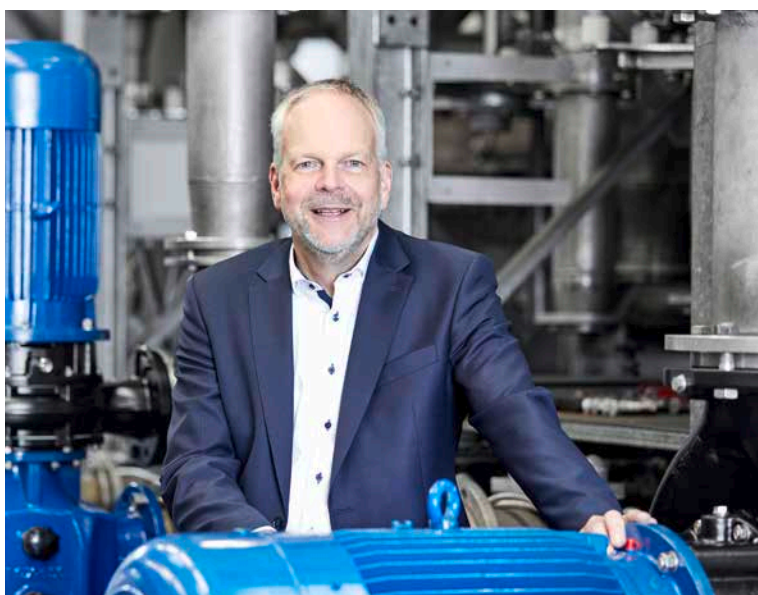


**RESOURCE EFFICIENCY
MEETS ENERGY EFFICIENCY**

Herborner Pumpen is developing the most innovative pumps in the world with the highest quality. The aim is to make the movement of water as efficient, environmentally sound and profitable as possible. Every day, Herborner Pumpen puts its nearly 150 years of experience to use to achieve the technically best and most energy-efficient product possible for pumping applications, whether in swimming pools, water supply and distribution, industrial plants, on ships or for wastewater treatment.

WHITE PAPER

COATED PUMPS FROM THE HERBORNER CONSTRUCTION SERIES



SASCHA KORUPP
Technical Director

INNOVATION AS STANDARD

Versatile. Specific. Individual. We love innovation. Our traditional approach draws on the whole of our expertise to win over customers with solutions that offer real added value. To help us live up to this high standard at all times, we cultivate close relationships with our customers.

This in-depth communication ensures we are very familiar with the performance our customers expect from our pumps in practice. Currently, alongside high user value, our innovative efforts are especially focused on aspects such as long service life, reliability, and energy and resource efficiency.

A FUTURE INSPIRED BY A SUCCESSFUL PAST

Climate change. The coronavirus pandemic. War in Europe. Catastrophes are flowing seamlessly one into another. Societal structures and the economy are undergoing stress tests that would have been unthinkable just a few years ago. All this places demands on modern businesses as well. Looking back at our colourful history, however, one thing is certain: there may be challenges ahead, but we will face them armed with our talent, our passion and our knowledge. The consistent development of our



business over many decades offers countless examples. With the courage to make revolutionary decisions, in the past we have frequently shown that when you take that step onto a new path, it really pays off. The most recent example to support this is the development of the herborner. neo series of pumps. With the aim of increasing efficiency and minimising the use of resources, we worked together with TH Mittelhessen University of Applied Sciences to develop the HPC coating (HPC = Herborner pump coating), as a result of which we launched a generation of pumps that has won over customers around the world.

This white paper sets out our systematic approach to implementing our latest pump innovation, the herborner. neo.

04	Starting point
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01 STARTING POINT

JOINT DEVELOPMENT GOALS OF ENERGY AND RESOURCE EFFICIENCY

Flexibility and adaptability have been built into our traditional company from Herborn in Middle Hessen, Germany, from the outset. Continuous growth and the courage to make pioneering decisions have always been defining features of the business, which was founded by Johann Heinrich Hoffmann in 1874.

And there have been no significant changes in this attitude over the course of nearly 150 years. On the contrary: it has long been clear that the continual development of its own products and services is a crucial selling point over the competition, reinforcing the company's position as market leader.

If you consider the development of the construction series, you can see that current issues such as energy and resource efficiency can be traced back to the start of the millennium – these have been priority development goals for Herborner Pumpen since 1999. The moves by the Hessen-based business have been supported by political changes at the national level. The end of Helmut Kohl's time as chancellor was followed by the first red-green coalition. From that point on, energy and environmental considerations were key issues.

With an increased emphasis on energy efficiency and consumption of resources, Herborner Pumpen picked the right area for development and had the courage to adjust its focus accordingly. And with success! Building on this, Herborner Pumpen has repeatedly introduced new construction series that set benchmarks in terms of energy and resource efficiency.

A portrait of Sascha Korupp, a middle-aged man with grey hair and a beard, wearing a dark suit jacket over a white shirt. He is standing in a factory or industrial setting, with large blue industrial pumps visible in the background. The image is partially overlaid with a dark blue circular graphic on the right side.

“Energy and resource efficiency are the benchmarks we use when developing our products and our production practices. Under this premise and using new technology, in recent years we have set benchmarks for coated pumps.”

