PASSAVANT GEIGER

Sludge Treatment

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INTRODUCTION

PASSAVANT GEIGER

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PASSAVANT

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Maschinen und Technik für die Wasser- und Schlammbehandlung
Machines and technology for water and sludge treatment

GEIGER

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Maschinen und Technik für die Wasserentnahme
Machines and technology for water intake

NOGGERATH

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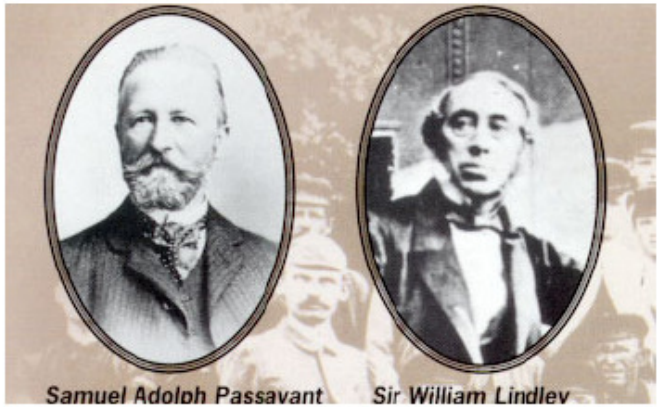
Maschinen und Technik für die Wasser- und Abwasserbehandlung
Machines and technology for water and wastewater treatment

INTRODUCTION

The **PASSAVANT** Story

- Samuel Adolf Passavant, architect from Frankfurt, acquired in 1884 the „Michelbacher Hütte". Together with the English engineer Sir William Lindley he worked resolutely towards the manufacture of cast iron components for the controlled drainage of roads and buildings.

Ever since the 30s of the last century, PASSAVANT concentrated on the development and production of components and complete solutions for the purification of municipal and industrial effluents.



INTRODUCTION

The GEIGER Story

- In 1891 the „Geiger'sche Fabrik" was founded by Carl Geiger who pioneered the fields of waste water disposal and the cleaning of cooling water using his own, patented equipment.

  Carl Geiger's grandson, Dr. Hellmut Geiger, continued the family tradition with the formation of the „Maschinenfabrik" in 1934.

  Nowadays, the brand GEIGER stands for leading products worldwide in the field of water intake works.

INTRODUCTION

The NOGGERATH Story

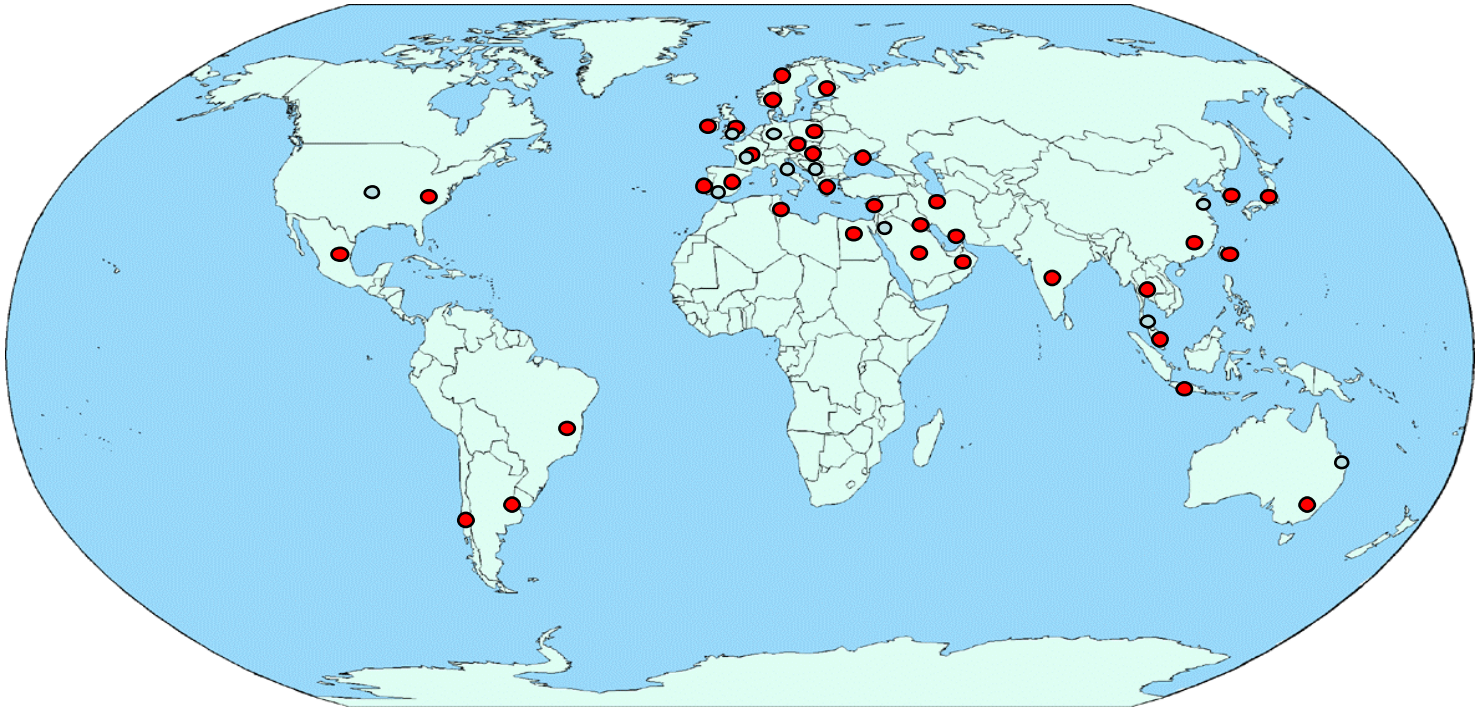
- Noggerath was founded as a trading company in 1884.

  Already in the 60s of the last century NOGGERATH as a pioneer of fine screening in waste water treatment pressed ahead with this topic.

  Today, NOGGERATH is one of the leading manufacturers of machinery and equipment for the mechanical sewage pre-treatment, liquid/solids separation, conveying and treatment of residuals.

INTRODUCTION

municipal and industrial Sludge Treatment



Local Representatives

Local Representatives

Business Unit PASSAVANT

Own Machinery Production

Headquarters at Aarbergen/Germany

Business Unit PASSAVANT - Sludge Treatment

Belt Thickener

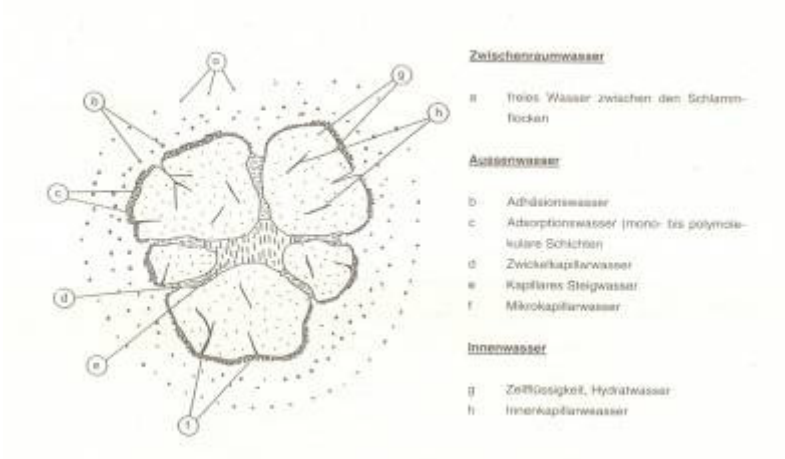
Drum Thickener

Belt Filter Press

Filter Press

Sludge Conditioning Process

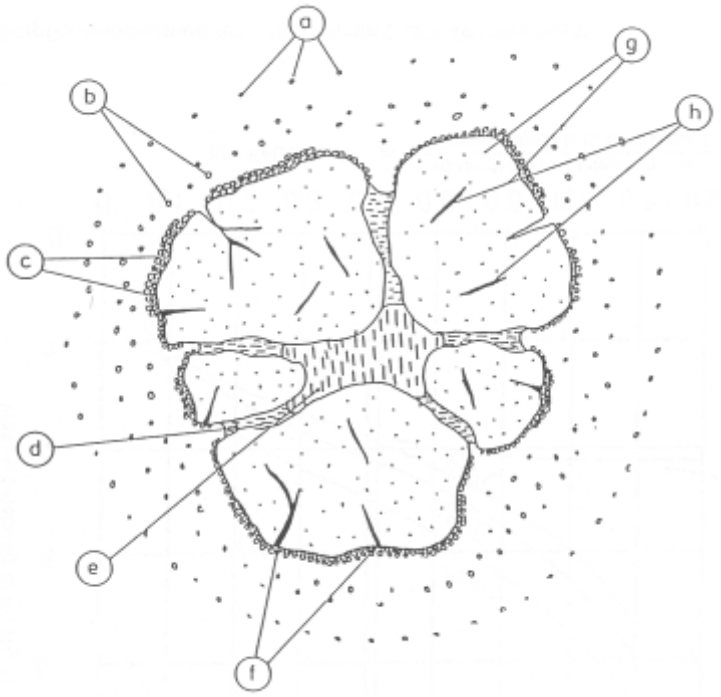
- Water is able to take up solids of different sizes –
- We are talking of SLUDGE



- however :
- No settling resp. flocculation by different loads of the solids parts and their wrapping with water molecules is possible
- Aims of Conditioning
  - Loosening resp. elimination of the bonding ability of sludge by neutralization of load No settling
  - Transmission of colloidal parts into a filterable form (flocculation)

