

Flexible and durable high-efficiency pumps for the chemical process industry

# Sustainable pumping solutions for polymer manufacturing

In the polymer-manufacturing industry, raw materials undergo chemical conversion during their processing into finished products. These conversion processes very often require conveying fluids with a wide range of characteristics. The liquids can be very hot or cold, they may be chemically aggressive, or they can contain solids or fibers. With the AHLSTAR process pump series, Sulzer meets the requirements of chemical process industries.

The wide range of processes in the polymer-manufacturing industries leads to an extensive scope of pumping necessities. It is essential to the operation of polymer plants that the process pumps fulfill a variety of requirements. In most polymer plants, pumps generate the majority of energy cost. Therefore, efficiency—of both hydraulics and electrical drive—is important. Another, even more crucial, criterion is the reliability

of the pumps, because unplanned interruptions of the often-complex chemical processes can cause significant cost increases and environmental impact.

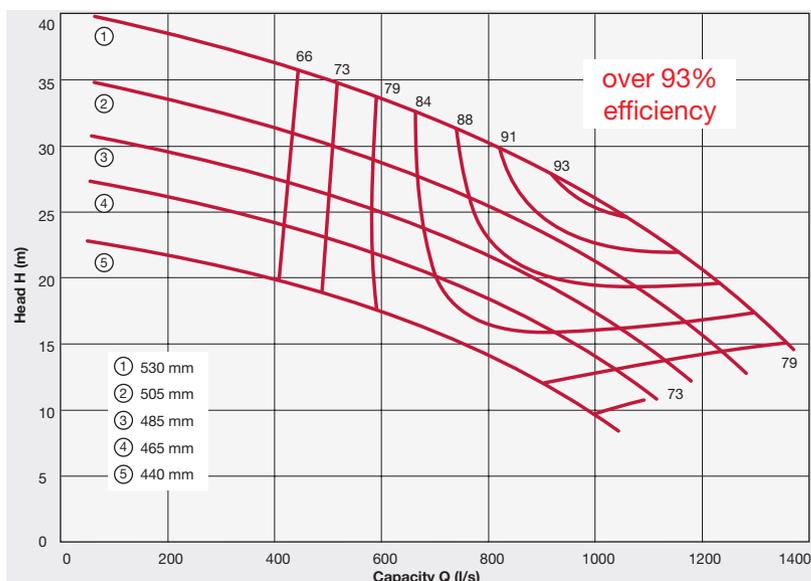
## Pumping various fluids

With many installed units operating globally, Sulzer's AHLSTAR series is the world's largest process pump series for demanding industrial processes including polymer processes. The capability to

work with all types of liquids makes this pump range particularly suitable for the challenging pumping operations required in chemical processes. Whereas the basics of pumping are the same in all applications—moving a liquid and increasing its pressure—the specific parameters of the liquids to be processed can differ dramatically. The fluids can vary in viscosity or they can contain fibers or solids.



AHLSTAR pumps are designed for safe operation and easy maintenance and service.



① The performance of the AHLSTAR pumps exceeds standard requirements.

Sulzer engineers had to consider all those and more boundary conditions when they designed the over ten different impellers that make the AHLSTAR range suited for almost every hydraulic requirement. Whether closed or open, dedicated for low discharge, or wear-resistant, impellers make it possible for the AHLSTAR pumps to work with slurries, clear, or contaminated liquids or fluids containing solids of various sizes. These process pumps can work at temperatures of up to 260 °C and pressures of up to 2.5 MPa, which is roughly equivalent to the pressure 250 m

below water. With the right choice of materials, these

pumps operate corrosion free even when handling liquids with extreme pH values from 0 up to 14.

### Exceeding international standards

International standards define sets of minimum criteria that clients can expect to be fulfilled by standard pumps. Depending on the specification, the following standards are applied to centrifugal pumps:

- API 610 (ISO 13709) standard for demanding processes in the oil and gas and hydrocarbon industries
- ISO 5199 and ISO 2858 (as well as American standards ASME73.1) for industrial processes

- European standard EN 733 for light industrial processes

The metric standard ISO 5199, for example, covers the requirements for pumps of back pullout construction as used primarily in the chemical and petrochemical industries. It includes design features relating to installation, maintenance, and safety. Other codes define main dimensions and operating ranges of the pumps.