Sascha Korupp, Technical Director and authorised signatory,
at Herborner Pumpen since 1991

THE SITUATION AT THE TURN OF THE CENTURY

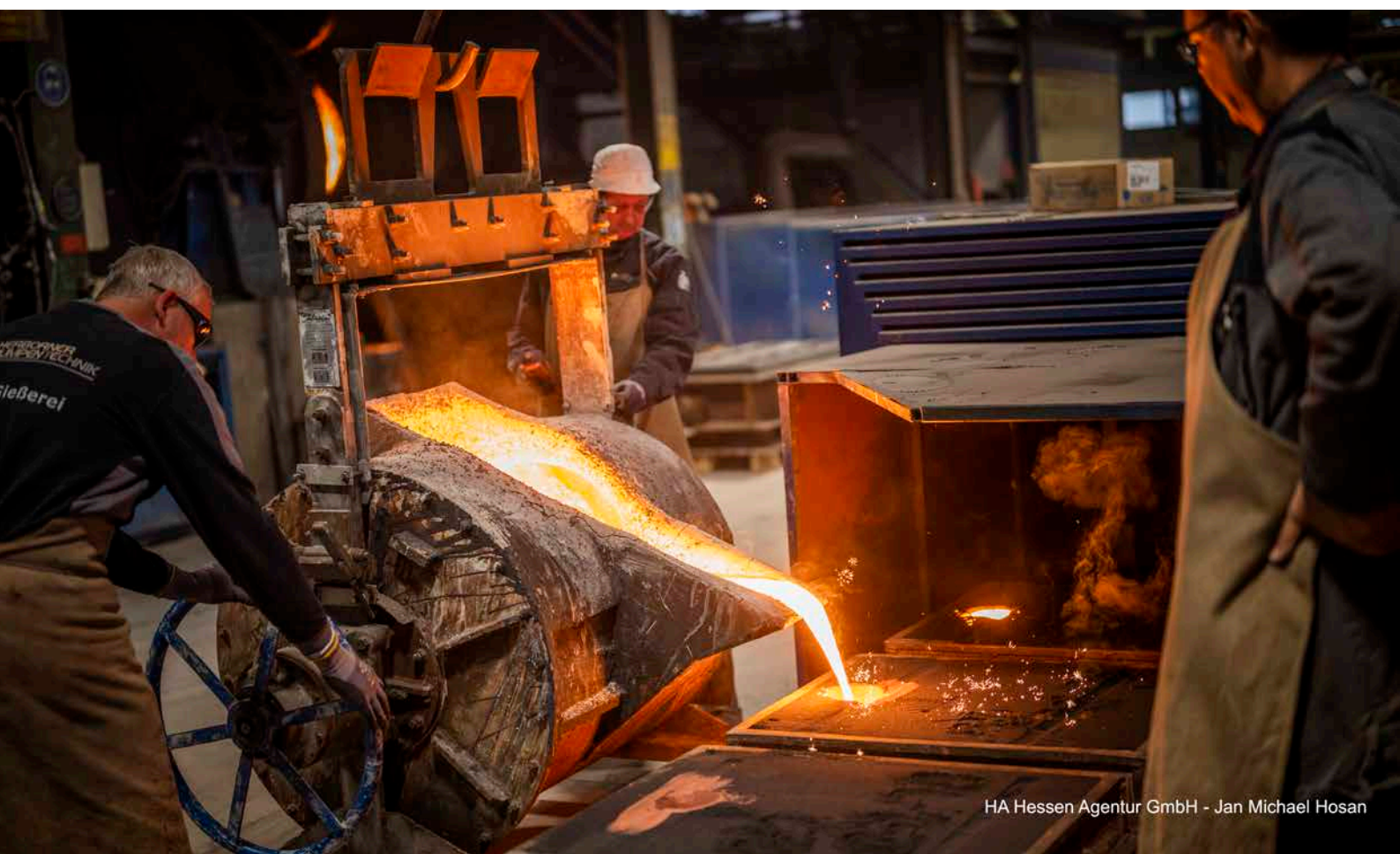
Around the year 2000, exciting new changes were taking place in the field of swimming pool technology. Control and monitoring equipment for system optimisation was increasingly being refined and digitalised. There was also increased investment in attractions, especially in stainless-steel pools and in pools for attractions, to meet the enhanced expectations of guests.

Although stainless steel was increasingly being used for pools and attractions for aesthetic reasons, the pumps for the system installed in the cellar were generally ordered in grey cast iron – even for applications where it might have been better to choose stainless steel or bronze materials.

At the end of the 1990s, for example, around 90 per cent of pumps installed in such systems were made of grey cast iron. The remaining 10 per cent were made of bronze or stainless steel to withstand the harsh pool water.

As a defence against aggressive media, for example in saltwater pools, individual components were also protected with rubber coatings.

On the basis of decades of industry experience, however, the experts at Herborner Pumpen spotted a latent problem with the above trend: the potential corrosion of conventional pumps made from grey cast iron and the negative effects of this on the parts made from stainless steel.