Sludge Conditioning Process

- Interstice water:
  - free water between the sludge flocks
- Outside water:
  - adhesion water
  - adsorption water
  - capillary water I
  - capillary water II
  - capillary water III
- Inside water:
  - cell liquid
  - cell capillary water



Sludge Conditioning Process

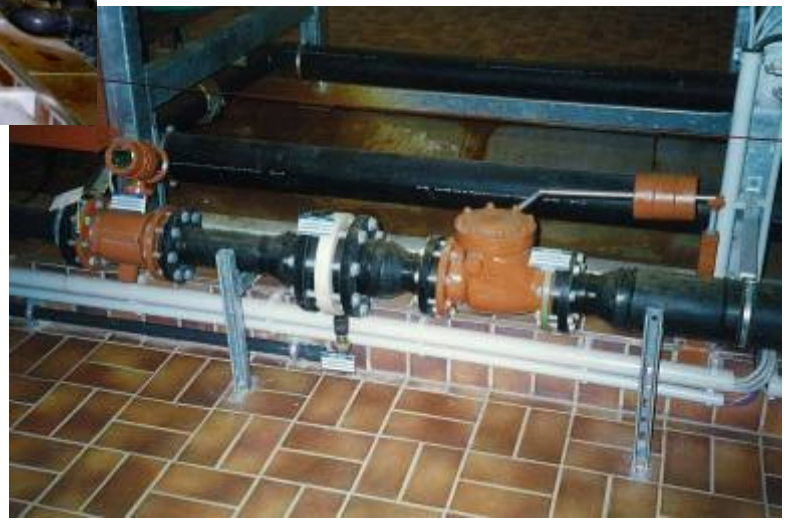
- Polymer flocculants are able to floc solids particles.
- In flocculated condition solids can be quickly and fully separated from the surrounding water.
- Tests by
  - Re-found method
  - Mixing method
- Realistic results only on the filter area

Sludge Conditioning Process

Polymer Preparation Station

Sludge Conditioning Process

Polymer Post Dilution



Sludge/Polymer Mixing Device

Sludge Conditioning Process

Sludge / Polymer Inline Mixer

Mechanical Mixing Device

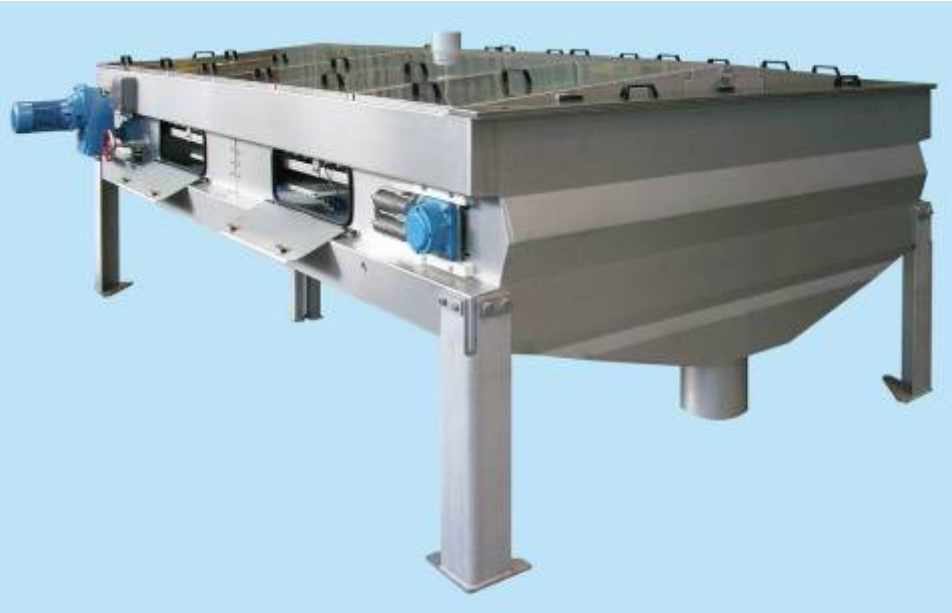
Sludge Thickening Process

- Separation according to the principle of gravity drainage
- Volume reduction of up to 95%
- Efficient in the matter of consumption of conditioning agents
- Guarantees high economic efficiency at low running costs

Mechanical in contrast to static thickening process

Static	Mechanical
Sedimentation in a tank	On principle of gravity drainage on a revolving filter belt
Separation depending on the settling particular features of the slurry	Result of separation as far as possible independent of the settling paricular features of the slurry
High space requirement Result of separation < 5% DS	Very low space requirement Result of separation up to 10% DS
Usable as sludge storage tank possible	No sludge storage possible
	

Belt Thickener FluX-Drain



Continuous separation of solids and liquids
- the cheapest process solution !

Belt Thickener Design

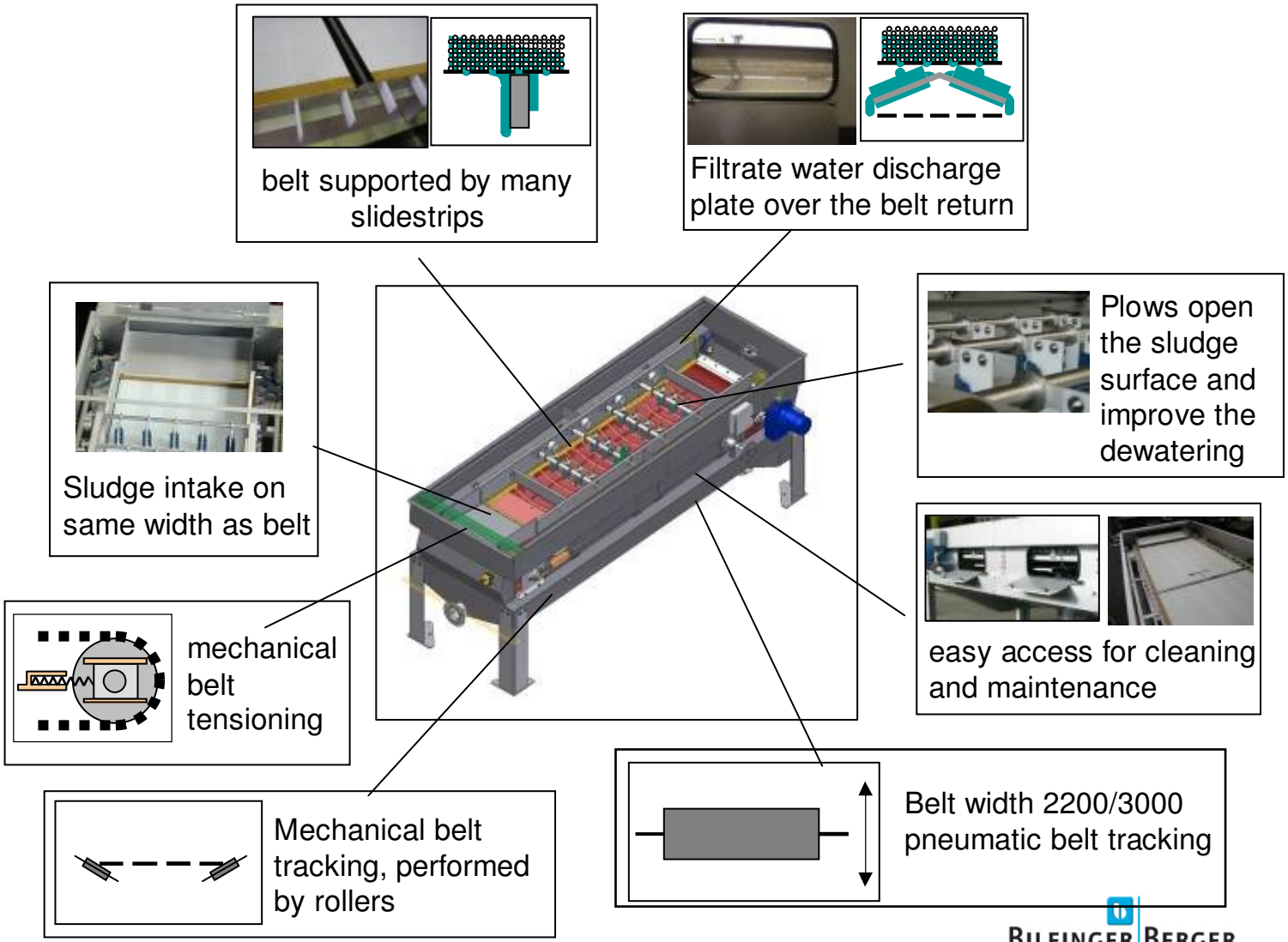
Scope of supply

Belt Widths:

700
1.100
1.600
2.200
3.000

PASSAVANT GEIGER

Technical details



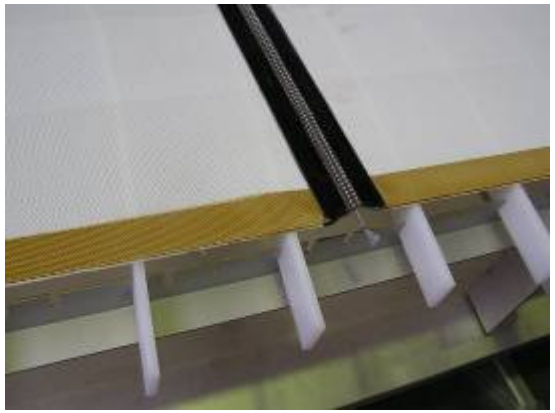
Technical details

- Self-supporting frame

- Sludge feeding tank, filtrate storage tank and thickened sludge storage tank integrated
- 4 pc separate feet, on request adjustable for height
- Cover (option)
- Variable position of sludge inlet / thickened sludge outlet

