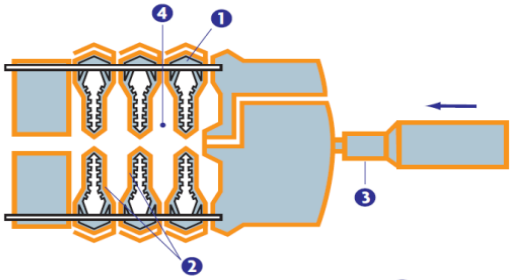
Dewatering Equipment Fundamentals

Langley Separation & Process offers complete range of dewatering equipment. Our 40-years of mechanical knowledge and process experience allow us to select the most effective size, type and model of dewatering equipment for the unique requirements of each customer. The principal methods include filter presses, belt filter presses and decanter centrifuges as fundamentally explained below:

Plate & Frame Filter Press Operating Principles

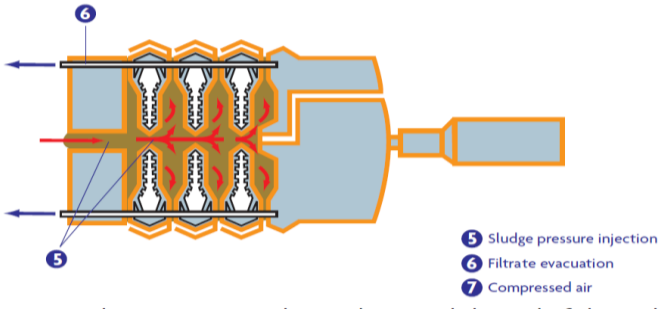
The operating principle of a plate & frame filter press, also called a filter press, is a batch **dewatering method**. A filter press is composed of a series of hollow vertical plate frames with filter cloths stretched on both sides of the plates. These plate frames are hung next to each other and pressed together with a hydraulic jack or ram forming a **filter chamber** between the plates.

Each operating cycle can be split into three phases:

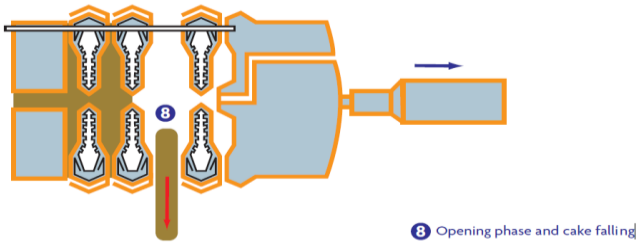


- **Filling phase:** At the start of the cycle, the conditioned sludge is injected in the filtration chambers by a high-pressure pump. The sludge fills each chamber and the water starts to seep out.

- **Filtration phase:** Once all the chambers are filled, the sludge continues to be pumped in and the pressure increases to reach up to 15 bars. The filtrate flows into the channels placed in each frame and is evacuated in a main pipe. The sludge injection flow reduces as the feed pressure increases. Very often, two separate pumps are used: a high flow/low pressure pump for the beginning of the cycle and a low flow/high pressure pump for the end.



- **Opening phase:** Several parameters may be used to signal the end of the cycle (stopping the injection pump): maximum pressure, filtration time, filtrate volume. Once the press has stopped, the central core is purged of the liquid sludge inside. The jack that presses the frames together is released. The chambers are opened sequentially and the cake falls below into a hopper or on to a conveyor.



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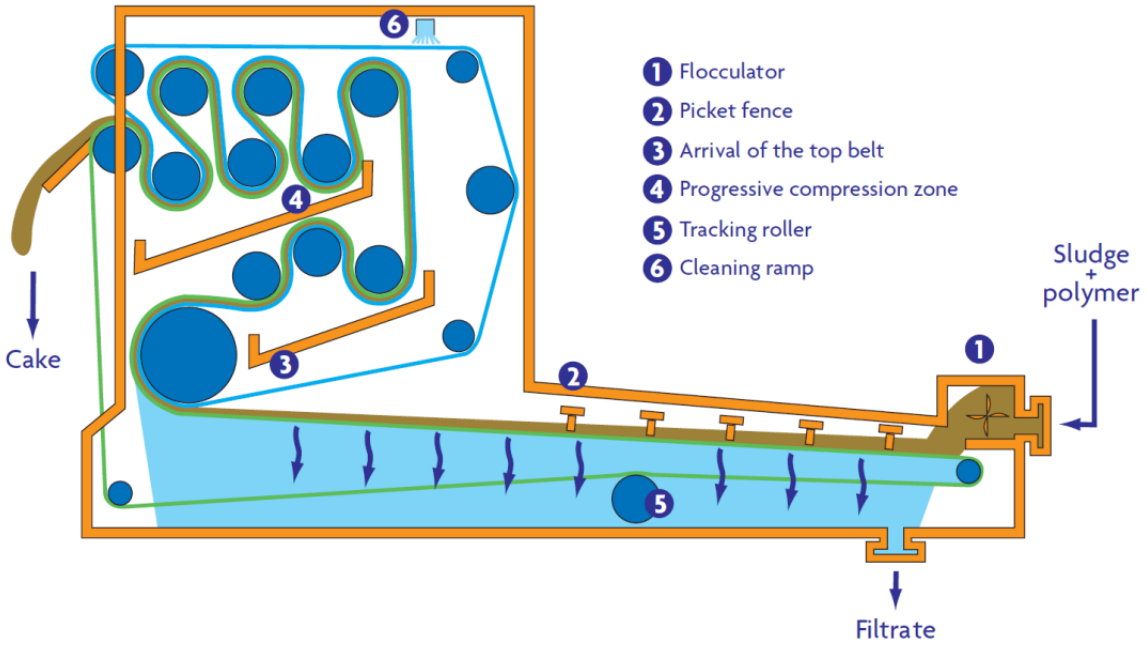
- **Belt Filter Presses, BFP, Belt Press Operating Principles**

The operating principle of a belt press allow for a continuous sludge dewatering between two filter belts traveling through a series of progressively compressing rollers.