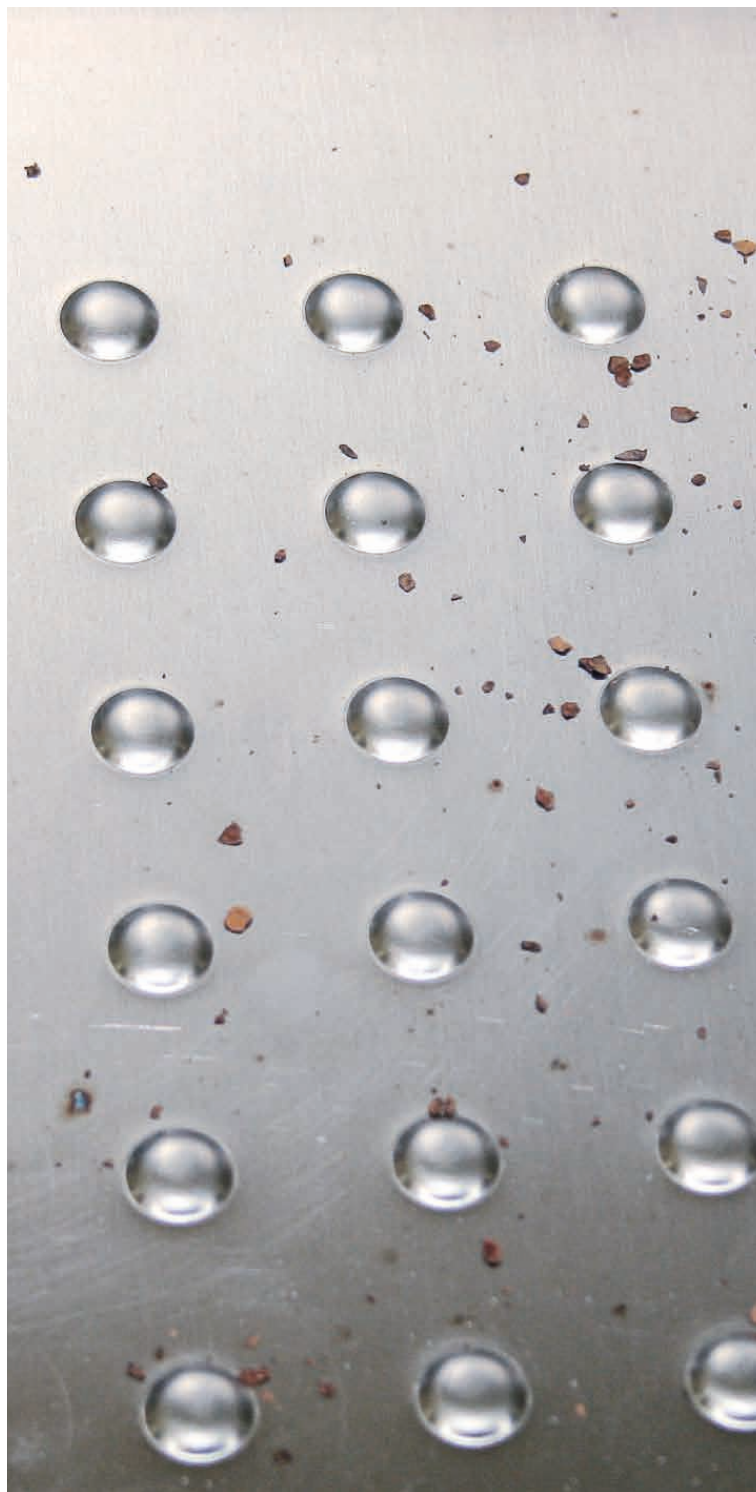
CORROSION – CUTTING COSTS IN THE WRONG PLACE

It happened as it was bound to happen. Corrosion products gave rise to traces of corrosion that were unsightly and, on stainless steel slides, also unpleasant. This resulted in conversations with the operators, who wanted to find a solution to the problem without having to take recourse to costly stainless steel or bronze as the pump material.

A bit of background: grey cast iron corrodes in a concentration of as little as 150 milligrams of chloride ions per litre. However, in some countries you can find quite different, significantly higher concentrations of chloride ions in pool water – with a corresponding effect on the grey cast iron.

“Corrosion became a problem. We needed to find innovative solutions to help our customers fight it.”

Michael Peter in 1999, then Head of Service, at Herborner Pumpen from 1993 to 2021



There are also other aspects that can cause problems: closer inspection of the systems revealed incorrectly configured water treatment plants, inappropriate operating methods or poor choices of materials. In many cases,

cutting costs in the wrong places is at the root of all ills. The consequences cannot be prevented. Visible corrosion deposits on stainless steel components are then an unavoidable outcome.

A man with glasses and a dark jacket over a light blue shirt is standing in a factory. The background shows industrial machinery and structures. A large, semi-transparent dark blue circle is overlaid on the lower half of the image, containing the text. The text is in a bold, white, sans-serif font.

**“Coatings
can solve the
issues and are one
possible option
for turning a good
pump into a great
pump.”**

Dirk Werner, Back Office Swimming Pool Pumps,
at Herborner Pumpen since 1983

INCREASING REQUIREMENTS ON PUMPS

At Herborner Pumpen, we quickly ascertained that the market was ready for a new generation of pumps. Following in-depth deliberations, we concluded that the new pumps should not focus solely on resolving the known corrosion problems. Rather, a new generation of pumps should fulfil two additional criteria.

There was no doubt that the development of new construction series must also have the aim of increasing energy efficiency with improved efficiency of the pump hydraulics. This was the only way to meet the customers' growing requirements as well as their desire for

reduced lifecycle costs. Another thing that needed to be taken into account was resource efficiency. The aim here was to eliminate dependency on critical and cost-intensive raw materials such as bronzes and stainless steels.



02

APPROACHES TO A SOLUTION

COLLECTING INSIGHTS

Meticulous preparations for coated generation of pumps

“We need a strategic approach

to find the right coating. The objective must be to ensure a reliable coating process.”

**Ralf Olmesdahl, Head of Quality Management,
at Herborner Pumpen since 1995**



SITUATION IN THE PUMP INDUSTRY

The idea of using high-quality coatings to counteract the tendency of grey cast iron to corrode and, at the same time, to minimise the use of expensive materials is not a new one.



Herborner Pumpen had been making plans and endeavours along these lines since the mid-1990s, so the engineers were not exactly starting from scratch. On the contrary: their task was to make use of existing knowledge from partial successes and to apply new technologies and coating techniques to the situation in such a way – including with the support of colleges and universities – that the development would meet all requirements.

