ABEL®
Pump Technology

Heavy Duty Mining Pumps

Made in Germany

Membrane Pumps
Solids Handling Pumps
High Pressure Pumps
Marine Pumps

Heavy Duty Pump Solution for all Abrasive Media in Mines

IN 1947, ABEL was founded in Düsseldorf by Mr. Wilhelm Abel as an engineering firm for pump technology. In the direct neighborhood of the coal mining district of the German Ruhr area, this new company pioneered pumping technology for pumping abrasive media. Mining required reliable and sturdy pumps to transfer dirty mine drainage water and the dependability of the technical equipment was important. The lives of the miners working at depths many hundreds of meters below ground depended on it.

The roots in mining have further developed in ABEL's history to become a seamless range of oscillating positive displacement pumps for the mining industry. Today, there is hardly a pump manufacturer world-wide that can offer a coherent range of pump solutions for mining in this way.

ABEL brochure title page 1949 - mining is our origin

Heavy Duty – Engineered and Made in Germany.

Technologically, ABEL pumps continuously undergo innovation and improvement. However, its fundamental solid design has not changed for decades. Particularly, thick-walled pump housings is just one example.

Meanwhile, ABEL engineers have broadened the scope of the **heavy duty principles** on which we were founded to become an innovative leader in pump technology for mining.

With its headquarters now in Buechen near Hamburg, the company has been fulfilling the quality norm DIN EN ISO 9001 since 1991 as one of the first companies in Germany to be certified by Germanischer Lloyd.

Specialist for Transport of Highly Abrasive Media with High Solids Content.

Whenever abrasive, aggressive media under extreme conditions and high pressure has to be pumped - often over long distances - ABEL has the expertise. Our SH series solids handling pump can transport slurries with high solids content up to 80% at pressures up to 16.0 MPa (2320 psi).

World-wide, mine operators know ABEL as the go-to supplier for all their transporting tasks involving abrasive media. From transport of mine drainage water loaded with solids to backfilling **highly abrasive paste media** at extremely high pressures over long transport routes - ABEL can provide a suitable pump solution.

Acidic ore slurries in refining processes for nickel, copper and gold mines are considered to be a particular challenge. In cases like this, ABEL supplies pumps with wetted materials made of polypropylene, stainless steel, duplex stainless steel or with an inside coating of acid and wear resistant hard rubber.
Customers can select from a wide product range of single-, dual, triple- and quadruple-action diaphragm and piston-diaphragm pumps. The full product range also includes piston pumps for transporting paste slurries and plunger pumps for filter cloth cleaning and gland seal water supply to larger centrifugal pumps.

There are open pit mines on all continents. Here, ores are mined and processed under a wide variety of climate conditions. Heat, cold, dust and high air humidity - pumps in a mine are often operated and serviced outside. And yet they need to provide reliable, 24/7 operation. Our task in designing and producing these heavy duty pumps, is to ensure that they persist under those extreme conditions.

Operators of ore mines on many continents trust in the heavy duty qualities of ABEL pumps

Why ABEL? Competence in Mining:

ABEL Piston Diaphragm Pumps Provide ...

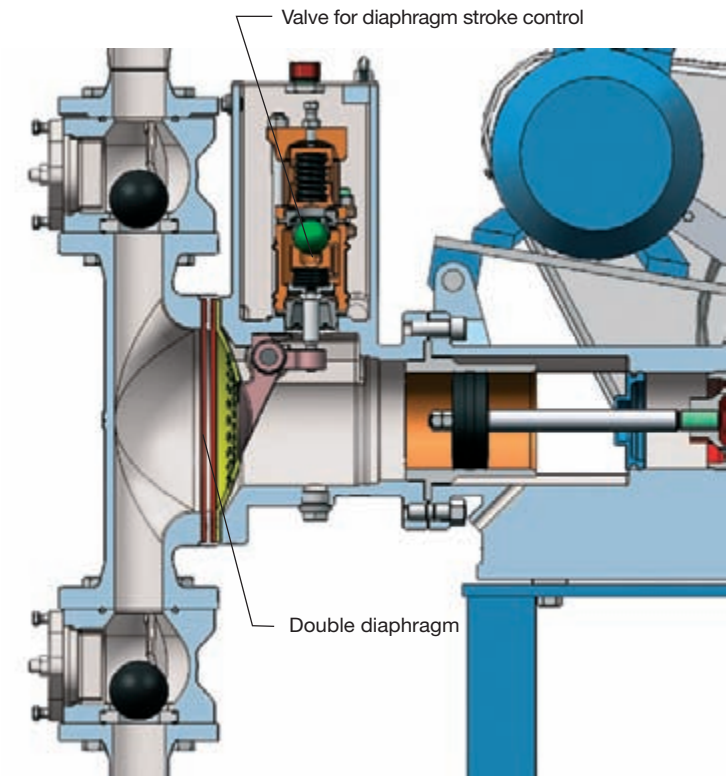
... DURABILITY - a clear advantage over other positive displacement pumps due to the hermetic separation of medium and hydraulic section. The diaphragms safely separate the abrasive pumped medium from the actual pumping organ (piston) via its regulating devices and safety valves, which protects and ensures longer wear life and reliable service of these components.

