MECHANICAL DEWATERING USING FILTER PRESSES TECHNOLOGY

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FAURE EQUIPMENTS : HISTORICAL BACKGROUND

Since 1868, FAURE EQUIPEMENTS has been manufacturing machines for the ceramic industry in LIMOGES. In FRANCE, this company was the first to manufacture ball mills and filter presses. Between the two World Wars, the company also specialized in mining safety equipment such as cables attachments..

In FRANCE, FAURE EQUIPEMENTS is currently one of the most important filter press manufacturer for the urban or wastewater industrial treatment plants. These machines are used in various industries such as chemical, pharmaceutical, food or ceramic industries … often using membrane plates filter presses.
FAURE EQUIPEMENTS is also known for its sturd and reliable filter presses feeding pumps.

FAURE EQUIPEMENTS has also specialized for over 100 years in fine dry or wet materials grinding. These up-to-date grinders are designed for any kind of powder or micronized industries.

FAURE EQUIPEMENTS has expertise in rope attachments for the hoisting cages and all equipments and handling machinery in pits for almost 80 years.

Thanks to its plant of 8000 s.q.m and a very complete manufacturing equipment, FAURE EQUIPEMENTS works in accordance with the specific standards in force and its own quality procedures. Communication and computing are widely developed.

MECHANICAL DEWATERING USING FILTER PRESSES TECHNOLOGY

INTRODUCTION

The filter press is one of the oldest mechanical dewatering devices.

FAURE EQUIPEMENTS first used filter presses in the ceramic industry in order to produce ceramic pastes.
The first filter press was made by **FAURE EQUIPEMENTS** in 1890.
Filter presses are also used in chemical, sugar and brewery industries since a long time.

The conventional filter presses are fitted with chamber plates, however membrane plates filter presses are developing rapidly.

The new changes are mainly arising in the plates (materials, removable membrane, …), automation, safety, ease of use, reduction of maintenance, increase of the productivity, (membrane plates) and remoted control.

I) Conventional filter presses

a) Presentation ***(Please refer to the enclosed documentation)***

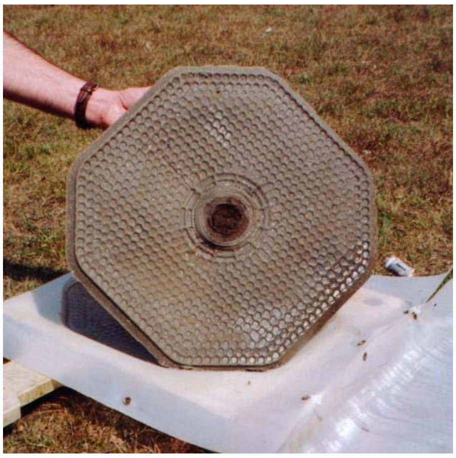
Filter presses are machines allowing to filtrate suspension under pressure in order to separate the liquid and the solid phases.

The cakes result from the dewatering process.
The filtrate is the liquid which is extracted from the sludge.

Until today, filter presses applications are very numerous such as :

* Urban / industrial sludge dewatering
* Filtration process in chemical, food, ceramic, pharmaceutical industries and mines and quarries.

Cakes



b) Design and Operating principles

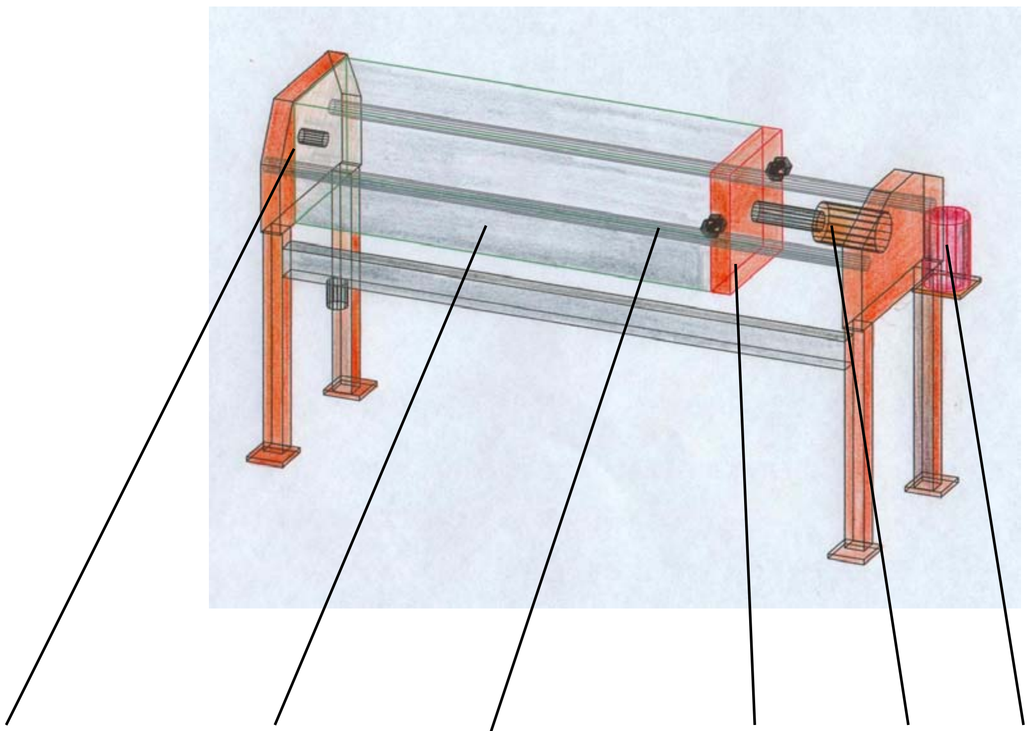
Filter presses comprise a set of chamber plates covered by filter clothes and squeezed by a hydraulic cylinder between a stationary frame and a mobile supporting beam. The plates determine a watertight volume in which is pumped the pressurized sludge.

A hydraulic unit allows the watertightness between the plates at the surface of the joints. By means of a cylinder, the hydraulic unit keeps the balance between the plates squeezing and the filling pressure induced by the feeding pump throughout the filtration process. Under this pressure, the liquids pass through the filter cloth that hold the solid particles. The filtrates are drained out either by taps set on each plate or by launders at the end of the filter.

The feeding pump must regulate its flow rate according to the pressure increase produced by the formation of cakes in the chambers.

At the end of the plate compressing process, the cakes formed between the filter clothes are discharged by the backward movement of the supporting beam and the successive separation of the plates. A plate shifting system fitted with trolleys allows the automation of this process.