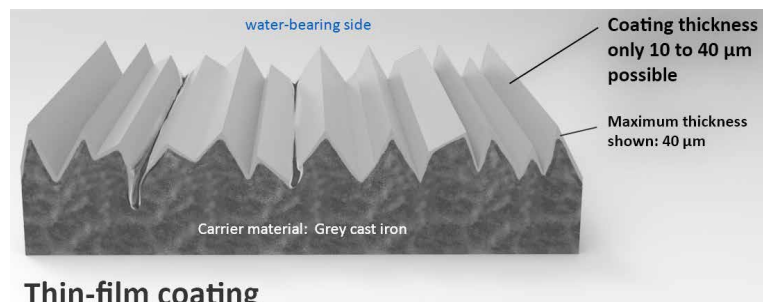
Nevertheless, a glance at the status quo highlights the complexity of the

task, because previous efforts had shown that, above all, the matter of a suitable coating and the actual coating process was still unsolved. It was also still necessary to resolve certain design details so that the individual pump components could be 100 per cent protected against corrosion.

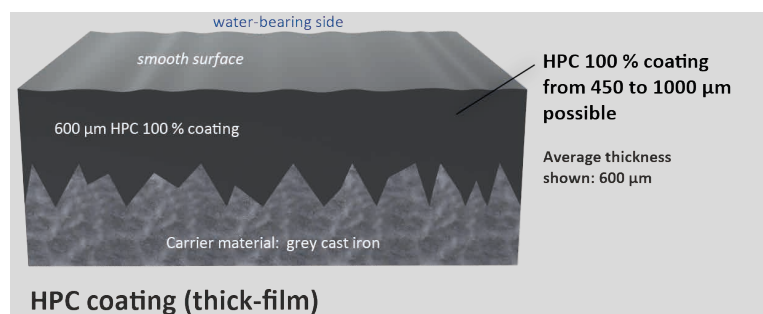
Herborner Pumpen was not the only company seeking to address the issue of corrosion. Between 2005 and 2007, a large part of the pump industry was working on a practical, cost-effective solution for using coatings to enhance low-cost materials in such a way that corrosion protection was guaranteed without altering the component geometry – which would have a knock-on effect on the casting moulds. The aim was to find a solution that allowed existing pump designs to be reused without adaptations, avoiding considerable additional expenses. The hope was that these requirements could be met using thin-film coatings, also known as nanocoatings.

From a technological viewpoint, this approach inevitably entailed a certain degree of complexity, and it proved to be very difficult if not impossible to completely cover the raw component surface, peppered with surface defects (blowholes) from the casting process, using nanocoatings.

Advanced and contemporaneous research activities at universities also failed to provide Herborner Pumpen with workable findings.



Thin-film coating



HPC coating (thick-film)



A bit of background: blowholes – a kind of roughness in the surface – are characteristic of cast pump components. They lead to surface defects in the cast parts, and can have sharp edges. With this in mind, the conflict between a thin-film coating of existing pump components, on the one hand, and a reliable process for coating the base material, on the other, is clear.

There had to be another solution. Based on the available findings, the

rest was a matter of course: since it was not possible to create a reliable nanocoating process, Herborner Pumpen concentrated on developing a thick-film coating that could be applied in a reliable process.

the development of completely new pump hydraulics with corresponding new casting moulds, and was therefore associated with considerable costs.

This may not sound earth-shattering, but it had far-reaching consequences. The thick-film coating necessitated



“The only way to meet the requirements for a coating that was of high quality and applied in a reliable process was to set up a new in-house coating zone.”

Oliver Trusheim, Production Control,
at Herborner Pumpen since 1999

REQUIREMENTS FOR SUITABLE MATERIALS

The unsuitability of the nanocoating and the fact that the thick-film coating entailed the development of new pump hydraulics was no cause for disillusionment. Ultimately, the purpose of the project was not only to achieve effective corrosion prevention, but also to improve resource and energy efficiency. The development of modern pump hydraulics contributed to these goals. With this in mind, it was possible to define the requirements for the interaction between base material and coating:

- **Matched to customer requirements**
(no corrosion products entering the system)
- **Increases efficiency**
(energy-efficient as a result of achieving improved pump hydraulic efficiency)
- **Resource-efficient**
(not dependent on critical and cost-intensive raw materials)
- **Sustainable**
(avoids toxic and environmentally damaging substances)

APPROACHING A SINGLE SOLUTION

On the basis of the findings available at that point, it was possible to specify some key technological parameters for the solution.



Grey cast iron has the necessary basic ability to withstand pressure, including surges, and is also an ideal base material from an economic perspective. Experiments with coating solutions have shown that total coverage of the grey cast iron surface with a film thickness of 0.5 millimetres is the desired technical solution for improving the material in line with requirements. It is necessary to ensure high-quality execution of the coating here to enable use in aggressive media and prevent signs of wear. Any variations in the coating due to the production process must be within the design tolerances of the solution.

03

DEVELOPMENT

UNIVERSITY AS DEVELOPMENT PARTNER

Creation of a new thick-film coated generation of pumps

“The project management needed to find a suitable coating material and the necessary coating technology all required close collaboration with the university so that the

research results could be incorporated promptly into the development of the series design.”

**Lars Runte, Head of Development,
at Herborner Pumpen since 1999**



SCIENTIFIC INVESTIGATION OF THE POSSIBLE SOLUTIONS

When we decided to develop a new generation of pumps with a thick-film coating, it was clear that Herborner Pumpen had to bring in a player from the world of science to act as project partner. The idea was that they would carry out a scientific investigation of possible solutions for a high-quality coating that we would then process in our company.

From the beginning of the project, Herborner Pumpen refused to rule out the

possibility of building a completely new production zone for thick-film coating.

