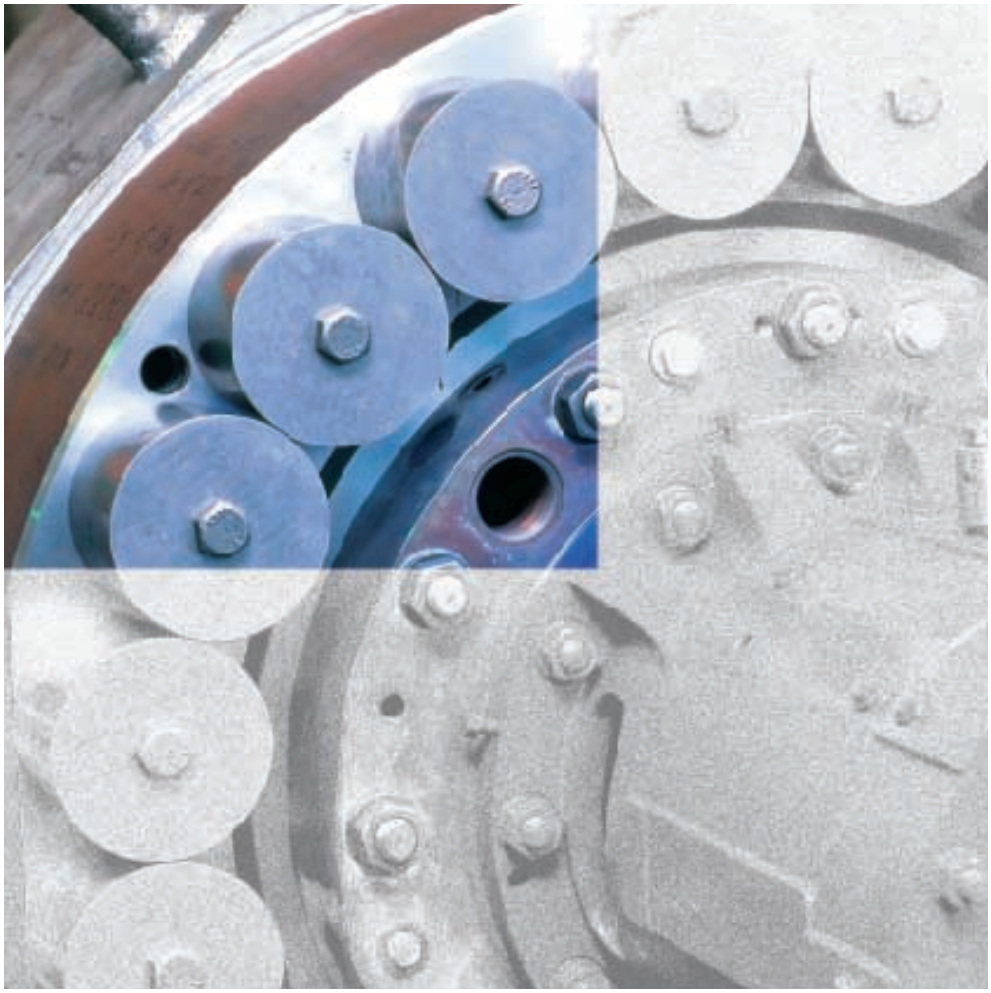
Upgrade Your Pump



KSB

Upgrade Your Pump –
Make power generation more efficient

Supplying power reliably, cost-effectively and with economical use of resources is and will continue to be a global challenge – and something we must all work to achieve.

”Upgrade Your Pump” is our economical concept for the rehabilitation of installed pumps. This extensive action plan includes all the necessary measures to bring your pumps up to the state of the art. Customized rehabilitation also saves you money, since fully functional old components, such as for example foundations, barrels and piping, can be re-used.

The starting point is a detailed on-site pump diagnosis by our team of experts. After that, everything happens very quickly: engineering, design, production of the upgrade components, installation, the test run and start-up – experienced KSB specialists ensure that the project is completed conscientiously and on time.

And once your installation is up and running again, all work performed and all upgrade components are covered by the comprehensive KSB warranty. Go for rehabilitation now – with the assurance of KSB.

1

INCREASE OPERATING RELIABILITY AND PLANT AVAILABILITY

New designs and new materials minimize wear.