FRAME OF A FILTER PRESS



- Sturd mechanically welded frame alowing an even distribution of the stress for a nominal pressure of 7 up to 15 bars.

- Lateral sidebars takes back the tensile stress and support the plates and plate shifting trolleys.

- Hydraulic unit running 1 or 2 cylinders fitted with a maintaining pressure device.

- The filtrates can be drained out either by lateral launders or at the stationary head of the filter press

- Electrical panel, fitted or not with an automate, directly set on the frame for small capacity filter presses or set in a separate room in case of larger installations. Supervision is possible.

PLATES

- Chamber or membrane plates.
- Made of polypropylene.
- You can choose between a range of chamber thickenesses.

FILTER CLOTHES

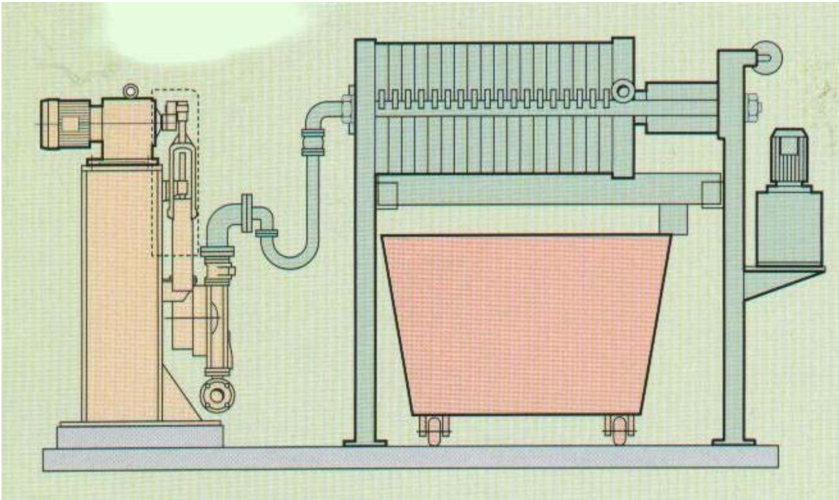
The choice of a filter cloth is another determining factor. It depends on the sludge to be filtered (grinding degree, concentration, presence of colloids , etc …) and the conditioning.

The filter clothes can be :
- multifibre or single fibre.
- more or less watertight
- made of different materials (polypropylene, polyamide, polyester, …)
- calendred or not
- joint surface lined or not

Filter clothes manufacturers have carried out a lot of improvements especially in the cakes discharge during the plate shifting process.

TITAN 212 HMP filter press is fitted with plates of 500*500 and filter clothes made of polypropylene.