TH Mittelhessen University of Applied Sciences (THM) quickly came on board as an expert partner who wanted to

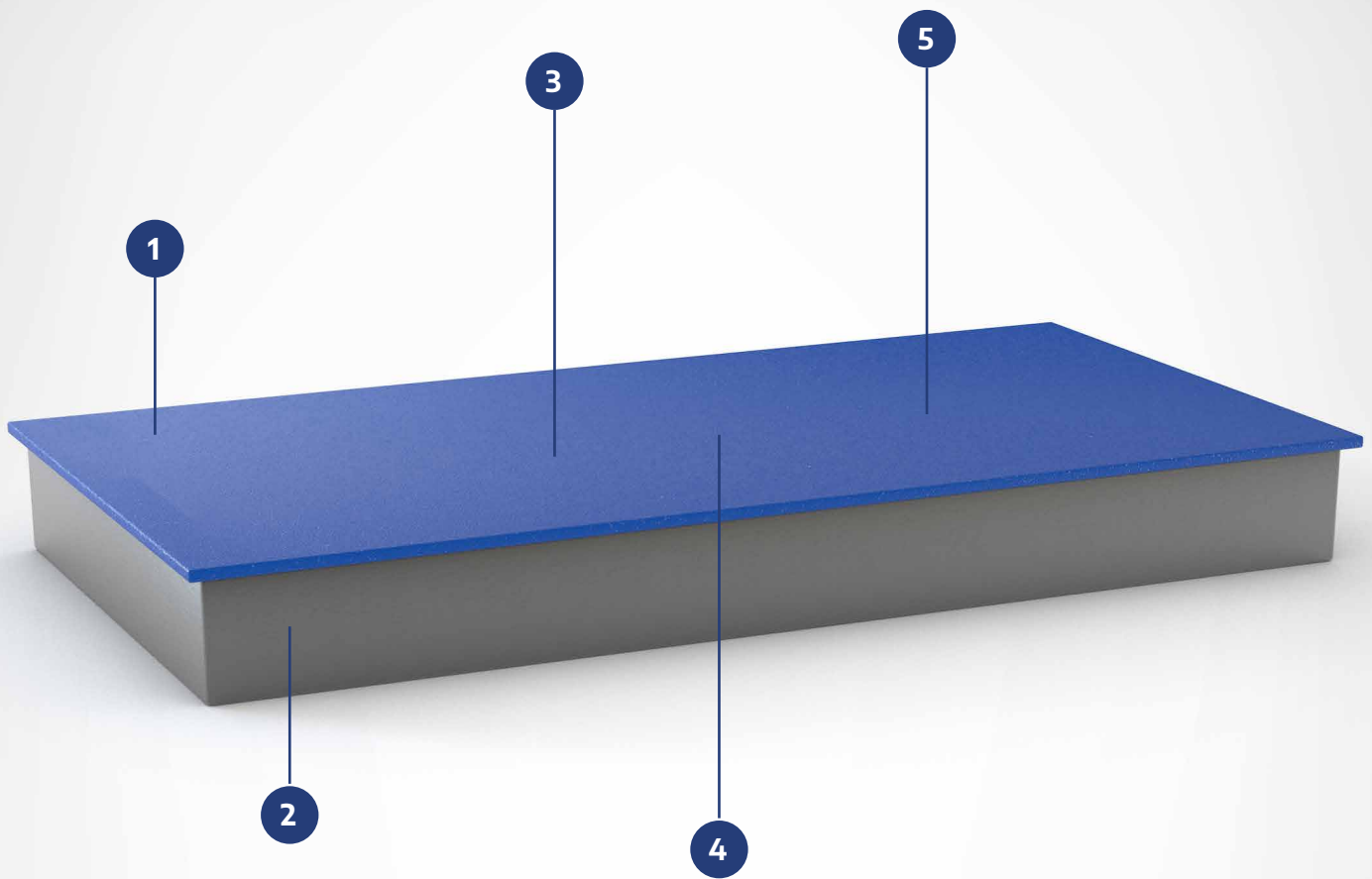
ting". They also tested the behaviour of the new pumps in terms of friction, wear and corrosion. The partners had developed four test stands specifically for this purpose. A win-win situation for all involved. While Herborner Pumpen benefited from scientifically grounded insights, the interdisciplinary centre of competence in materials sciences and material testing at THM received a massive boost as the knowledge obtained was applied in their teaching. The test stands have been of use in research since then.

“Owing to the successful collaboration with Herborner Pumpen, the interdisciplinary centre of competence received a massive boost.”

Prof. em. Dr.-Ing. Hans-Joachim Schwalbe,
Chair in Materials Technology,
TH Mittelhessen

support us. A three-year research and development project was conceived especially for this purpose, in which the developers from Herborner Pumpen cooperated closely with the scientists from THM. Herborner also constructed test pumps for the project – successfully: in 2013, the result achieved second place in the Hessen Cooperation Awards.

The scientists from the centre of competence in materials sciences and material testing at THM analysed the various materials under consideration for the coating and created the formulation for the special “thick-film coa-



SEQUENCE OF SCIENTIFIC INVESTIGATION OF THE POSSIBLE SOLUTIONS

- (1) Development of a new coating
- (2) Agreement on grey cast iron as the base material
- (3) Specification of the production process (immersing, spraying, painting, etc.)
- (4) Definition of the surface functionality (scratch resistant, water repellent, etc.)
- (5) Tests and specification

GAINING INSIGHTS IN THE LAB

The process first took the developers into the lab. As part of a broad spectrum of tests, it was possible to assess features of the specific surface functionality.

