

Sludge Dewatering for Waste Reduction and Water Reuse

**Presented By Scott Hardy
H&T Systems, Inc.**

For

16th Annual P2 Conference

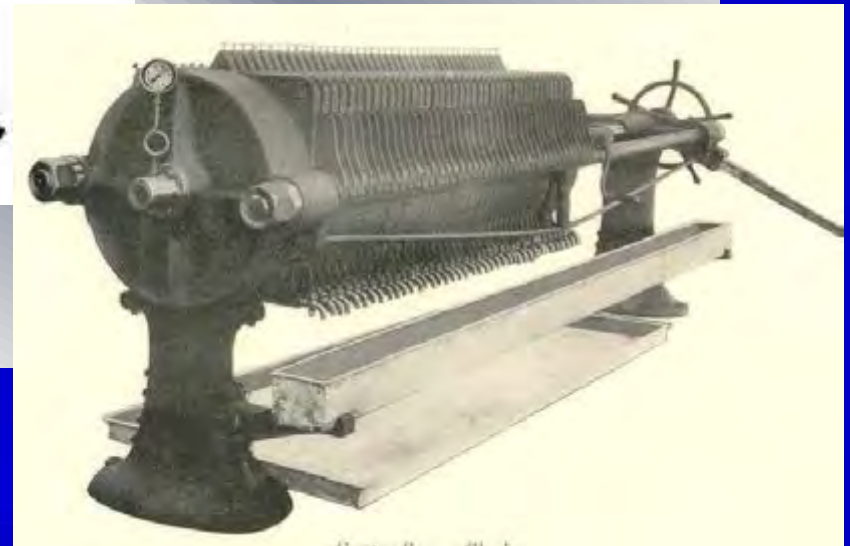
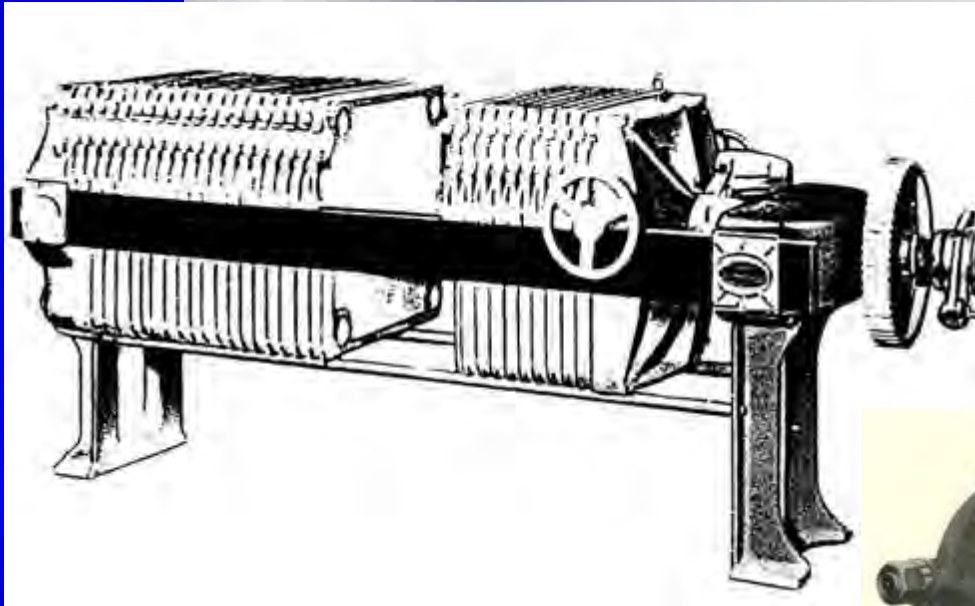
Personal Intro

- **Worked in Automotive / Agricultural Industry for 26 years.**
- **15 years as an operator in Wastewater Treatment plants with processes for Chromium Reduction, Metals Precipitation, Solids Dewatering and Oil Water Separation.**
- **1995 Indiana Industrial Plant Of The Year Award for waste reduction**
- **2002 Indiana Governors Award winning plant for waste reduction**
- **10 years as a WWT Equipment Manufactures Representative. Equipment Sales, Service, Start-up, Pilot Testing, Operator Training**
- **22 years as an Indiana “Class C” Certified Wastewater Treatment Operator.**
- **Member of 2 time winning team in the Indiana Industrial Operators Association “Operator Challenge”**



JWI
FILTER PRESSES

Filter Press Evolution



- Cast components
- Manual open/close
- Wooden or cast iron plates-and-frames

JWI Filter Presses



What Is A Filter Press? (Besides A Technology That Is Almost 200 Yrs Old)

While the origin of the term "filter press" is unclear, it most likely refers to the primary function of the equipment as that of a "filter" and the construction of the skeleton as that of a "press" frame similar to those used in printing and juice processing that were popular at the time presses were developed in the early 1800's.

The first record of patents filed in the United Kingdom for filter presses was in the 1830's for use in the processing of clay slips.

SMALL PORTABLE PILOT PRESS



470 PILOT PRESS with MEMBRANE SQUEEZE



470MM Press with APCS



630MM with APCs & Semi Auto Plate Shifter



800MM with Short & Long Legs



1000MM Presses with Expansion



1200MM Press with Short Legs and top mount hydraulic cabinet



1200MM Sidebar Press



Large Presses Overhead - Compression Close

- Available in presses 1000 mm and larger



Large Presses Overhead - Tension Close

- Available in presses 1500 and larger



Trailer Mounted Filter Presses

- For completely portable filtration requirements



General Overview

Filter Presses

JWI Filter Presses

- **Designed for large volume liquid/solid separation**
- **Can handle a variety of separations, organic and inorganic**
- **Can handle both acidic and basic suspensions**
- **Provide high dry solids in the filter cake**
- **Low suspended solids in the filtrate**
- **Post filtration treatment of the cake before discharge is possible**
- **Filter cake may be recovered**
- **Filtrate may be recovered**

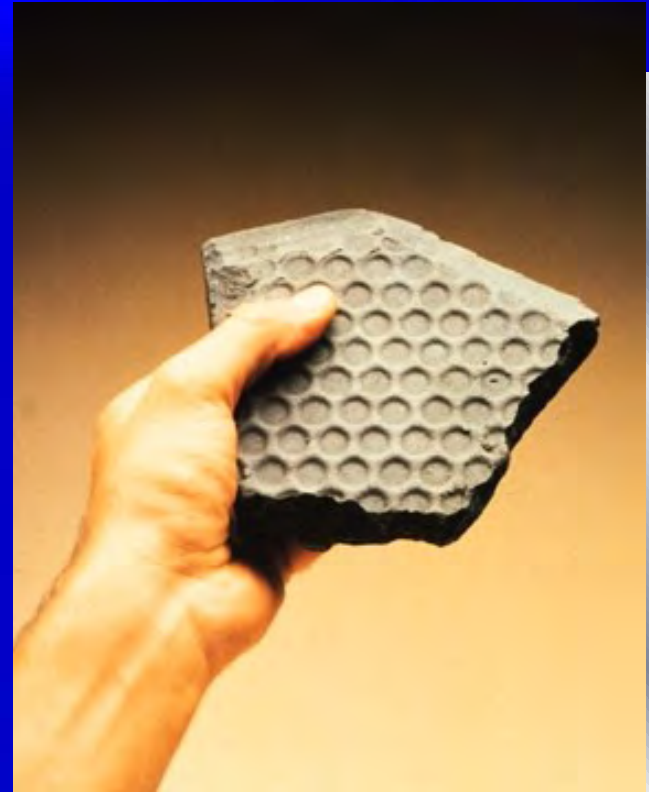
Typical Volume Reduction

**80 barrels of metal hydroxide
sludge reduced to 4 barrels of
cake.**

**Additional reduction can be
realized by drying the filter cake.**

Who Uses a Filter Press?

- Product manufacture
- Wastewater filtration
- Liquid / Solid separation requirement
- High dry solids requirement