Technical details

- Gravity dewatering zone
  - Stainless steel chute, integral to the feeding tank
  - Grid of PE wear bars support the dewatering belt
  - Adjustable sludge plows
  - Stainless steel side channels with neoprene seals
  - Filter belt made of Polyester wovenware, selected for optimal gravity dewatering of the pertinent sludge



PE grids

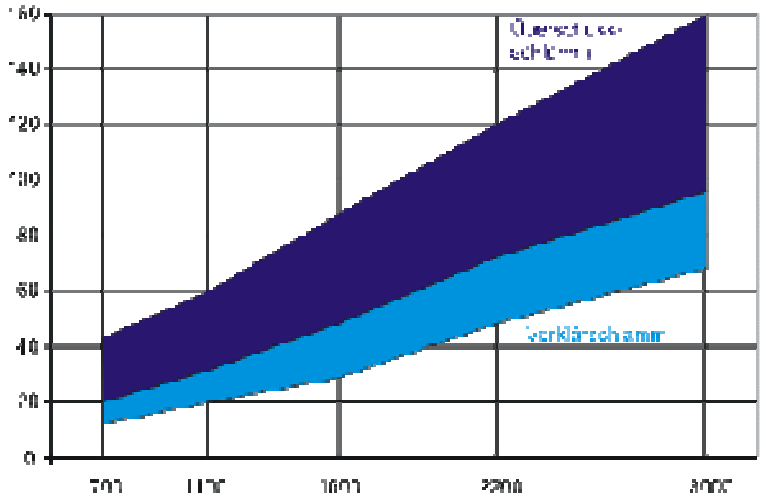
Sludge plows

Technical details

- Sludge concentrator
  - Adjustable ramp at the end of the gravity dewatering zone
  - Highest thickening performance by sludge around roller

Performance of Belt Thickener Flux-Drain

• Throughput per meter appropriable belt width	approx. 350 kg/h
• Output	5 – 8 % DS
• Separation efficiency	96 – 99 %
• Polymer consumption	approx. 2 – 3 g / kg DS
• Filter belt cleaning water	Filtrate or non-potable water with a maximum solids concentration of 200 mg/l without clogging



References

WWTP Löningen / Germany

WWTP Bad Wildungen / Germany

WWTP Bramsche / Germany

WWTP Saad / Wathba / UAE

Sludge Dewatering Process – Belt Filter Press

- Separation according to the principle of gravity drainage and filtration by increasing of pressure continuously to the sludge between two filter belts
- Efficient in the matter of consumption of conditioning agents
- Guarantees high economic efficiency at low running costs

Belt Filter Press – FluX Press

Continuous separation of solids and liquids
- the cheapest process solution !

Belt Filter Press - FluX Press

Scope of supply

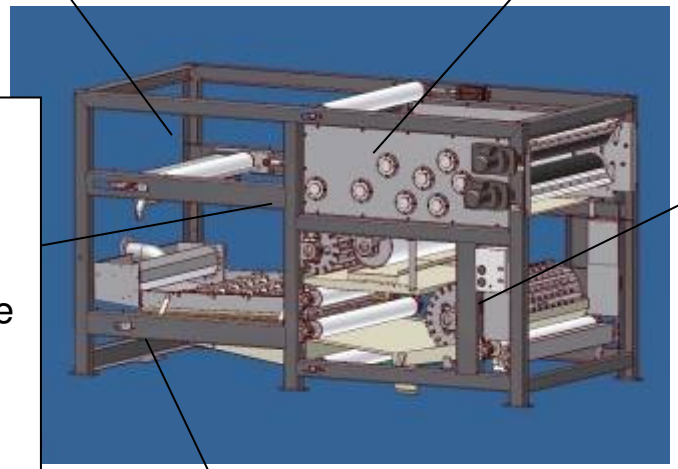
Belt Widths:

700
1.100
1.600
2.000
2.500
3.000

Technical details

The dewatering process proceeds from bottom to top:
The liquid sludge is fed at the bottom / The dry cake is removed on top

The press section is designed for continuous, sequentially increasing pressures of 2.5 to 3.5 bar and transient peaks of up to 5 bar



FluX-Press consists of 2 pre-dewatering rollers and 9 press rollers
Two perforated rollers for quick resistant-free discharge of the filtrate to both sides of the filter cake.

The filter belts are continuously cleaned with spray pipes with Exchangeable nozzles
In the spray nozzle pipe a rotating stainless steel brush is installed to allow cleaning of the spray nozzles during operation by turning a wheel.

The tension of the upper and lower belt is generated by a parallel guided infinitely adjustable pneumatic belt tensioning system with pneumatic cylinders.

Technical details

Sludge intake
- on same width as width of the filter belt

Plows open the sludge surface and improve the dewatering

Low pressure zone

Wedge zone

Technical details

Filter belt cleaning

High pressure zone

Filter cake discharge

Technical details

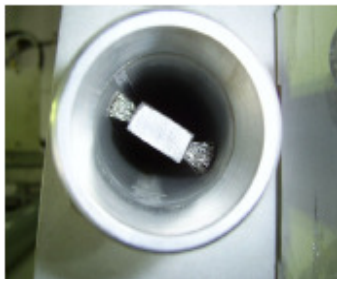
- Belt wash station
  - In case of using filtrate water for belt cleaning separate storage zone for filtrate water and wash water
  - Additional process water needed after stop of sludge feeding to clean the belt completely

Centrifugal pump

Float valve to control additional process water

Technical details

- Belt wash station
  - Removable stainless steel nozzles
  - Internal handwheel operated brush and flush valve
  - Automatic nozzles cleaning as option possible



brush

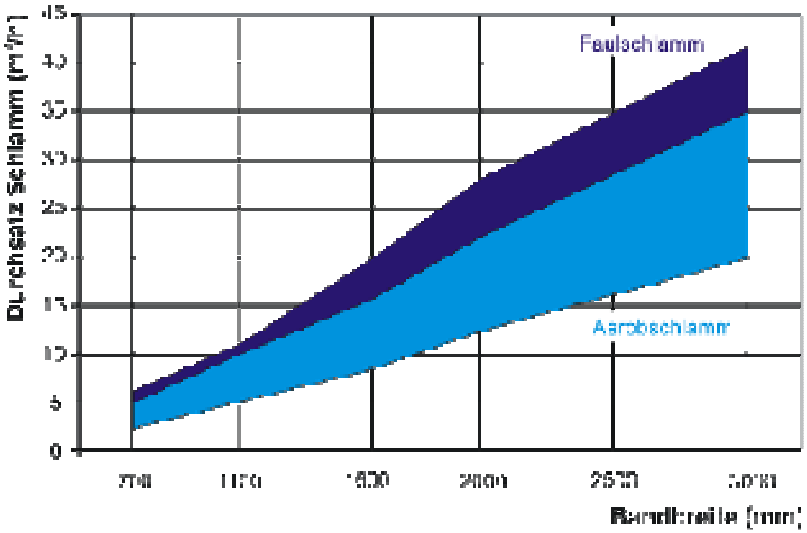
Spray nozzles in function

Performance of Belt Filter Press Flux-Press

- Throughput per meter appropriable belt width approx. 370 kg DS / h
- Output

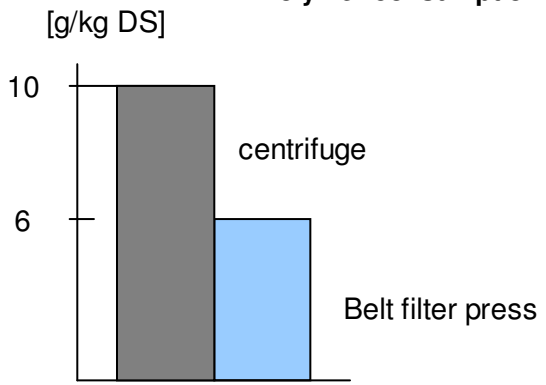
Excess sludge	20 – 24 % DS
Digested sludge	22 – 27 % DS
Mineral / Industrial	40 – 65 % DS
Separation efficiency	95 – 98 %

- Polymer consumption: approx. 5 – 7 g / kg DS
- Filter belt cleaning water: Filtrate or non-potable water with a maximum solids concentration of 200 mg/l without clogging



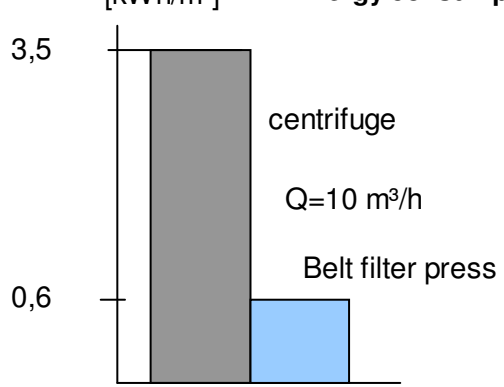
Operational cost

Polymer consumption



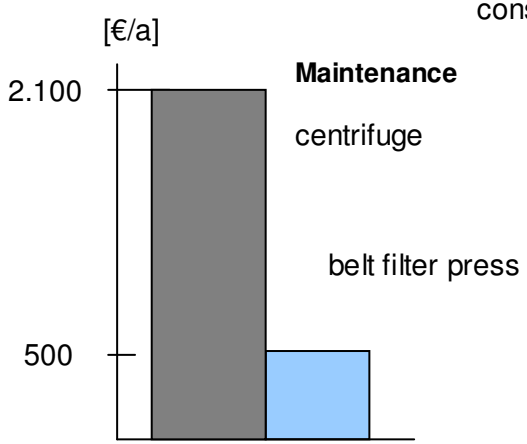
approx. 60% lower consumption

Energy consumption



approx. 80% lower consumption

Maintenance



approx. 75% lower costs

Mobile plant

- Mobile Belt Filter Press
  - Picture shows the PASSAVANT-GEIGER test plant
  - complete dewatering device, ready for operation
  - for presentation of performance and application
  - to order as semi-mobile plant or as completed unit

Sludge Dewatering – Chamber Filter Press

- During mechanical dewatering higher pressure differences between suspension and filtrate side are generated. With the aid of these differences the total free water part between the solids particles can be separated.