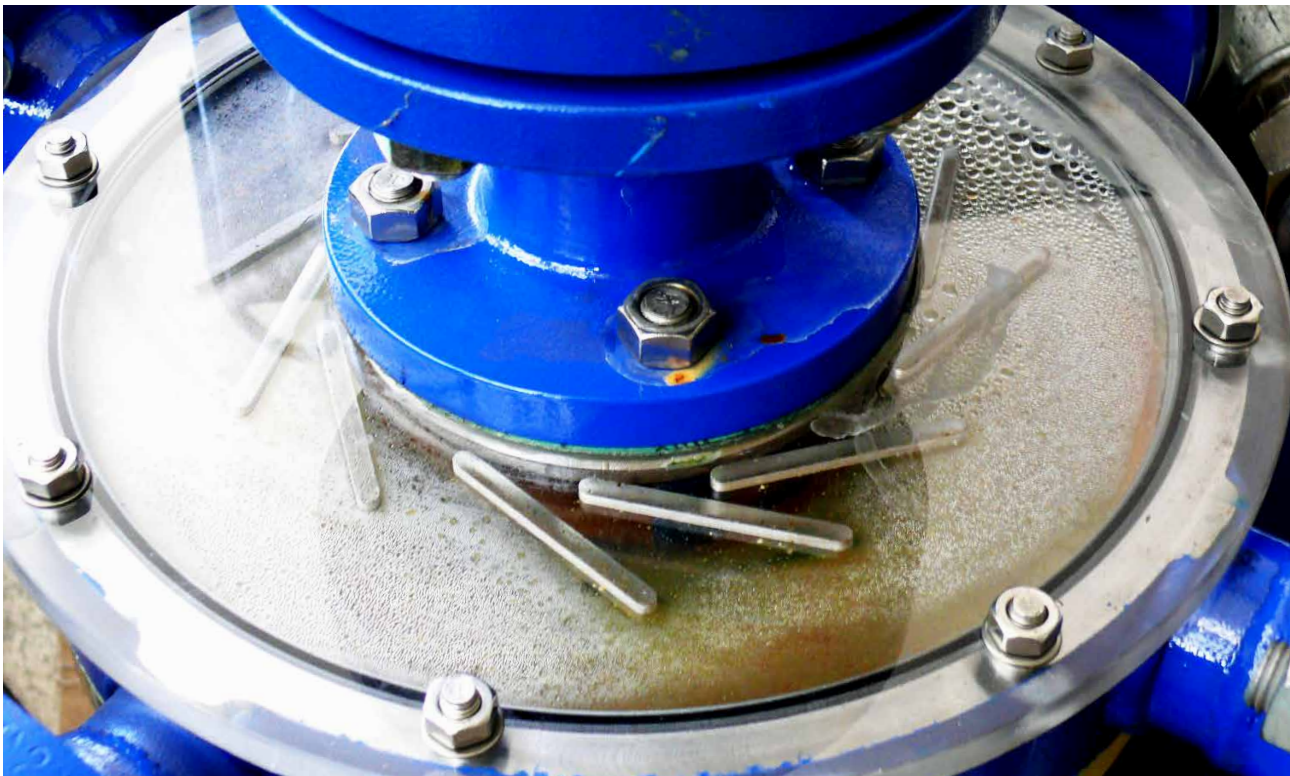
Essentially, the aim of the lab tests was to evaluate the corrosion protection of the base material and its resistance to scratching and wear. At the same time, the developers on the research team tested how well the coating repelled dirt and water. The antibacterial behaviour and cavitation resistance of the surface was also investigated in a targeted manner.

Furthermore, a key aspect of the research was the functionalisation of the coating. Applying a very wide range of measures, such as the use of additives or the inclusion of nanoparticles, the experts directly affected the functionality of the coating, improving it up to an effective maximum value.



SOPHISTICATED TESTS UNDER LABORATORY CONDITIONS

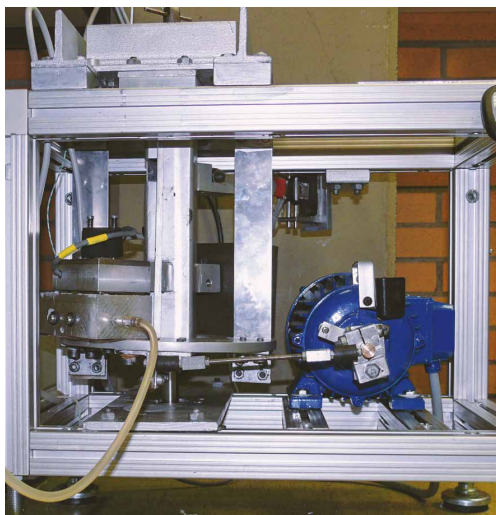
This much is certain: pumps from Herborner really have to work hard to do their job. It's not for nothing that the manufacturer claims the title of one of the most innovative high-end pump manufacturers in the world. By using endurance tests during development, the company lays the foundation for the high quality of its in-house developments – including for coated pumps.



So as to simulate real conditions in the laboratory, the experts from Herborn developed a system of sophisticated wearing tests, which can subject eight coating prototypes to stress simultaneously. The wearing tests took several weeks to complete and brought to light key findings about the wearing behaviour of the respective coatings.

For the tests, the respective test object was designed in the manner of a casing tongue or spur and subjected to flow accordingly. This location has proven to be subjected to particularly strong