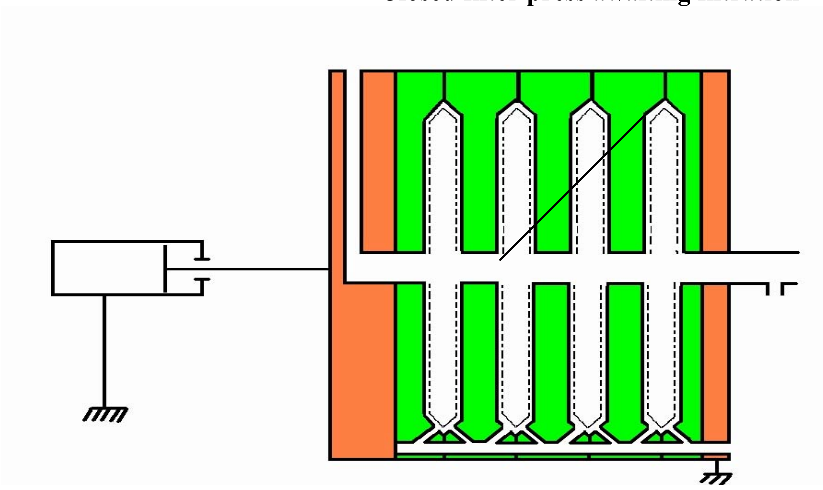
Operating principles of filter presses



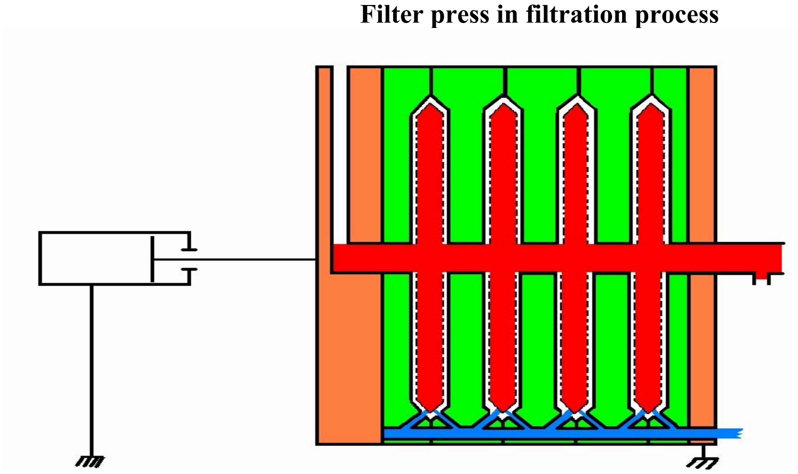
Filter press and its feeding pump

OPERATING PRINCIPLE

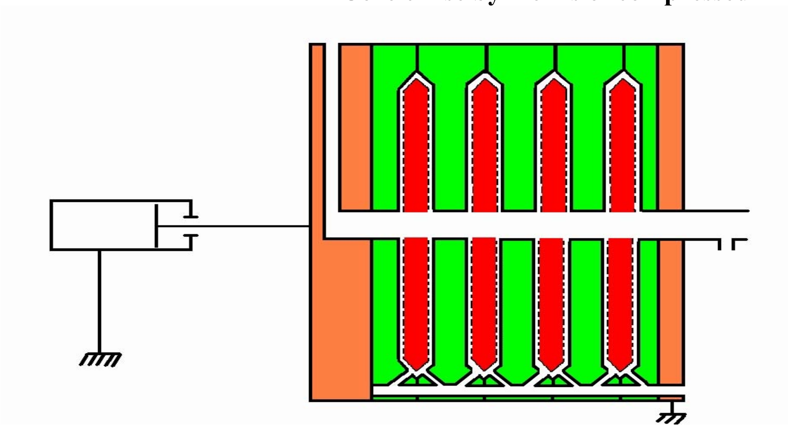
Closed filter press awaiting filtration



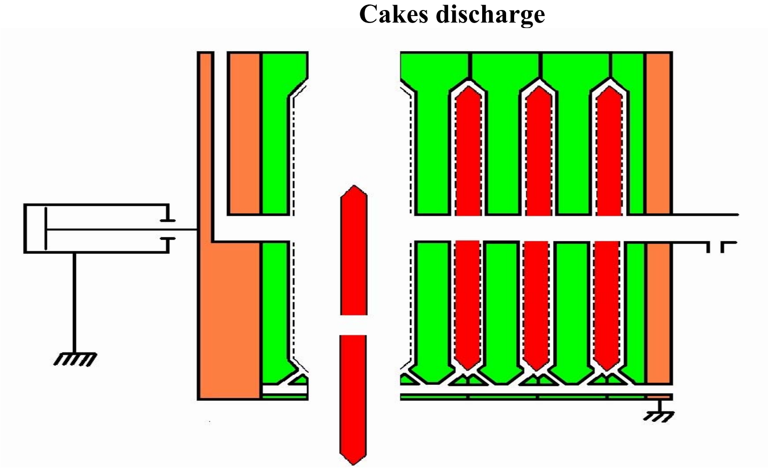
Filter press in filtration process



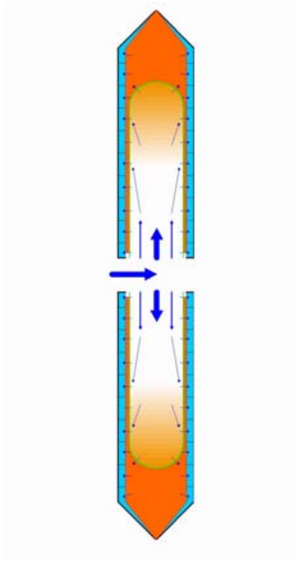
Core chase by means of compressed air



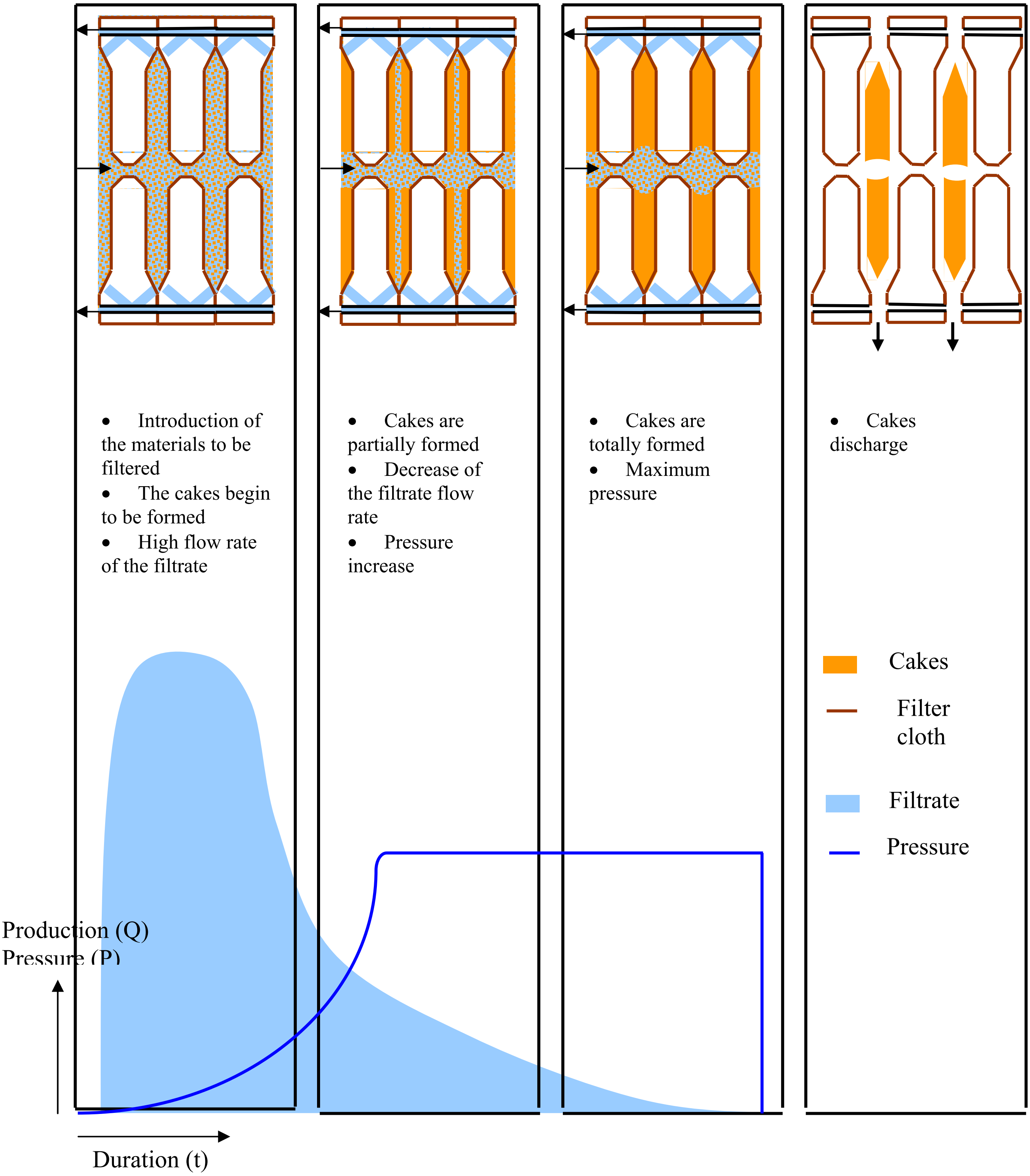
Cakes discharge



Formation of cakes in a chamber



Conventional filter presses operating principles



c) Equipments

ANTICORROSIVE MECHANICAL PLATES SHIFTING PROCESS

- Accurate and reliable device that automatically opens the chambers separating the plates after the opening of the filter in order to discharge the cakes.

HIGH PRESSURE FILTER CLOTH WASHING SYSTEM

- Fixed on the plates shifting trolley, it allows an optimum washing of the filter clothes that cover the plates with a minimum loss of productivity. Washing pressure (100 bars).

AUTOMATIC ACIDIC FILTER CLOTH WASHING SYSTEM

- It allows to dissolve the limestone formed in the fibres of the filter clothes produced by a lime conditioning.