Markets

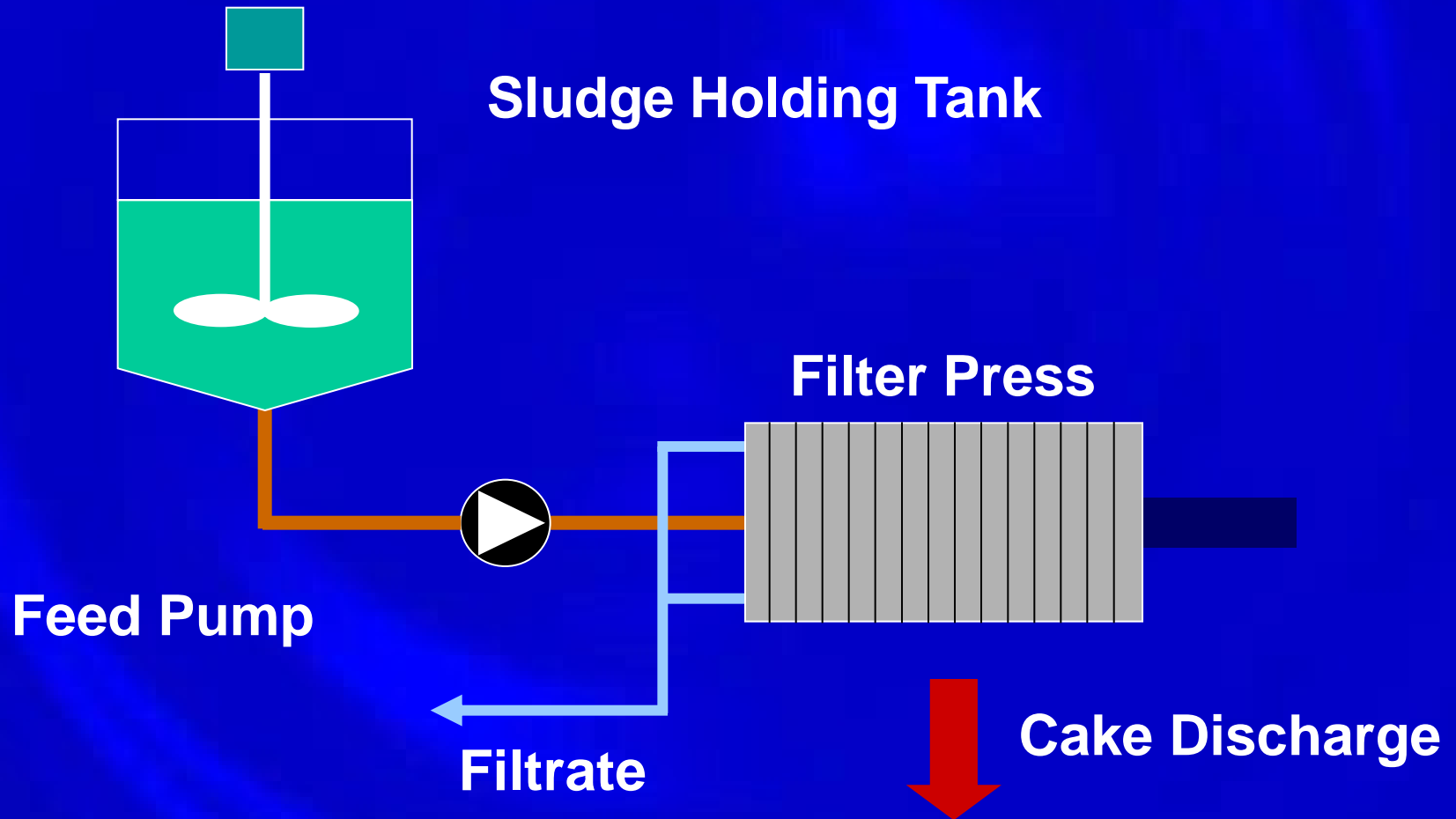
- Pharmaceutical
- Chemical
- Food
- Industrial Wastewater
- Power
- Pulp and Paper
- Municipal WW
- Potable water

Typical Industrial Applications

- Aluminum hydroxide waste
- Ash/Scrubber sludge's
- Battery reclamation
- Ceramics
- Drilling mud/completion fluid
- Flexographic ink
- Food and beverage
- Landfill leachate
- Industrial laundry
- Phosphate sludge
- Pigments and dyes
- Semiconductor waste
- Tannery waste
- TV tube manufacture
- Winery waste
- API Separator bottoms
- Acrylic polymers
- Textile waste
- Phosphatizing sludge's
- Specialty chemicals
- Metal finishing waste

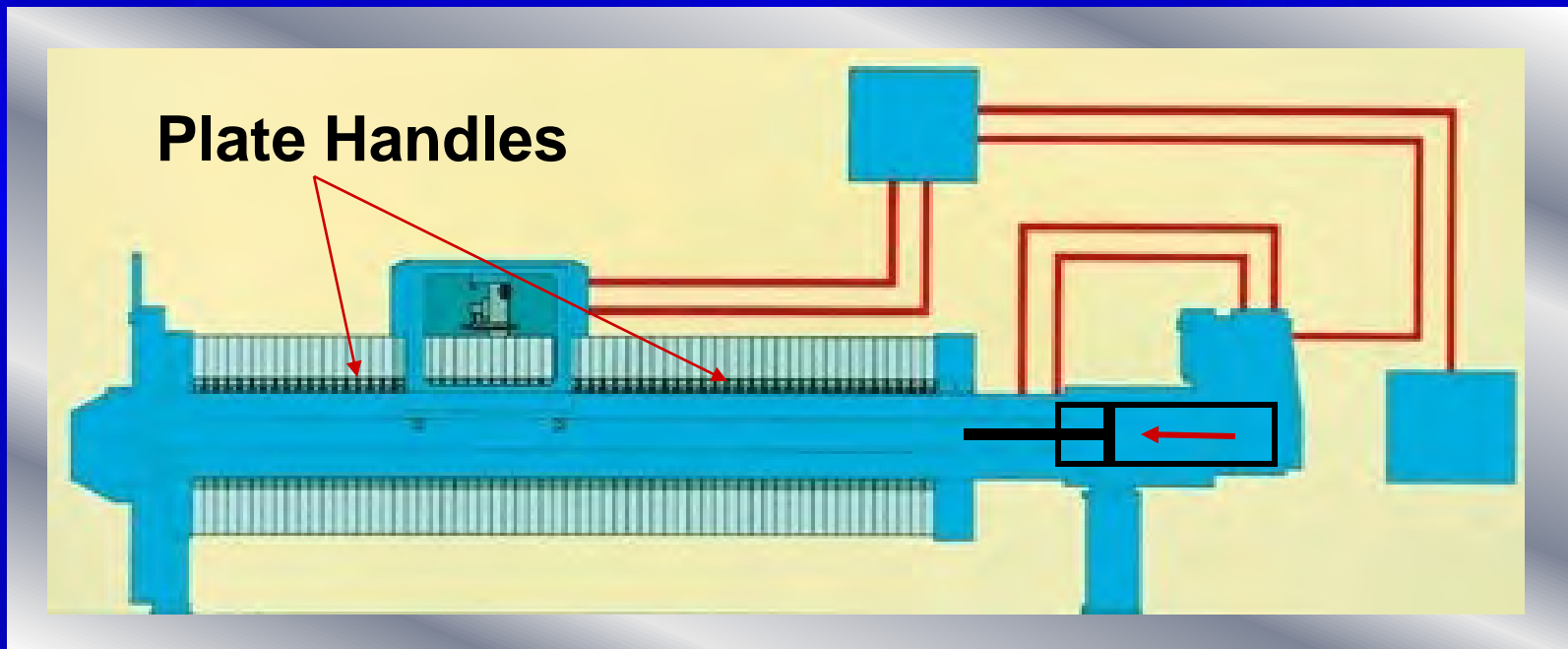
Operation/Basic Components of Filter Presses

Used in Simple Filtration



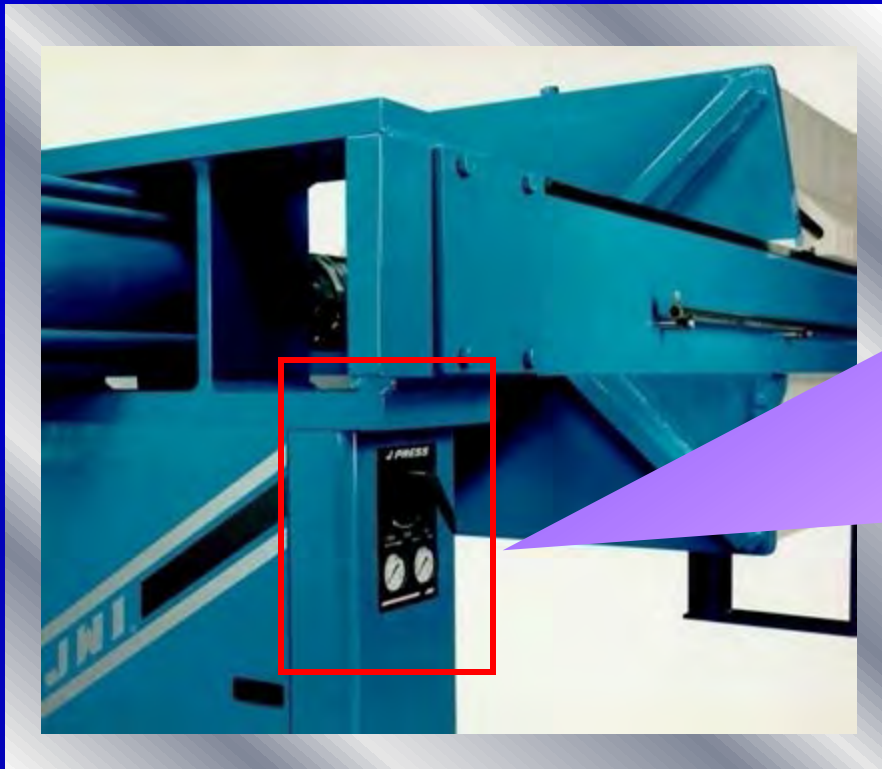
Sidebar Style - Compression Close

- Filter plates are suspended by handles resting on the sidebars
- Hydraulic cylinder keeps the filter pack closed while in the compression stroke



Standard Closure Controls

- Single Hydraulic Valve
- Dual Gauges



Air Hydraulic Closure System

- Modular Manifold Block
- Only Needs 85 psi Air Pressure
- Maintains Constant Closure Pressure
- Color Coded Connections



Electric Hydraulic Closure



- Standard on 1200 mm Presses and Larger
- Optional on smaller presses
- Regenerative hydraulic circuit
- Smooth operation
- No air required so poor plant air is not an issue.