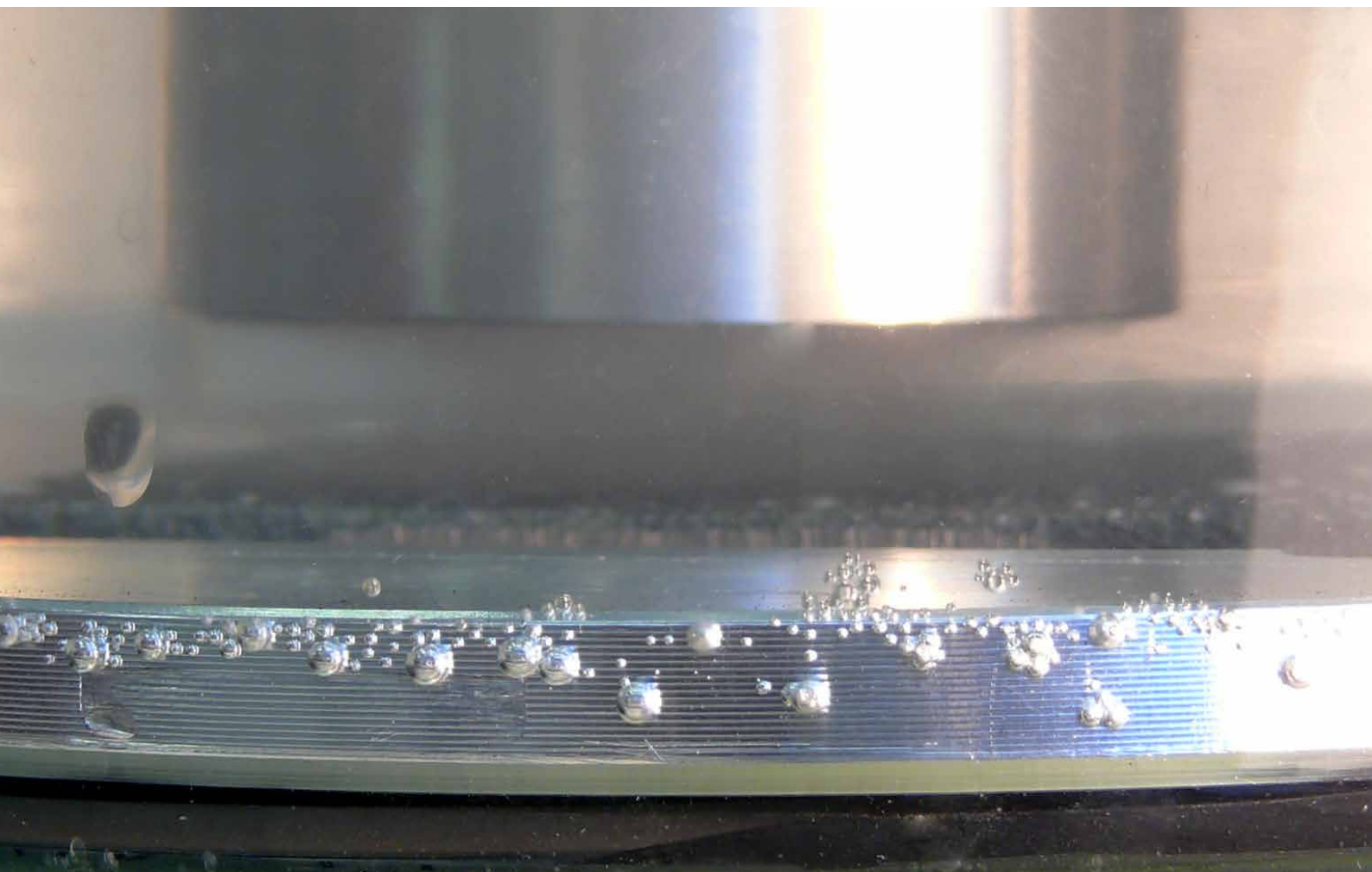
flow effects within the hydraulic system of a pump. These effects intensify during partial or overload, regardless of the actual pump configuration. The test vanes were held here in three different angular positions to imitate flow behaviour in the different modes of operation.

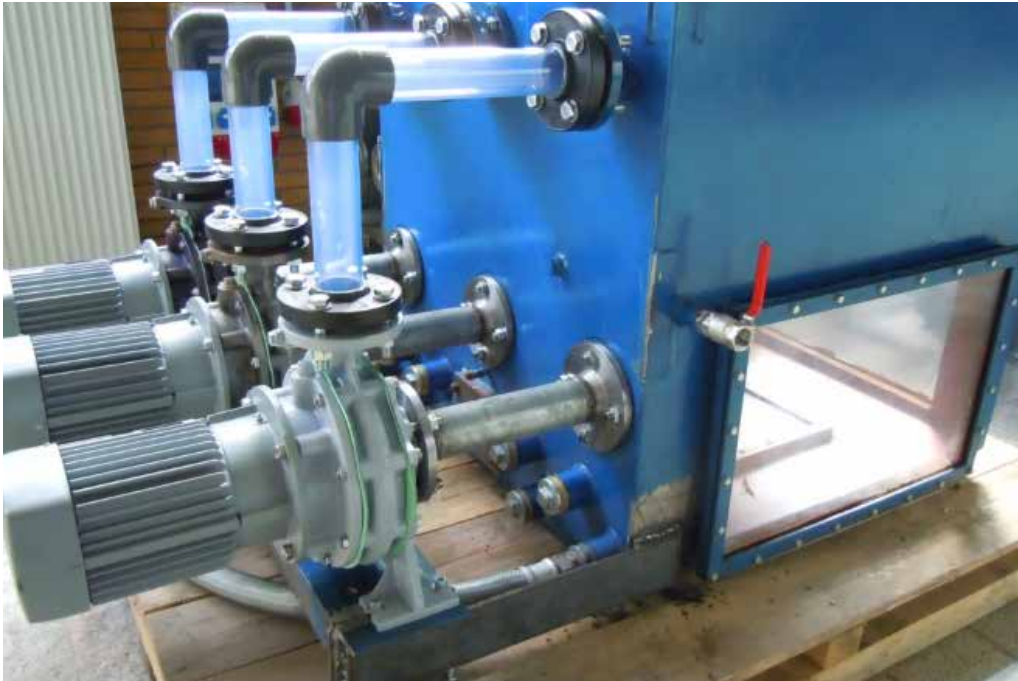


The developers carried out fretting tests to determine the wear resistance of the material to fretting corrosion. For this purpose, they used special sample chambers that can be flooded with liquid. The actual tests were then carried out with the objects exposed to various concentrations of chloride ions.