... SAFETY - because these pumps can inherently run dry and in particular they are slow-stroking during standard operation. Due to their structural properties they are very suitable for low-wear transport of mineral slurries against high pressure.

... FLEXIBILITY - for various pressures. All of our high pressure pumps are equipped with cone valves according to API (also in reverse construction design for transport of slurries with high settling rates) and our low-pressure pumps have ball valves that are durable with a long service life even in case of coarse-grain solids.

... RESILIENCY - in construction. The HM series pump is equipped with pre-shaped diaphragms that are not subject to stretching over the entire stroke length. The service life of the diaphragm is thus clearly increased.

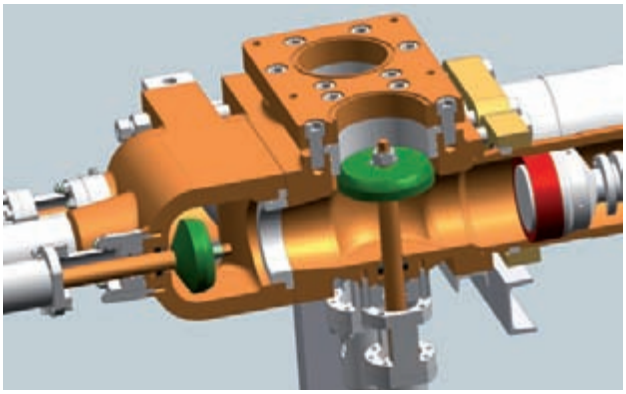
... RELIABILTY - for critical processes. The CM series pump provides true double diaphragm containment technology for cost-intensive processes that do not allow switching off in case of a diaphragm rupture.



CM pump with double diaphragm technology for safe operation without unplanned down-time.

ABEL Cone Valve Solids Handling Pumps Provide …

... ORIGINALITY - in design. The SH series solids handling pumps are equipped with extended cone valve rods. This design detail avoids potential soiling of the hydraulic circuit by limiting the stroke of the valve rod that comes into contact with the pumped medium.



... EFFICIENCY - that saves you money. The SH series pump is equipped with extra-large suction valves so as to achieve a high filling level of the pump cylinder even with very pasty media

ABEL High Pressure Plunger Pumps Provide …

.... VERSATILITY - that gives you an edge. The HP series high pressure pumps are available with various plunger seals, also in flushed or lubricated version.

... MOBILITY - that eliminates down-time. The containerized version is fully installed and ready-to-use for mobile applications which gives you more productivity in the field.

All ABEL pumps are available in explosion-safe design according to ATEX.

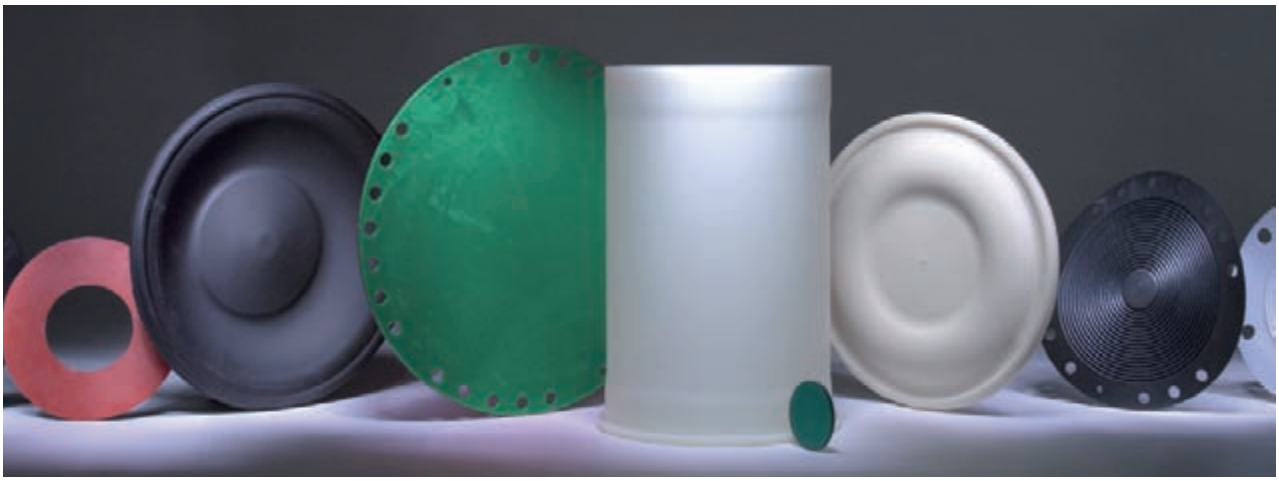
A seamless product range of full service mining pumps

No unpredictable downtime - that is the goal that we work towards every day.

