Vertical plate pressure filter
VPA

Development in filtration and dewatering technology has advanced rapidly in the last years. Environmental awareness has been a major driving force and increase in cost of energy and personnel has made tougher demands on efficiency and automation.

Metso now launches the next generation of the VPA including the "JUMBO", with capacities in excess of 250 tonnes per hour in a single unit.

The basis of this development has been the requirement of the heavy industry for reliable automatic operation and simple maintenance.

Metso developed the VPA pressure filters for the mineral industries which brought together high performance and high degree of automation into lowest total cost.

The result is an automatic pressure filter with unique features such as:

- Compressed air system
- Product weighing system for production monitoring
- Filter cloth damage detector
- Process controller for complete automatic operation
- Service platform

The heart of the system is the pressure filter which is available in two basic versions VPA and VPC.

VPA means Vertical Plate Airblow and designates the filter which provides for compressed air dewatering of the filter cake.

The operating pressure of this machine is usually 7-10 bar and is the standard machine for dewatering of mineral concentrates.

Membranes are inflated with compressed air. Cycle time can often be as short as 6 minutes.

The complete filtration system (see page 3) must be carefully considered for each individual application. Metso supplies the complete system:

- Slurry thickener with automatic discharge
- Feed slurry buffer tank
- Flow and density meters for filter feed
- Slurry feed pump
- Cloth wash water pump and tank

For more information, contact your local Metso representative. www.metso.com

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VPC means Vertical Plate Compression and designates the filter which provides for high pressure membrane dewatering of the filter cake.

This machine can operate with pressures up to 16 bar and is used where high pressure filtration and membrane pressing is required for dewatering.

The field of applications is wide and ranges from very fine particle slurries in the industrial mineral industries to precipitated sludges in the chemical industry.

Membranes are inflated with high pressure water. Cycle time often varies from 10-30 minutes depending on application.

**Equipment sizing**

Accurate sizing of any process equipment is a key to a successful installation. The Laboratories of Metso have comprehensive facilities for investigation of most tasks of Solid-Liquid Separation.

For Pressure Filtration these facilities include:

- Particle size analysis
- Parameter studies of feed concentration, pressure and time for feed, membrane compression air through-blow etc.
- Air consumption
- Treatment of feed with coagulants and flocculants
- Cake washing

**Pilot scale testing**

When required, pilot testing at customer’s site or in Metso’s pilot hall is performed on self-contained pilot scale pressure filters. These are frame mounted and are complete with mixers, pumps and process controller for fully automatic pilot scale operation.

**Mechanical design**

The basic design consists of a rectangular frame built up from a fixed press head, a frame to support the hydraulic cylinders and two horizontal side rails.

The moving press head runs on the horizontal rails and is controlled by two, or four, parallel hydraulic cylinders.

Filter chambers are placed between the fixed and moving press heads.

The filter chambers are fitted with filter cloths which allow filtration on both sides of the chambers.

The filter cloths are suspended from tubular supports which run on the two upper rails. These tubular supports also serve as spray bars for washing of the filter cloths.

Motor vibrators are mounted on the upper rails. These can be activated for cake discharge and during the cloth washing cycle to remove any residual solids. Vibration also assists rapid removal of wash water from the cloths.

The moving and fixed press heads and the filter chambers are linked together which allow smooth and uniform movement of the filter chambers when the press is opened.

Similarly, the cloth support bars are linked together, to ensure that the filter cloths are always located in the centre of the chambers.
Pressure filter on load cells
By installing the pressure filter on load cells a multitude of data becomes available. Accurate production monitoring and measurement of weight increase and decrease rates to optimise filtration and air blow times are examples.

Hydraulic pack
The hydraulic pack is usually located on the top of the pressure filter conveniently away from the floor area.

The pack consists of a common shaft multiple pump unit for high speed movement of the plates and a separate high pressure pump for applying the closing pressure.

Cloth damage detector
Filter operation with damaged cloths is undesirable for several reasons. By monitoring the clarity of the filtrate a damaged cloth is quickly detected. A turbidity sensor can be used to send an alarm in the automatic control of the filter.

Service platform
One outstanding feature of the Metso VP pressure filters is the cloth suspension system which makes cloth changing a very simple operation. To make best use of this feature a service platform is available.

VP control system
The pressure filter is controlled by a system consisting of a PLC connected to a PC.

All control logic’s are implemented in the PLC. The operator uses the PC monitor and the mouse to operate the filter press either in manual mode or automatically. The operator can also perform Settings, Statistics and Alarm handling from the monitor.

Dimensions
The complete Metso VPA or VPC pressure filter installation can be arranged in several ways and the table beside is for guidance only. Detailed installation drawings are available from Metso and are issued with quotations or upon request.
<table>
<thead>
<tr>
<th>Model</th>
<th>H mm (inch)</th>
<th>L mm (inch)</th>
<th>W mm (inch)</th>
<th>Weight (empty) ton</th>
<th>Power** (hydraulic motor)</th>
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<td>2 310 (91)</td>
<td>5 500 (217)</td>
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* 1012, 10 = filter chamber size 10x 10 dm (40x40 inch), 12 = number of chambers

** High = high pressure stage, Low = low pressure stage
The dewatering cycle

Filtration
The pressure filter plate pack is locked under pressure by the high pressure hydraulic pump.

Feed slurry enters the filter chambers through the top-feed ports. Filtration begins immediately on both sides of the chamber. The filtrate is drained through the four ports of each chamber. The double sided filtration gives speedy build-up of the filter cake and a short filtration part of the cycle.

A. Slurry feed
B. Filtrate
C. Filter plate
D. Membrane plate
E. Filter cloth

Compression
When the cake is formed it is stabilized by inflating the rubber membrane on one side of each cake. This is normally a short part of the cycle and is beneficial for the dewatering economy and reduces the total cycle time. Membrane inflation is accomplished by compressed air or, for high pressure applications, by pressure water.

F. Diaphragm
G. Pressure medium (air or water)

Air Dewatering (VPA)
Compressed air is supplied to the membrane side of the filter cake and displaces the free water in the cake to the filtrate discharge on the opposite side of the cake. The membrane is usually kept inflated to maintain good cake stability. This reduces air consumption and ensures lowest residual cake moisture. The time for air blow depends on the material to be dewatered but is typically 1-4 minutes.

H. Compressed air
B. Filtrate
**Cake Discharge**
When the cakes are ready for discharge the cake chute door (drip tray) is retracted and the filter opened by actuating the high capacity hydraulic pump. The filter opens at a rate exceeding one chamber per second. The cloths hang freely from the suspension bar and the cakes are released at the same rate. In the fully open position the cloths are vibrated to ensure release of any cake residue.

I. Chamber opens
J. Cloth vibration

**Cloth Washing**
With the plate pack still in the open position the cake chute door (drip tray) is closed and the cloths are rinsed by the spray nozzles in the cloth suspension bars. The cloth vibrators may be actuated during the cloth washing.

This sequence takes about 30 seconds and after this the filter is closed and the cycle begins again.

K. Drip tray in position
L. Washing cloth from internal spray bar
J. Cloth vibration