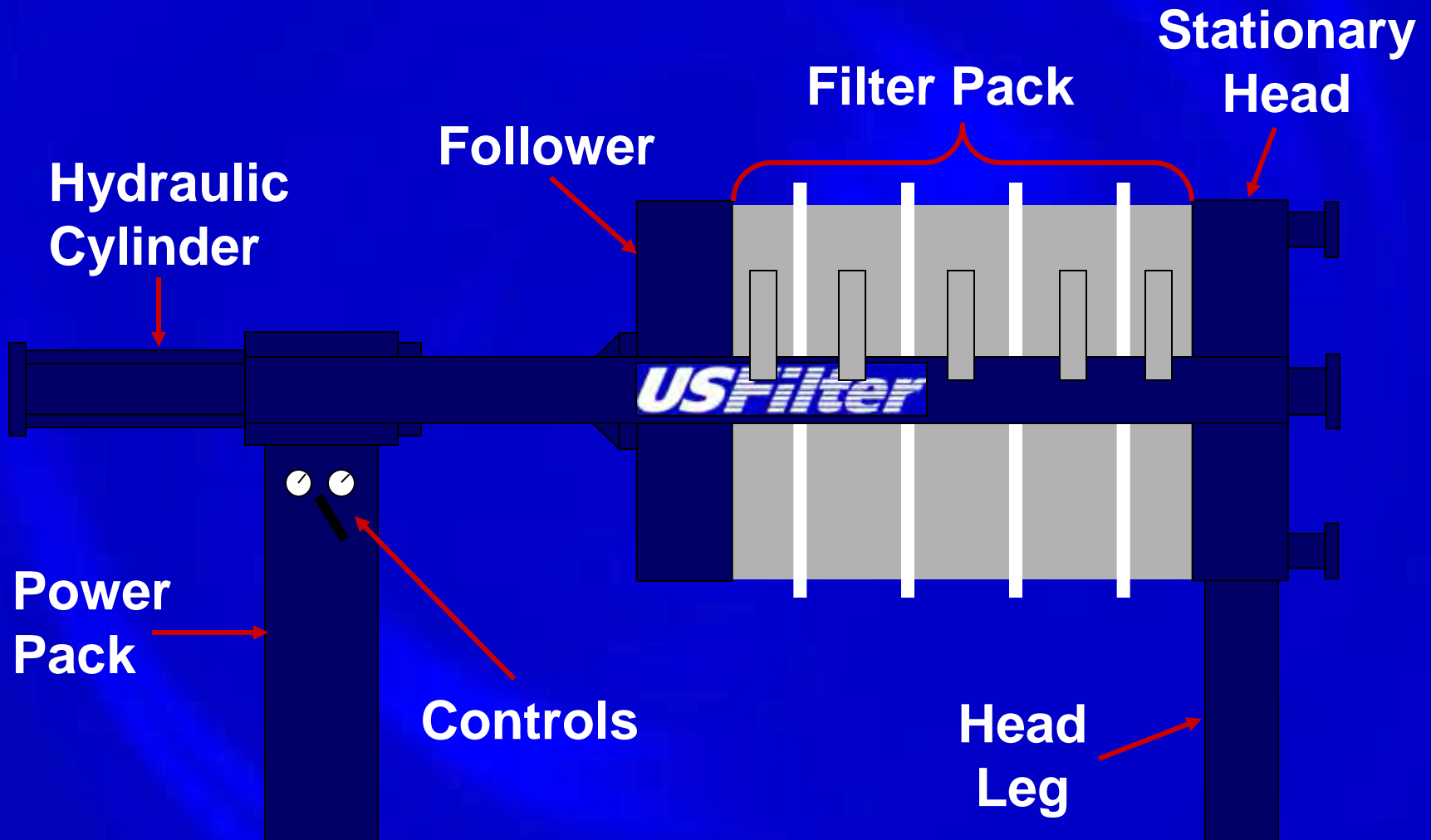
Manual Screw Closure



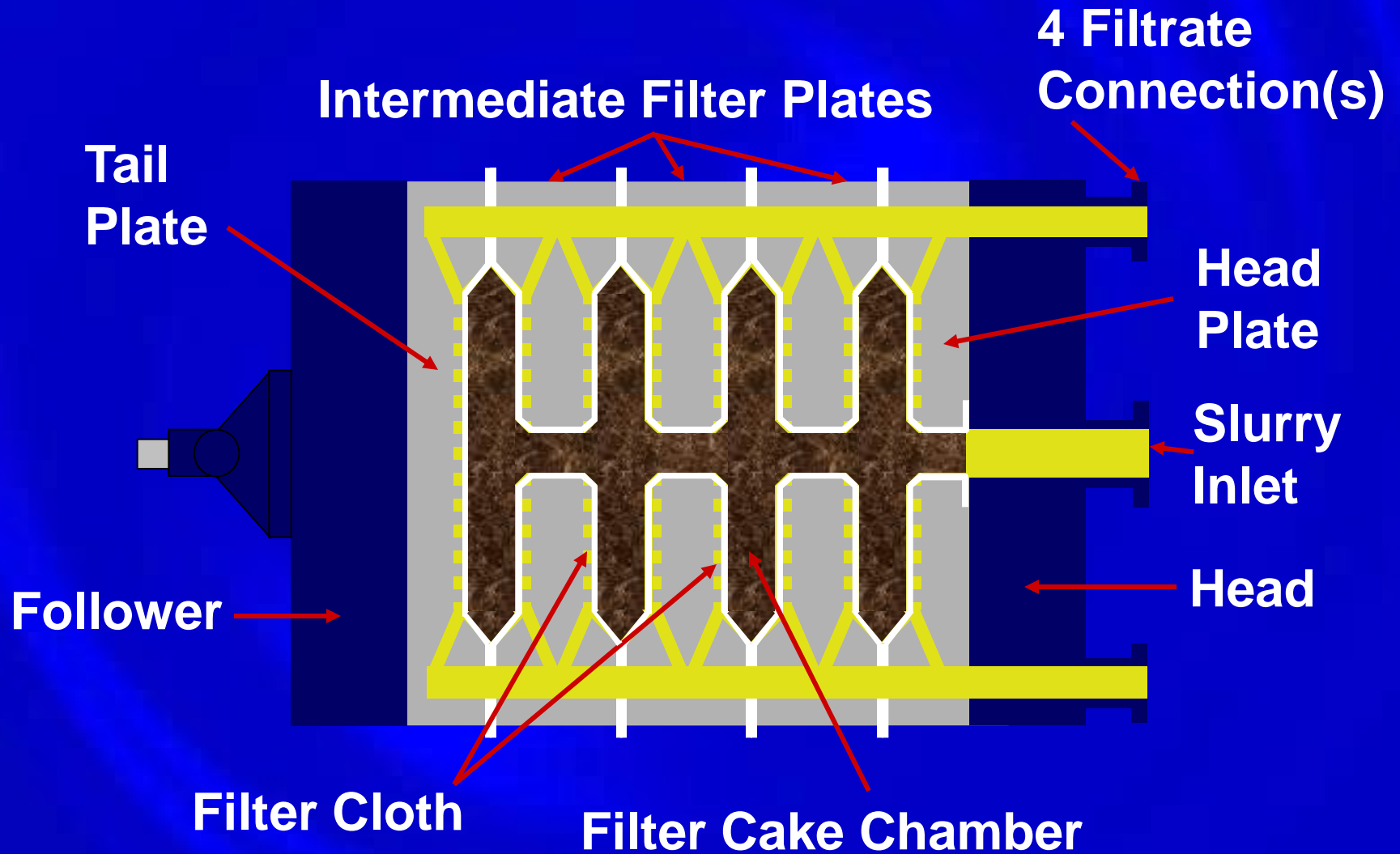
Parts of the Filter Press

- Frame (or skeleton)
- Filter Pack
- Piping manifold

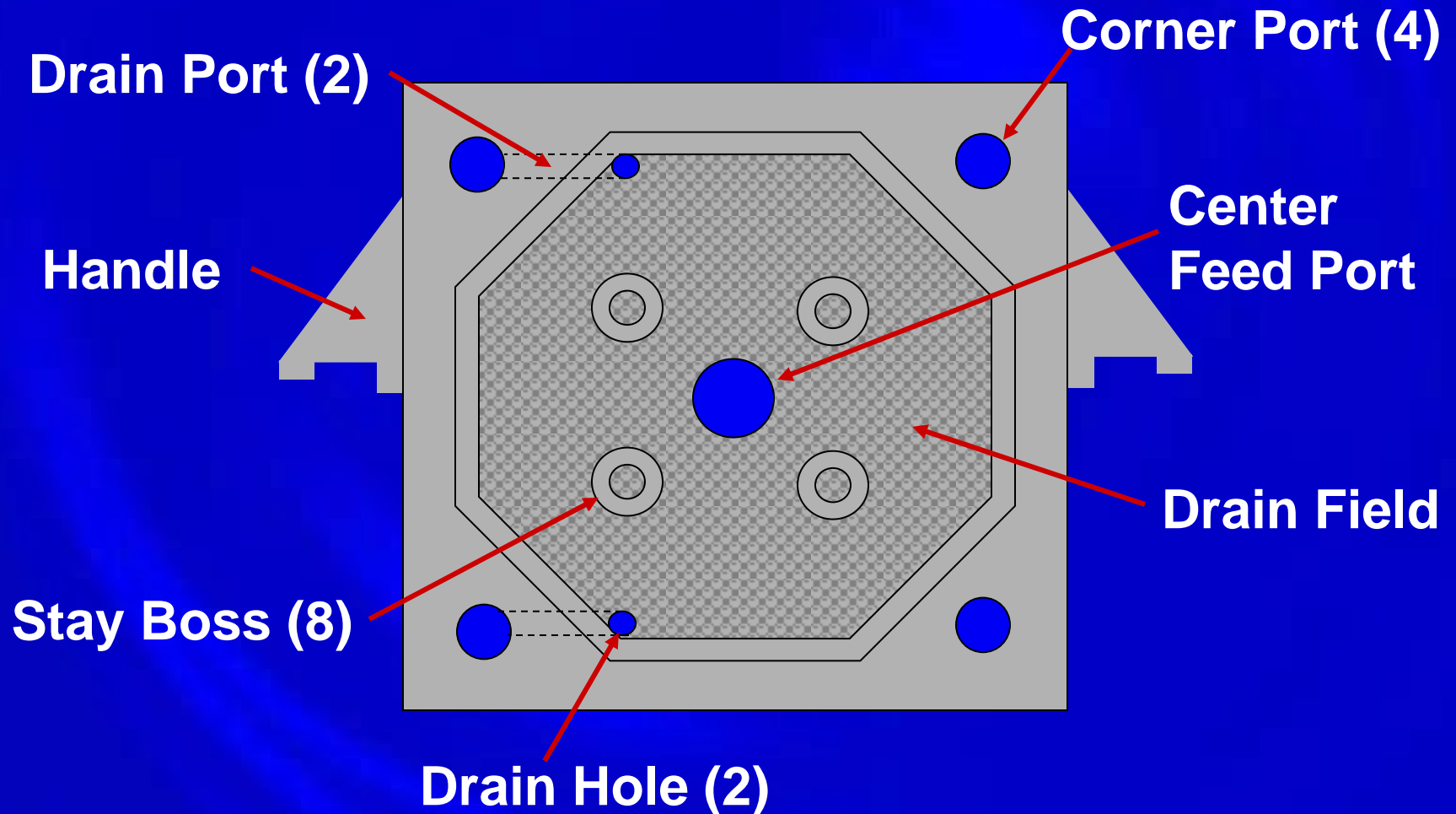
Parts of the Filter Press Frame



Parts of the Filter Pack



Parts of the Filter Plate



Standard Recessed Plate Filter Press

- **Fixed volume filtration**
- **Requires sufficient solids to completely fill the chambers**
- **Cake consolidation performed by a feed pump**
- **Operating pressure of up to 100psi**

Key Points-Recessed Chamber

- Dewatering pressure is supplied by feed pump, most common are Air Operated Diaphragm pumps
- The filter press does not squeeze the slurry
- No moving parts during dewatering
- Batch process

Gasketed Recessed Filter Plates



- Lightweight
- Corrosion resistant
- Durable
- Eliminates leakage
- Filtration pressures to 225 psi

Gasketed Recessed Chamber

- Little dripping
- More difficult cloth installation
- Recommended for smaller presses up to 800 mm
- Also used on larger presses if leakage is a problem



Non-gasketed Recessed Chamber

- Easier cloth installation
- Some dripping
- Recommended for presses 1000 mm and larger but frequently used on smaller applications
- A Latex edge coating can be applied to reduce leaking



Filter cloths are the front line of a filtration process, serving as the foundation needed to build a filter cake.

It can be easy to look past the cloth's true role in a process, believing that the cloth does the filtering, when in reality most of the filtering gets done by the cake itself forming in the recessed chamber.

Understanding this, it becomes easier to improve the press operation, and to adjust to problems and changes.

CLOTH BLINDING

- **When a cloth's porosity is hindered, and the cloth no longer allows the filtrate to flow.**

CLOTH RATING

- CFM
- "Cubic Feet per Minute" is the measure of flow or air permeability of the cloth media.
