

# Consistent innovations for medium consistency material

Modern pulp and paper mills rely on high-productive medium consistency (MC) pumps and mixers. With the MCE pumps, Sulzer developed the world's largest, high performance pumps with low energy consumption. With the latest innovation, the SX mixer, the industry achieves a sustainable reduction of consumable materials for bleaching.



Pulp is consisting mainly of water and short cellulosic fibers. The pasty consistency of pulp — so called medium-consistency material (MC) — is quite demanding for pumping processes. Free air is incorporated inside the pulp, between or even inside the cellulosic fibers. The various chemicals used in the pulp and paper production process are a daily endurance test for the material of the pump components.

The pulp and paper industry is facing big challenges. Recycling paper materials, reducing energy consumption and chemicals are ways to make the process more cost- and energy efficient and sustainable as well. The innovations of Sulzer aim to support the pulp and paper industry in achieving this goal.

#### Patented way to create turbulences

The new MCE pumps provide a new level of performance over a wide temperature and pressure range with high consistency. Sulzer designed a unique, patented fluider impeller, which creates effective turbulences inside the MCE pump. The fluider technology uses twisted blades with changing pitch and is patented by Sulzer in many countries. The fluider impeller maintains an exact turbulence level, preventing an over-treatment of the fibers in the pulp.

#### Degassing included in the pump

The slurry consistency (up to 18% solid mass per kg of water) leads to air-gas inclusion of the pulp. The gas content typically increases with a pulp consistency. For example, with a pulp consistency of 10% about 15% of air/gas content is included in the pulp. This increases up to 35% air/gas content with a pulp consistency of 15%.

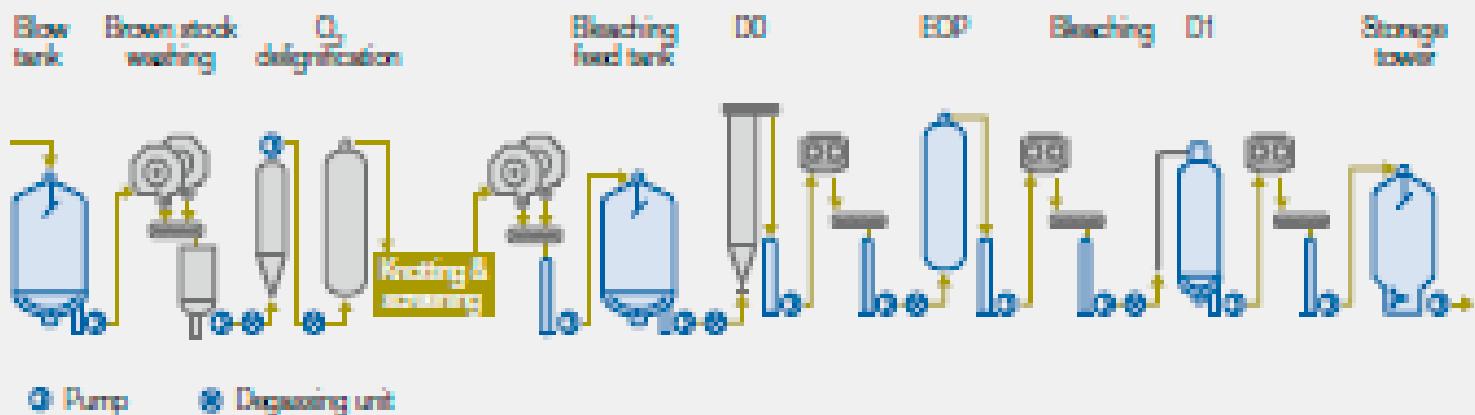


#### Some details about pulp production

The pulp and paper industry uses wood chips, fiber waste, and recycled paper as raw material for the extraction of cellulosic fibers. The processed cellulosic fibers have usually a length of 1-4 mm. The main ingredients of wood are cellulose and lignin. During the delignification process these two components are split from each other. A bleaching process is applied to reach the required color specifications of the fiber pulp.