ABEL Service

- On-time flow of spare parts with foresighted stock building. 95 % of all ordered spare parts are delivered on the date requested by the customer - we are working on the other 5 %
- World-wide deployment of service personnel
- Service contracts by ABEL Service for increased support of your pump
- Online monitoring to track performance and mitigate potential problems down the road

ABEL Pumps are available in an explosion-proof (ATEX) design



ABEL original diaphragm ensure maximum pump lifetime

There is a special ABEL pump solution for every pumping task in mines:

ABEL has special technical know-how and extensive experience everywhere in the world when it comes to transporting **highly abrasive media**. The most important features: Reliable operation and long service life. Pumping problems may vary considerably from mine to mine. As a manufacturer of positive displacement pumps, ABEL offers an **extensive range** of specialty mining pumps worldwide.

Mine Dewatering - Expert Experience Since 1947

ABEL HM series triple- and quadruple-action piston diaphragm pumps are made for mine dewatering. Their high pumping capacity and sturdy, high pressure design allows drainage of mine water in **only one stage** to the surface.

The pre-shaped diaphragms of an ABEL HM series pump are not subjected to stretching over its entire stroke length. A control valve unit on the hydraulic side monitors the front as well as the back diaphragm end position. This simple and unique design far exceeds our competition and is designed for long service life; the main reason for the renowned robustness of this series.

Key features HMQ/HMT:

- Flow rate/pressure: Max. 800 m³/h (3500 GPM), 25.0 MPa (3625 psi)
- Power transmission by means of intermediate gear unit or V-belt drive
- Generously dimensioned pulsation dampeners
- Available with ball or cone valves
- Wetted parts are available in spheroidal cast iron (also rubber-coated), cast steel, stainless steel as well as special exotic materials.

Benefits:

- Long service life of the diaphragms due to pre-shaped diaphragms. Easy start-up against load by ramping up with a frequency converter
- No need for additional pumps at higher levels (single stage)
- Explosion proof and ATEX design possible

Deep mining requires reliable dewatering and can be done in only one stage all the way to the surface - ABEL provides that in addition to a long service life of the pumps.

Thickener Underflow - Depending on Discharge Pressure ABEL EM, CM or HM Series Pumps

Positive Displacement (PD) pumps are ideal for thickener underflow applications. They are able to pump slurries with a high content of solids and high viscosity, since their flow rate is independent on the occurring counter pressure.

Here, ABEL electric diaphragm (EM series) and piston diaphragm (CM and HM series) pumps are often superior to other positive displacement (or PD) pumps, because as oscillating displacement pumps they have **no rotating parts that come into contact** with the abrasive pumped medium. With their low stroke rate they are also far less sensitive to wear than other pump designs.

For transport from the thickener, ABEL PD pumps are the preferred solution for highly abrasive slurries with heterogeneous grain size. The electric diphragm pumps of the EM series cover the low-pressure range up to max. 0.6 MPa (90 psi) while piston diaphragm pumps of the CM or HM series are used for higher pressures.

Key features:

ABEL EM: Flow rate/pressure max. 120 m³/h (525 gpm), 0.6 MPa (90 psi)
ABEL CM/HM: Flow rate/pressure max. 70 m³/h (300 gpm), 10.0 MPa (1450 psi)

Benefits:

ABEL EM: Cost effective, abrasion resistant and highly efficient
ABEL CM: Reliable, double containment diaphragms
ABEL HM: Extra-long service life due to pre-shaped diaphragms

ABEL EM-080 for transfer of thickened ore tailings

ABEL EM-100 in a thickener underflow application

ABEL EM-100 pumps. A perfect solution for abrasive slurries.

Backfilling - a Job for Sturdy Pumps

Backfilling of tailings into the original mining spaces requires extremely robust high-performance pumps, most of the time with high pumping capacity at high pressures. ABEL triple-action or quadruple-action piston diaphragm pumps of the HMT and HMQ series are used for this purpose even if conditions are extreme. These pumps can transfer tailings with a **high degree of dry substances**, up to 800 m³/h (3500 GPM) at a pressure up to 25.0 MPa (3626 psi).