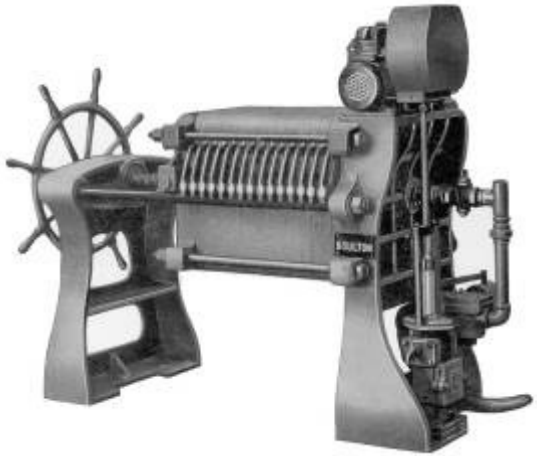
- Mechanical dewatering can be applied for:
  - Rural utilization of the solids
  - Conveyance of solids to deposits
  - Utilization as combustibles / compensation for combustibles
  - Utilization for asphalt production / in the cement industry

Sludge Dewatering

- to be considered:
  - The selection of the mechanical equipment is subject to the goal of the dewatering
  - Due to variations of the solids accumulation in the sludge and permanently changing operation conditions, the process and the mechanical equipment have to be carefully selected to achieve the required dewatering result!
- The following can be applied:
  - Chamber Filter Press
  - Membrane Filter Press

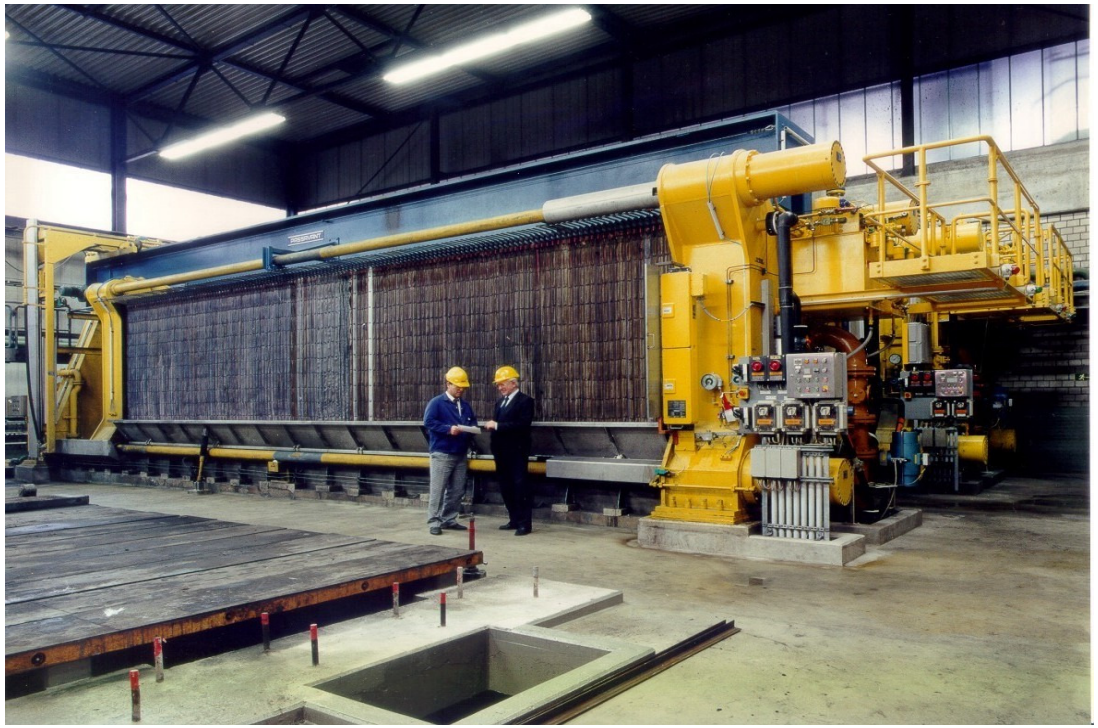
Chamber Filter Press

- From the beginning to ...



Chamber Filter Press

➢ ... state of the art



Types of Slurry to be treated by Filter Press

- Sludge from Primary Sedimentation Tank
  - Sludge, separated during preliminary treatment and not mixed with other sludge
- Primary Sludge
  - Sludge separated in the primary sedimentation tank, mixed with other kinds of returned sludge, for example, excess sludge
- Anaerobic Digested Sludge
  - Sludge stabilized by anaerobic treatment
- Aerobic Stabilized Sludge
  - Sludge stabilized by aerobic treatment

Types of Slurry to be treated by Filter Press

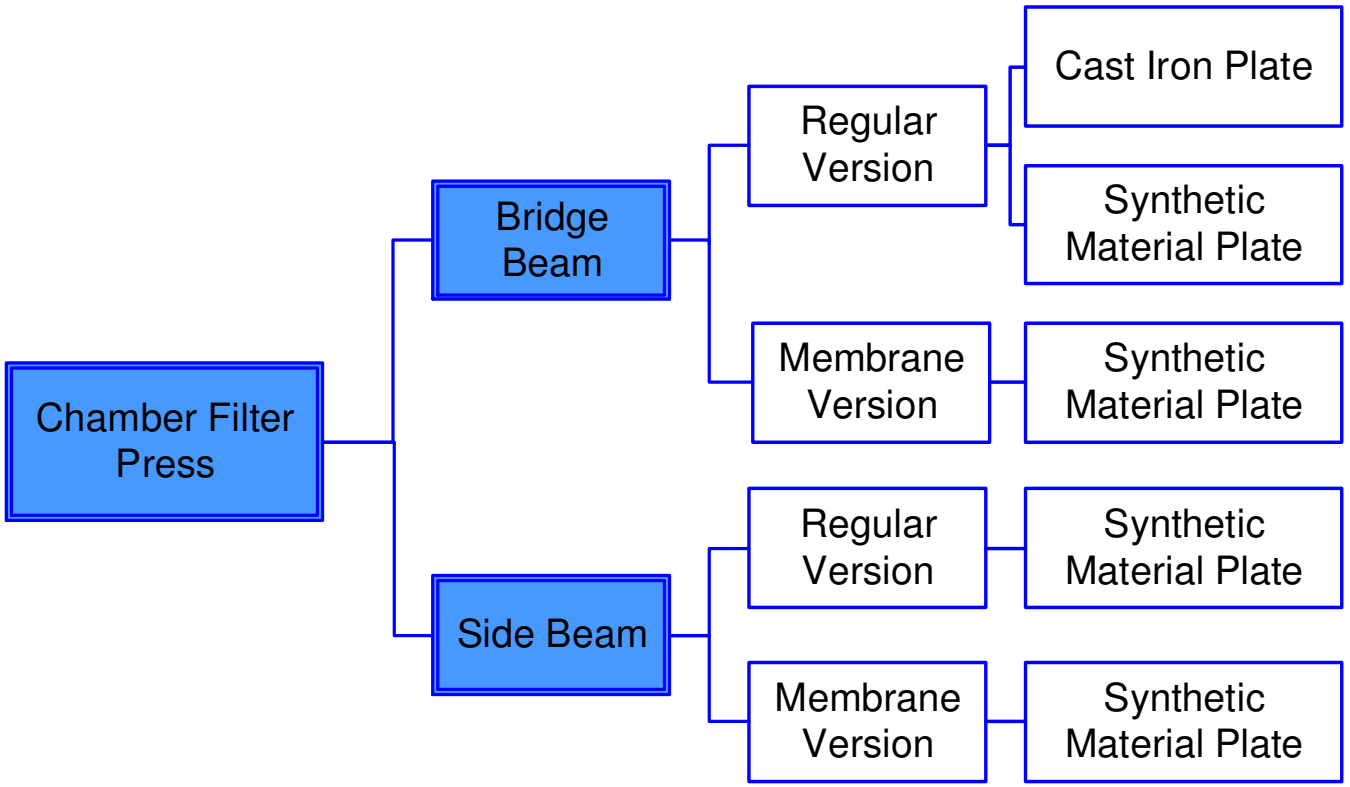
- Industrial Sludge

  Sludge from ...