The graph below shows a typical Oxygen delignification and bleaching process in a paper mill. Sulzer produces equipment that fulfills all pumping and mixing requirements and enhances process efficiency by facilitating stable and reliable operation through reactors and towers.

#### Process steps in delignification and bleaching

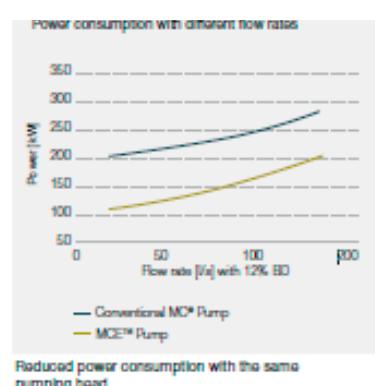
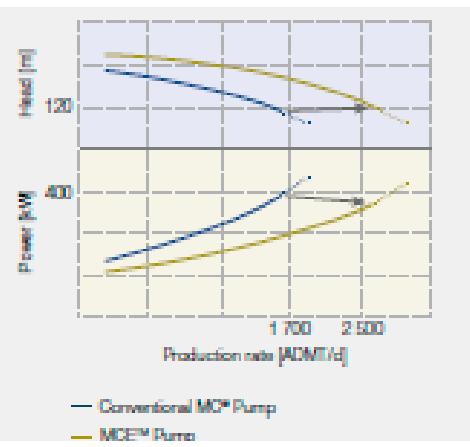


The new technology, using the patented fluider impeller, improves the degassing efficiency. The installation of an MCE pump with included degassing system guarantees a high MC pump performance — regardless of the prevailing pumping conditions and applications. Additional drive motors, components, or controls for degassing are a matter of the past. MCE pumps are also available with a separate external MDS degassing system for extremely high degassing amounts.

## Capacity range of MCE pumps

The MCE pump series covers an extremely wide capacity range from 10 to 9 000 air dried metric tons per day (ADMT/d) and pump heads up to 240 meters. This allows a high-flexible use, thus leading to a high reliability, even with changing conditions from the previous production step- The new MCE technology leads to remarkable savings in power consumption. Compared to the power consumption of conventional MC pumps, the MCE pump saves up to 80 kW with a pump head of 100 liter/second. This is a reduction of power use by 43% in this example with pulp of 12% consistency (Fig. 3). Alternatively, customers can increase their daily production rate with the use of an MCE pump instead of a conventional one-. At a pump head of 120 m, customers can produce 1 700 to 2 500 ADMT/d without increasing the power consumption (Fig. 4).

Today several ways for bleaching pulp are in use: with Chlordioxide (Cl O<sub>2</sub>), elemental chlorine free (ECF) or totally chlorine free (TCF). Good bleaching results for achieving white pulp—and later-on white paper—need a defined dwell time for all 3 methods. The extremely high MCE pumping performance—up to 9 000 ADMT/d — makes it possible to work with high production rate bleaching sequences without parallel pumping, without additional steam and without extra chemical mixing arrangements.



## Retrofit solutions for MC pumps

A cost-efficient upgrade of existing MC pumps is possible in order to improve process economy and increase production rate. The MCE RETROFIT and MCA/MCV HYDROFIT solutions are designed in a way that only minor changes to existing pumps have to be done. In most cases customers do not have to change piping nor drive units. Foresighted, Sulzer designed two retrofit sets for older pumps. For the first generation of MC pumps and for the second generation MCA and MCV pumps. Customers, who retrofitted their pumps already, do not only report higher pump efficiency. They realized remarkable savings in consumable materials, as the use of chemicals, dilution water, and steam. The process upgrades to update earlier MC pump generations to MCE pumps lead to up to 75% increase of the efficiency level.