ABEL piston diaphragm pumps are the preferred choice because of their robust design, reliability and their impressive service life. Their durability is supported by an optimal slow stroke rate, which reduces wear and is typical for oscillating positive displacement pumps such as these.

Pumps of the HMT and HMQ series are equipped with spring-loaded cone valves that ensure safe closing **even in case of high counter pressure**. Together with the diaphragms, the cone valves are the only consumables that come into contact with the abrasive transferred material.

Depending on the pressure stage and on the composition of the pumped product, the pumps and valve housings are made from spheroidal cast iron (also with hard rubber coating), cast steel or stainless steel.

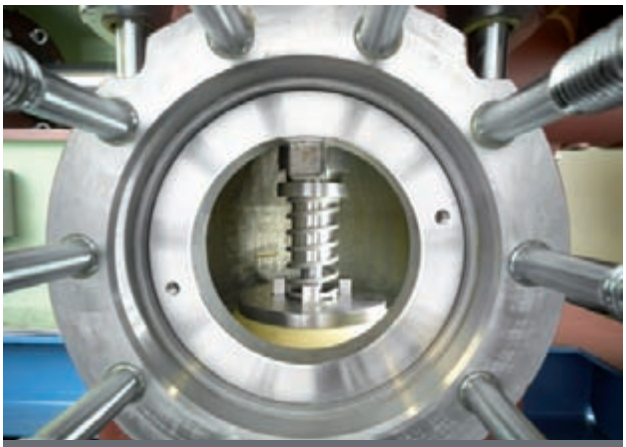
Key features HMQ/HMT:

- Pumping performance range: Up to 800 m³/h (3500 GPM), 25.0 MPa (3626 psi)
- Can run dry
- Low pump speed (rpm) for longer part life

Benefits:

- Extra long service life due to pre-shaped diaphragms
- Suitable also for chemically contaminated media

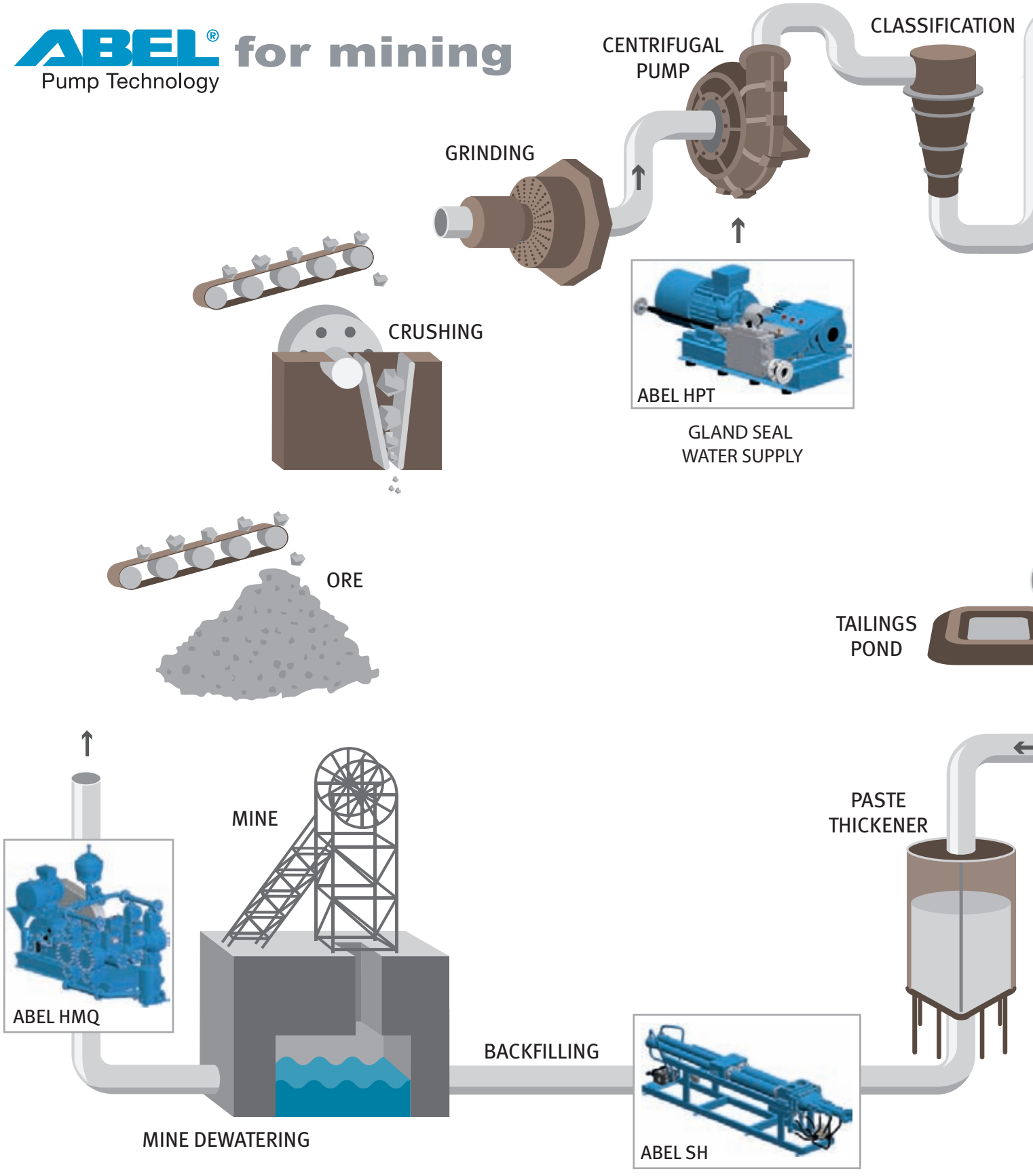
ABEL HMQ in a saline application for backfilling of brine slurry with 30 % solids concentration