- Filter cloths are not rated by "Microns" as with other types of liquid filtration.

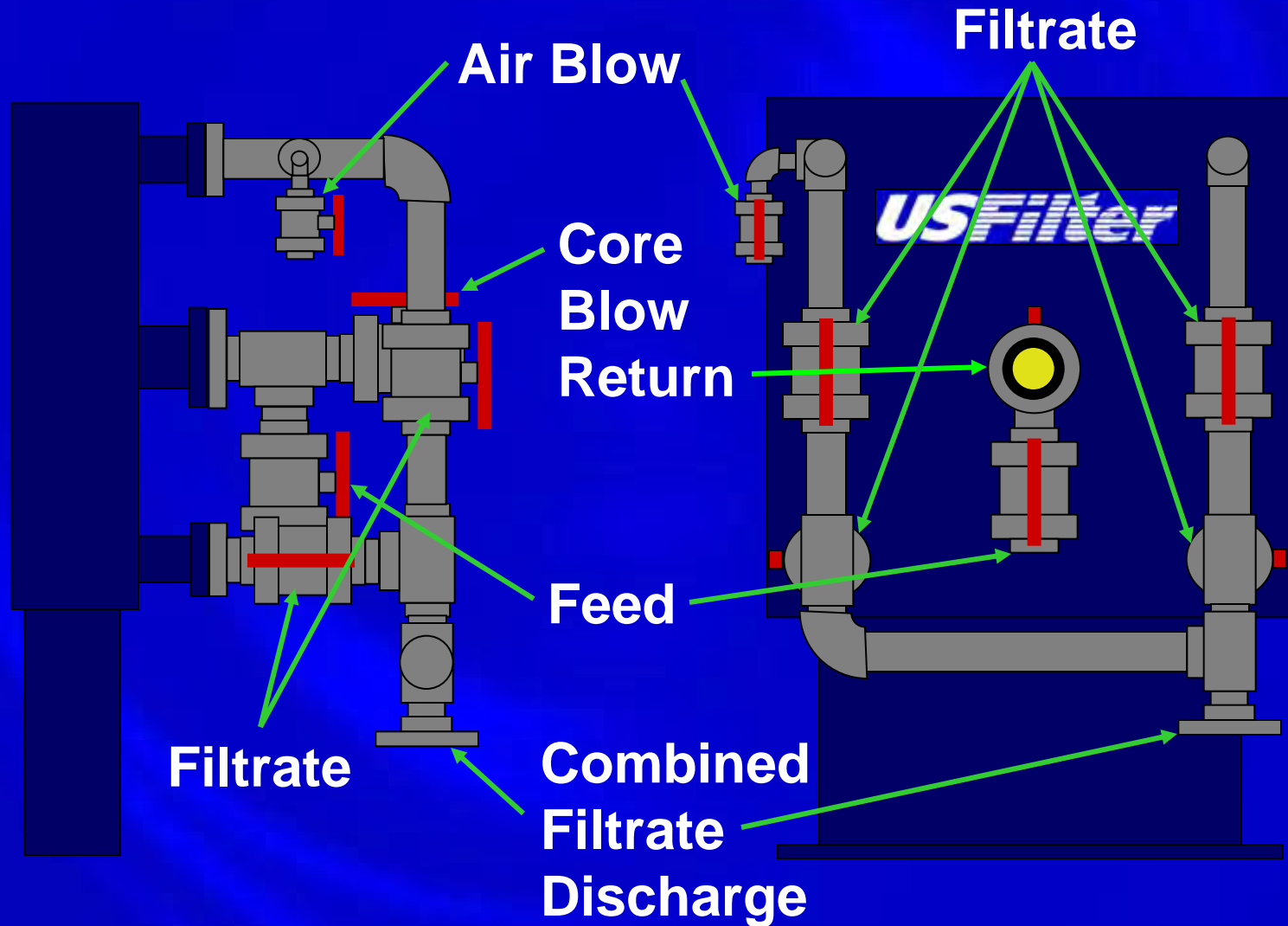
FILTER CLOTH MATERIALS

- Filter cloths come in many different materials including polypropylene, polyester, cotton, nylon, felt, and many other materials.

Polypropylene:

- By far the most popular cloth material.
It has strong resistance to acid and alkali alike. A satin finish added to the fiber can allow for easy cake release.

Typical Piping Manifold



Manifold with Air Blow, Evenfill and Precoat capabilities



Stainless Steel Manifold with Air Blow and Cake Wash Capability



Typical Sequence of Operation

- Filter press is closed
- Valves are placed in proper positions
- Feed pump is turned on
- Feed Cycle commences
- Manual Air Blow Cycle
- Open Press
- Discharge cake

Press filling Cycle – “CAUTION”

Do not stop the feed in mid cycle!

- ❖ Stopping the feed in mid cycle causes settling of the formed solids, which may plug the center feed eye.
- ❖ Restarting the cycle with a plugged feed eye will cause differential pressure across the plate web.
- ❖ This can lead to distortion of the web or total failure of the plates.

Automatic Pump Control System



- Designed for air operated diaphragm pumps
- 4 stage pump control
- Includes hydraulic pressure interlock

Automatic Pump Control System (APCS)



- Relays a signal to the timers on the control panel
- Increases pump pressure automatically

APCS Components



- No Flow Detector and Reed Switch
- Pilot Operated Regulator
- 4 - Pressure Regulators
- 4 - Timers

APCS Regulators and Solenoids



Filter Cloth & Sludge Conditioning

Pre-Coating and Body Feed

Certain slurries, particularly those containing greases and oils can decrease the permeability of the pores in the filter media on contact.

This is called cloth blinding. By coating the cloth each time the filtration is being performed, the cloth is protected and, therefore, the cloth life is extended and the cloth cleaning requirement is reduced.

