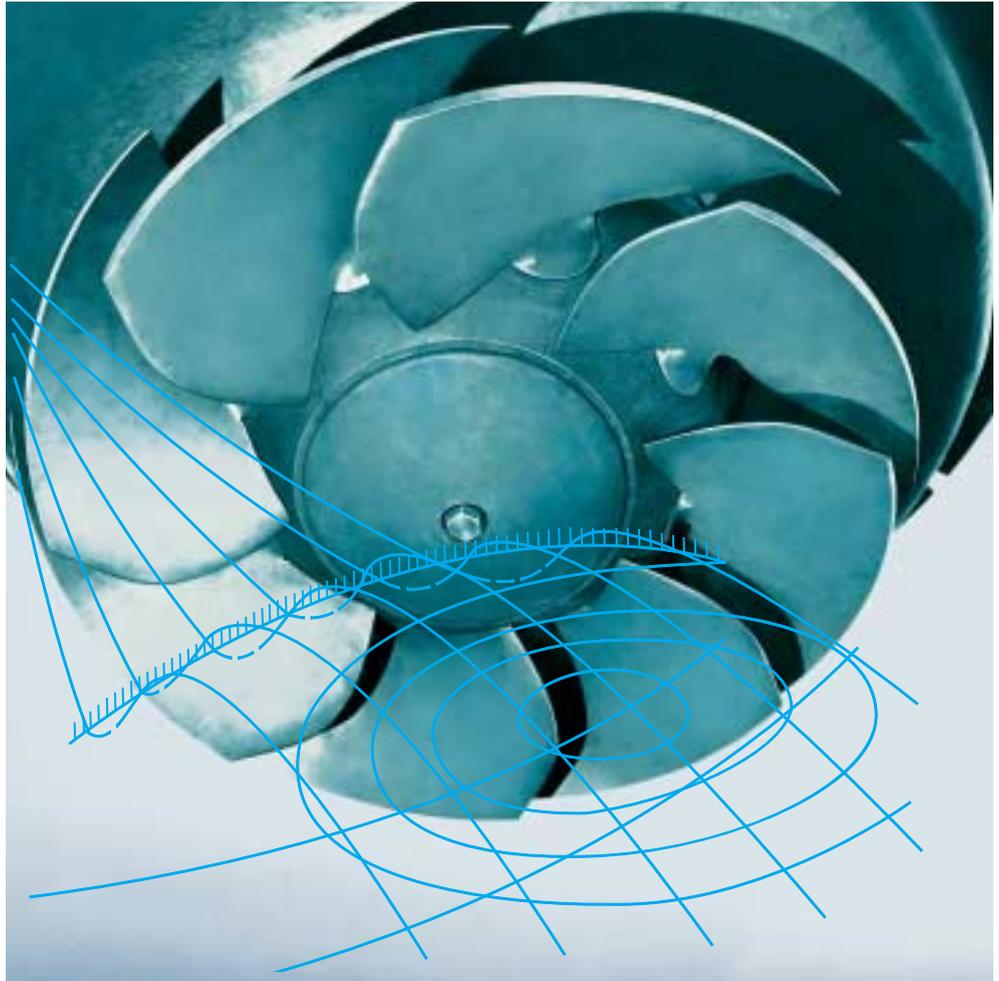


# The Driving Force in Your Cooling Water System





## **K S B k n o w - h o w , e x p e r i e n c e a n d s e r v i c e . . .**

More than 120 years' tradition in the design and construction of pumps, valves and relevant systems for industrial and process-engineering applications, building services, water, environmental and power engineering. Over six decades in the production of tubular casing pumps for fossil-fueled and nuclear power plants. That adds up to many years of experience and comprehensive know-how in pump engineering.

With more than 12,500 employees at 30 production facilities and more than 100 sales companies and offices around the world, we are genuinely customer-oriented, thoroughly flexible and fully cognizant of the international market and its workings. Consequently, we at KSB are also in a position to offer you much more than a mere line of products.

Each and every KSB product is backed up by the pertinent know-how of KSB's engineers in research & development, design and manufacturing. This applies not only to pump engineering, but just as well to contiguous areas. Our specialists are at work in all areas, investing their knowledge, experience and creativity in the quest for innovative, trend-setting and, above all, user-

friendly solutions. The fruits of their work go beyond state-of-the-art technology. Consider the field of pump hydraulics, for example, where KSB's comprehensive fluidic know-how has engendered novel hydraulic strategies. Or materials technology, where our extensive experience in the application of pumps under diverse conditions has paved the way for the development of new materials and material combinations. Noridur®, a highly durable material for, say, pump impellers, and Residur®, a ceramic material designed especially for shaft guide bearings, are but two pertinent examples. At KSB, development engineers naturally also concern themselves with the modification of existing technology to meet new requirements. Seawater desalination plants, for example, impose extra-stringent demands on the durability and corrosion resistance of all constructional materials used.