2

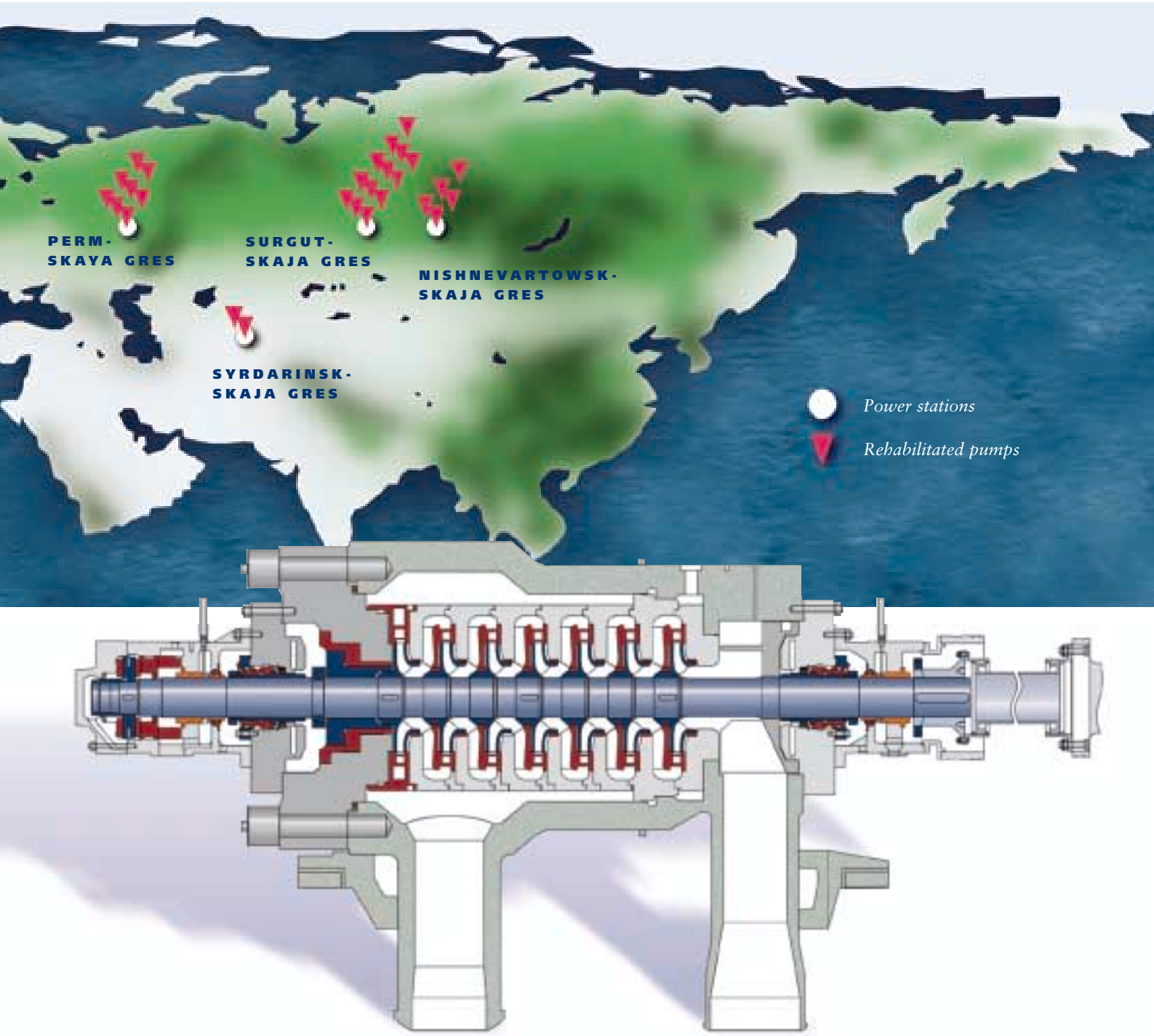
INCREASE EFFICIENCY

New hydraulic systems and targeted engineering optimize pump performance

3

EXTEND MEAN TIME BETWEEN MAINTENANCE

Parts ”made by KSB” and precision matching of components reduce the need for maintenance