  - water treatment plant
  - chemical pulp factory
  - paper and cellulose manufacturing
  - enamel, lime and calcium sulphate sludge
  - surface and underground water
  - kaolin industry
  - breweries
  - coal mining
  - lime stone washing
  - sand and gravel production

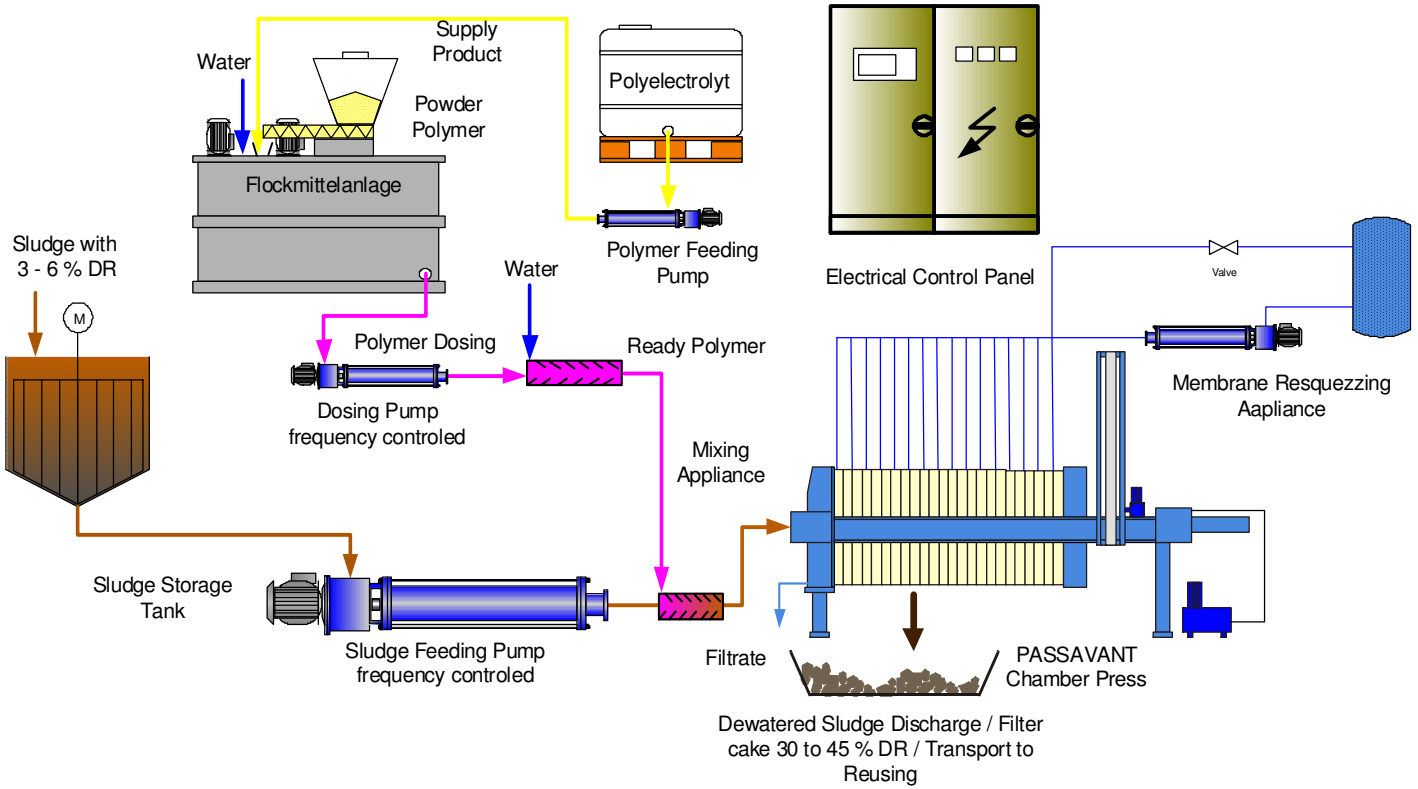
Chamber Filter Press

➢ Types of Chamber Presses and Plate Systems



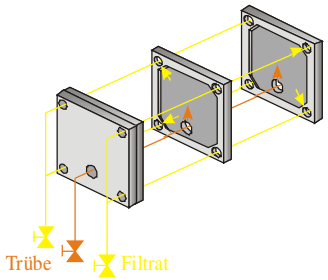
Chamber Filter Press

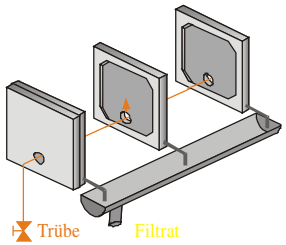
➢ Flow Sheet



Chamber Filter Press

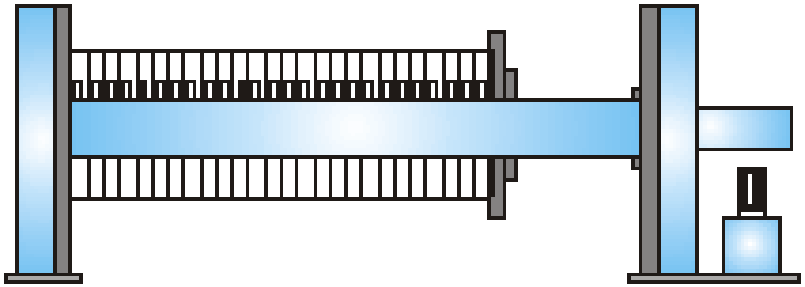
Filtrate Outlet Systems

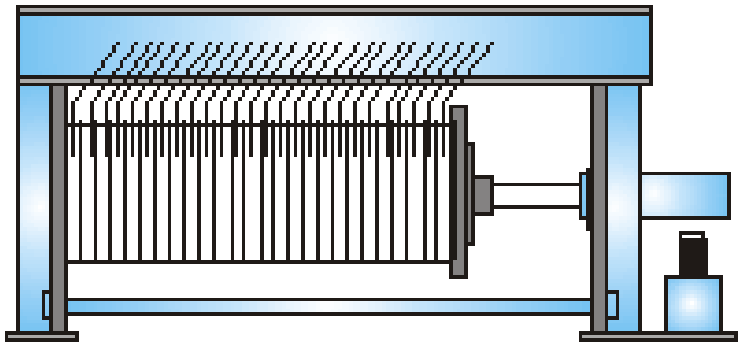




Closed Filtrate Outlet	Open Filtrate Outlet
Filtrate outlet by 1or 2 connection points	Individual filtrate outlet in a lateral trough
Difficult of monitoring of filtrate quality and recognize of cloth failure	easy monitoring of filtrate quality and recognize of cloth failure
Comfortable rinsing with acid – only one or two outlet pipes	Complicate rinsing with acid – need of lots of valves
No arising of aerosol during of out-blow of feeding pipe	Arising of aerosol during out-blow of feeding pipe
Usable for all slurries and sludge – necessary by contaminated sludge	Usable for all slurries and sludge – but not by contaminated sludge

Side Bar / Overhead version



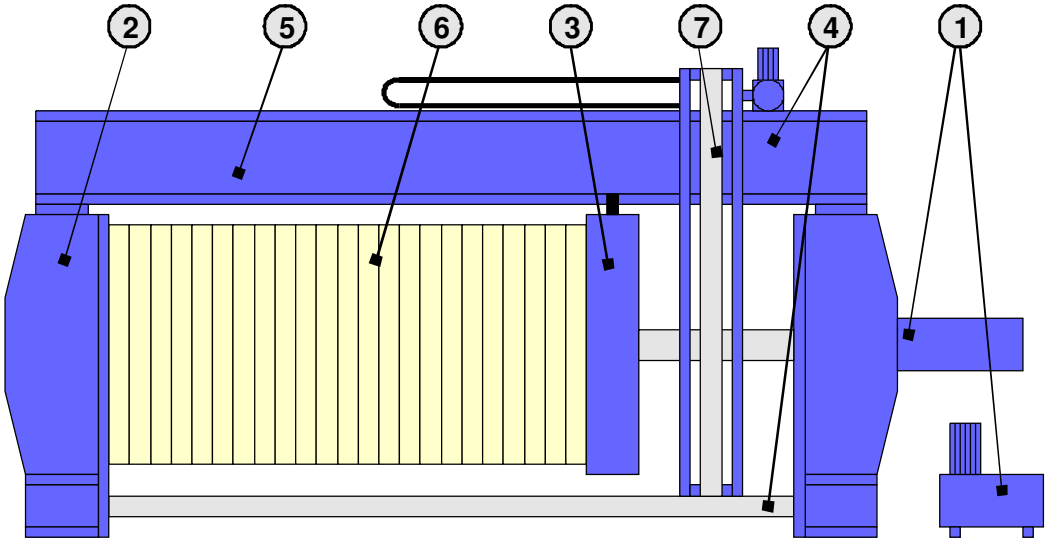


PASSAVANT GEIGER

Versions	Side Bar	Overhead
Construction	Simple, light design, generally cheaper	Sophisticated, strong frame, more expensive design as swinging of filter plates has to be avoided
Plate package	Lying on lateral beams	Guiding and support from above
Access to plates	Impeded by lateral beams	laterally easily accessible
Wear during plate transport	Possible, remaining cake can fall into the lateral guides	Plate guidance above, contact with filter cake not possible
Change of cloth	Difficult, because access to plate package is hindered	Easy, due to free access to the filter plates
Filter plates	Can shift laterally, leakage possible	Chamber plates are centred above support

Chamber Filter Press – Overhead

➢ General construction of Chamber Presses



1 - Hydraulic system
2 - Inlet support leg
3 - Pressure plate
4 - Bridge / Pulling beam
5 - Plate transport device
6 - Filtration plates
7 - High pressure rinsing appliance

Chamber Filter Press – Overhead Version

Sizes:

800 x 800

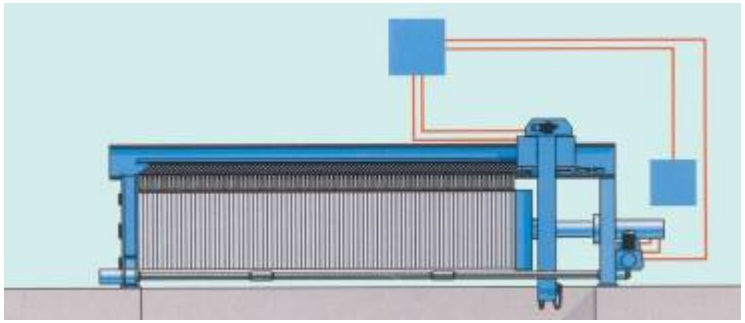
1.200 x 1.200

1.500 x 1.500

1.500 x 2.000

Plates closed by:

Pressure



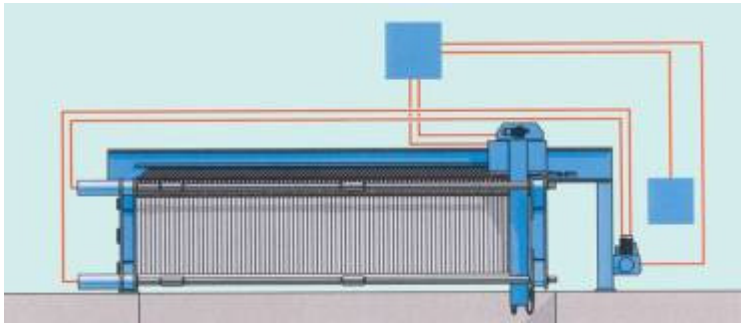
Sizes:

2.000 x 2.000

2.450 x 2.450

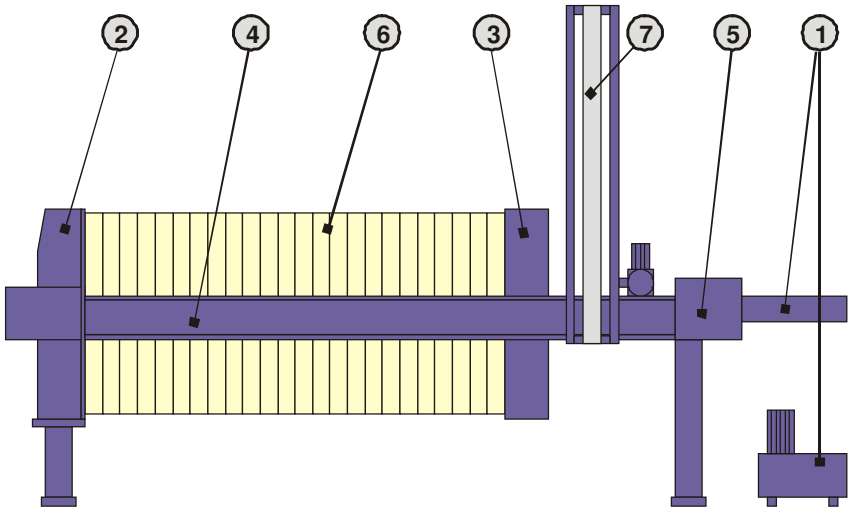
Plates closed by:

Traction



Chamber Filter Press – Side Bar Version

➢ General construction of Chamber Presses



1 - Hydraulic system
2 - Inlet support leg
3 - Pressure plate
4 - Bridge / Pulling beam
5 - Plate transport device
6 - Filtration plates
7 - High pressure rinsing appliance

Chamber Filter Press – Side Bar Version

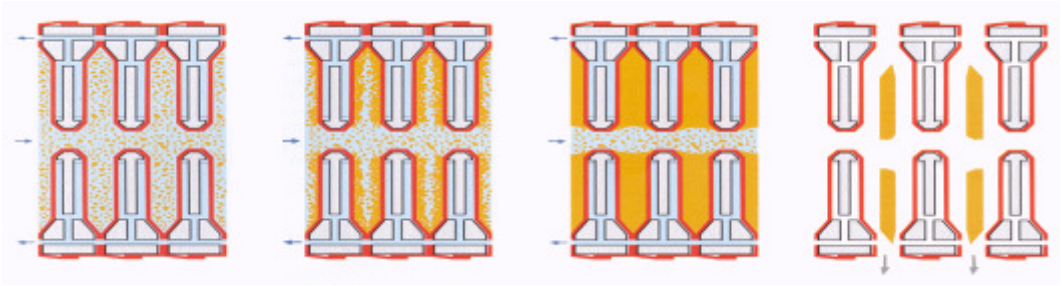
- Types and sizes of Side Bar Press
  - 6 machine types
  - plate size 470, 630, 800 mm
    manual hydraulic
  - Plate size 630, 800 to 2000 mm
    fully automatically
- Design of frame
  - Side bar
  - Systems as regular chamber filter press and membrane press

Chamber Filter Press – Side Bar Version

➢ Advantages of Chamber Press

- Robust mechanical equipment
- Very long reliability and durability
- Very low maintenance costs comparing to centrifuges
- Easy operation and handling of dewatering equipment
- Sensitive and serious press and plant design
- High service life at low maintenance
- Very high degree of dewatering by feed pressure (16bar) i.e. up to 35 % DR without additives
- Closed filtration system

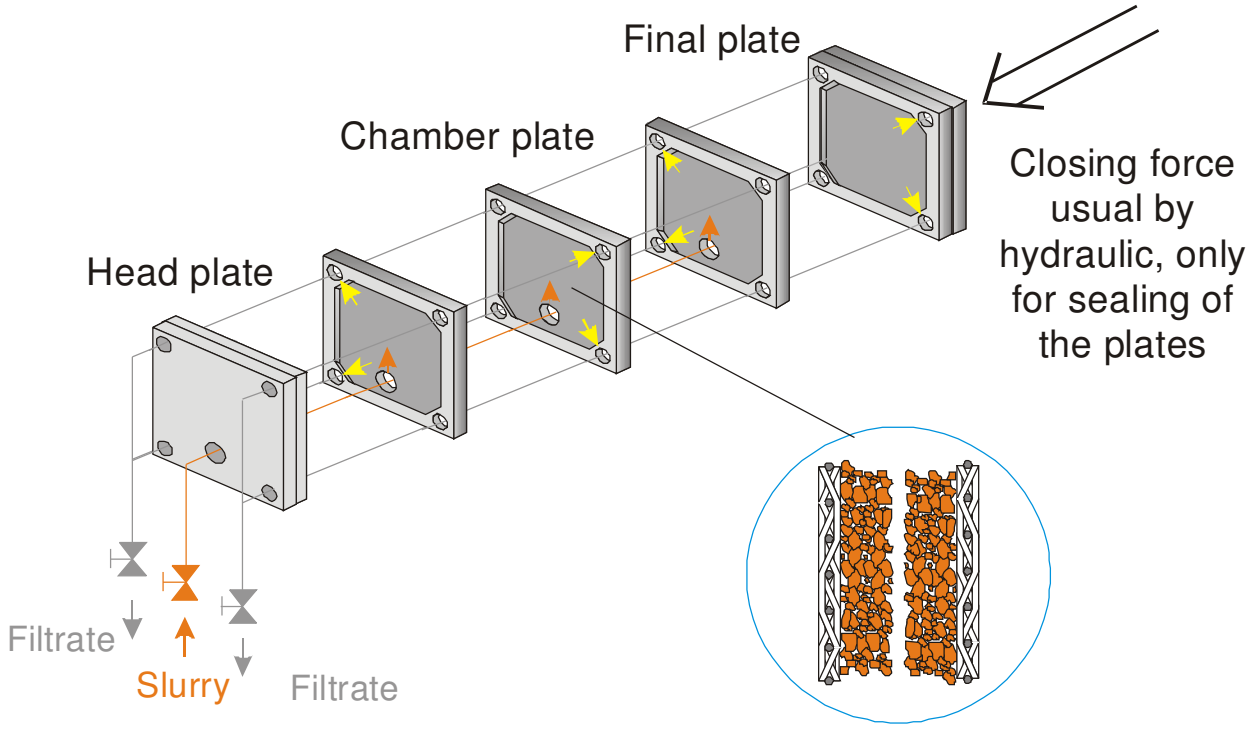
Process Description of Chamber Filter Press



max. flow rate of feeding pump	Pressure increase – Reducing of sludge flow	Minimized sludge flow on high pressure level	Blowing out of the feeding pipe – drop-off of filtrate
Empty chambers filling with sludge	Equalization of solid – sediment on the cloth	Stop of building solid cake between the chambers	Discharge of solid filter cake
High filtrate outflow. Solids separate on filter cloth	Outflow of clear filtrate	Low filtrate outflow stops the filtration process	Reduction of throughput indicates filter cloth rinsing

Process Description of Chamber Filter Press

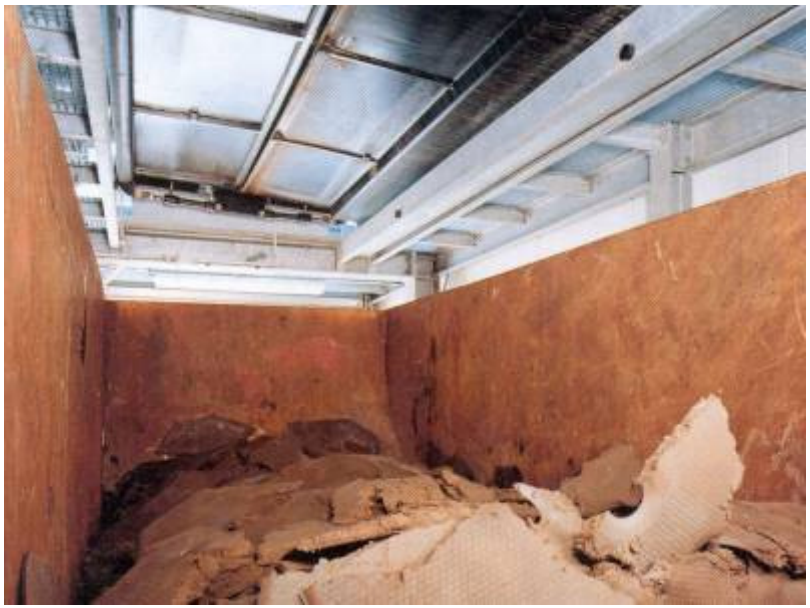
➢ Working principle of Regular Chamber Presses