As far as power plant pumps are concerned, maximum safety and reliability are the foremost criteria. To satisfy those criteria, each and every component must be of provenly high quality. And so, in order to guarantee the high quality of all KSB products and services, our organisational units are subject to a consistent quality system to ISO 9001 that is borne by the entire staff and applied to our every activity.

Safety also means access to competent, dependable customer support personnel. KSB has ample numbers of highly qualified staff for engineering services and planning support work. Let them help you find the best approach to your particular problem. They know how to pick, choose and design the optimal pump for your service conditions. They'll calculate all the requisite strength, vibration, surge-pressure and seismic data for you. Any pump up to 6,000 kW and 70,000 m<sup>3</sup>/h can then be put through full-load trials in our test loop to pinpoint its performance data in accordance with international rules of acceptance, its exact operating values

... to help you keep your cool.

(e.g., bearing temperatures) and its vibration and noise levels. Alternatively, model experiments can be run and the results extrapolated to full size by approved methods.

With regard to the efficiency of cooling water pumps, it is particularly important to optimize their inlet conditions, in which case model inlet experiments yield reliable data for use in optimizing the geometry of the intake chambers.

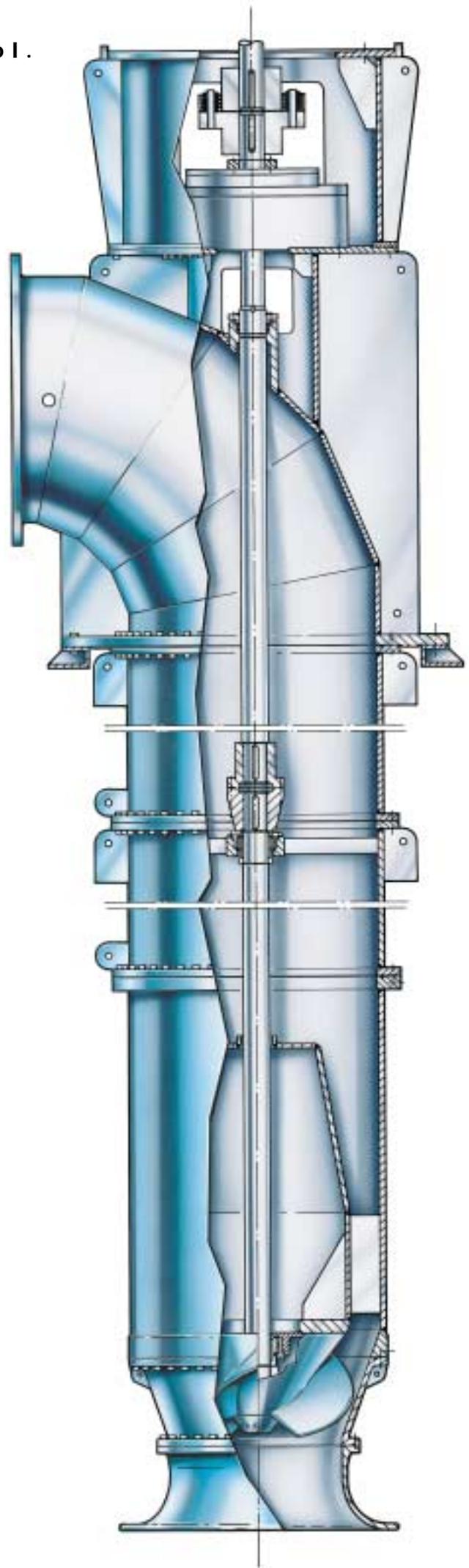
In addition to the competent advice and guidance rendered, you naturally can also count on us to install and commission your cooling water pumps.

And afterwards, our Service Division will remain at your disposal for maintenance work and such related activities as our Express Repair Service.

(For immediate help in case of need, call +49 6233/86-0 any time, night or day.)