The pumps of the AHLSTAR series fulfill ISO 5199 and ISO 2858 international standards relating, e.g., to dimen-

*With the right choice of materials, the AHLSTAR pumps operate corrosion free.*

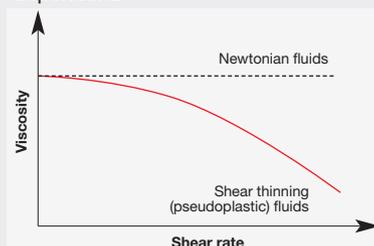
sions of flanges and base plates and, therefore, do not require special effort to install or maintain within existing pipework. When it comes to performance and quality, the pumps of the AHLSTAR range have extra features exceeding the basic requirements and even surpass the international standards governing technical performance and quality ①.

### Solutions for liquids with high gas load

Conventional centrifugal pumps can handle liquids with gas content below 4%, but gas bubbles collected in the impeller eye do impair pumping and will reduce capacity and head. At a gas content of

### Typical fluid properties in polymer manufacturing

Viscosity is an important fluid property that is relevant for pumping technology. The viscosity describes a fluid's resistance to shear stress. Fluids like water have constant viscosities and are called Newtonian fluids. Molten polymers and salt solutions show non-Newtonian fluid behavior. Their viscosity depends on the rate of shear and can even be time dependent.



The shear-thinning behavior of polymers (also known as pseudoplastic behavior) means that the viscosity becomes smaller if the rate of shearing increases. Such changing viscosity coefficients have to be considered in the pump design for polymer manufacturing.



Non-Newtonian fluid behavior.

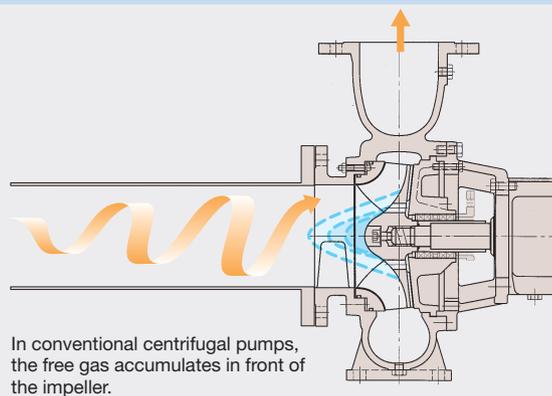
### What are the challenges of high gas loads?

Gases can be present in liquids in three different states:

- Dissolved in the liquid
- Bound on the particles contained in the liquid
- As free gas in the form of bubbles

Gas in the form of bubbles disturbs pumping. Gas bubbles collected in the impeller eye reduce the pump capacity and head. Pumping becomes very unstable, varies heavily, and requires excessive overdimensioning of the pump.

Sulzer Pumps has developed pump types, like the AHLSTAR pumps, which, through their operating principle, remove disturbing gas or air contained in the liquid so as to maintain proper pumping.



above 4%, pumping is very unstable, and, without special measures, it requires excessive overdimensioning of the pump. Sulzer has found a solution to this customer requirement by offering degassing and self-priming units in the AHLSTAR series, which will stabilize centrifugal-pump operation with liquids containing

up to 40% weakly bonded gases or up to 70% strongly bonded gases. The AHLSTAR pumps can be fitted with self-priming or degassing units to start the pump with the inlet pipe empty or to help the pump operate with liquid containing high gas content, where conventional centrifugal pumps would lose suction compatibility.

#### High efficiency, low energy cost

Energy costs make up about 80% of the life cycle cost of a process pump. Sulzer's engineers have considered this fact when designing the AHLSTAR pump series. Traditionally, pumps are operated with a constant-speed drive motor and a flow control valve to adjust the discharge. This operating mode can be compared to

always driving a car at full throttle engine speed and only using the brakes to control the velocity. If the pump motor is operated using an electronic frequency converter, it is possible to vary the rotating speed of the impeller and, thus, to run the pump at high efficiency in a broad operating range, making energy savings of up to 60% possible. Furthermore, when operated with variable speed, the pump runs smoothly without recirculation and with lower vibration and noise due to the low internal hydraulic loads. With this smoother oper-

ation, customers benefit from longer pump life, fewer unexpected shutdowns, and lower maintenance costs.