For easier understanding plates are shown with distance

Operation result of Chamber Press

- Dewatered filter cake approx. 35 % DR in a transport container under the chamber press with closed bunker flaps

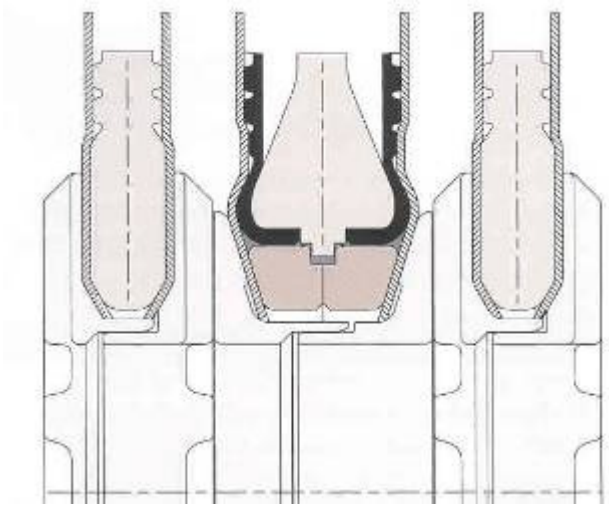


Equipment of Filter Presses

- Filter plates in synthetic material – PP (polypropylene)

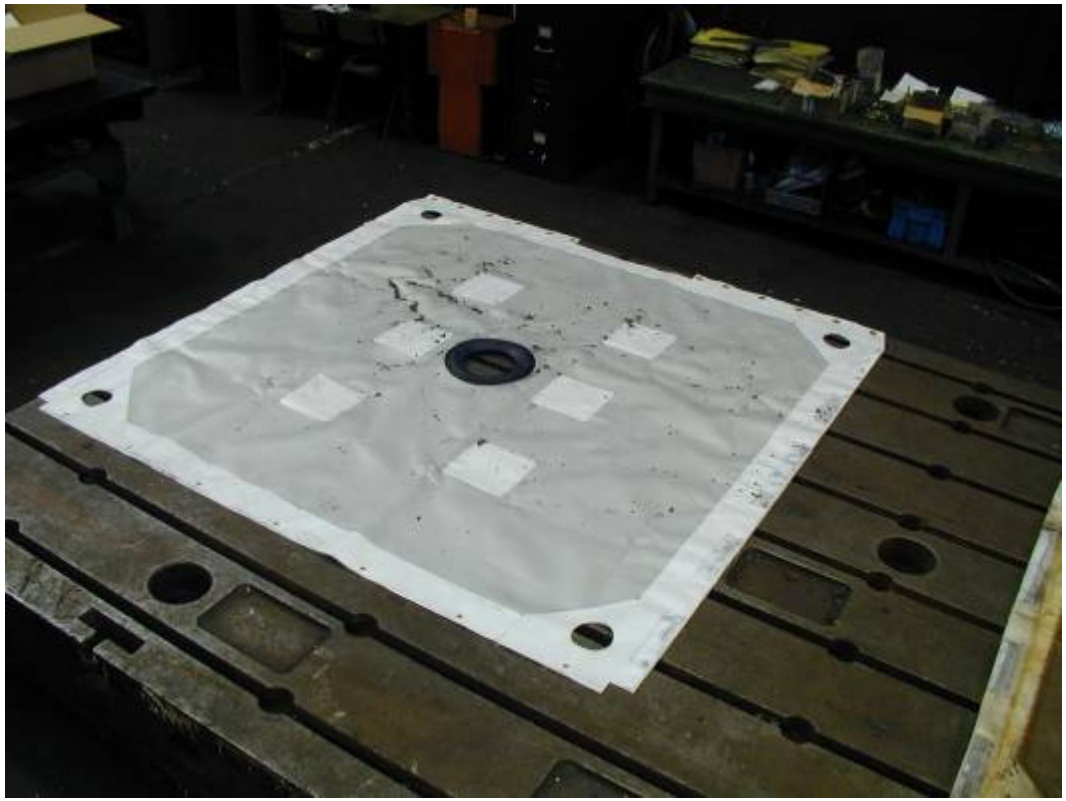
Equipment of Filter Presses

- Membrane filter plates in synthetic material – EPDM



Equipment of Filter Presses

- Typical filter cloth, made of PP or PA



Equipment of Filter Presses

Electro-Hydraulic Closing Device

- modularized system
- hydraulic unit with a two-stage hydraulic pump
- double-acting closing cylinder

Equipment of Filter Presses – Overhead Version

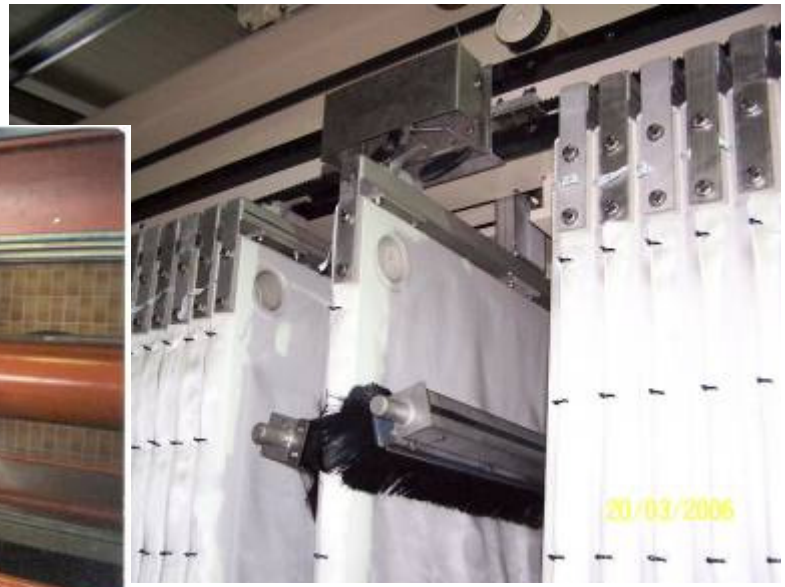
Automatic Plate Shifter - alternative

- right and left outside of the overhead I-beams
- two continuously revolving toothed belt with special transport device

Equipment of Filter Presses – Overhead Version

Filter Cloth Cleaning Device

- will be positioned by proximity switches
- compact portal design
- using fan nozzles



Equipment of Filter Presses

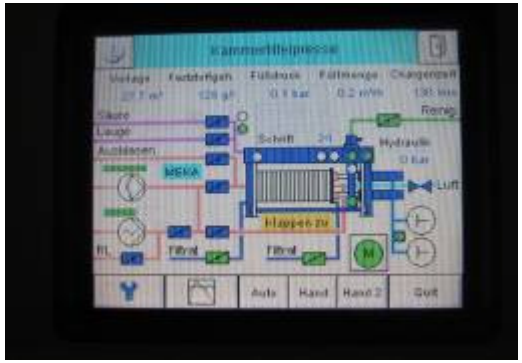
Accessories and Optional Equipment

- Filter Cake Transport Device

Equipment for Filter Presses

Accessories and Optional Equipment

- Control Panel



Filter Press Installation

- References and Experience
  - first Chamber Press Installation from PASSAVANT in Germany in 1964
  - first Chamber Press Installation from PASSAVANT abroad in 1965
  - different Chamber Press System worldwide
  - still in Operation more than 750 units
  - various numbers in operation longer than 25 years
- Service support worldwide
- manufactured and preassembled in Germany

Filter Press Installation

- MERCK AG, Colour and Paint Production: automatic Side Beam Press 800 x 800 mm
- Water Works Schöneck, Germany automatic Side Beam Press 1200 x 1200 mm

Filter Press Installation

- LOBBE GmbH, rehash of acid
  automatic Side Beam Press 1200 x 1200 mm
- MOZYR refinery, Republic of Belarus
  automatic Side Beam Press 800 x 800 mm

Filter Press Installation

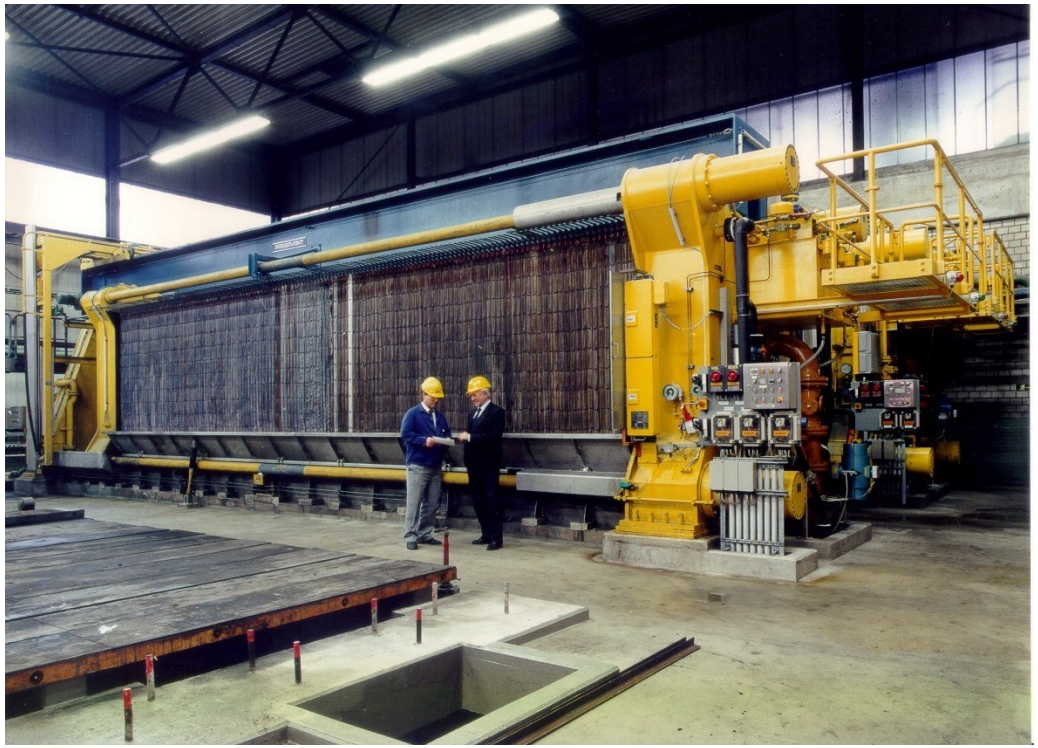
- 3 pc. Overhead Filter Presses
  CFP 2000x2000 / WWTP Mailand Nosedo, Italy