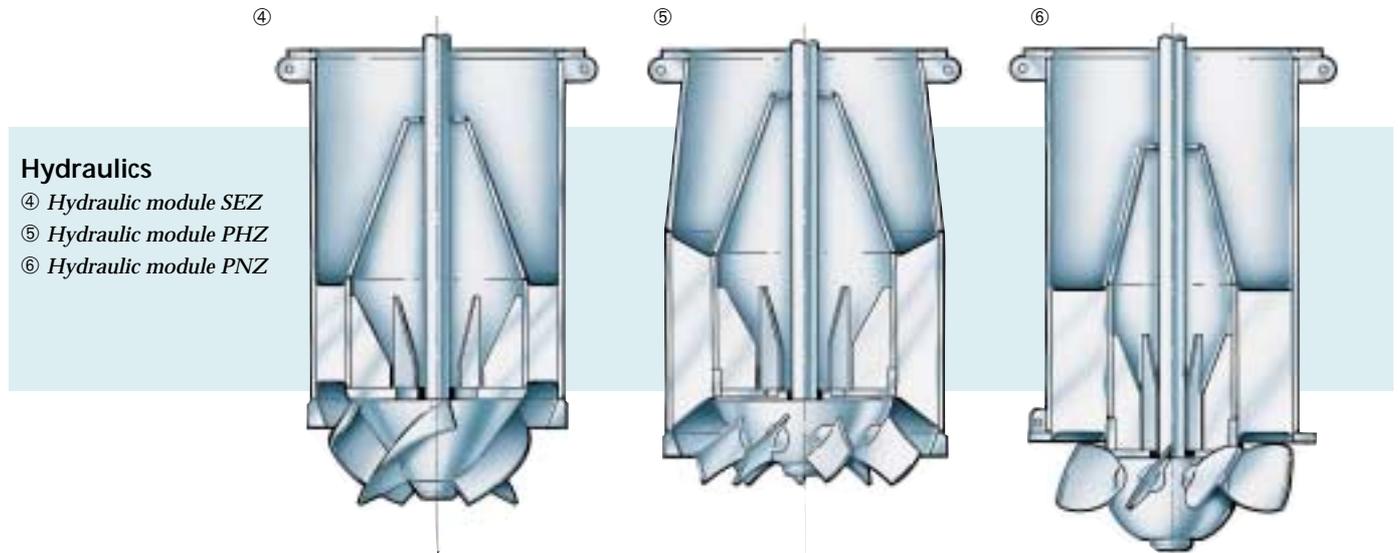
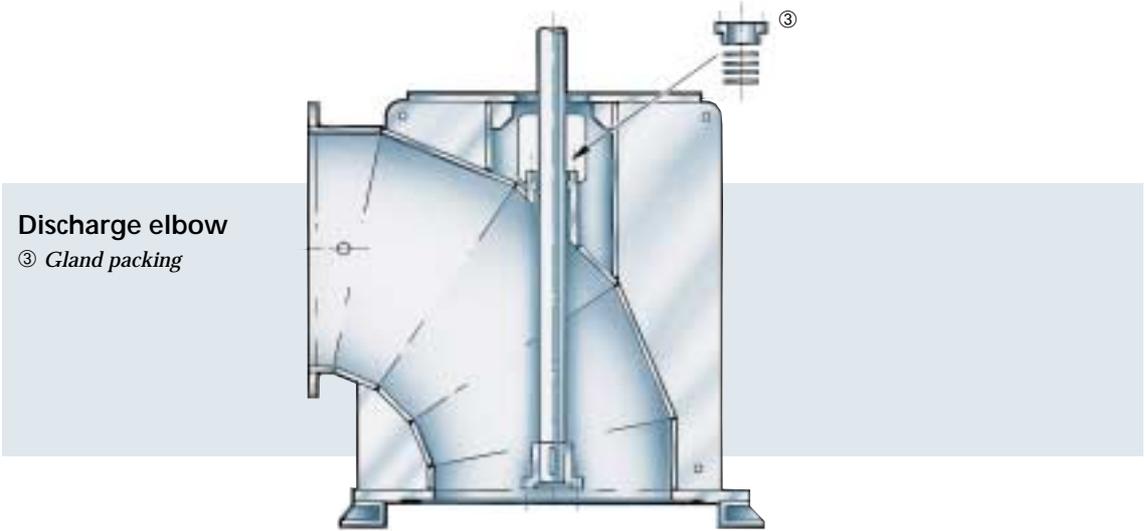
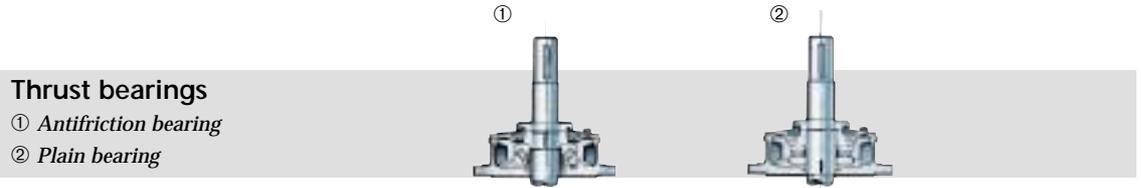
Reference applications around the world attest to the fact that tubular casing pumps by KSB satisfy a broad range of international standards. For example, our cooling water pumps are used not only in Germany's Biblis, Heyden and Brokdorf power plants, but also in plants as far away as Maasbracht (the Netherlands), Forsmark (Sweden), Cumberland (USA), Yonggwang (Korea) and Taichung (Taiwan).