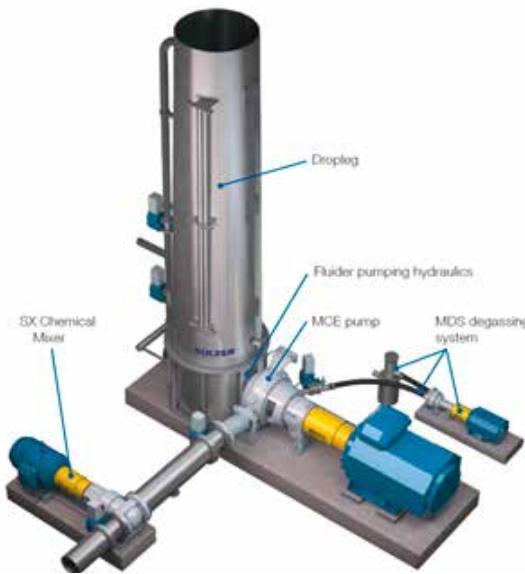
## Pump material specification

Sulzer pumps are known to be robust and long-lasting. Process specialists analyze the process steps in pulp and paper production and recommend the best-suited pump material to customers. Stainless duplex steels A-890 grade 3A, A-890 grade5A, 654SMO or even titanium can be selected as corrosion resistant material for the wetted parts of MC pumps.

## High temperature pumping

A common application of MC pumping is to transfer pulp stock from washers and thickeners to the next process stage. The pulp stock falls into a storage vessel, called medium consistency drop leg (MDL). The low inlet-head of the MCE pump allows transporting the pulp from a low-level vessel easily. Significant process cost savings are achieved, because the the pulp stock is pumped from the MDL drop leg with a consistency of 12 – 16% at temperatures between 95 – 98°C. Because a reheating is no longer necessary , less

| MCE RETROFIT   | MCA/MCV HYDROFIT   |
|--|--|
| Retrofit set for upgrading MC pumps  | Retrofit set for MCA/MCV pumps   |
| Exchange unit with new patented fluider impeller, casing cover, bearing unit adapter, shaft seal and vacuum pump parts for internal degassing. | New hydraulic parts will be used, e.g. new MCE pump volute casing, new patented fluider impeller, O-rings and gaskets. |
| Existing pump volute casing, coupling, and motor is reused.  | Bearing, coupling, motor can be reused, depending on their condition.  |



steam is needed. The amount of chemicals can be reduced thanks to higher reaction temperatures. In several processes, like Oxygen delignification, EOP and PO stages, the layout and positioning machines can be optimized with the MCE pumps.

The stock level in the MDL drop leg can be measured by a radiometric, capacitive or pressure transmitter. Thus the flow rate through the pump can be adjusted. In case consistency variations occur in the incoming stock, caused by a disturbance at the thickener or washer, an automatic dilution system will stabilize the pulp consistency for a stable pumping result.

#### Mixing of chemicals and steam in one

Mixing chemicals and stock is one of the most important operations in pulp bleaching. Good mixing provides homogenous bleaching conditions. It reduces the consumption of chemicals and energy, improves product quality, and reduces the environmental load. Proper chemical mixing is a key factor in the success of new bleaching sequences.

The Sulzer SX chemical mixer can mix both — gaseous and liquid bleaching chemicals — into paper pulp. It is used for a consistency range from 3 - 20% and the product sizes cover capacity ranges up to 5 500 AD-MT/d. The installation of the SX chemical mixer is easy thanks to its small size, lightweight, and special valves. Bleaching chemicals are very aggressive. Depending on the chemical in use or the bleaching stage arrangement, SX chemical mixers are manufactured from stainless steel, titanium, Hastelloy, or 654SMO.