There are many variations of belt filters, but all of them share the same basic operating characteristics:

- Flocculator: The sludge is conditioned before arriving in the drainage zone. The sludge-flocculant blend is prepared in the flocculator and the flocculated sludge is then distributed evenly on the filter belt. At this stage the sludge is in the form of flocs with the free water in between the flocs.
- Gravity drainage zone: The flocculated sludge is drained on a first belt (lower belt) by simple gravity. The drainage is helped by fences that freely lay on the belt. In this zone a water line is created that corresponds roughly to the spot where the majority of the water freed by flocculation is removed.
- A progressive compression zone: After drainage of the water freed by flocculation the sludge is then pressed between two filter belts. With the arrival of the top belt, a progressive pressurization takes place:
  - Up to 4 bars for low-pressure belt filters
  - Up to 5 bars for medium pressure belt filters
  - Up to 7 bars for high-pressure belt filters
- A cake scraping zone: Once pressed, the sludge has a more solid aspect. It is called a sludge cake or simply cake. This cake is then scraped off from the surface of the two belts that separate at this level.
- A high pressure wash or bank of nozzles under (100 to 120 PSI) continuously cleans each belt.



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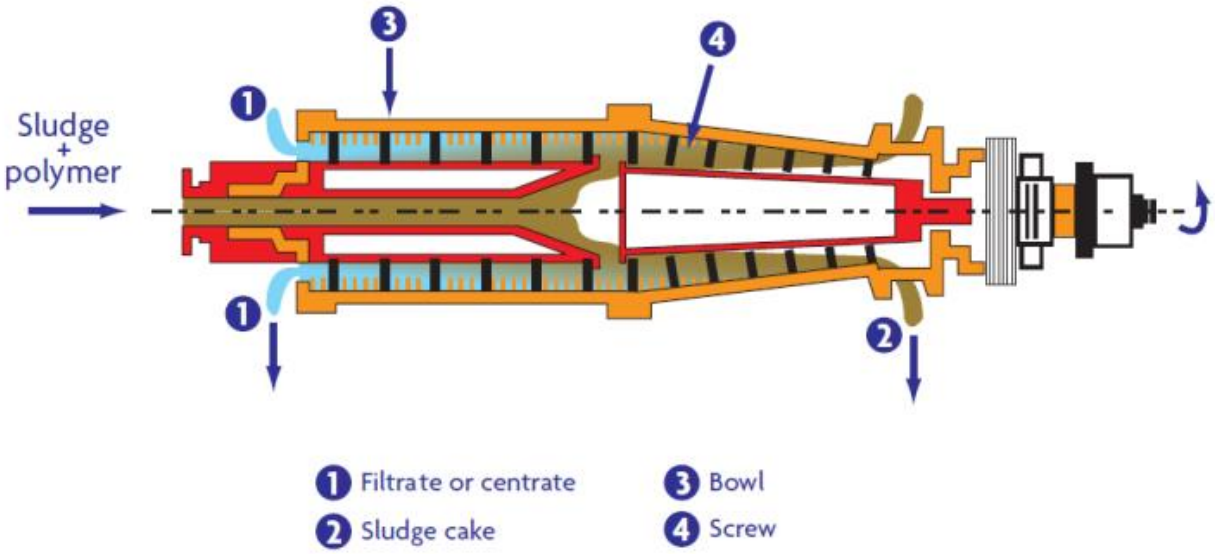
Decanter Centrifuge Operating Principles

The principle of a centrifuge, also known as centrifugal decanter, is to use centrifugal force to accelerate solid-liquid separation, which is completely different (from previous methods). Centrifugation relies upon the mechanical creation of centrifugal force or the multiplication of gravitational force to rapidly force the solid/liquid separation instead of gravity. This force is created in a conical-cylinder centrifuge bowl that rotates at high speed (2500-3500 rpm). The flocculated sludge is continuously injected into the centrifuge bowl clarification zone through an injection feed pipe. The liquid and solids separate and the sludge particles are pressed against the inside wall of the bowl and conveyed out of the conical end of the centrifuge by a screw (scroll) that rotates at a slightly different speed than the bowl (a few rpms). The clarified liquid called, centrate, is evacuated at the other end of the bowl by overflow.



Several parameters specific to centrifuge dewatering should be considered:

- Liquid Pool Depth / Pond Diameter:
  Inside the bowl a liquid ring is created, its depth is equal to the distance between the bowl's inside wall surface and the edge of the diameter of the centrate over flow exit ports. The exit ports are set by a series of plates that can be adjusted to alter the clarified liquid discharge height. The smaller the overflow plate diameter, the deeper the liquid ring / pool depth. The pool depth is adjustable to obtain the best compromise between centrate clarification and sludge dryness.
- Relative speed / Differential Speed:
  The relative speed is the difference in rotation speeds (RPM) between the bowl and the screw/scroll. The higher the relative speed, the faster the sludge is extracted.
- Torque:
  The torque measures the pressure of the sludge on the screw/scroll. This pressure creates torsion on the screw axis. This torsion is measured to give the torque. The higher the sludge pressure on the screw, the higher the torque. Torque and relative speed are linked. An increase of the relative speed will lower the torque and the sludge is extracted more quickly. High Performance Centrifuges increase sludge dryness as they have a method for controlling the conveying that allows for a longer residence time in the centrifuge and greater pressure.

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