To ensure that our pumps meet all the various requirements of power engineering, we've modularized our entire line of cooling water pumps according to a system comprising hydraulic, control and material modules plus a selection of installation modes. That system makes it possible to implement fully customized product solutions, because it is the case-by-case requirements that determine the composition of the respective modules.



# The Modular System for Individual Standards

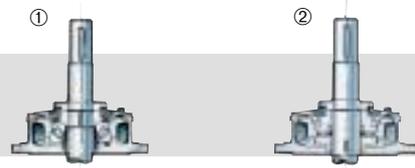
Tubular casing pump  
"non-pull-out type"



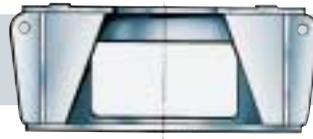
Tubular casing pump  
"pull-out type"

**Thrust bearings**

- ① *Antifriction bearing*
- ② *Plain bearing*

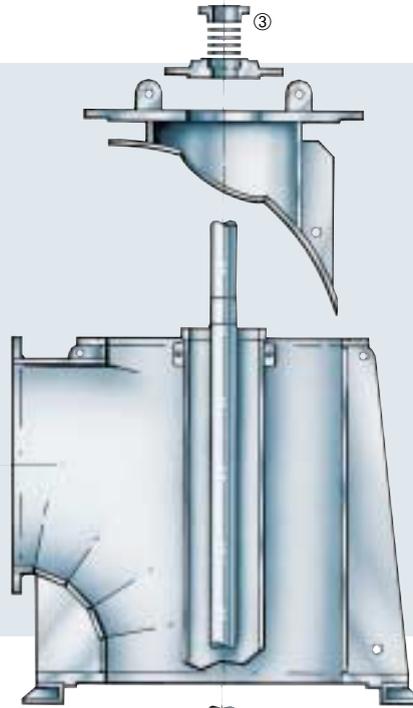


**Motor stool**

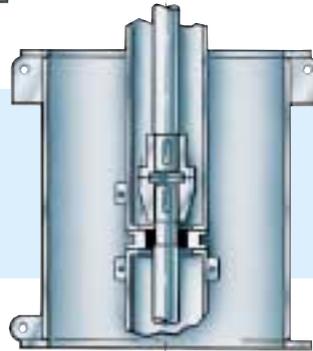


**Discharge elbow**

- ③ *Gland packing*

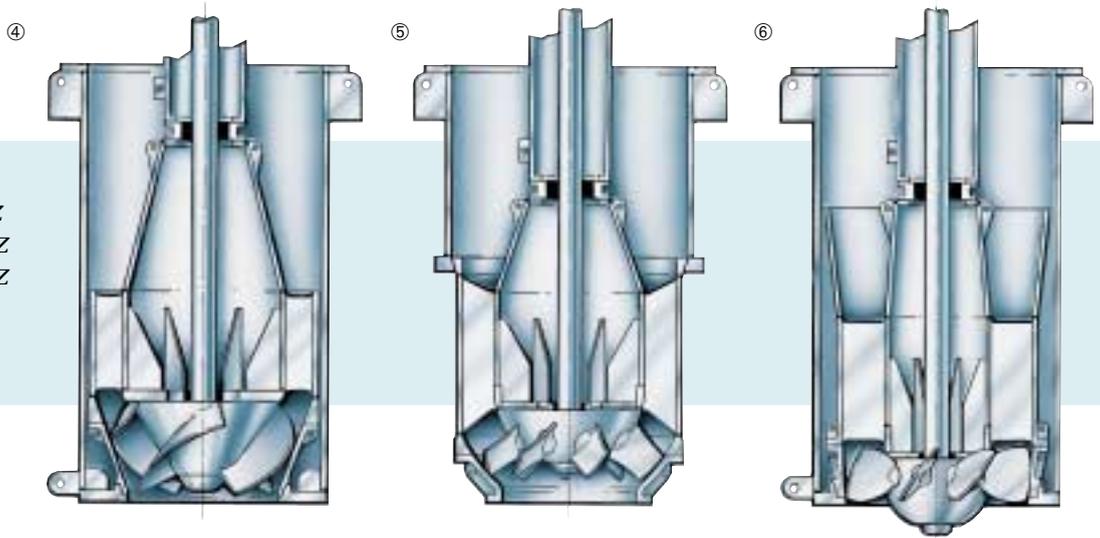


**Column pipe**



**Hydraulics**

- ④ *Hydraulic module SEZ*
- ⑤ *Hydraulic module PHZ*
- ⑥ *Hydraulic module PNZ*



**Entry nozzle**





## **Vital factor: flexibility**

Maintaining a power plant's full performance capacity despite variable operating conditions demands a lot of flexibility – and constant efficiency – on the part of the cooling water pumps. Major factors of influence include the existing inlet conditions and possible fluctuations in flow rate and head.

In order to stay both cost-effective and situation-appropriate, KSB's modular cooling water pumps are available with a choice of hydraulic variants and control modes. Moreover, the vertical tubular casing models are designed for wet or dry installation, and their discharge elbows can be installed above or below floor level.

*Complete installation and  
commissioning of pumps  
for the Al Taweelah Seawater  
Desalination Plant*



*Type PNZ 1600  
cooling water pump*

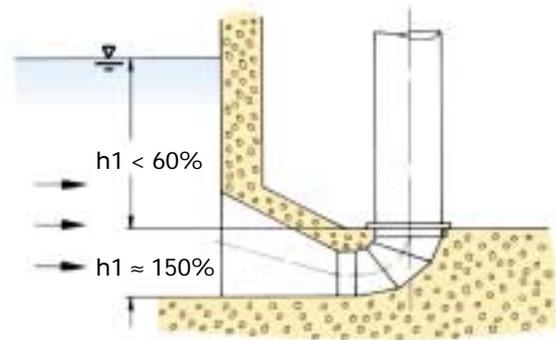
# Intake Chamber Module

The pump's inlet conditions are a crucial factor for smooth operation. The nature of the inflow into the intake chambers as well as their design are of particular importance. An optimized intake chamber must feed the medium to the impeller uniformly and irrotationally all around. Owing to the correlation between the equipment costs on the one hand and the structure costs on the other, the pump supplier and building contractor need to jointly conduct a holistic situation analysis

as a basis for finding the best solution for the case at hand. KSB's modular system incorporates optimized standard intake chambers for diverse structural circumstances. These standard chambers can be individualized. For a particularly out-of-the-ordinary situation, the intake structures are designed and verified via extensive experimental investigations conducted on true-to-scale models in compliance with the specified conditions of similarity.