API cone valves for pressures >4.0 MPa and mineral slurries with high solid content

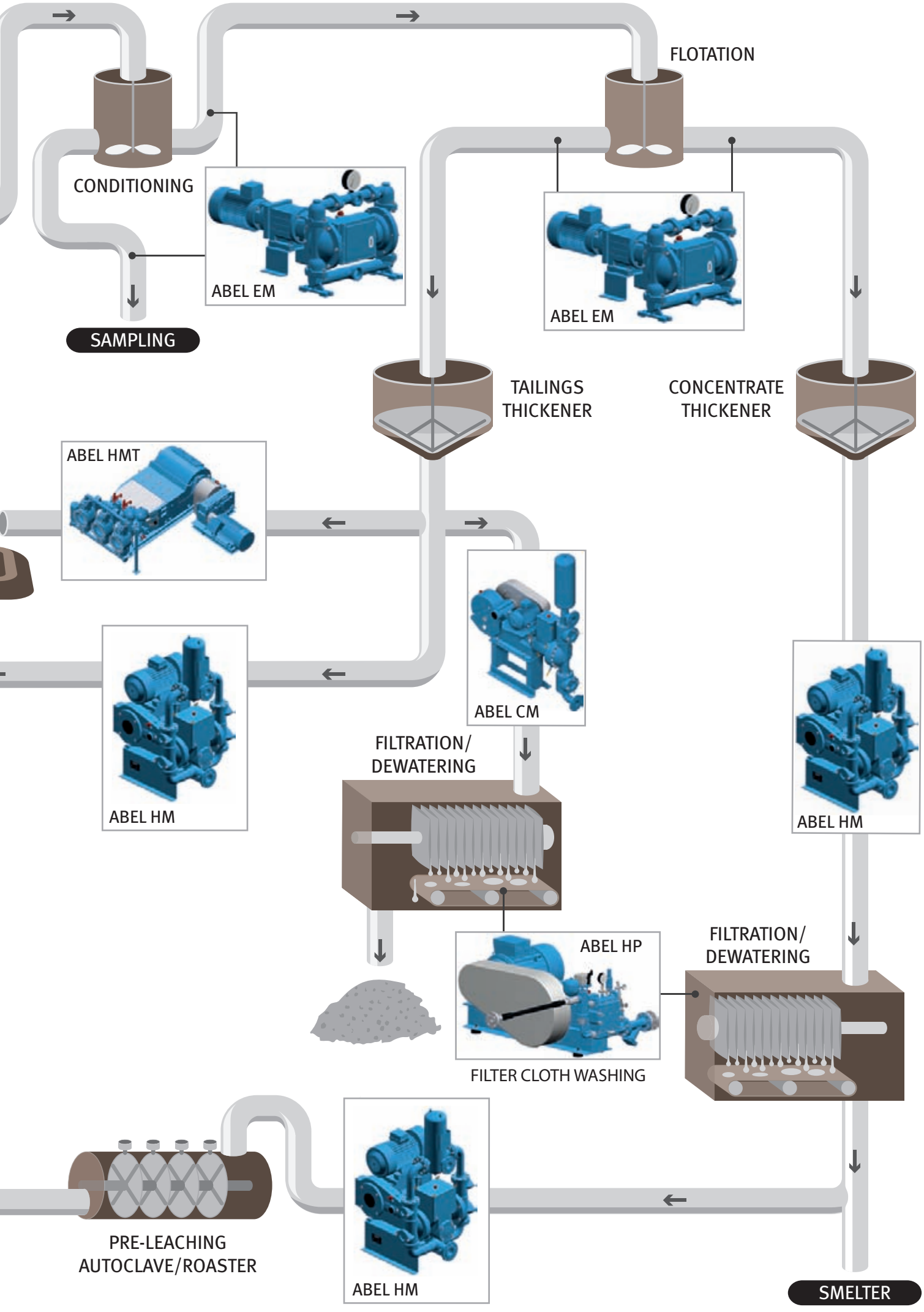
Classified copper tailings. 50% solids concentration. 90 m³/h (390 gpm); 50.0 MPa (720 psi). Transfer distance: 3.5 km (2.2 miles).