4

REDUCE MAINTENANCE COSTS

Longer service lives of components extend the mean time between maintenance

5

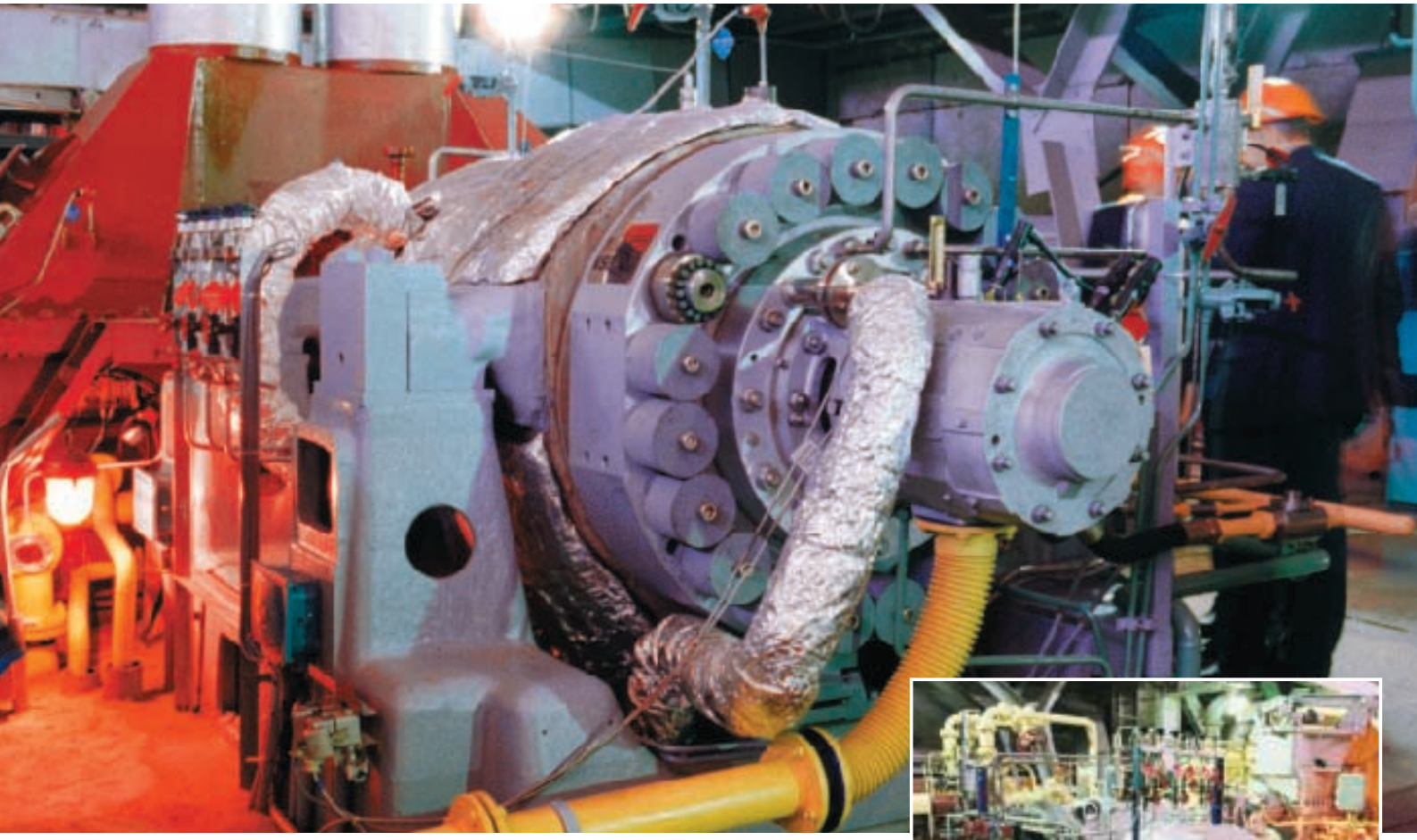
EXTEND REMAINING SERVICE LIFE

The extensive diagnosis and systematic elimination of weak points increase the service life of the entire machine

6

SAFEGUARD SPARE PARTS SUPPLY

Standard components are available off the shelf. CAD archiving allows rapid production at any time



Back in top form:

Rehabilitated boiler feed pump with booster pump at the gas-fired Perm power station

Power with KSB safety

"Rehabilitated" pumps for Perm

Power generation at Perm is reliable and efficient again.

The three units of the gas-fired Perm power station at the foot of the Urals are now working at full capacity again, each with an output of 800 MW.

The situation used to be different. Antiquated boiler feed pumps badly affected operation of the plant. Modernization was absolutely essential.

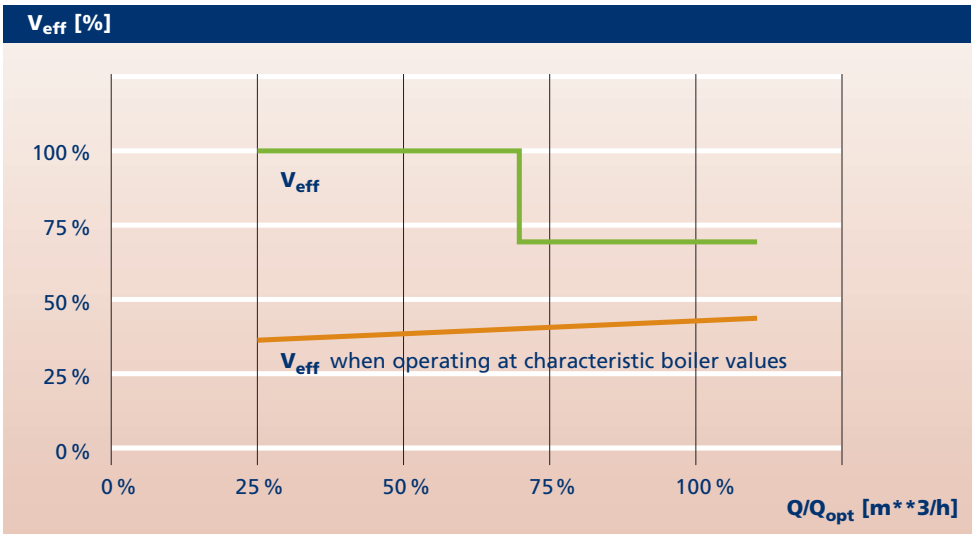
Following an extensive on-site diagnosis by a KSB team of experts at the power station, a comprehensive rehabilitation programme was drawn up for the installed pumps.