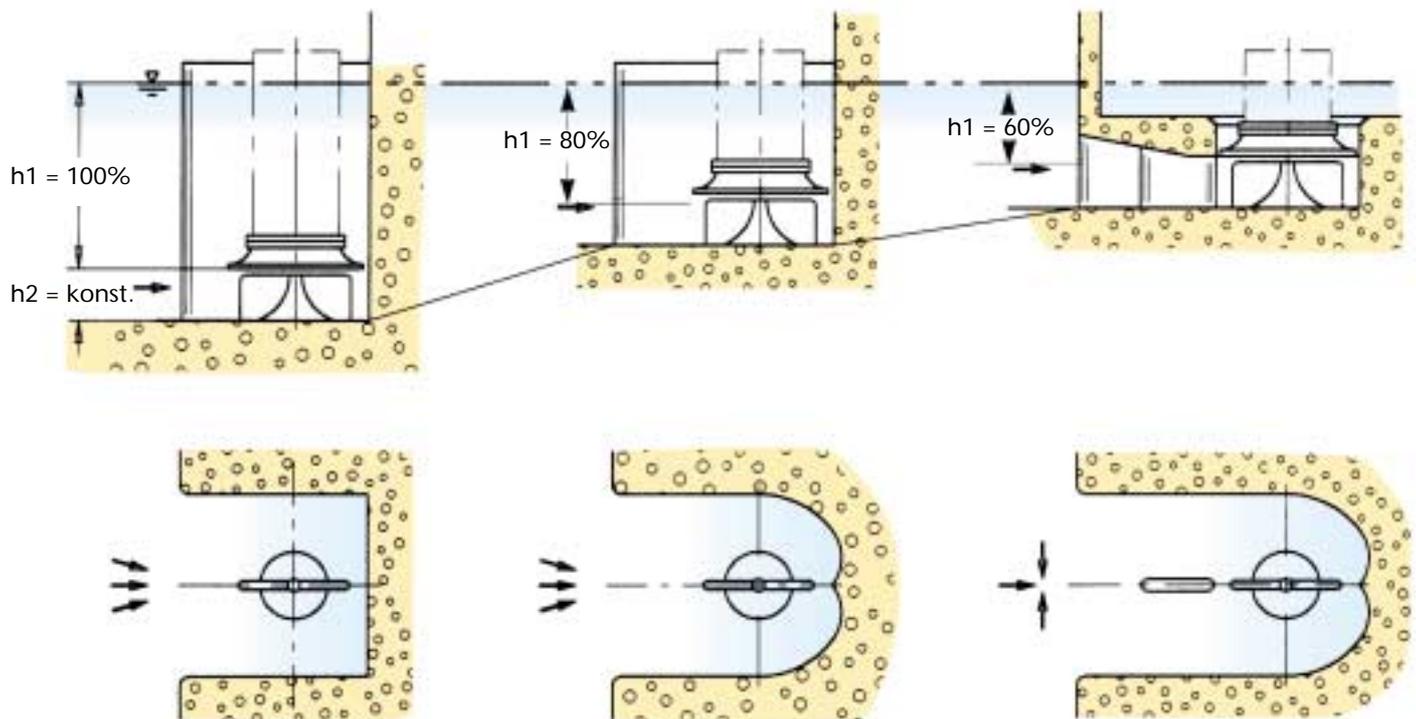
- Accelerating intake elbow



- Open intake chamber, unlined

- Open intake chamber, lined

- Covered intake chamber

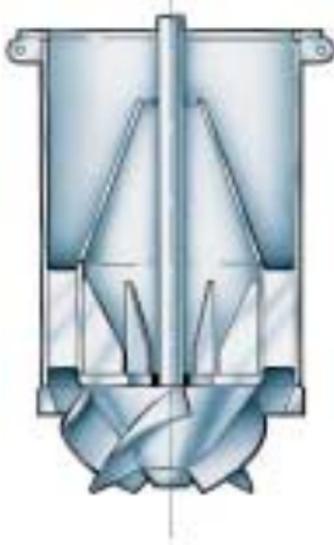


*h1 = minimum fluid level above the pump to preclude air-entraining vortices*

# Hydraulic Module

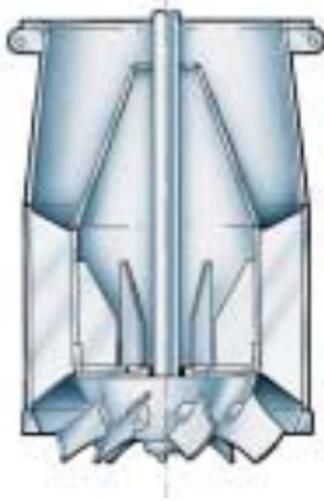
## Mixed-flow impeller with multiply curved blades

- *for minimal to maximal heads and capacities*
- *high efficiency*
- *good NPSH values*
- *optional: with manual or electric pre-swirl control, in or out of operation*