Filter Press Installation

- 4 pc. Overhead Filter Presses
  CFP 1500x1500 / WWTP Jiaxing, China

Filter Press Installation

- Overhead Filter Press
  CFP 2250x2250 / BASF, Germany



Filter Press Installation

- Semi mobile installation, used by construction work of subways – slurry of bore mining

Quality Management

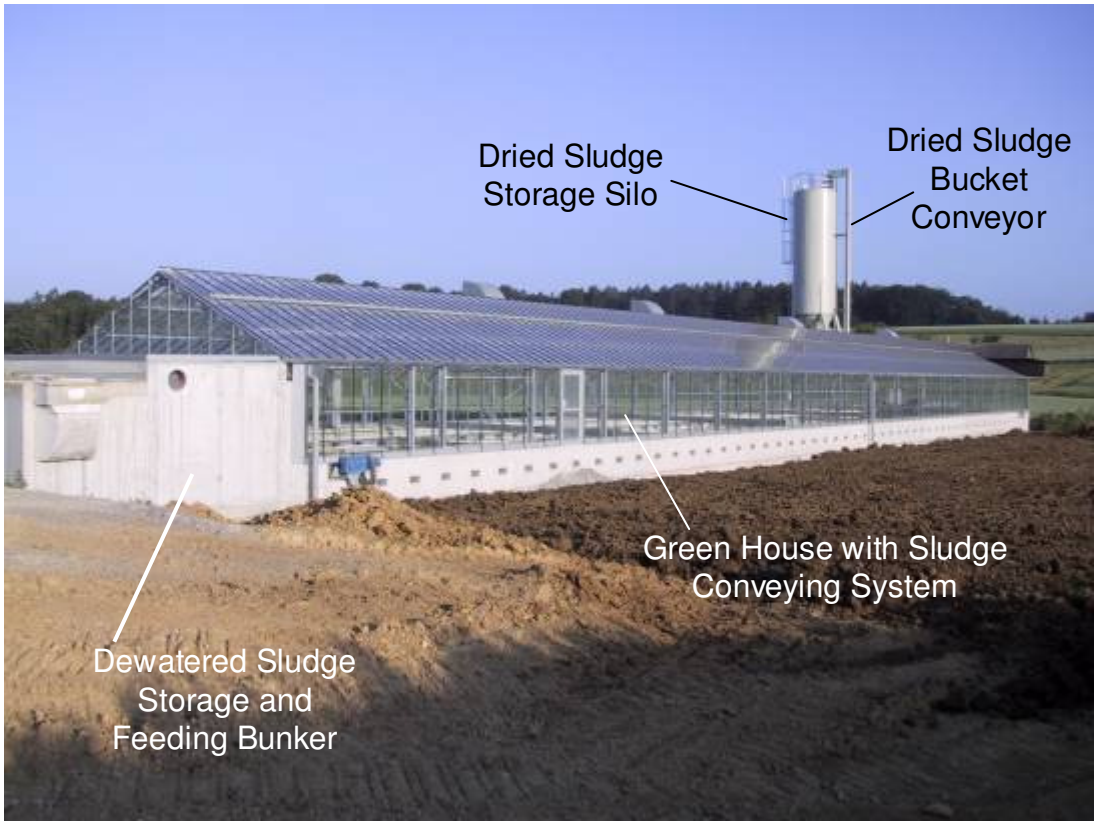
- Quality inspection of all single parts
- Inspection of the function in the workshop in Germany
  - Frame – Plate Transport – Hydraulic equipment
  - Closing System

Drying Process

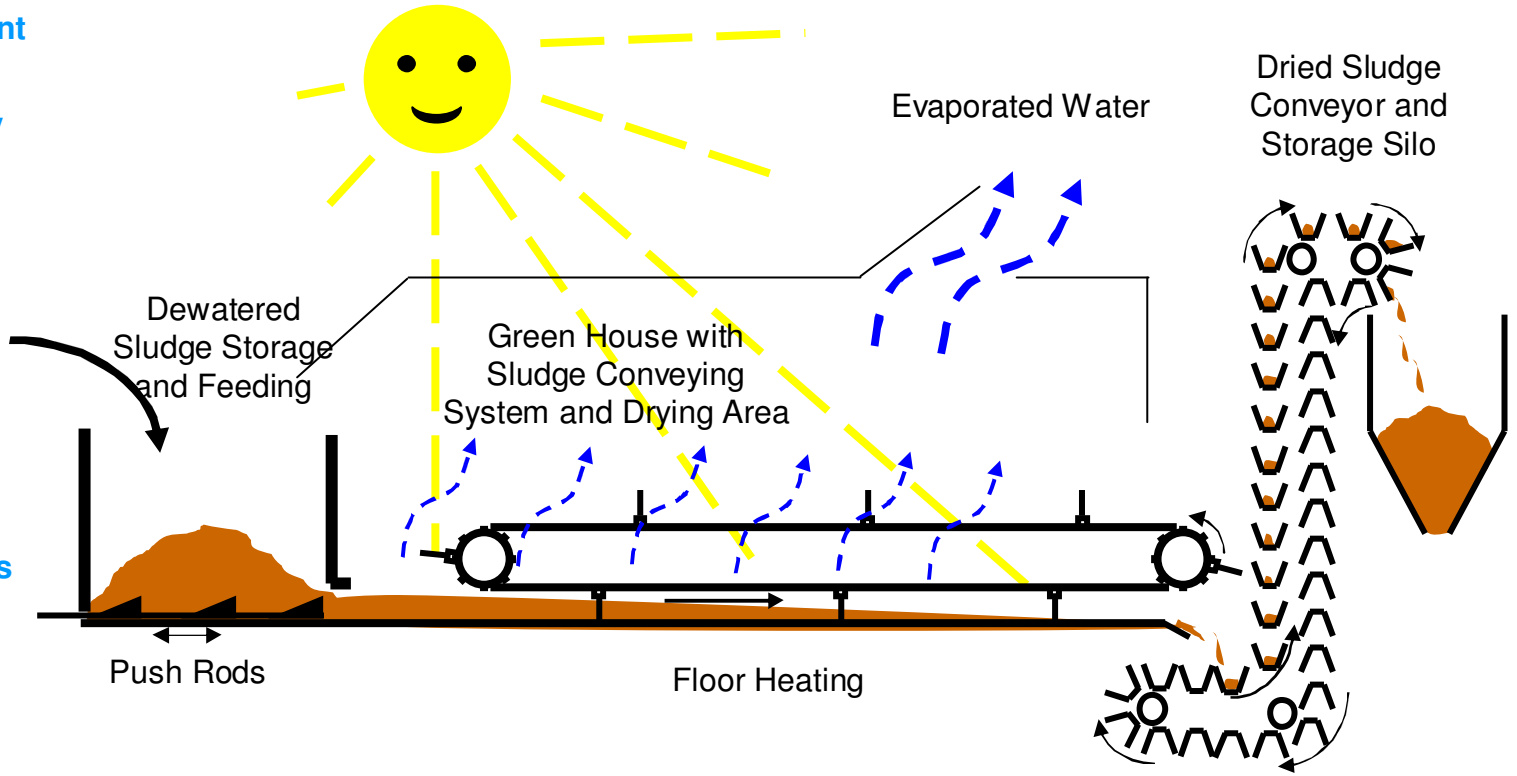
Most efficient system: **EDZ-Solar Sludge Drying System**

Drying Process

EDZ-Solar Sludge Drying System



Drying Process - Schematic Overview



Drying Process

Final Product of EDZ-Solar Sludge Drying System

Granulate >90% DS, 0 – 8mm size

Drying Process

Advantages of EDZ-Solar Sludge Drying System

- Fully Automatic, no Front Loader required
- No Pollution of surrounding streets and areas as in systems with front loaders
- Use of additional heat can reduce required surface by 75%
- Use of additional heat enables high DS concentration (>90%)
- High evaporation rate and efficiency due to thin sludge layers
- No odour problems due to thin sludge layer and continuous aerobic conditions
- No sticking of sludge, as sludge is constantly moved
- 19% higher Surface Area due to EDZ Harrow System
- No dust due to smooth conveying system
- Very low electric energy consumption (< 25 kWh/t Water Evaporation)
- Very low maintenance requirements
- The EDZ System is the most economic system on the market

Conclusion

We are working at high pressure for you

Thank you very much for your attention.
Tarek Huseino