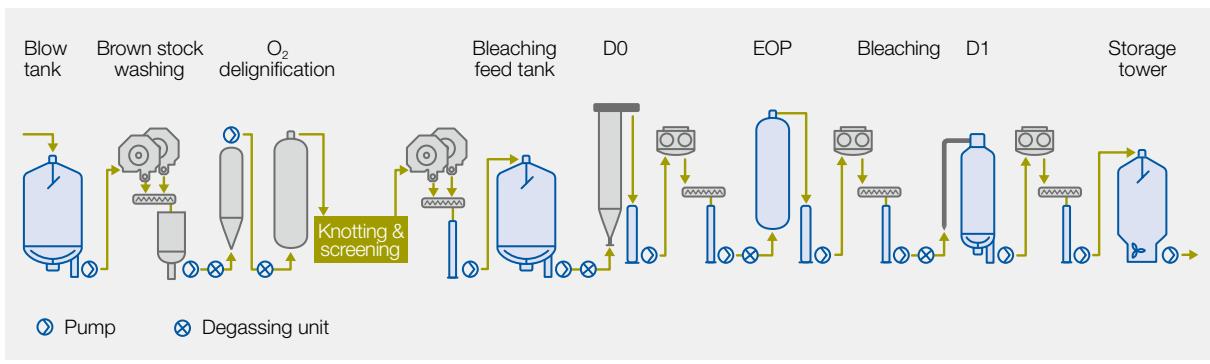
#### Tower discharge pumping

It is demanding to have a well-controlled pulp flow with high consistency materials. When discharging large storage or bleaching towers, the MC tower discharge pumping system comes into operation. The MC discharge scraper assures that the pulp from the complete bottom area of the tower is lead into MTB feed chute. The scraper allows an even discharge of the stock and prevents at the same time channeling of the stock inside the tower. The scrapers are available as diluting or non-diluting models. The diluting MC discharge scraper allows to keep the consistency of the pulp high in the tower (20-35%), but lower for the pumping process. Adding extra water allows to achieve the right pulp consistency for the pumping process.

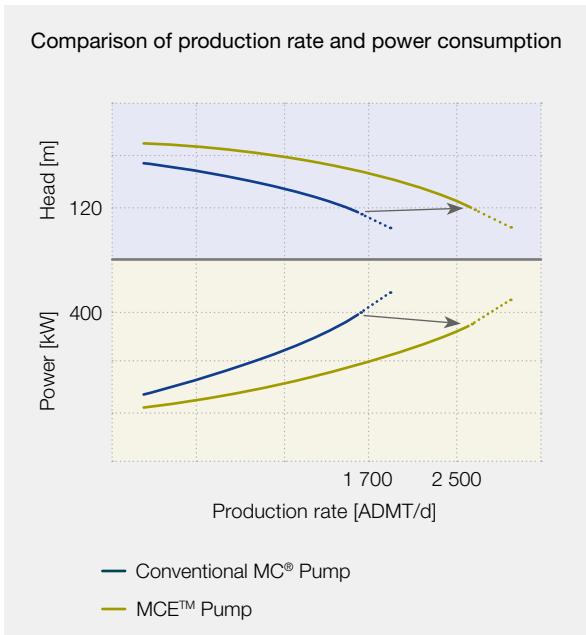
#### Consistent development for pulp and paper

Offering to customers in the pulp and paper industry innovative, cost-efficient and energy saving equipment is Sulzer's top priority. As a result, Sulzer has more than 35 patents related to MC pumping, transfer and mixing.

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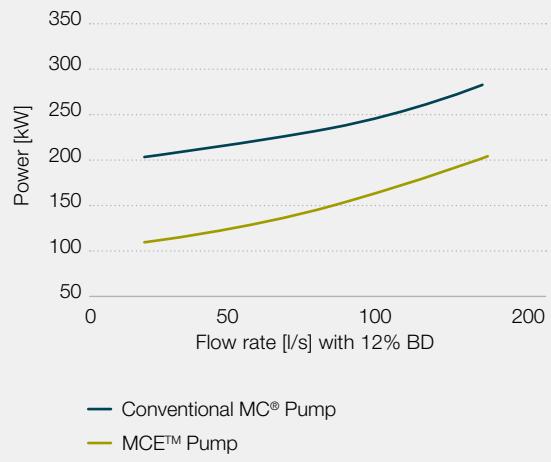


A typical Oxygen delignification and bleaching process in a chemical pulp mill.



Higher production and less power consumption with MCE pumps.

Power consumption with different flow rates



Reduced power consumption with the same pumping head.