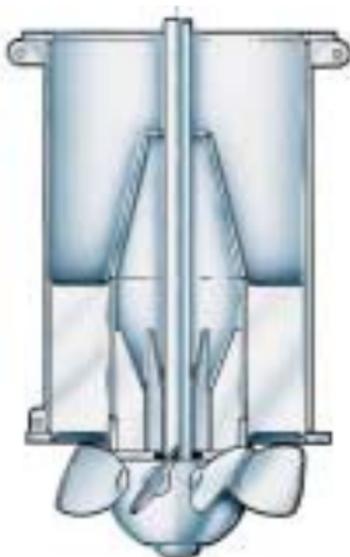
## Mixed-flow impeller with inserted, adjustable-angle blades

- *for heads up to 25 meters*
- *neutralization of uncertainties possible at the system design stage*
- *optional: with manual or electric blade pitch adjustment control, in or out of operation*



## Axial impeller with inserted, adjustable-angle blades

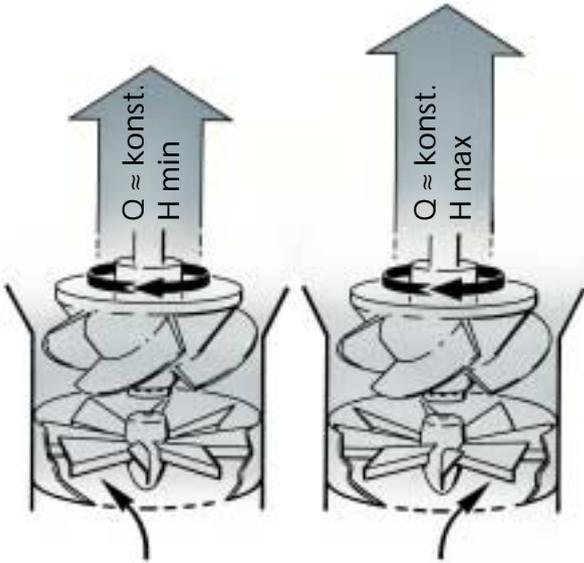
- *for heads up to 15 meters*
- *neutralization of uncertainties possible at the system design stage*
- *optional: with manual or electric blade pitch adjustment control, in or out of operation*