The scope of supply comprised six cartridges for barrel casing pumps, two reserve cartridges and six new booster pumps. All measures, from engineering and new design through dismantling, transport, conversion and the test run at KSB right up to installation and acceptance testing at the power station were carried out or supervised by KSB specialists.

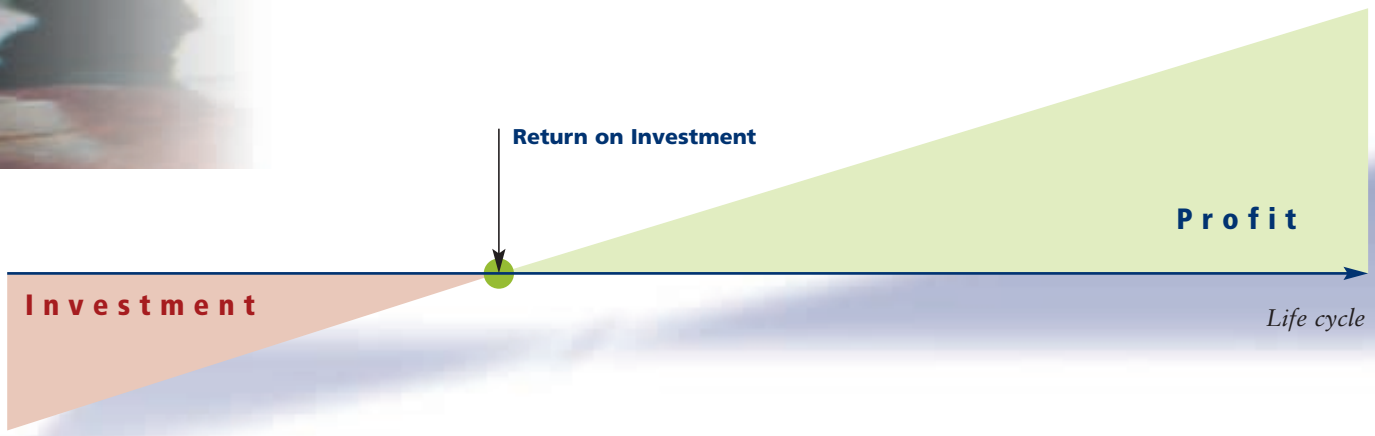
Boiler feed pump performance data:

Q	*6000 m³/h*
H	*322 bar*
T	*165 °C*
n	*4665 rpm*
P	*17150 kW (turbine drive rating)*

Vibration measurements demonstrate the excellent vibration behaviour of the rehabilitated pump



Vibrations, specified values
Vibrations, measured values



Return on investment – Costs fully under control

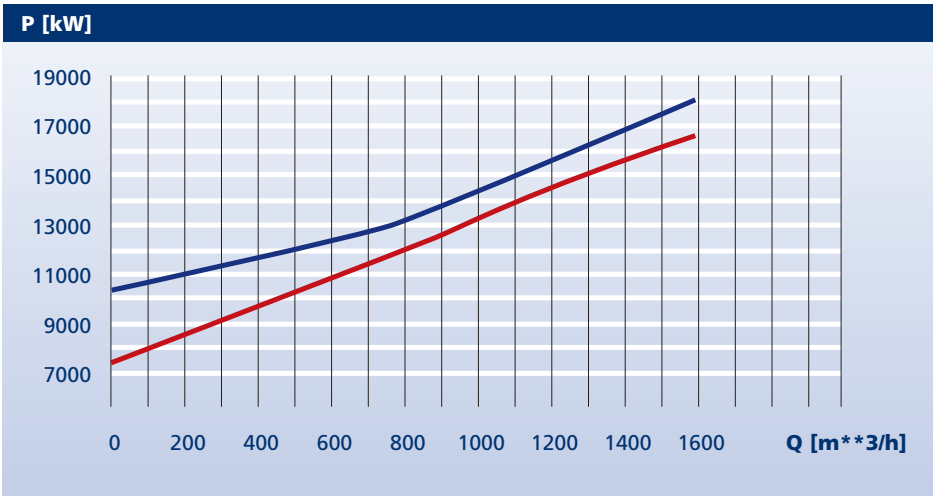
Rehabilitation yes – but not at any price.
Perm shows that all the modernization and optimization measures for power station pumps can pay for themselves after a short time. In other words: rehabilitation makes economic sense. At Perm, investment costs were recovered after less than two years.

Do you want to know how this would pay off for you too? Just ask us. We'll prepare a customized return-on-investment analysis for you, taking into account all the cost-relevant data. To provide a sound basis for this, our specialists will meet with you to identify all the factors we need to know for proper analysis.