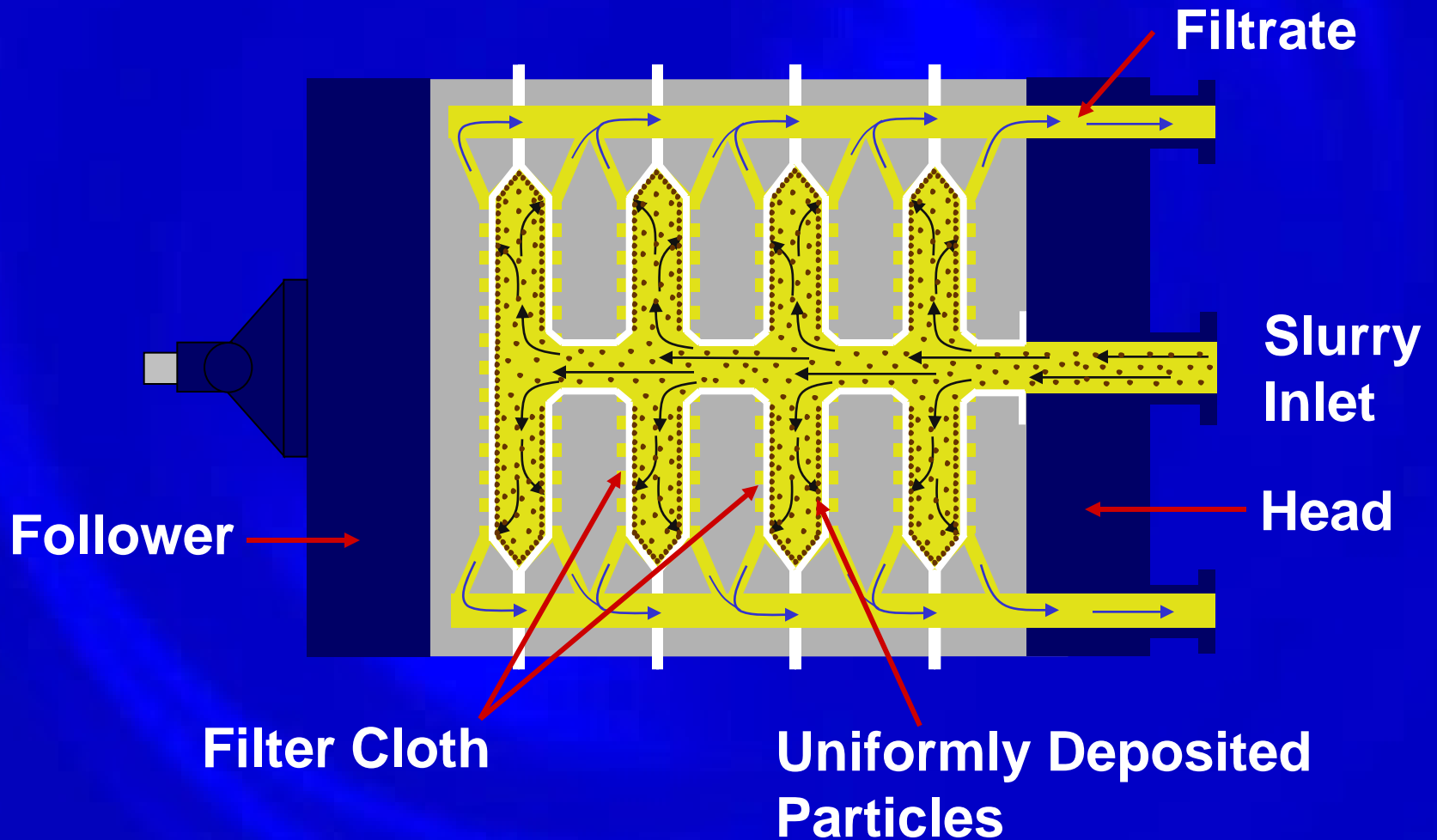
In some instances, filter cake can be very sticky and, therefore, adhere to the filter cloth. This can substantially increase the labor and time required to discharge the filter cakes from the filter press.

It is possible to greatly decrease this labor and time requirement by precoating the cloths.

Precoating allows a non-sticky layer of material to separate the cake from the cloth and prevent the cake from adhering to the cloth.

Typical materials used for precoating are the same as those used for body feed materials such as diatomaceous earth, ash, Perlite, and cellulose

Filter Press Feed Cycle

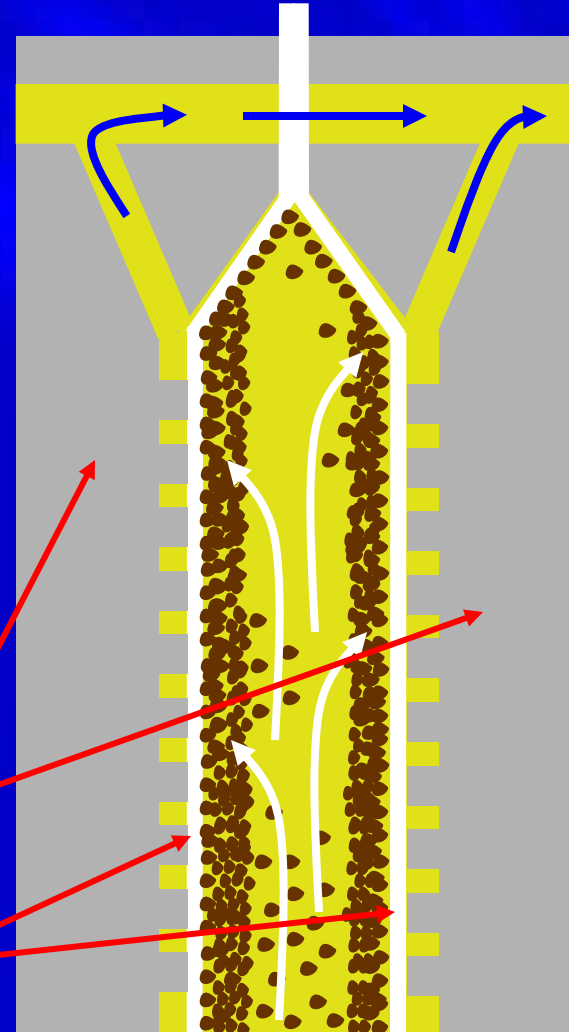


Even Distribution of Cake Solids

- Solids are evenly distributed on the filter cloth during the initial stages of cake filtration
- 3 phases of filtration