## Control Module

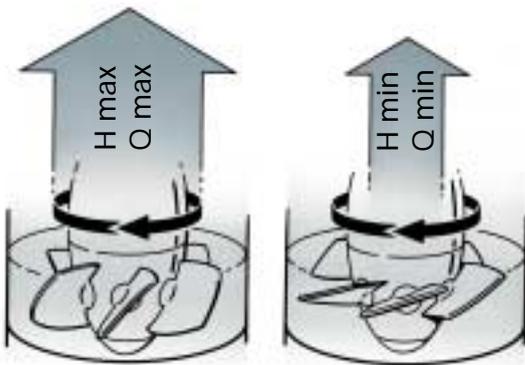
### Pre-swirl control

- *pre-swirl control of approach flow*
- *particularly well-suited to cases in which pronounced variation of head is anticipated in combination with relatively constant flow rates, e. g., to compensate for tidal flow or for combined operation (cooling tower/fresh water)*



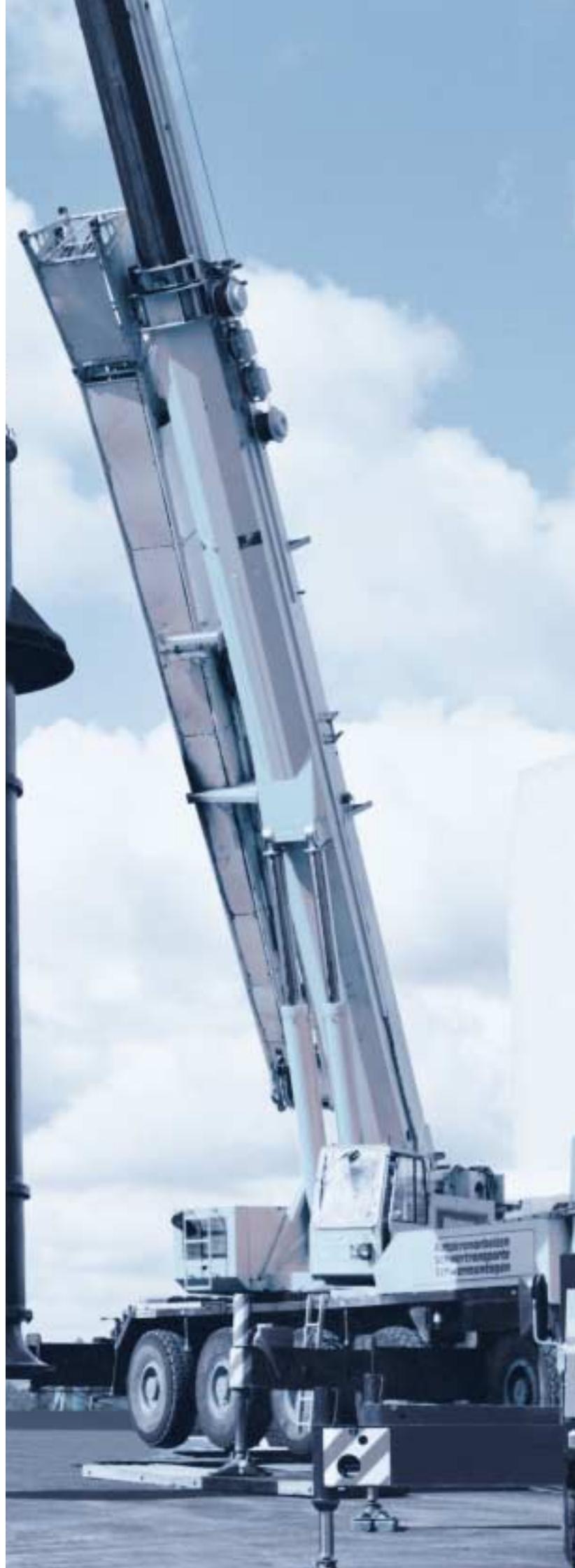
### Blade pitch adjustment/control

- *infinitely adjustable blade pitch angle, with the pump in or out of operation, via an electromechanical adjustment gear or a manually operated adjusting mechanism*
- *particularly well-suited for controlling sizable variations in flow rates and modest changes in head*
- *precise adjustment of the duty point to maintain high efficiency while reflecting the momentary demand and system conditions*