SAFETY BARRIERS

- Mechanical or optical barriers forbidding access to the machine while operating.

DETECTION OF END OF PLATE SQUEEZING PROCESS

- By means of a pressure switch or a timer or the control of the filtrate discharge, this device allows to automatically stop the filtration process.

SYNOPTIC VIDEO

- A computerized supervision can be set on in order to manage a full installation ad have a global look at it..

EXTENSION POSSIBILITIES

- In order to add a certain number of plates in the future to increase the ability of the filter press..

HOPPER UNDERNEATH THE FILTER

- This device guides the drop of the cakes during the plate shifting process with the possibility to set mobile trays so as to collect the drips of the filtrate.

MECHANIC TRAYS

- This device allows to close the flaps underneath the filter press in order to collect the drips and the washing water.

BELT

- This device allows to evacuate the cakes with or without storage and shredding process.

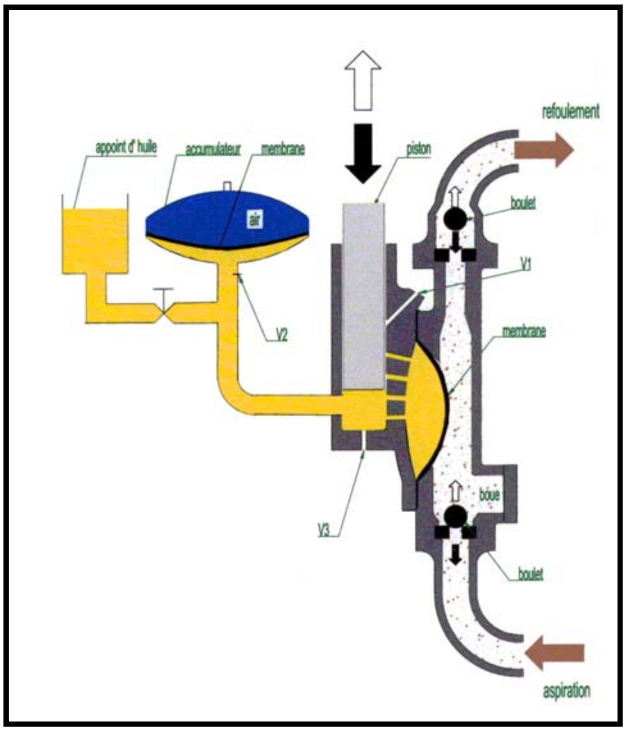
d) Feeding pumps

The feeding pump must regulate its flow rate according to the pressure increase produced by the formation of the cakes in the chamber. Positive displacement pumps fitting with an automatic regulation device are usually used to do so.

The positive displacement pumps are piston/membrane, peristaltic or ***moineaux*** pumps. The regulation can be hydropneumatic, hydraulic or electronic.

Impeller pumps can be used mainly with minerals.

Example of a self-regulating piston/membrane pump, COTRE range



d) Conditionings

The sludge to be dewatered very often must be conditioned so as to flocs can form by means of coagulation or flocculation in order to improve their filterability. The compounds used are usually minerals (iron salt, limestone and aluminium salt in a minor part) or organic (polyelectrolyts). A heat treatment can also be used so as to break the colloidal chain by means of a temperature increase thus modifying the structure of the sludge. After the thickening process, the sludge can be filtered without any additives. This process is not the most standard and will not be referred to below.

<u>Mineral reagents</u>

Mineral reagents are the most conventional compounds. The disadvantage is that a lot of these reagents must be added to the conditioning. In case of a ferric chloride / lime treatment, the reagents are usually and respectively 7% and 30% (in masse) proportioned. Because of these proportions, almost the same amount of mineral material and solid particles in the sludge must be treated. However, the flocs thus formed are granular, mechanically stable and they usually well wear pumping transfer.

<u>Polyelectrolyts</u>

Polyelectrolyts (or synthesis polymers) are used in conditioning since a short time and progressively substitute to the former reagents. They can be used alone or they can be combined with a iron salt thus producing a precoagulation. They allow thick flocs to form with about some grams per kilograms of dry materials only (from 4 kg up to 8 kg of dry materials) as treatment proportions. However the flocs thus formed are more fragile than the ones produced by means of mineral reagents.
Among the polyelectrolyts, the cation-active polymers and anion-active polymers can be found. The cation-active polymers are used in mainly organic sludge and the anion-active polymers are used in mineral sludge.

<u>Procedure</u>

The reagents are usually fed before the filter press in a conditioning tank. The conditioning should be carried out right away since stocking them too long may damage the filterability on the thicken sludge. The reagents are proportioned according to the amount of dry materials by means of a proportioning pump. In case of polymers forming fragile flocs, the feeding can be made in a linear way in proportion with the flow rate of the sludge. The flocs thus form in the pump itself and in the outward pipe. Finally, in case of large installations, automated systems allow to find out the optimum flocculation conditions whatever the concentration of the feeding sludge.

In all cases, the reagents must be fed in a diluted way in order to ease the blending. For instance, a lime milk at 50-80 g/L and polymer stock solutions at 2 or 4 g/L are usually used. In case of mineral reagents, contact time is about of ten minutes (thinned at a high speed for the ferric chloride and slower for the lime). In case of polymers, the flocculation is almost immediate (slowly thinned).

<u>Other conditionings</u>

The wood flour is increasingly used in particular, in case of greases (FAURE EQUIPEMENTS' patent) and sludge difficult to be conditioned such as food industry or other.
This type of conditioning has the advantage to add an organic material and allows to get high drynesses.

Consequently the sludge can be discharged by means of incineration, coincineration and agricultural improvement. The conditioning by means of flour can be combined with a conditioning with $FeCI3$ and polymers depending on the case.

f) Sizing

The sizing is a calculation made using your data. It is used to determine the sizing of the filter press and the pump according the following formula:

-SIZING CALCULATION FOR A FILTER PRESS

The sizing of a filter press is determined by the volume (in litre) of cakes in the chambers formed between the plates.

Your data: V = volume of sludge to be dewatered per day (L)
Ci = sludge concentration (g/L)

We need to know the amount of dry material to be dewatered per day = Ms in kg in order to calculate the sizing of a filter press.