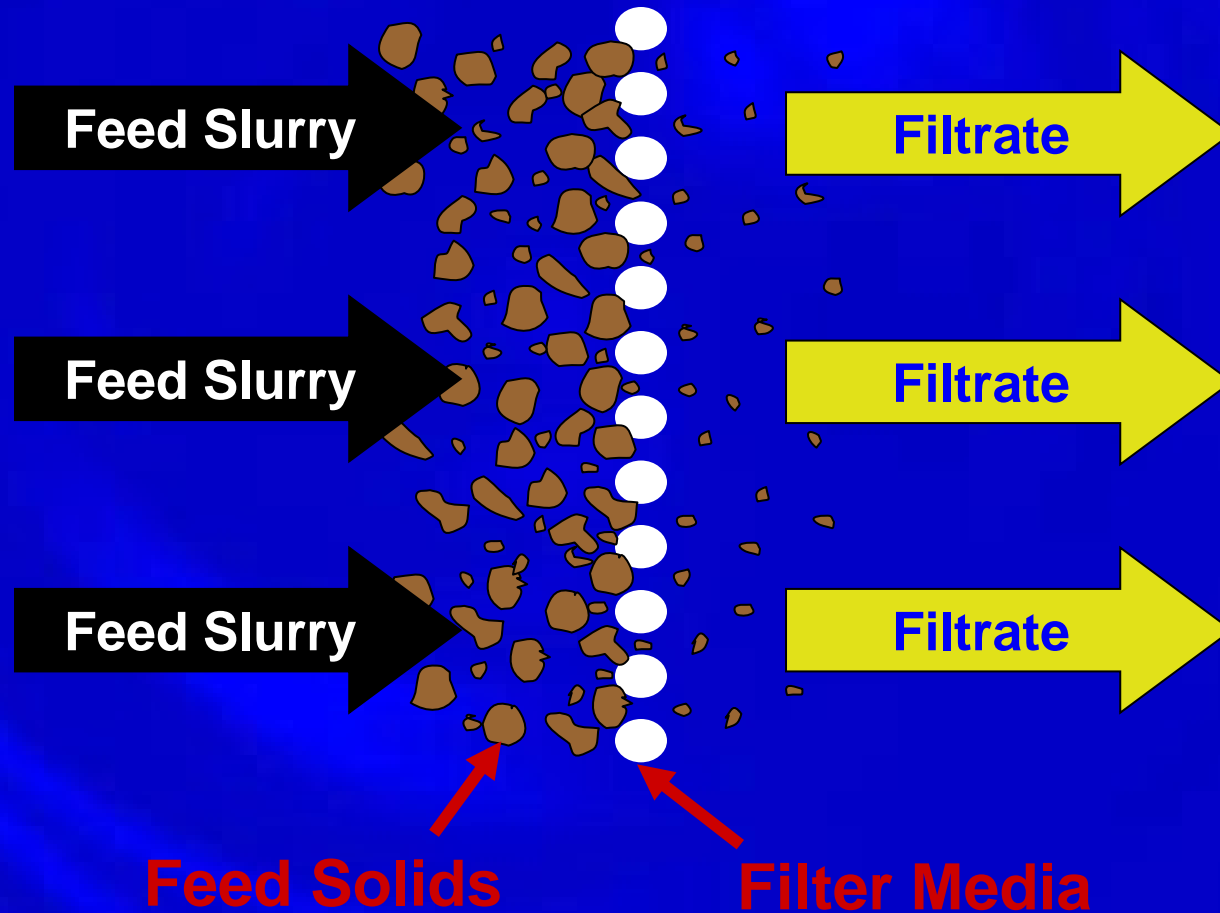
Filter Plates

Filter Cloths



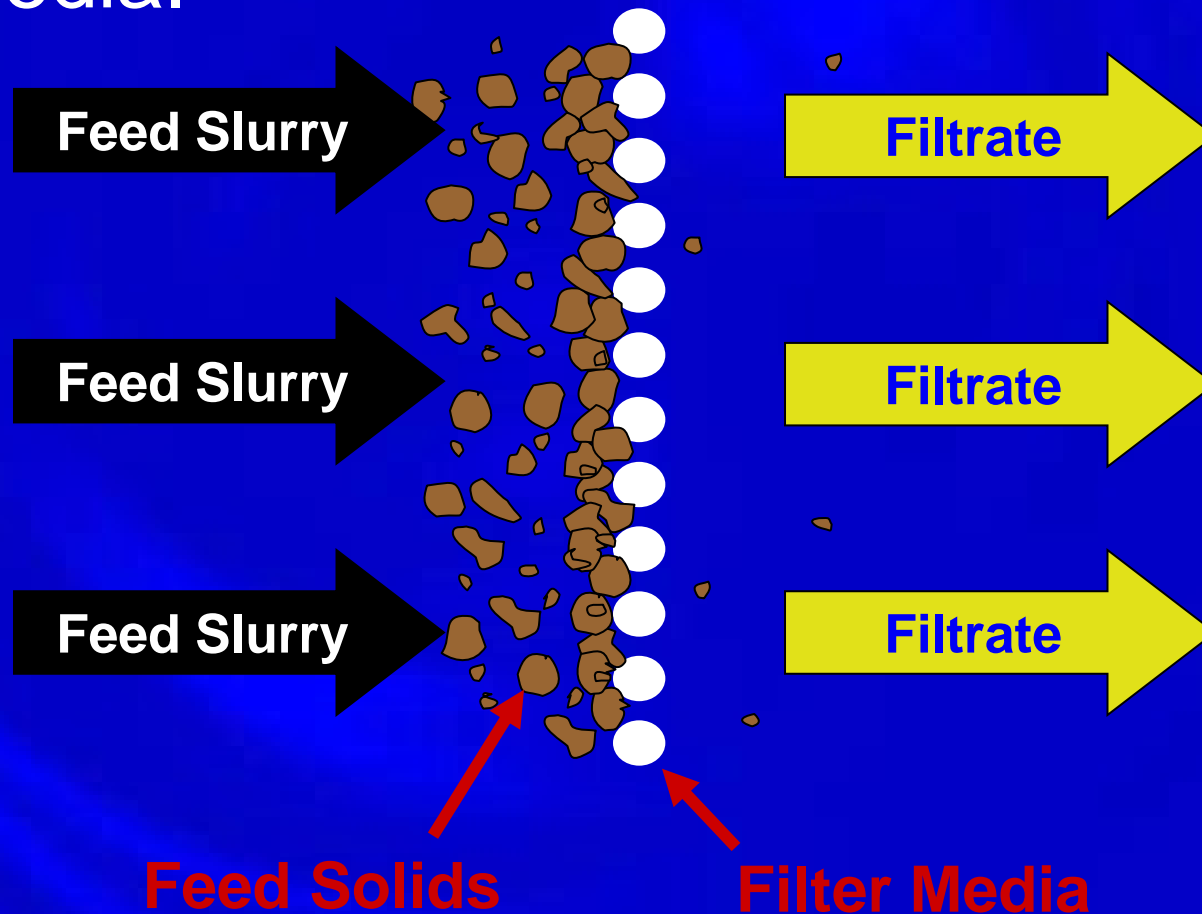
Phase 1

Larger particles first bridge the openings in the media. Some fines may pass through.



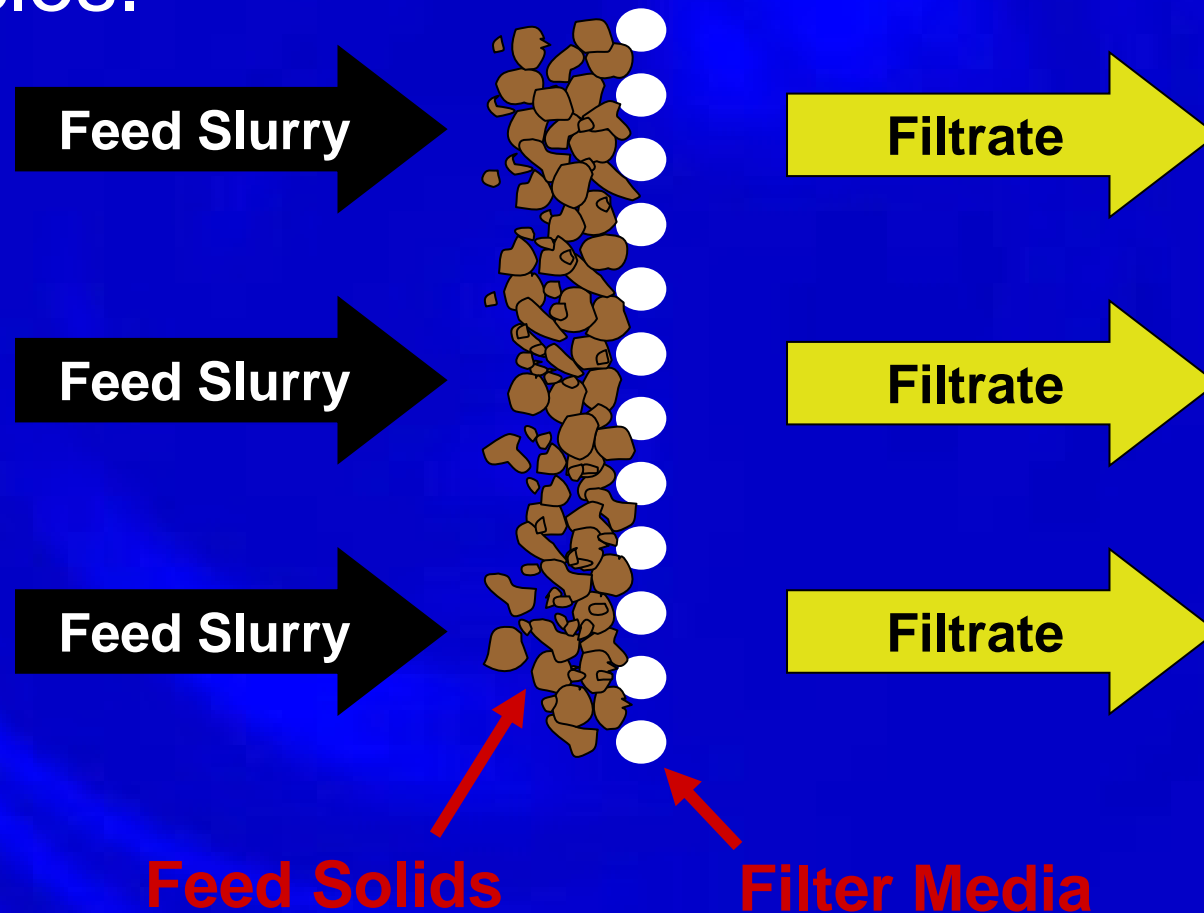
Phase 2

Larger particles then form a precoat layer and reduce the effective openings through the media.



Phase 3

As cake filtration progresses, fines are trapped in the matrix formed by the larger particles.