### Speed control

- *can be used wherever the pump is driven by a variable-speed electric motor or diesel engine*
- *optimal means of control for systems characterized by low static head, as it allows fine-tuning and pump operation at peak efficiency*



## The big and little of performance

For a cooling water pump to achieve high efficiency, all its various components must interact without a hitch. Consequently, KSB's modular system includes an appropriate choice of bearings, casings and materials for a broad diversity of service conditions.

Good performance means safety, reliability, availability, quality and economic efficiency - not to forget know-how, experience and competence. KSB's modular system is built up around just such characteristics. For standardized and tailor-made solutions. Give us a call. We'll help you keep your cool.





*Cooling water pump with a nominal nozzle diameter of 1.8 m and an overall height of 18 m*

# Bearing Module

## Radial bearings

- *RESIDUR® bearings:*

*RESIDUR® is a ceramic-base shaft guide bearing designed by KSB for the following positive attributes:*

- *wearless (and, hence, long-lasting) bearing guidance*
- *constant pump efficiency*
- *suitable for all media and solids contents, chemically stable*
- *medium-lubricated, i.e., no lubricant supply system, no water pollution, no monitoring, no external piping, no valves, no filter*
- *dry-start tolerability*
- *maintenance-free*

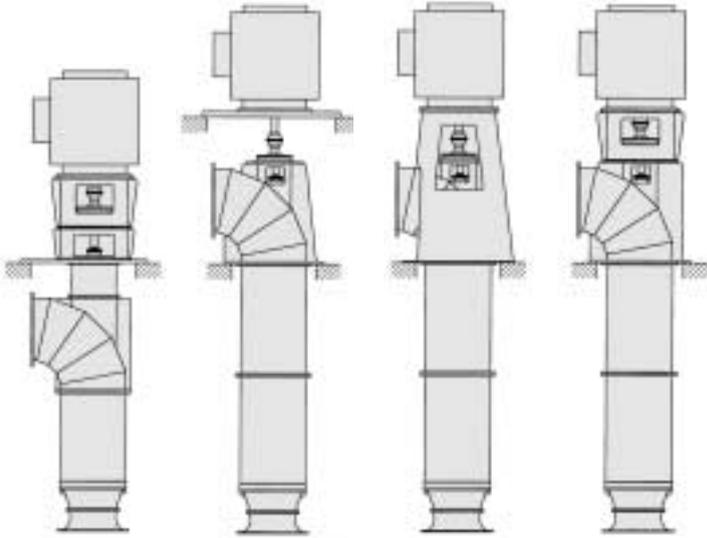


## Axial thrust bearings

- *antifriction tapered-roller bearings*
- *tilting pad plain bearings*
- *motor bearing suitable as axial thrust bearing*

## Casing Module

Four different casings for KSB's vertical tubular casing pumps enable customized installation.



The casings are made of the following materials:

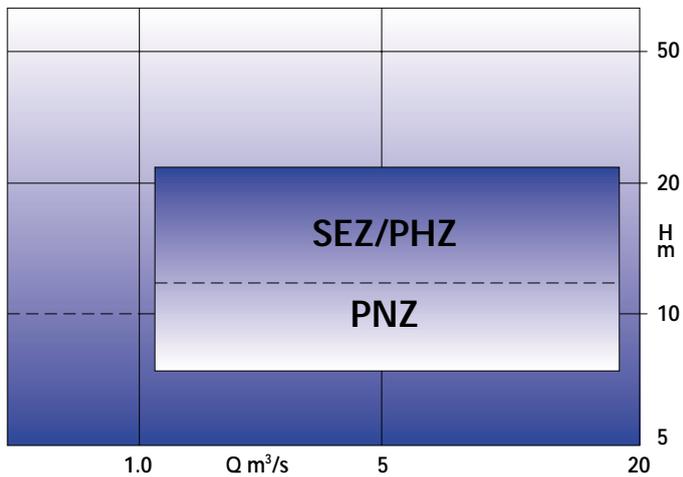
- metal
- concrete (for nominal diameters above 1,800 mm)

## Material Module

The following materials are used on a medium-dependent basis:

- casing: cast iron/steel, CrNi steel or duplex steel
- impeller/diffuser: CrNi steel or duplex steel
- shaft: carbon steel or duplex steel

## Performance Ranges





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