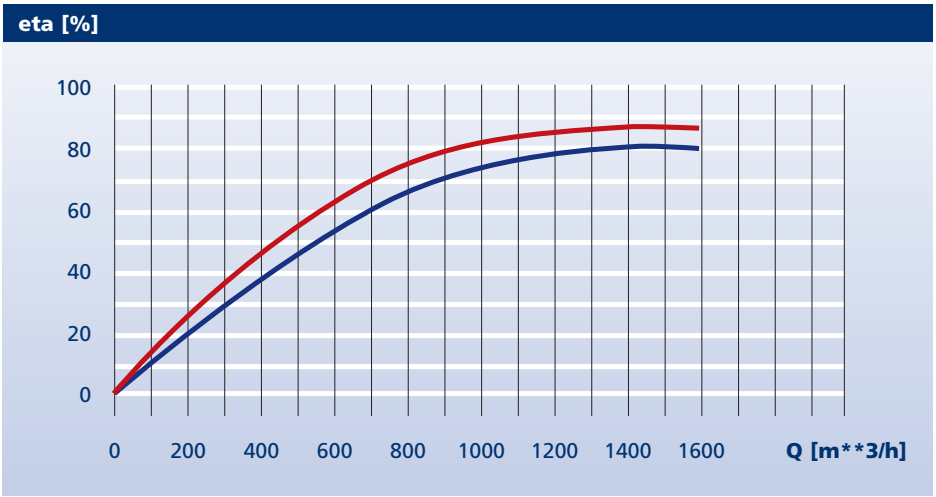
In this way, rehabilitation remains clearly in focus at all times, and you keep a firm grip on costs.

The steeper H/Q curve means stable parallel operation of the feed pumps

Lower power input means high energy savings



Enormous improvement in efficiency means cost-effective operation



CHTD 8/7 (KSB)
PN-1500-350/7

Condition of the pumps before rehabilitation

The old pumps had the following problems:

- Unstable operating conditions caused thermal deformations which, in turn, affected the pump's balancing system and shaft seal.
- Thermal, mechanical and hydraulic influences led to high vibration amplitudes and wear.
- High barrier fluid consumption of the shaft seal (inflexible throttles).

Consequences

- High wear and high repair costs
- Unplanned downtimes
- Unsatisfactory plant availability
- Shorter mean time between maintenance
- High energy consumption

Design safety: new balancing system

Avoid barrier fluid losses: efficient shaft seals

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Inspection visit and diagnosis by KSB at the power station*																
Conclusion of contract																
Design / engineering																
Materials procurement																
Production																
Pump assembly																
Trial run on KSB test rig witnessed by customer																
Piping, final assembly of cartridge																
Transport to the destination (ex works)																
Barrel casing: adaptation at the power station																
Installation of the cartridge, pressure test																
Tests and start-up																

* The diagnosis need not be done immediately prior to conclusion of contract. The actual timetable begins with conclusion of contract.

This is how fast it can be: rehabilitation time management for Perm

EXTEND SERVICE LIFE

Main assembly studs with special tensioner:

- *Minimizes stud loading by tightening without exerting any torque*
- *No special design – can also be used on existing main assembly studs*
- *No special tool required*

BALANCING SYSTEM

Double drum:

- *Maximum operating reliability*
- *Fail-safe mechanism prevents total failure*
- *Minimizes thrust bearing loading even when there is internal wear*
- *Stable performance under transient operating conditions*

GREATER SAFETY

Thrust bearing:

Defined axial clearance of the drum

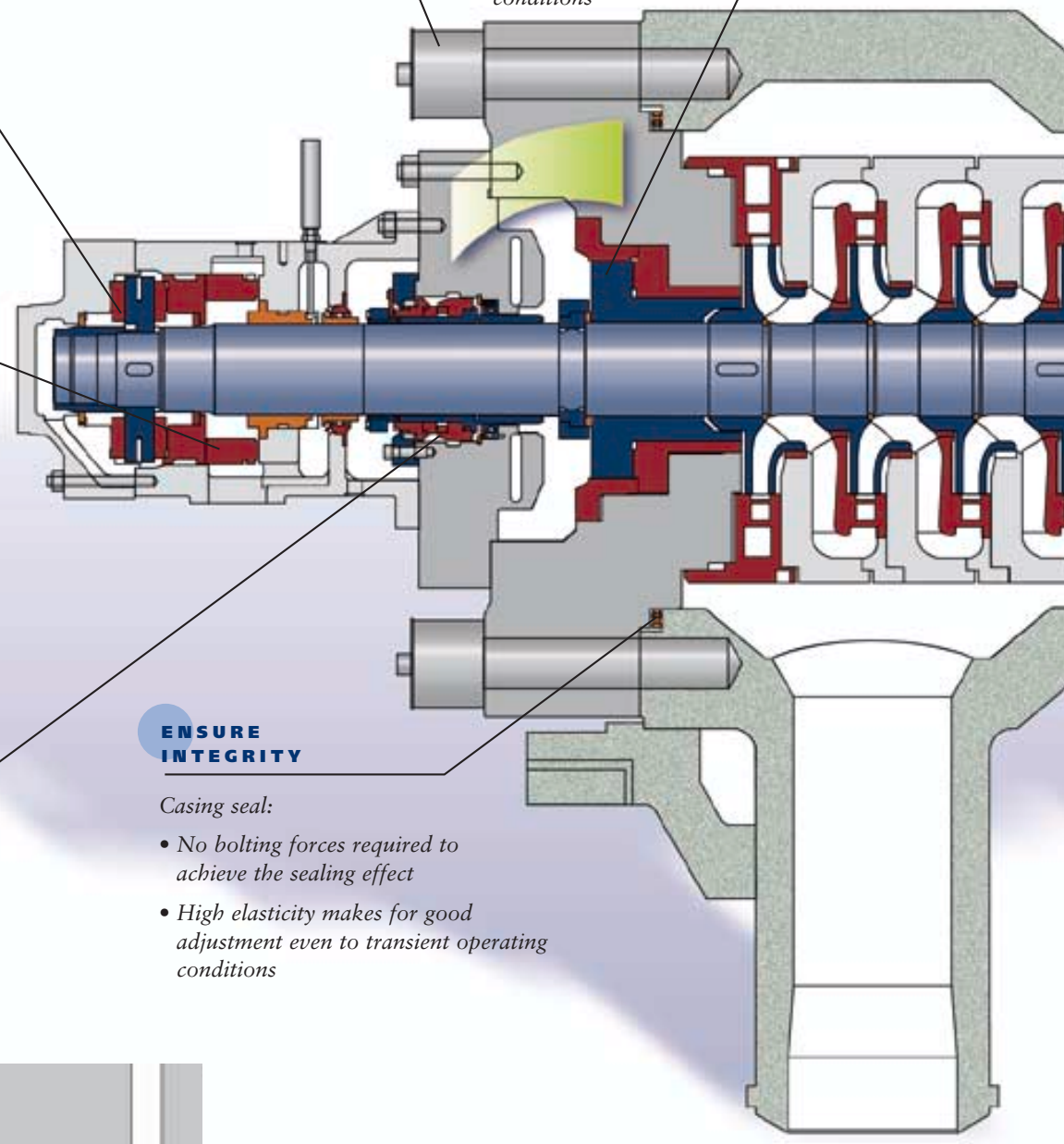
- *Additional safeguards under transient operating conditions*

PREVENT OVERLOAD*

**Additional measure*

Thrust ring:

- *Ensures uniform, concentric thrust bearing loading*
- *Extends service life*
- *Well-adjusted elasticity protects thrust bearing against overloading*



INCREASE RELIABILITY

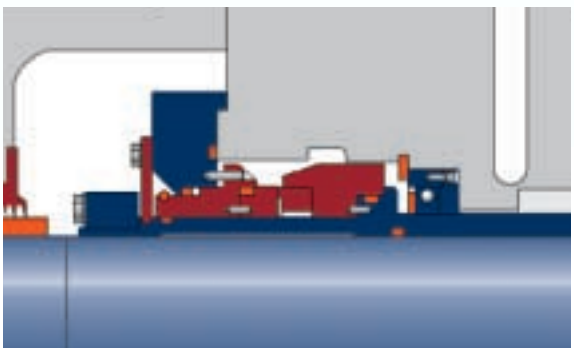
Efficient shaft seal:

- *High reliability*
- *Low losses thanks to cartridge design*
- *Easy to maintain*
- *Optimized protection prevents thermal deformations*

ENSURE INTEGRITY

Casing seal:

- *No bolting forces required to achieve the sealing effect*
- *High elasticity makes for good adjustment even to transient operating conditions*



PREVENT CAVITATION*

**Additional measure*

Inlet casing:

- *Hydraulically optimized geometries ensure uniform, concentric inflow*
- *High level of cavitation prevention*
- *Smooth running, low vibration*