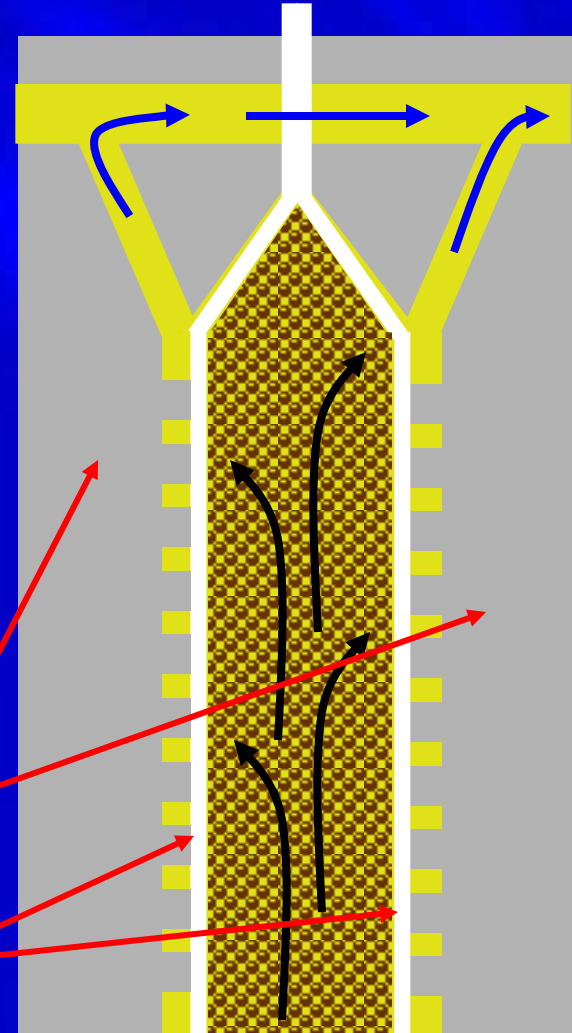


Completion of Filtration Cycle

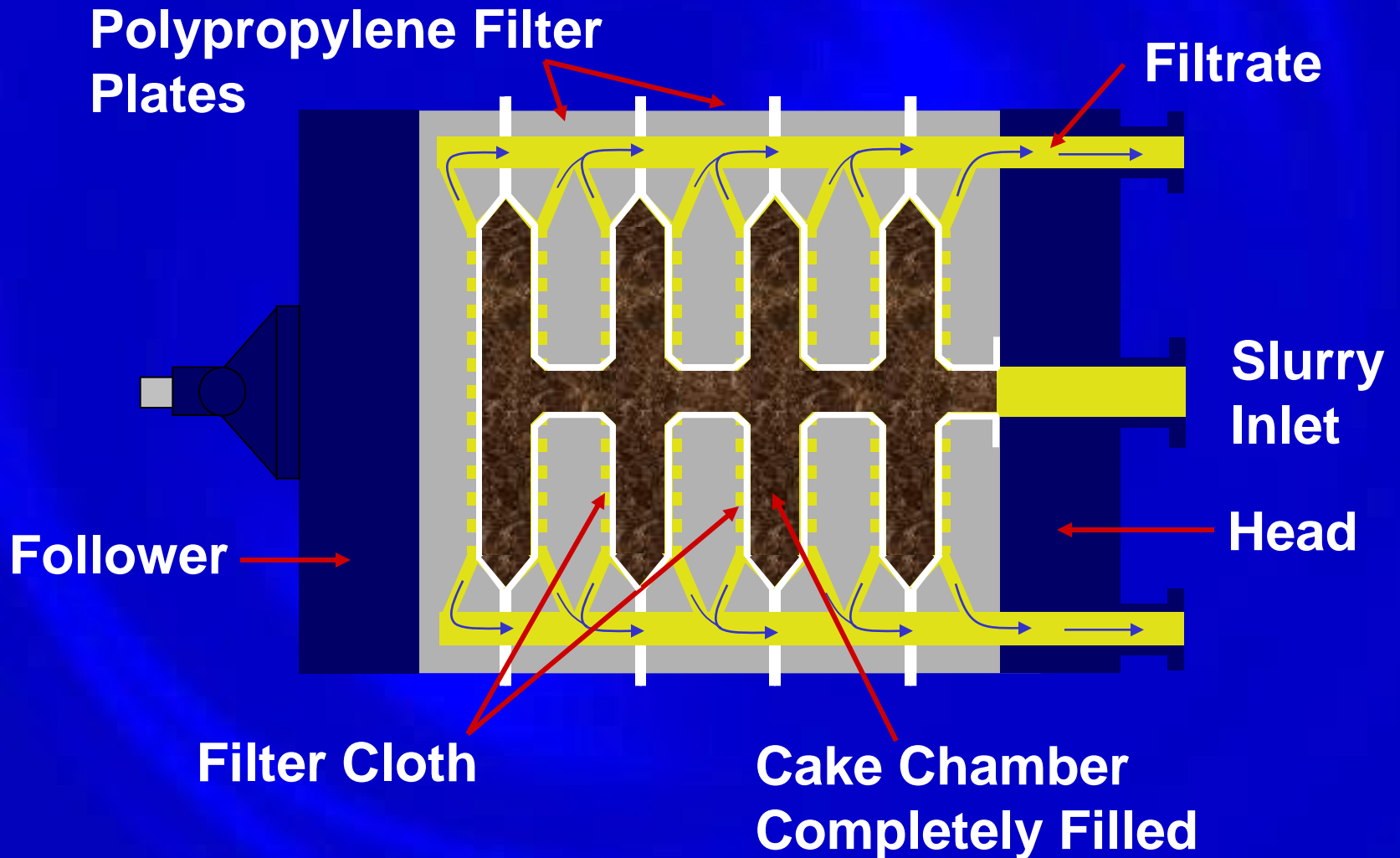
- Solids continue to build on the surface of the filter cloths until cakes meet at the center of the chamber

Filter Plates

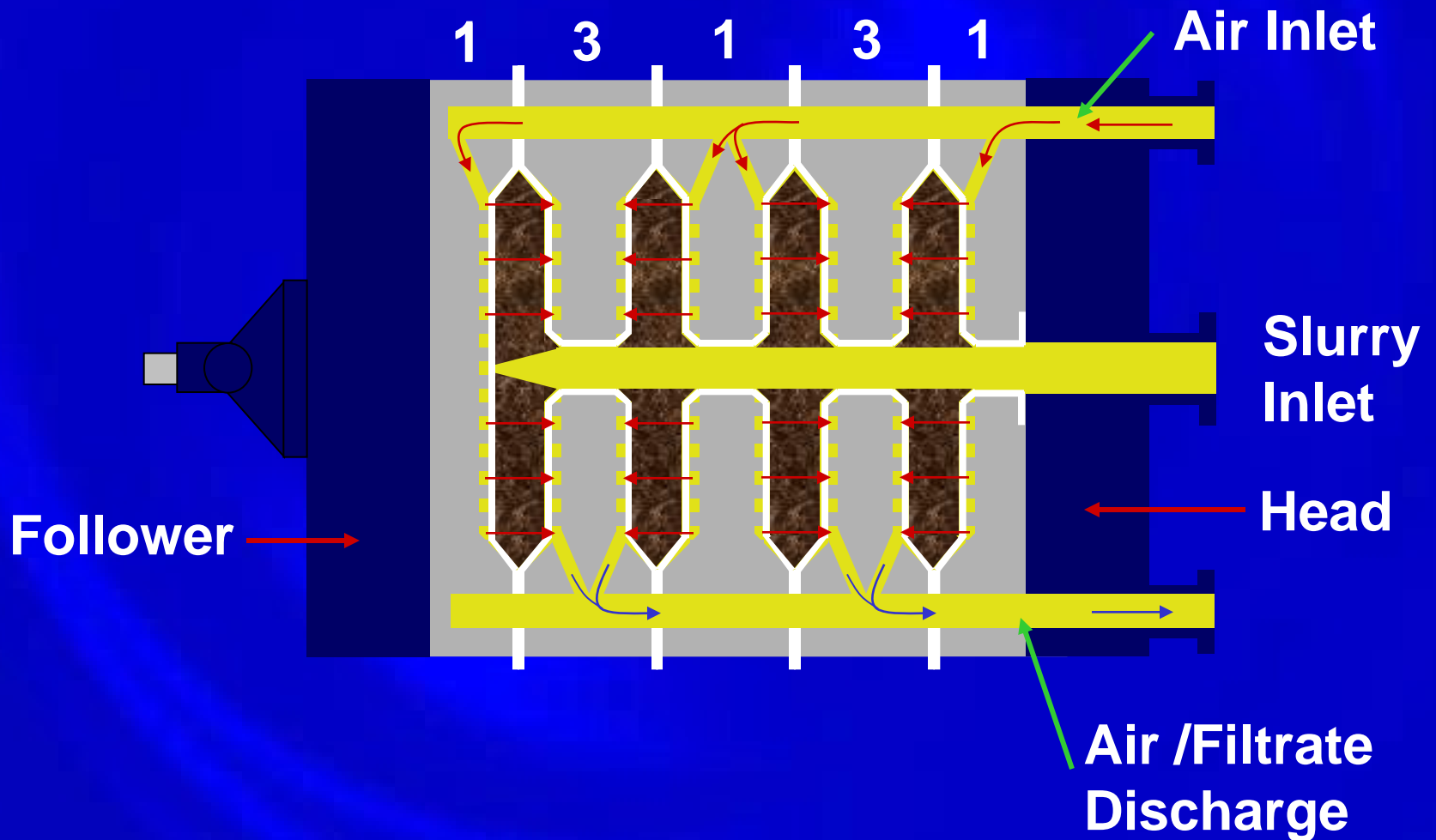
Filter Cloths



Filtration Cycle Complete



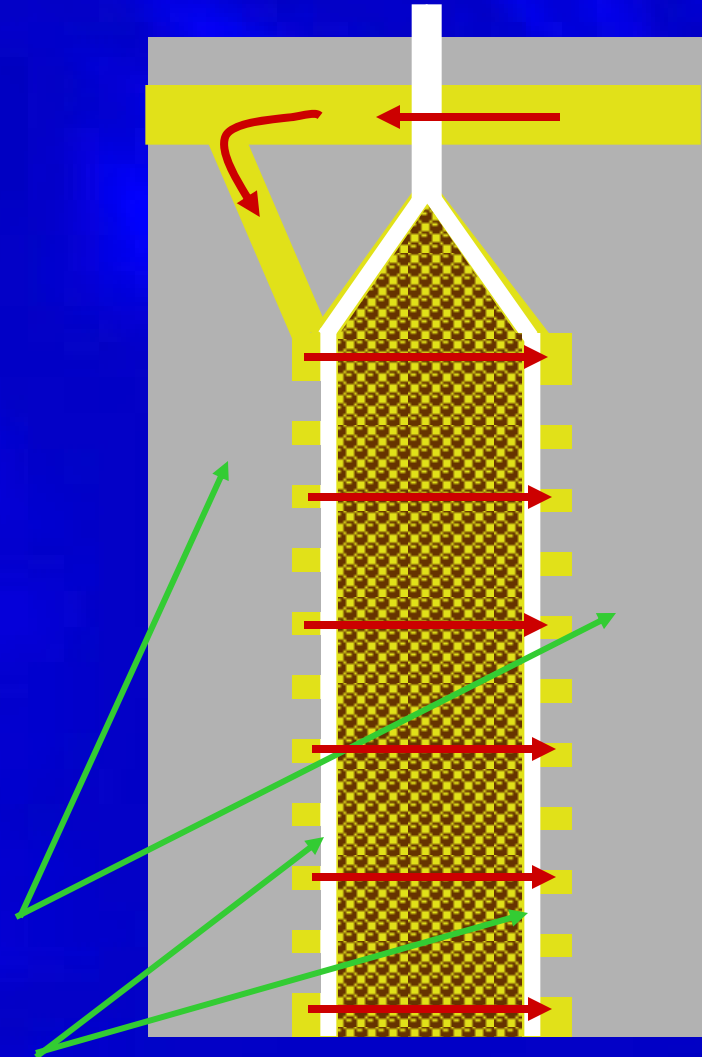
Air Blow Cycle



Air Blow Cycle

- Air is forced through the filter cake under pressure, removing free liquid from between the particles that make up the filter cake

