the chamber with the full cake. Calculation of the force being applied to the web is; filtration area of one plate x differential pressure e.g. for a 1200mm plate assume a filtration area of 42” square or 1,764 square inches, a differential pressure of 5 psi. The force being applied to one side would be 1,764 x 5 or 4.4 tons. The cake inside this chamber is compressed and the other chamber grows in depth. This creates thick and thin filter cakes at the end of the cycle.

Over deflection will result in permanent deformation. If the filter cakes are in two different stages of the cycle for an extended period of time then the potential for damage is greater. Finally, repetitive cycles, where differential pressures occur, will weaken the web and thus it will deflect at lower pressure escalating the cycle.

If Out of Balance Pressure is Suspected

- a. Do not use cloths with different permeability or separation characteristics together in one plate stack – small test installations are an exception.
- b. Where practical, clean and replace cloths for the entire stack.
- c. Check the discharge of the cakes at the end of each cycle and clean blocked feed channels i.e. improve housekeeping.
- d. Keep feed flow velocity low as practical to reduce the pressure loss at corners or at locations of disturbed flow inside the feed channel.
- e. Reduce the final feed pressure if practical i.e. feed to an acceptable point then stop.

Options

Membrane plates can eliminate the potential for out of balance pressures when used in a specific way. Filtration may be stopped when the cake formation is in the first phase i.e. the cake is not yet a full homogeneous mass. The cake may then be squeezed to achieve similar dry solids that would normally have been reached by the final filtration pressure of the feed pump. This reduces the potential for high differential pressure as the membrane squeeze distributes pressure evenly in all directions.

Alternatively (or in addition) feed distribution rings, attached at the feed hole, will control plate deflection (see our data sheet on distribution rings).