MS = V x C/1000

Results of the dewatering process:
Sf = dryness of the cakes produced in % (dry/wet)

Sf = (Mass of MS / Total mass) X 100

φ = (Mass of MS / Total mass) X 100

Daily volume Vj of cakes produced

$$Vj = \frac{MS \times 100}{Sf \times \varphi} \quad (L)$$

Volume Vf of a filter press:
The filter press usually runs several cycles per day. It depends on the cycle duration Tc and the process duration Te of the filter press. **tc =**
N refers to the number of cycles per day, **te** =

$$N = \frac{Te}{Tc} \quad .... \quad =$$

In case of larger installations, several filter presses can be used.
N refers to the number of filter presses to be used, **n** =

$$Vf = \frac{Vj}{N \times n} \quad ....(L)..... \quad =$$

In order to determine the sizing, we need the following data:

- dryness sf
- density φ
- cycle duration, tc

If you do not know them, you can find them in the tables enclosed. The empirical results you can find in these tables have been given by current installations.

- *Sizing calculation for a pump*

The sizing of the feeding pump of a filter press is determined by the initial flow rate before the regulation process and by the pressure at the end of the filtration process.

Total hydraulic volume to be pumped is calculated by means of the following equation:

$$= \quad Vh\ (\text{litres}) = \frac{Vf \times Sf \times \varphi \times 1000}{100 \times Ci}$$

<u>Data</u>:

Vf : Volume of the filter press in (L)

Sf : Dryness of the cake produced

Ci : Sludge concentration in (g/L)

φ : Density of the cakes (kg/L)

Tf : Total duration of a filtration cycle
(Tf = Tcycle - 0,25 (h))

Initial flow rate of the piston/membrane pump:

D = k VH/Tf =

or k = - 0,33 Tf + 2,3 =

- EXAMPLES

URBAN WASTEWATER TREATMENT PLANT SLUDGE

10 000 EH
Long time aeration
Phosphorus removal with FeCI3
Conditioning : FeCI3,5 %
Polymers, 3 kg up tp 5 Kg per MS Tons

-SIZING CALCULATION FOR A FILTER PRESS

Your data: V = volume of sludge to be dewatered per day (litre) | 17 000
Ci = sludge concentration (g/L) | 30

We need to know the amount of dry material to be dewatered per day = Ms in kg in order to calculate the sizing of a filter press:

MS = V x C/1000 + MS Conditioning | 535

Results of the dewatering process:

Sf = dryness of the cakes produced in % (dry/wet) | 28
φ = density of the cakes (kg/L) | 1.05

Daily volume Vj of cakes produced

$$Vj = \frac{MS \times 100}{Sf \times \varphi} \text{ (litres)}$$ | 1820

Volume Vf of a filter press:
The filter press usually runs several cycles per day. It depends on the cycle duration Tc and the process duration Te of the filter press. **tc =** 2.5
N refers to the number of cycles per day,

te = 8

$$N = \frac{Te}{Tc} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad = 3$$

In case of larger installations, several filter presses can be used.
N refers to the number of filter presses to be used **n** = 1

$$Vf = \frac{Vj}{N \times n} \quad \ldots\ldots\ldots\ldots (.L.).. \quad = 606$$

Equipment chosen : 1 TITAN 217 range FILTER PRESS - 45 plates of 800X800
- 44 Cakes 30 mm thick
- Automatic plate shifting
- Automatic filter cloth washing device

-SIZING CALCULATION FOR A PUMP

Total hydraulic volume to be pumped is calculated by means of the following equation:

$$= \quad Vh\ (L) = \frac{Vf \times Sf \times \varphi \times 1000}{100 \times Ci} \qquad \boxed{5940}$$

Data:	Vf : Volume of the filter press in (L)	606
	Sf : Dryness of the cake produced	28
	Ci : Sludge concentration in (g/L)	30
	φ : Density of the cakes (kg/L)	1.05
	Tf : Total duration of a filtration cycle (Tf = Tcycle - 0,25 (h))	2.25

Initial flow rate of the piston/membrane pump:

D (L/h) = k VH/Tf = 4118

OR k = - 0,33 Tf + 2,3 = 1.56

Equipment chosen: 1 Cotre 4000 range pump - Initial flow rate 4m3/h
- Maximum pressure 15 Bars

g) Results on different types of products

URBAN SLUDGE FILTRATION DATA

TYPE OF SLUDGE	CONDITIONING	SLUDGE CONCENTRATION	RESULTS					
			DRYNESS	CYCLE DURATION FP CHAMBERS / FP MEMBRANES		DENSITY OF THE CAKES	THICKNESS OF THE CAKES	FILTRATION OR SQUEEZING PRESSURE
A 100% domestic sludge	Lime + FeCl3 30% 7%	40 g/l	**35% mini**	2 h 30	2 h 00	1,15	32 mm	15 bars
Long time aeration + Phosphorus removal with FeCl3	Polymers + FeCl3 4 kg / T MS 5%	40 g/l	**28% +-2**	3 h 00	2 h 00	1,05	25 mm	15 bars
	Polymers only 5 kg / T MS	40 g/l	**26% +-2**	3 h 00	2 h 00	1,05	25 mm	15 bars
	Wood flour 30 % + FeCl3 5 % + poly	40 g/l	**32 %**	2 h 30	2 h00	1,05	25 mm	15 bars
A 50% domestic sludge	Lime + FeCl3 35% 8%	40 g/l	**35% +-2**	2 h 30	2 h 00	1,15	30 mm	15 bars
A 50% agricultural and Food industries sludge (dairy, paper industries…)	Polymers + FeCl3 4 kg / T MS 7%	40 g/l	**26% +-2**	3 h 00	2 h 00	1,05	30 mm	15 bars
	Flour + FeCl3 + poly	40 g/l	**32 %**	2 h 30	2 h00	1,05	25 mm	15 bars
A 100% domestic sludge	Chaux + FeCl3 30% 7%	40 g/l	**37%**	2 h 30	2 h 00	1,15	30 mm	15 bars
Mixed: A 50% primary sludge A 50% secondary sludge Long time aeration	Polymers + FeCl3 3 kg / T MS 5%	40 g/l	**32%+-2**	2 h 30	2 h 00	1,05	25 mm	15 bars
	Polymers 4 kg / T MS	40 g/l	**30%+-2**	2 h 75	2 h 00	1,05	25 mm	15 bars
	Wood flour + FeCl3 + poly	40 g/l	**32 %**	2 h 30	2 h00	1,05	30 mm	15 bars
A 100% domestic sludge	Lime + FeCl3 30% 7%	40 g/l	**38%**	2 h 30	2 h 00	1,15	30 mm	15 bars
Physico-chemical sludge	Polymers + FeCl3 4 kg / T MS 4%	35 g/l	**32% +-**	2 h 30	2 h 00	1,05	30 mm	15 bars
	Wood flour + FeCl3 + poly	40 g/l	**32 %**	2 h 30	2 h 00	1,05	25 mm	15 bars