OPTIMIZED LINES OF ACTION OF FORCES

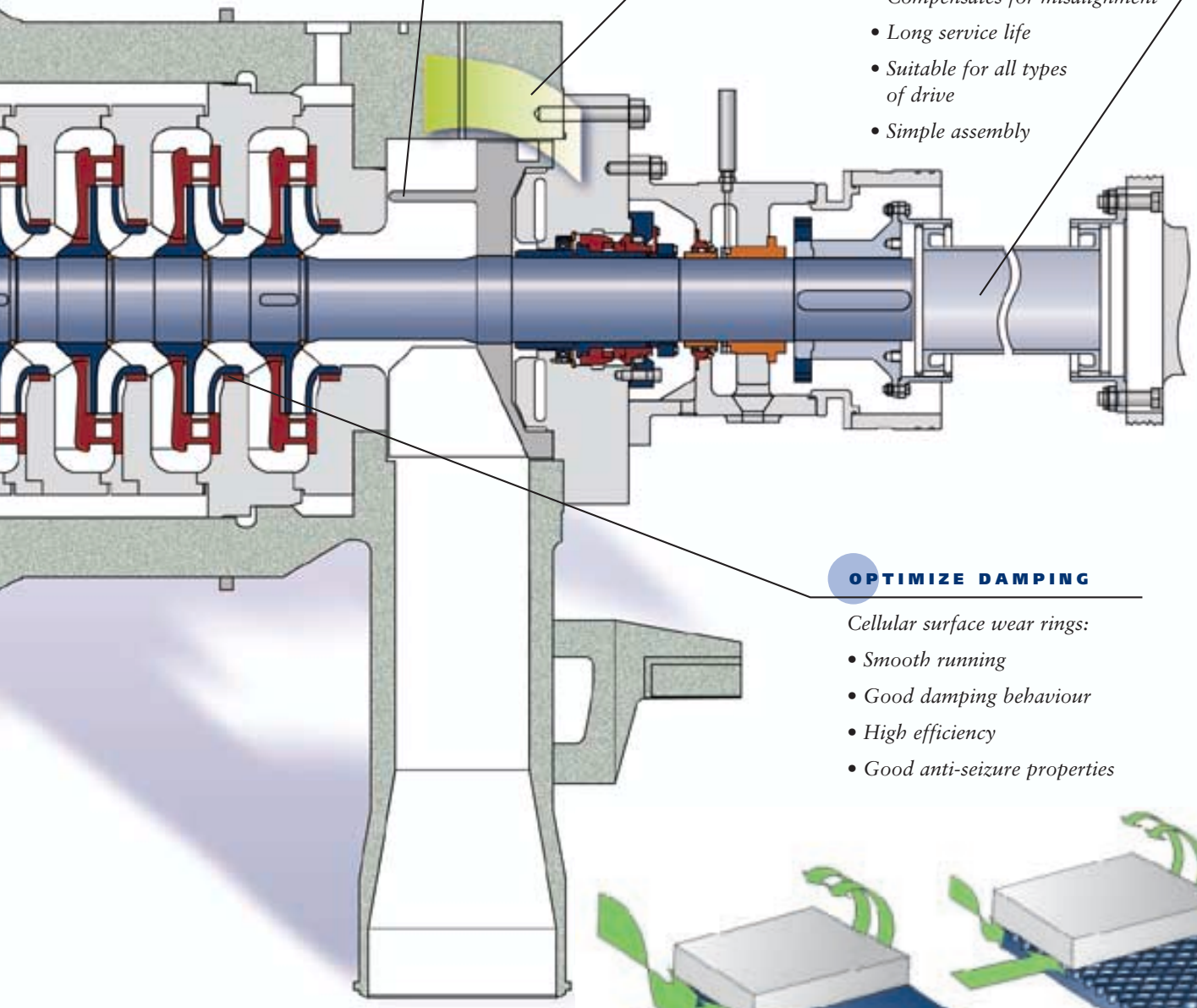
(Green markings)

- *High rigidity*
- *Excellent vibration behaviour*
- *Minimized deformations under load*

REDUCE VIBRATIONS

Modern coupling:

- *Precise and lightweight*
- *Compensates for misalignment*
- *Long service life*
- *Suitable for all types of drive*
- *Simple assembly*



OPTIMIZE DAMPING

Cellular surface wear rings:

- *Smooth running*
- *Good damping behaviour*
- *High efficiency*
- *Good anti-seizure properties*

Cellular surface wear ring

Conventional casing wear ring

CUT COSTS

Back pull-out cooling water pumps:

- *Rotor assembly can be replaced*
- *New hydraulic system improves efficiency*

Lippendorf power station

REDUCE WEAR

Impeller, elbow, shaft protecting sleeve etc. are replaced by new, more wear-resistant components

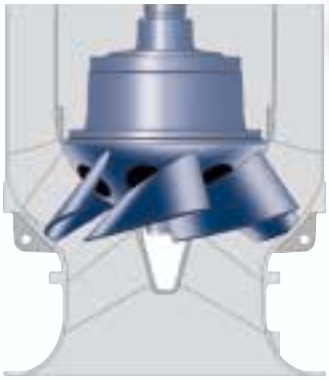
RESIDUR® SHAFT GUIDE BEARING

- *Medium-lubricated*
- *Maintenance-free and low-wearing*
- *No need for additional lubricating and cooling systems*
- *Resistance to hydroabrasive wear*

OPTIMIZE INTAKE CHAMBERS

Vortex-free conditions by:

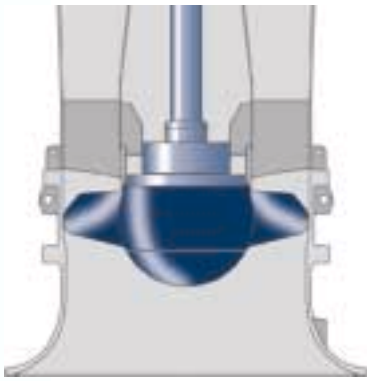
- *Fitting pre-swirl control equipment*
- *Structural changes in the intake chamber*