ABEL® for mining
Pump Technology



ABEL Applications

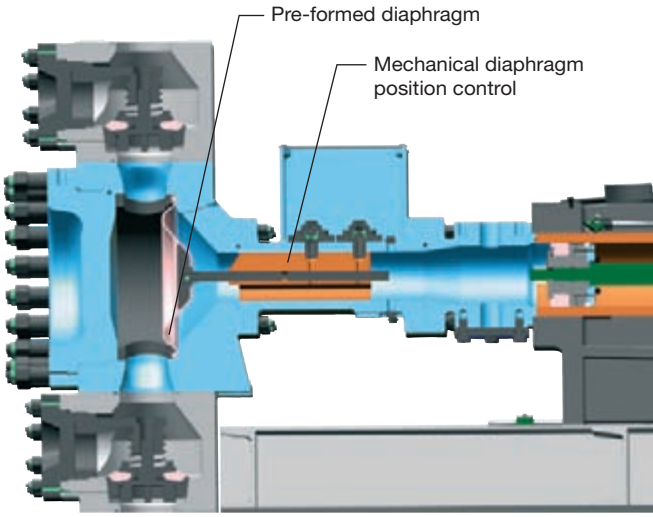
- Gland seal water supply
- Sampling
- Tailings transfer
- Thickener underflow
- Filter press feed
- Filter cloth washing
- Autoclave/roaster feed
- Backfilling
- Mine dewatering



Tailings Transfer - Our Job Exactly, Even for Extremely Sedimenting Slurries

Transfer of mining slurries can affect the wear behavior of pumps in very different ways. Together with particle size and density, the solids content of the slurry is at least as important as the necessary and permitted flow speeds in the pump. Depending on the composition of the slurry and the quantities to be dealt with, operators either decide in favor of a piston diaphragm pump of the ABEL HMD series or, in case of larger flow rates, a pump of the ABEL HMQ series. ABEL HMD dual-action is available up to 70 m³/h (300 GPM) while the HMQ series can handle flow rates up to 800 m³/h (3500 GPM).

For extremely sedimenting slurries, both series can be equipped with so-called “reversing valves”.



100 m³/h (440 GPM); 1.6 MPa (225 psi), Medium: iron ore tailings, solids concentration: 47 %, up to 3 mm particle size.

60 m³/h (260 GPM); 1.0 MPa (145 psi), Medium: sulphate slurry, solids concentration: 50%, density: 1.6 kg/ up to 8 mm particle size.

These are spring-loaded cone valves where media flows from top to bottom, i.e. against the normal transporting direction. Sedimentation rate and flow speed thus work in the same direction rather than opposite directions. This prevents the pumped material from settling in the product valves of the pump.

Key features:

ABEL HMD: Flow rate/pressure: Max. 70 m³/h (300 GPM); up to 10.0 MPa (1450 psi)
ABEL HMQ: Flow rate/pressure: Max. 800 m³/h (3500 GPM); up to 16.0 MPa (2320 psi)
ABEL HMT: Flow rate/pressure: Max. 600 m³/h (2640 GPM), 25.0 MPa (3625 psi)

Benefits:

- Installation: outdoor, humid, coastal, dusty
- Extra long service life due to pre-shaped diaphragms

Autoclave Feed - Transporting Hot Abrasive Media While Retaining Long Service Life

Metallurgical processes in the extraction of gold, molybdenum, copper, zinc, nickel or uranium require high pressures and temperatures and sometimes a low pH-value. For this, autoclaves (alternatively also so-called roasters) are used that are loaded with slurries of different temperatures, depending on the ore and the process requirement.

Hydraulic piston diaphragm pumps by ABEL are particularly suitable for this. Their hermetically sealed, tight designed diaphragms permits **extremely high pressures** and accommodates **high medium temperatures**. Due to their low stroke frequency and their generously sized delivery valves, ABEL pumps of the HMQ and HMD series are perfectly suitable for autoclave loading even in case of highly abrasive ore slurries. The advantages are longer service lives and high availability.