			RESULTS					
				CYCLE DURATION				
TYPE OF SLUDGE	CONDITIONING	SLUDGE CONCENTRATION	DRYNESS	*FP CHAMBERS*	FP MEMBRANES	DENSITY OF THE CAKES	THICKNESS OF THE CAKES	FILTRATION OR SQUEEZING PRESSURE
A 100% digested domestic sludge	Lime + FeCl3 30% 7%	40 g/l	**35 % $^{+2}_{0}$**	2 h30	2 h 00	1,15	30 mm	15 bars
	Polymers + FeCl3 4 kg / T MS 4%	35 g/l	**30 % $^{+-}$2**	2 h 30	2 h 00	1,05	30 mm	15 bars
	Polymers only 5 kg / T MS	35 g/l	**28 % +-2**	2 h 30	2 h 00	1,05	30 mm	15 bars
	Wood flour + FeCl3 + poly	40 g/l	**33 %**	2 h 30	2 h00	1,05	30 mm	15 bars

FAURE EQUIPEMENTS *Filter presses* *Page 22*

INDUSTRIAL SLUDGE FILTRATION DATA

TYPE OF SLUDGE	CONDITIONING	SLUDGE CONCENTRATION	DRYNESS	RESULTS				
				CYCLE DURATION		DENSITY OF THE CAKES	THICKNESS OF THE CAKES	FILTRATION OR SQUEEZING PRESSURE
				FP CHAMBERS	FP MEMBRANES			
Metal hydroxides Iron, Nickel, Chrome neutralized with lime		40 g/l	**35 à 40%**	2 h 25	1 h 30	1,2	30 mm	15 bars
Metal hydroxides, Iron, Nickel, Chrome neutralized with sodium hydroxide		30 g/l	**30 à 35%**	4 h 00	3 h 00	1,15	25 mm	15 bars
Metal hydroxides, Aluminium neutralized with hydroxide sodium		20 g/l	**25%**	4 h 30	3 h 00	1,05	20 mm	15 bars
Dairy industry	Lime 50 à 70% + FeCl3 10 % Wood flour + FeCl3 + poly	25 g/l	**30%** **35 %**	3 h 00 3 h 00	2 h 30 2 h 00	1,1 1,1	30 mm 30 mm	15 bars 15 bars
Cardboard industry ink + glue	electroflocculation	10 g/l	**50%**	4 h 00	3 h 00	1,2	30 mm	15 bars
Quarries (mineral)	Polymers	300 g/l	**70 à 85%**	0 h 30	0 h 15	1,8	35 mm	7 à 15 bars
Smoke washing sludge UIOM		90 g/l	**50%**	2 h 00	1 h 30	1,35	35 mm	15 bars
Washing water ceramics sludge	Nothing or polymers	100 g/l	**60 à 80%**	1 h 30	0 h 75	1,7	30 mm	15 bars
Tanneries sludge	Polymers	50 g/l	**40%**	4 h 00	3 h 00	1,3	30 mm	15 bars
Drinking water sludge – Coagulation or aluminium sulphate sludge	Lime 30% FeCl3 7%	20 g/l	**33%**	2 h 30	2 h 00	1,1	30 mm	15 bars

	Polymers 5 kg / T de MS	10 g/l	**28% $^{+2}_{0}$**	5 h 00	3 h 00	1,05	25 mm	15 bars

Notes:

We very often carry out trials in our laboratory but also on one of our pilots directly in our customers'sites.
By means of these trials, we are able to find out results and to ensure them.
These trials are necessary in case of any type of unknown sludge.

h) Advantages

- Sturd and reliable machine without adjustment needed while operating and reduced maintenance.

- Low energy cost and few reagents (flocculant) needed.

- Reduced manpower required : only supervision for plates shifting.

- Highest performance of all the mechanical dewatering machines : dryness > 30 %
  The high dryness of the cakes allows to reduce and to ease sludge storage (storage in pile on a flat area). The dryness also allows to discharge the cakes in various ways such as :

  . Agricultural improvement
  . Incineration and coincineration
  . Compost
  . Long time storage
  . Burial centres
  . Etc ...
- Clear filtrates
- Very easy to use, accommodation to new products and to the variations of production
- Chemical conditioning or conditioning with polymers

i) Set up

Filter presses can be set up in several ways according to their size.

The filter press can be set up in a no-freezing place either :

- on elevators for the small ones
- or on a iron frame
- or at the first level of a building for the largest ones

The cakes can be directly collected in trays placed underneath the filter press.

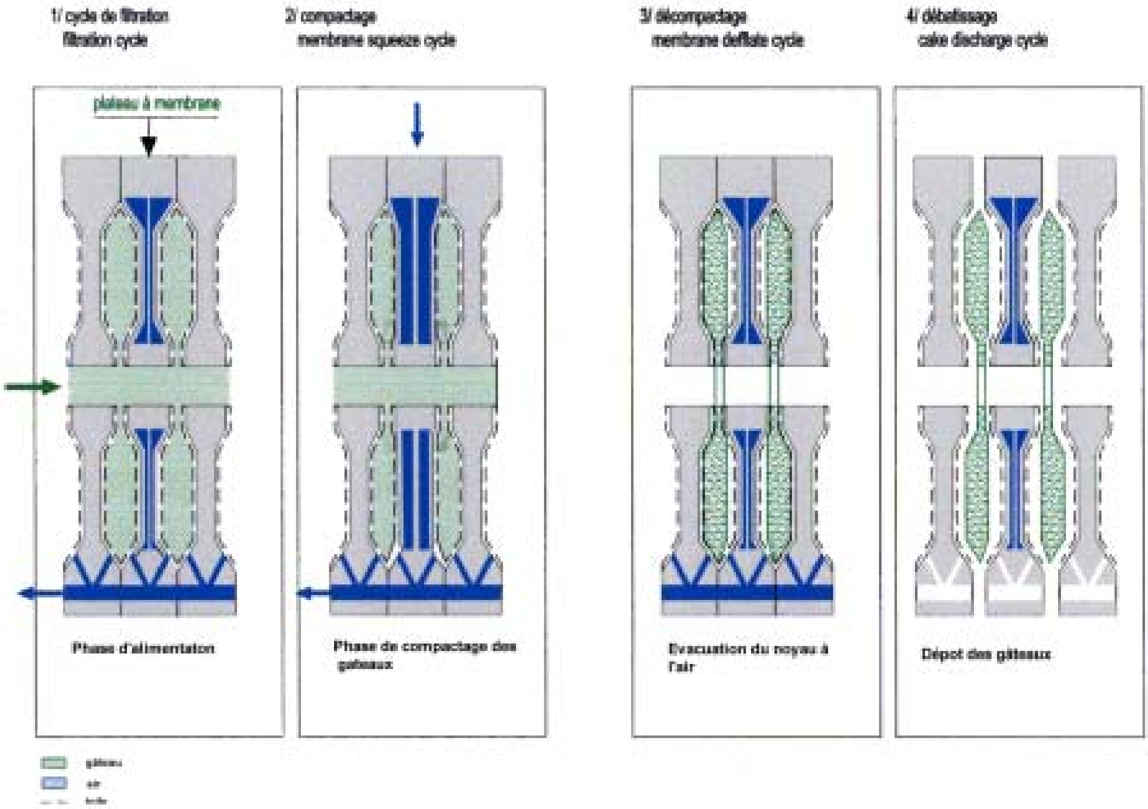
A conveyor belt can be placed underneath the filter press in order to discharge the cakes to one or several trays.