Filter Plates
Filter Cloths



Cake Discharge

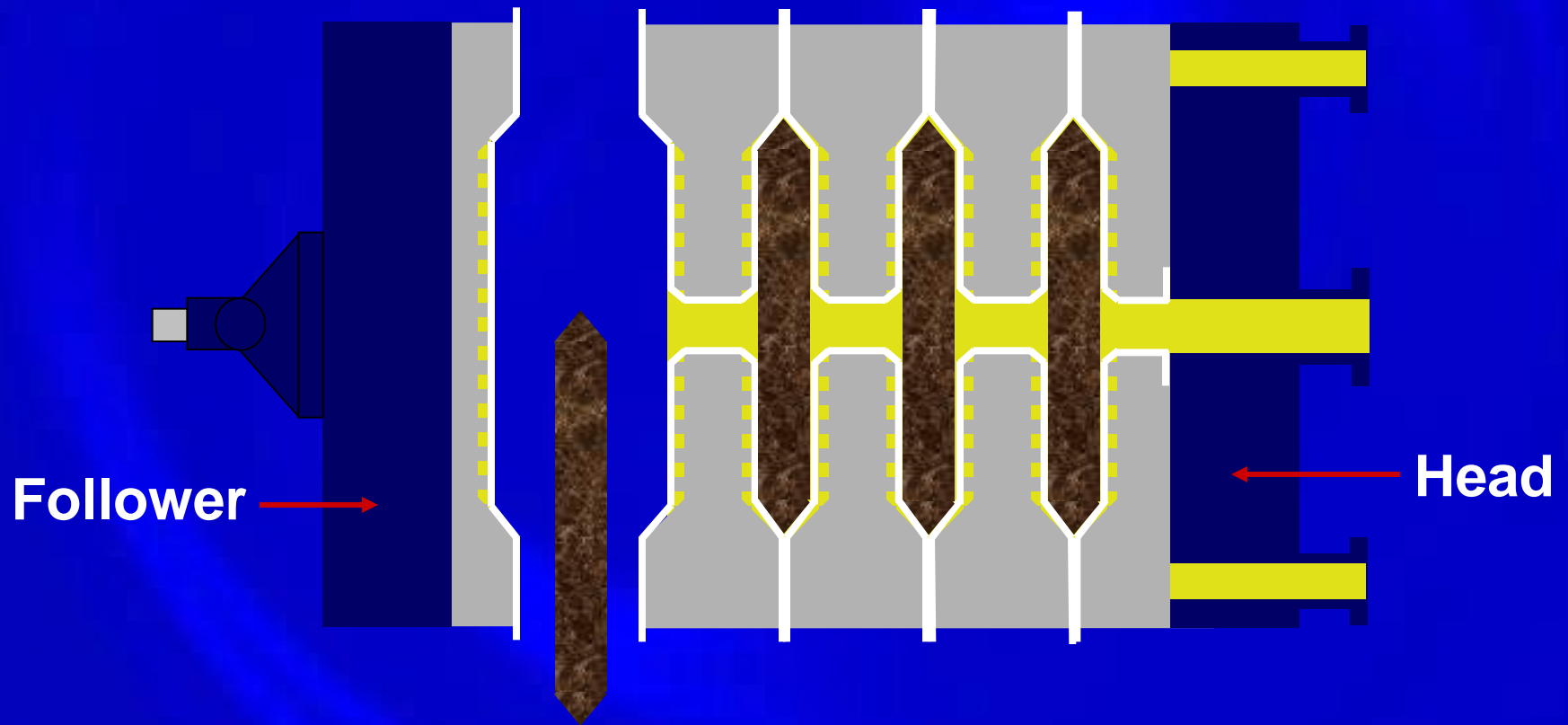


Plate Shifters

- Manual shifting - no shifter
- Semi-Automatic (operator assisted)
 - Sidebar only
 - Medium to large presses

Manual Plate Shifting



Semi Automatic Plate Shifter



- Pneumatically operated
- Pistol Grip Control
- One Person Operation

Semi-Automatic Plate Shifter



Filter Press Options

OPTIONAL Semi Automatic Plate Shifter

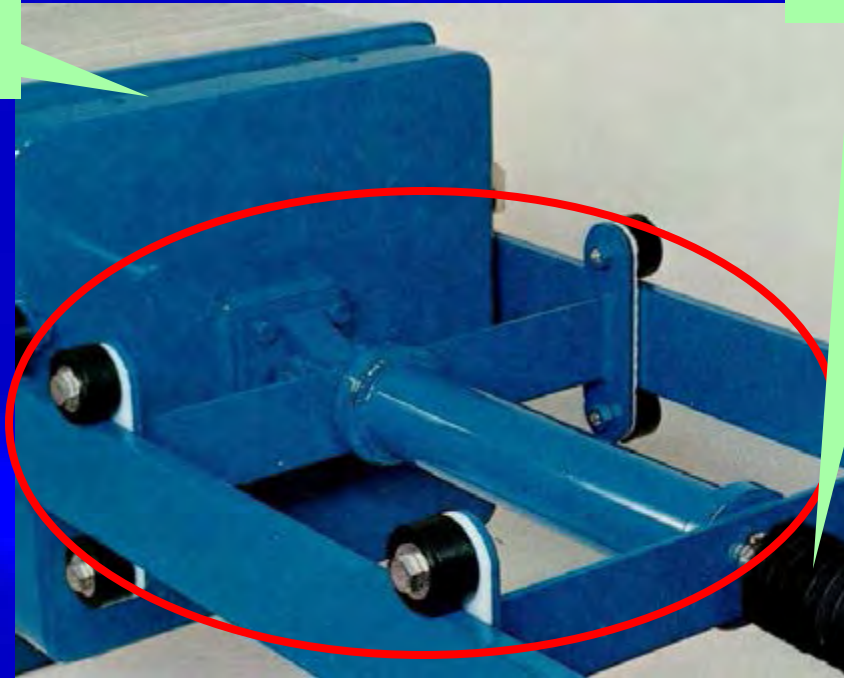


Expansion Piece

Can be removed and plates added to the stack to increase press capacity in the future.

Movable Follower

Piston Rod



OPTIONAL

Automatic Pump Control System



- Designed for air operated diaphragm pumps
- 4 stage pump control
- Includes hydraulic pressure interlock

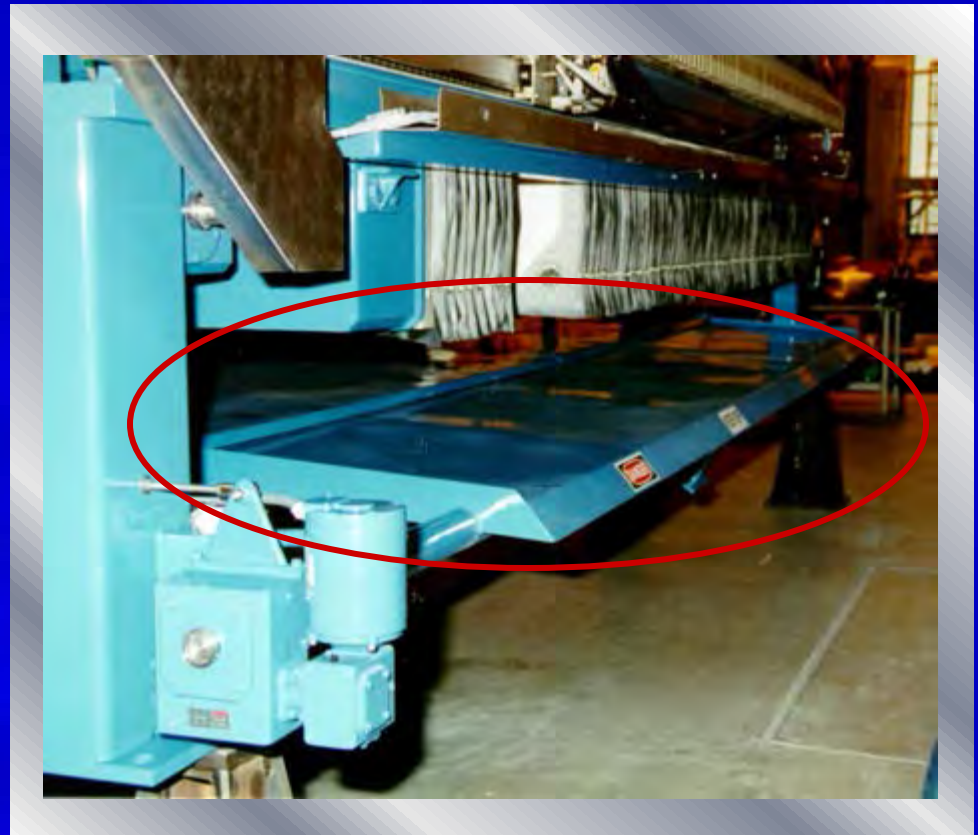
Electric Hydraulic Closure



- Standard on 1200 mm High Pressure Presses and Larger
- Regenerative hydraulic circuit
- Smooth operation
- No air required so poor plant air is not an issue.

Automatic Drip Trays

- “Bombay doors”
- Used with non-gasketed cloths
- Electrically driven
- For use with overhead and sidebar
- Available in PP, painted carbon steel and stainless steel



Safety Guard for Semi Auto Plate Shifters



Corrosion Resistant Coating Nicklad 3000



DUAL FEED PUMP SKIDS





JWI
Filter Presses