As a specialist for mining, ABEL uses pre-shaped diaphragms for both pump types that, unlike conventional diaphragms, are not subject to any stretching over the entire stroke length. As a result, the diaphragm is subject to less stress and the service life is greatly increased.

Key features ABEL HMQ:

- Flow rate/pressure: Max. 800 m³/h (3500 GPM); up to 16.0 MPa (2320 psi)
- Medium temperature up to 100 °C (210 °F)
- Parts of the pump with medium contact are from spheroidal cast iron (also rubber-coated), cast steel or stainless steel
- ATEX design possible

Key facts ABEL HMD:

- **ABEL HMD:** Flow rate/pressure: Max. 70 m³/h (310 GPM); up to 10 MPa (1450 psi)
- Medium temperature up to 100 °C (210 °F)
- Parts of the pump with medium contact are from spheroidal cast iron (also rubber-coated), polypropylene, cast steel or stainless steel
- ATEX design possible

Benefits:

- Pre-shaped diaphragms (HMQ, HM) for very long diaphragm service life
- Slurry valves as ball or cone valves
- Generously dimensioned pulsation dampeners for low residual pulsation

HMQ pumps for autoclave feed: Max. 105 m³/h (460 GPM), 1.6 MPa (225 psi), max. 74 µm particle size, solids concentration: <15,4 %, slurry temperature: 60°C, medium: concentrate slurry with 0.2 g/l sulphuric acid. Pump wet end made of duplex stainless steel due to the low p/t valve. Installation: outdoor.

Filter Press Feed - WANTED: Heavy Duty Pump with Automatic Control of Flow Rates

Self-regulating piston diaphragm pumps are the ideal solution for filter press feed. ABEL pumps of the HM and CM types have proven to be the ideal feed pump for chamber and diaphragm filter presses in thousands of cases. These pumps maintain a **constant flow** rate during the filling phase **and automatically decrease flow with increasing pressure during the filtration phase**. The inflection point can be selected variably. This reduces cycle time and saves considerable costs.

In addition to the actual pumping capacity, an important feature of loading or feed pumps is that they are resistant against wear caused by abrasion of aggressive slurries often processed in mining. In particular, the moving parts in contact with the medium, for instance valves and diaphragms, should be very durable.

The combination of heavy duty reliability and progressive control technology for discontinuous filter press operation

A very suitable pump for feeding smaller to medium-sized filter presses is the ABEL CM with its compact design, a piston diaphragm pump with true double-diaphragm technology. It is used as a single-action or dual action filter press feed pump in the low capacity up to 30 m³/h (130 GPM); it is equipped with a robust, **automatic mechanical feed rate control -** without complex electronics. Its heavy duty design is the main reason for its success in "around-the-clock" transporting tasks within the medium pressure range.

On the other hand, the ABEL HM pump series controls pumping capacity with energy efficiency by means of a variable frequency converter (VFC or VFD) and a pressure sensor. This makes higher initial flow rates during the filling phase possible.

Both CM and HM series pumps have proven to be ideal pumps for filter press feed, especially for abrasive mineral media. They are available in spheroidal cast iron (also rubber-coated), polypropylene, cast iron or stainless steel. For standard applications in filter press loading, both pumps are equipped with non-return ball valves on suction and pressure side and with plastic/steel core balls and plastic or stainless steel valve seats.

Key features:

ABEL HM: Flow rate/pressure: Max. 90 m³/h (395 GPM); up to 2.5 MPa (360 psi)
ABEL CM: Flow rate/pressure: Max. 30 m³/h (130 GPM); up to 2.5 MPa (360 psi)

Benefits:

ABEL HM: Pre-shaped diaphragms for very long diphragm service life
ABEL HM: Energy-saving variable frequency control
ABEL CM: Additional safety due to double-diaphragm technology
ABEL CM: Robust and simple due to automatic flow rate control without complex electronics

Filter Cloth Washing
ABEL HP - Dynamic in Pressure and Flow Rate

Plungers made of different materials to match different water qualities

Apart from a perfect filtration result at the shortest cycle time possible (and possibly residue-free loosening of the cake) the reliability of all components is important when dewatering mining slurries through chamber and diaphragm filter presses. This includes the washing device for regular cleaning of the filter cloths. For many years, ABEL has been supplying filter cloth cleaning pumps to leading filter press manufacturers worldwide.

Whether the spray nozzle of the washing device drives between two filter plates or whether one plate is cleaned on both sides - ABEL HP is the pump of choice for high pressure cleaning of filter cloths in countless mines everywhere in the world. Robust and long-life, the HP provides a pumping capacity of up to 25 m³/h and up to 16.0 MPa. This heavy duty high pressure pump has also proven to be successful in climatically challenging regions.