<u>II) Membrane plates filter presses</u>

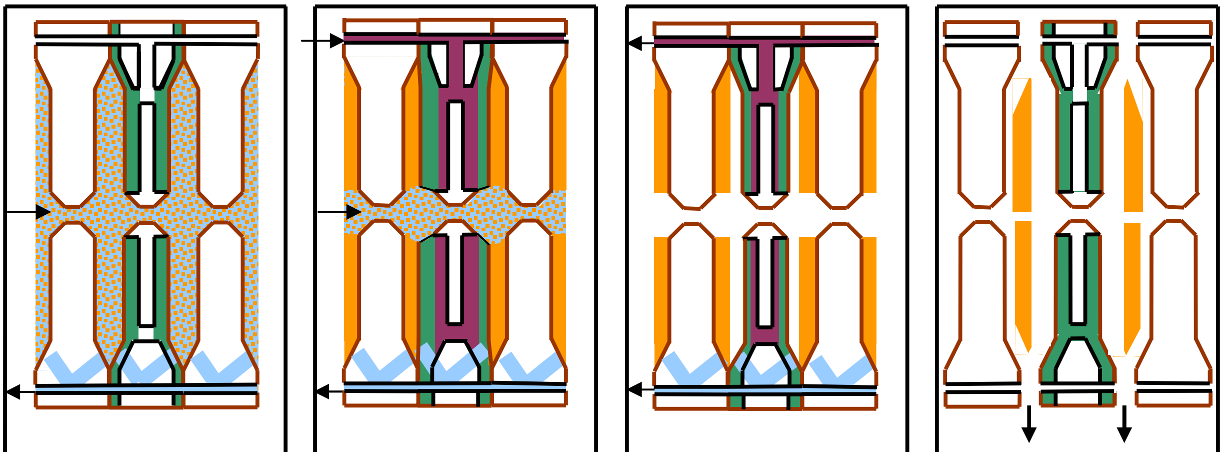
a) Presentation and operating principles

Membrane plates filter presses are used since several years in the chemical, food and industrial industries. Nowadays this kind of filter presses is more and more used for any kind of materials (quarries, urban and industrial sludge of any kind).

This kind of filter presses is fitted with membrane plates. The outside sides of these plates are lined with a plastic or rubber membrane (the membranes can be removed). The membrane plates are very often mixed with chamber plates. After a conventional filtration process in the filter press (usually at a low pressure : 7 up to 10 bars), the membranes are inflated by means of pressurized water (15 bars) thereby squeezing the cakes all over their surface. The volume of the cake thus decreases and an additional volume of filtrate is extracted.
The feeding pump of a membrane filter press is very often fitted with a separate impeller and flow rate regulation device in accordance with the pressure increase.
At the end of the filtration process, the maximum pressure is of 7 up to 10 bars. Since the flow rate is still high by the end of the filtration process, a pump alone can be used.



Membrane filter presses operating principles

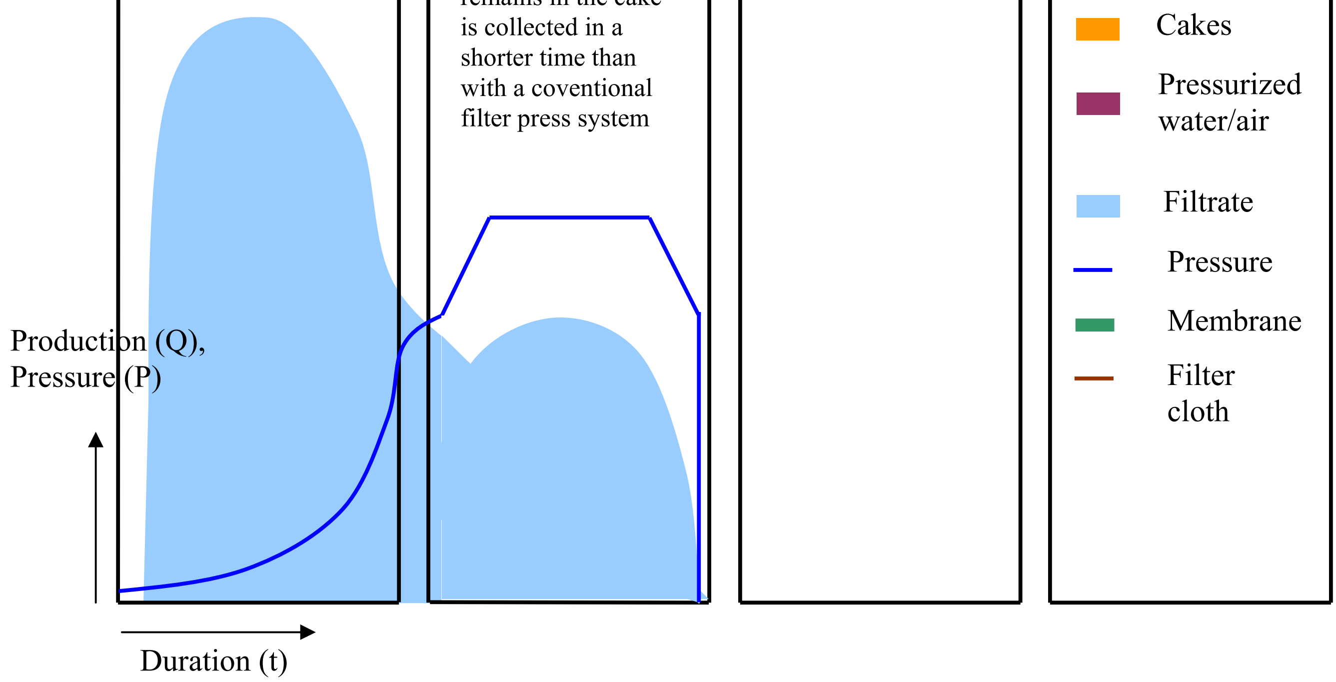


- Introduction of the materials to be filtered
- The cakes begin to be filtered
- High flow rate of the filtrate