SAVE COSTS

3 impeller types permit selection of a cost-efficient, optimized pump for any operating point

- *Pump control by blade pitch adjustment/control*



ADD SAFETY AND RELIABILITY

Shaft seal:

Replace gland packing by mechanical seal

- *Greater reliability*
- *Safe operation*

EXTEND SERVICE LIFE

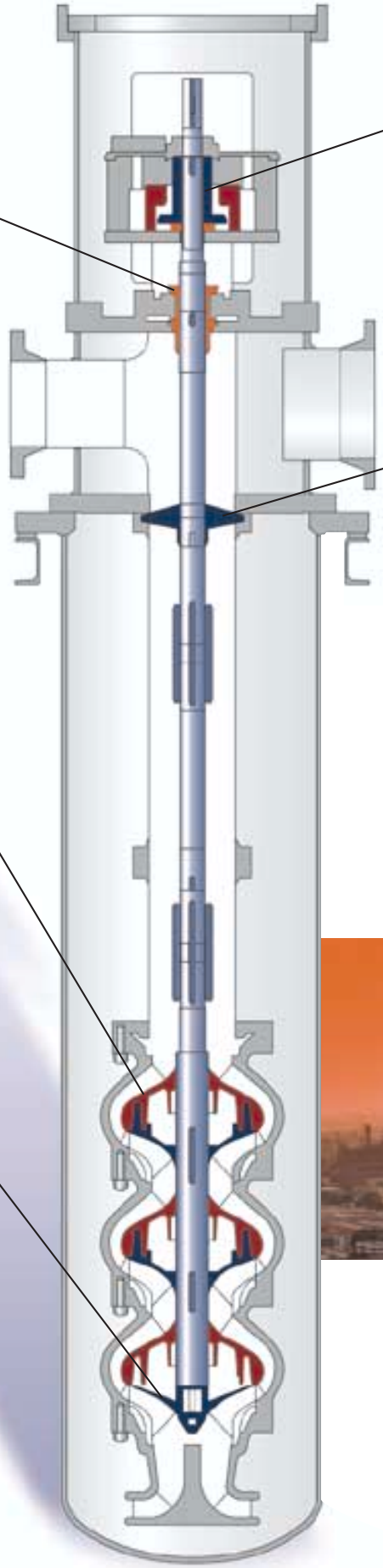
Hydrodynamic bearings:

- *Medium-lubricated*
- *Replaceable casing wear rings*

IMPROVE RESISTANCE PROPERTIES

Replace first-stage impeller by model of higher-grade material:

- *Copes better with cavitation*
- *Lower maintenance cost*



INTEGRATED THRUST BEARING

Fitting monitoring instrumentation for oil lubrication and cooling systems:

- *Longer service life*

CUT COSTS

New pump cartridge with new hydraulics:

- *Improved efficiency*

Heilbronn power station

KSB engineering team
Frankenthal, Germany

More than just a pump...

What we have to offer you is a complete engineering package comprising everything from customized inspection of your pump, through upgrade component manufacture, re-assembly and test run, up to and including re-installation and commissioning on site:

- Efficient pump and upgrade component selection
- Selection of accessories, e.g., instrumentation, minimum-flow system, oil supply, cooling water supply, etc.
- Engineering of the complete pump set, incl. drive, couplings, gearing, variable-speed couplings and booster pumps
- Calculation of, say, foundation loads, strength analyses (finite-element method), seismic tie-downs
- Sensor equipment design, e.g., for pump diagnostic systems
- Tests and analyses, e.g., of vibrations and noise

Engineering services	Boiler feed pump	Cooling water pump	Condensate pump
Minimum flow system	●		
Drives	●	●	●
Gear / geared variable-speed coupling	●	●	
Pump diagnostic system	●		
Remaining lifetime calculation	●		
Payback analysis	●	●	●
Vibration analysis	●		
Cycle calculation	●	●	●
Optimization of process parameters	●	●	●
Optimization of intake structure		●	

Engineering services at a glance

Responsibility awareness

Your task as a power station operator is to continue to provide power safely and cost-effectively. The decisions you make and action you take today pave the way for power supply tomorrow.

We are there to help you in this task.

So why not rely on over 125 years of experience and know-how in pump and valve engineering for fossil-fired and nuclear power stations. Why not benefit from the manpower of the world's leading manufacturer – more than 12,800 specialists cater to your needs – wherever you are.

Our ongoing product research and development, systematic quality management and global service network provide you with the necessary certainty – for today and the future.

Feed pumps being tested under operating conditions on KSB's own test rigs (top photo)

Research sets standards:

Only continuous research enables us to keep improving our products

You can rely on support from KSB – around the world

As a global player, we feel at home anywhere in the world. Our international presence enables us to provide intensive local customer service.

More than 1000 KSB service employees worldwide are there to make sure that your pumps, systems and facilities keep working reliably and efficiently.

Responsibility for the future – assured by KSB.

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