#### Superior reliability

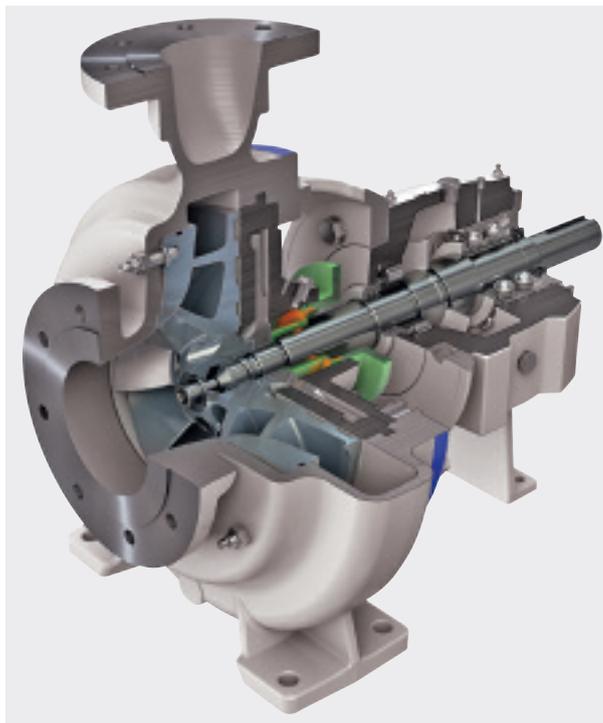
Centrifugal pumps in industrial applications usually operate over a period of several decades. The design of the AHLSTAR pumps [2] aims to minimize the life cycle costs during the long expected lifetime. Whereas energy comprises the most significant direct cost of the pump, high reliability and easy maintenance help to bring down the indirect cost. The failure of one pump can stop the whole chemical process—leading to increased costs and environmental impact

*AHLSTAR pumps operated with variable speed drive make energy savings up to 60% possible.*

that easily outweigh the lifetime energy cost of the pump.

A design with the goal of achieving low outage costs for the pump has to take into consideration two main aspects. First, a reliable pump design minimizes the lifetime maintenance costs and reduces the risk of unscheduled process interruption. Second, the units must be designed to be service friendly to shorten downtime whenever maintenance is required. One example of this approach is the innovative impeller mounting, which allows for easy and quick instal-

[2] Design of the Sulzer AHLSTAR process pump.



lation and dismantling of the impeller. The highly standardized modular design of the AHLSTAR range facilitates spare parts service for the large number of pumps installed all around the world in different industrial segments.

### Minimal environmental impact

All industries must consider the ecological consequences of their processes and reduce the impact of those on the envi-

ronment. The Sulzer process pumps support these efforts with various features.

Reliable shaft seals of the pump specifically selected for pumped liquids and related applications prevent the pumped liquids from leaking, and reliable shaft seals of the bearing unit prevent both the contaminants from coming into contact with lubricant and lubricants from

leaking. The shaft seals of AHLSTAR require little or no water lubrication and

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*Over 90% of the metallic material used for manufacturing the pump can be recycled.*

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thus help to further reduce the environmental impact and operation costs.

Recycled metallic materials, reliable operation, high energy efficiency, as well as few leaks from shaft sealing and bearing additionally minimize the environmental impact of the units. Furthermore, over 90% of the metallic material used for manufacturing the pump can be recycled at the end of the pump's lifetime.

### Innovative and patented pump design

Pumping critical liquids in demanding applications requires innovative designs. Various characteristics of the AHLSTAR pump range are so advanced that Sulzer has decided to protect them by patent. Unusual for a mature product such as a pump, the AHLSTAR features several patented designs for hydraulics, shaft sealing, and bearing unit. These patents ensure reliable and highly efficient operation for challenging pumping applications and help to reduce the number process shutdowns, limit maintenance needs, and lower energy consumption, thereby minimizing total life cycle costs.

The excellent flexibility, durability, and efficiency make the AHLSTAR pumps a perfect choice for the chemical process industry—and especially for polymer manufacturing. Several key polymer producers have turned to Sulzer for the outstanding pumping performance and extensive experience.

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Sulzer Pumps has a full-scale laboratory in Kotka, Finland, and can test the final design options in real operational conditions.