- Pressure increase of the feeding pump until an intermediate value
- Compacting step by means of water or air injection onto the membranes
- The filtrate that remains in the cake is collected in a shorter time than with a coventional filter press system

- Deflate step : water/air evacuation within the membranes

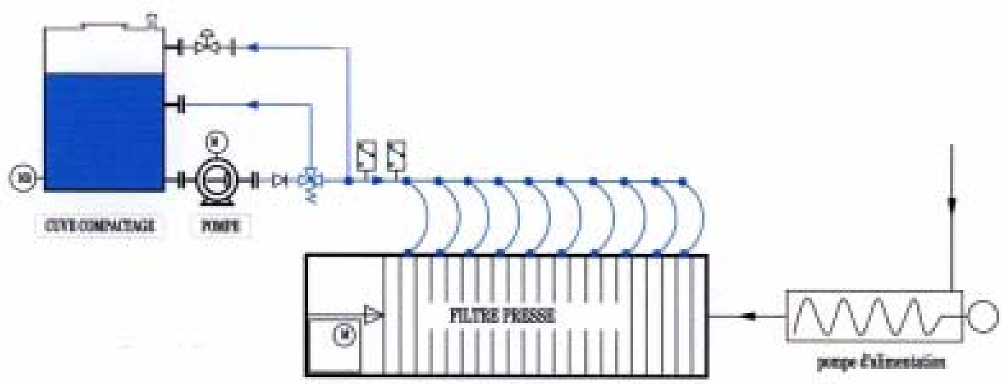
- Plate shifting (cakes discharge)



Membrane plates TITAN 218 range filter press

b) Squeezing system

A pump is used to splash pressurized water onto membrane plates in order to carry out the squeezing process. Depending on the cases, this pump can be an impeller or a volumetric pump fitted with a flow rate / pressure regulation device. At the end of each squeezing process, the volume of water behind the plates is sucked and goes back to in a stocking tank. The squeezing process water is used in a closed circuit.



Water squeezing system

c) Membrane filter presses advantages

The main advantage of this kind of filter presses is the high productivity increase (cycle duration reduction of 20 % up to 50 %).
A better dryness and cakes discharge are also noteworthy (10 % up to 15 % extra).

In case of certain sludge or pulp, membrane filter presses allow to wash the cakes.
By means of water, or another fluid, circulation through the cakes, soluble products are collected (i.e. removing sugar from cakes in the sugar industry).

d) Sizing

The volume of filter presses is calculated in the same way as for chamber plates filter presses.

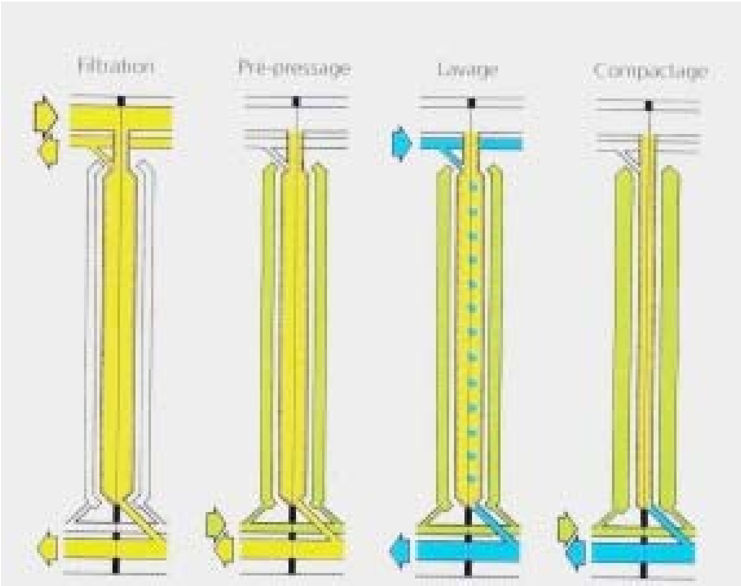
This volume is the volume we get after the squeezing process.

Before the squeezing process, the volume of a filter press is thus higher. It depends on the cakes thickness decrease during the squeezing process.

For this kind of filter presses, trials only will properly determine the following parameters:

- Filtration pressure
- Filtration duration
- Squeezing pressure
- Squeezing duration
- Cake thickness before the squeezing process
- Cakes thickness after the squeezing process
- Dryness and density of the cake

d) Applications in the chemical industry: operating principles of cakes washing



Filter presses can be used to separate liquid and solid phases but also to extract the remaining liquid phase that is “trapped” between the solid grains.

In order to do so we can “pre-squeeze” the cakes (diagram 2) and splash water (at the most convenient temperature according to the process – diagram 3). The chambers are fed with water at the higher level and on one side of the cakes and goes out at the bottom of the cakes, at the other side of the plates thereby spreading through the whole volume of cakes.

We can also feed pressurized air onto the cakes in order to “chase” the liquid phase. The air thus goes like water. This process is ancillary to the first one and they can be combined as many times as required in order to achieve the desired extraction results.

Practically, the pre-squeezing pressure and the quantity of water to be fed should be adapted according to the process requirements such as the type of sludge, the desired maximum dilution, etc ...

Once the washing process is over, the squeezing process can be ended at the desired pressure (15 bars maximum). The process can go on in a conventional way.

Conclusion:

The filter presses productivity increases thanks to membrane plates.

The devices that make filter presses totally automatic can currently be found in the market.

The desired drynesses are increasingly high.

Filter presses remain the fundamental filtration and mechanical dewatering equipments.