ABEL HP-K-25 for filter cloth cleaning of chamber filter presses

Key features ABEL HP:

- Pumping performance range: Up to 25 m³/h (110 GPM); up to 16.0 MPa (2320 psi)
- Developed especially for filter cloth cleaning, the ABEL 3/2-way changeover valve switches into bypass operation when plates are changed. This way, water is not wasted.
- Manual fine tuning valve for adjustment of the discharge pressure in case of worn washing nozzles

Electro-pneumatically actuated ABEL 3/2-way bypass valve

Jet arm of a washing device for filter cloth cleaning

Gland Seal Water Supply - Reliably Constantly High Rinsing Performance

In mining, centrifugal pumps are generally used for managing very large flow rates at low to moderate discharge pressures. The shaft seals of these pumps are usually gland seals. To reduce wear and therefore leakage through the shaft seal, the gland seal is constantly fed with gland water.

The gland water is used to flush solids particles from the sealing area and to cool the sealing area and the shaft in case warm slurries are transported. It is important that the gland water is injected into the sealing area with a pressure that is slightly higher than the discharge pressure of the centrifugal pump; otherwise an effective water film cannot build up.

Mine operators again find the ideal pump for this supply task in the ABEL product range. Depending on required pressure and water quantity, the suitable pump is either an ABEL HP or HPT series triplex plunger pump.

Both types are available in different material options, with a wide range of valve types and plunger seals.

Key features:

ABEL HP: Pumping performance range: Up to 25 m³/h (110 GPM); up to 16.0 MPa (2320 psi)
ABEL HPT: Pumping performance range: Up to 80 m³/h (350 GPM); up to 25.0 MPa (3625 psi)

Benefits:

- Reliable, constant gland water supply due to true positive displacement pump technology
- Simultaneous supply of several centrifugal pumps is possible

ABEL HPT gland seal water pumps on a phosphate mine in North Africa

ABEL HPT-K-32 to supply gland water to up to 5 centrifugal pumps in parallel

Both types are true positive displacement pumps; their **flow rate does not depend on counter pressure.** In addition, the gland water quantity remains constant at the set value, independent of the operating point of the centrifugal pump. Due to this characteristic, it is possible to supply several centrifugal pumps with gland water at the same time.

The ABEL HP is a solid triple-action plunger pump that has proven successful thousands of times worldwide and is known for its low-maintenance design.

The ABEL HPT high pressure triple-action plunger pump is even more powerful, provides more options and, like its smaller sibling, is suitable for use around the clock.

Application information ABEL HP/ HPT:

Phosphate mine in North Africa - up to 30 m³/h (130 GPM) and 2.9 MPa (420 psi). Medium: clean water. - Pumps supply gland water to up to 5 high pressure centrifugal pumps in parallel, which are used to pump phosphate slurry.

Gland seal water pressure must always be slighter higher than the centrifugal pump's discharge pressure. ABEL high pressure plunger pumps supply constant (pre-set) flow, independent upon the required pressure. Flow can be adjusted by VFD. With this configuration exact and optimized gland water supply to several centrifugal pumps in parallel is achieved.

Paste Transfer - Task: High Content of Solids, High Pressure, and Abrasive Media

ABEL Solids Handling Pump unit with hydraulic power pack and twin screw feeder

When extracting coal and metal ore, considerable quantities of tailings accumulate in mines. For safe disposal and simultaneous stabilization of disused mine shafts, the tailings are often conditioned with cement or other additives. After that, they are pumped over major distances back into the shafts.

Due to the very high content of solids of up to 80% with an almost solid consistency, **only slow-running piston pumps** are suitable for complex transfer tasks of this kind. They are the only pumps that are able to reach the high discharge pressures of up to 16 MPa (2320 psi) with this type of pumped medium.

Sticky and paste-like slurries - no problem for ABEL SH pumps

ABEL SH cone valve solids pumps with a pumping capacity of up to 200 m³/h (880 GPM) are ideal problem solvers for difficult tasks of this kind. One of the reasons: This heavy duty solids pump is equipped with a particularly large dimensioned wall thickness and extra-large suction valves. This is constructive backup that results in a **longer service life** even under the most difficult conditions.

An ABEL SH paste pump has a total of 3 main components: The actual pump, the hydraulic drive unit and a control cabinet with PLC.

Key features - ABEL SH

Pumping performance range: Up to 200 m³/h (880 GPM), 16.0 MPa (2320 psi)

Benefits:

- Transfer of media with a solids content of up to 80%
- Extra-large suction valves - high volumetric degree of effectiveness
- Backstroke-safe due to use of hydraulically operated cone valves
- Cone valves with extended valve rods for safe separation of the pumped medium from the hydraulic circuit.

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