Before the initial pump tests were carried out, fatigue tests were performed on a cavitation test stand.

In the top part of the image in the photo below, the sonotrode immersed in a liquid is clearly visible. A high-frequency excitation is used to generate transient bubbles in the fluid. These implode as “cavitation bubbles”, subjecting the surface of the sample – as can be seen in the lower part of the image – to stress in the form of a fatigue test.





INITIAL PUMP TESTS

The first tests using real pumps proved particularly demanding. Testing went on for many weeks. During this time, the pumps operated under very harsh conditions.

A wide range of solids was mixed into the test media in order to obtain findings for numerous stressors. The coatings were subjected to ongoing checks during the entire test phase; abrasion was a key indicator for the developers here.

The striking effect of this meticulous approach can be seen from a comparison between a test object at the start of the research project (image A) and the end result (image B). The latter shows the test object after being subjected to a range of stressors, and represents the outcome of the development process for the HPC thick-film coating.



Starting point at the beginning of the project: after being exposed to a range of stressors, the test object shows significant corrosive changes.



End result after conclusion of the research work: The surface of the new HPC thick-film coating shines after being exposed to a range of stressors.

04

CONSTRUCTION & MARKET ACCESS

TECHNICAL AND DESIGN CHALLENGES

Rapid development of pump components suitable for coating

“The design requirement to implement complete coverage of our pump hydraulics with a thick-film coating meant that

**new casting moulds
were urgently required.**

Flow simulations and the inclusion of additive technologies were essential for the prompt implementation and availability of the new generation of pumps.”

**Felix Hees, Development Engineer,
at Herborner Pumpen from 2008 to 2022**



TECHNICAL TASK

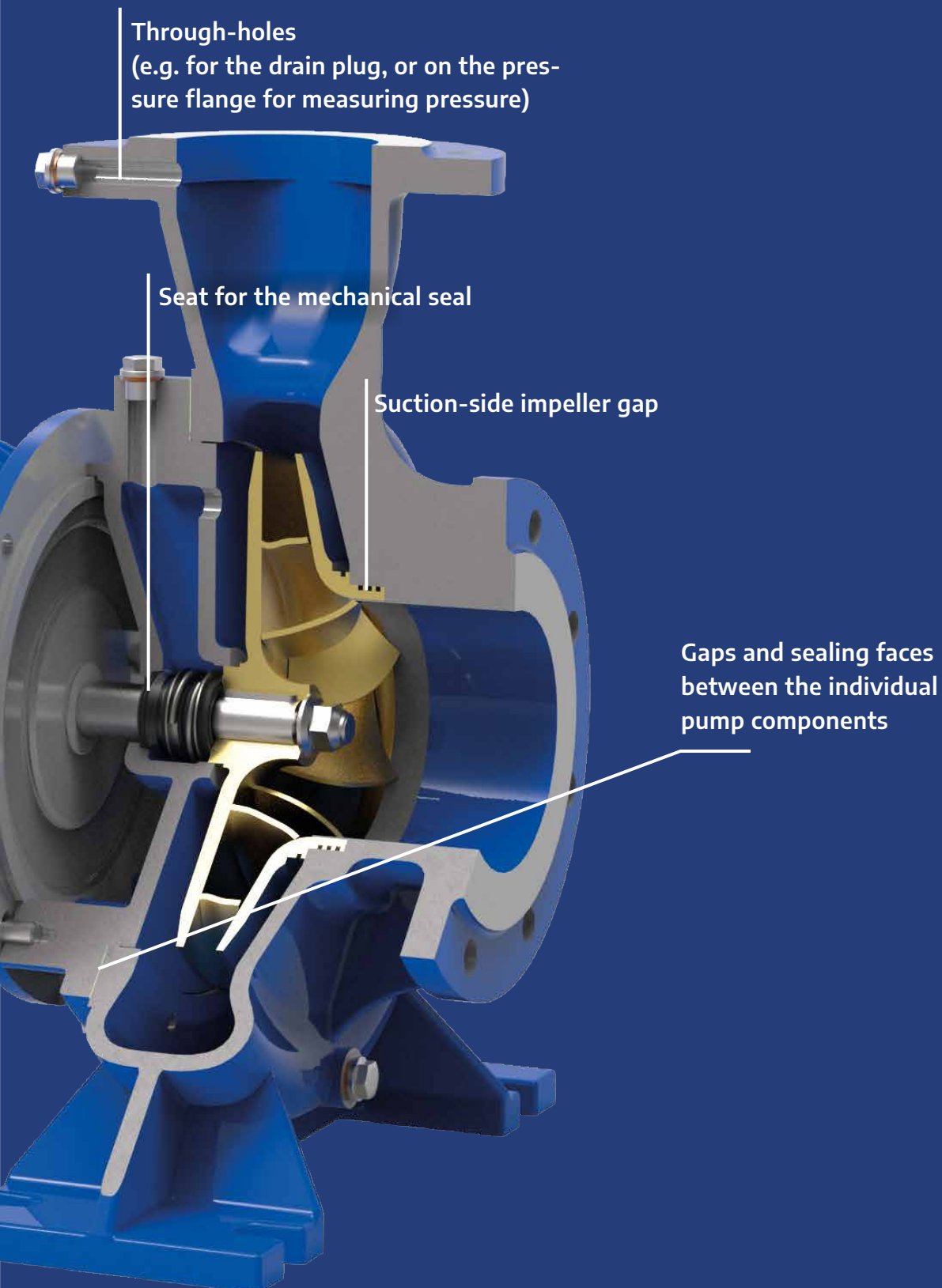
It was now down to the construction team to engineer the design details of the new hydraulics while fulfilling the premise of a demanding requirements profile including total coverage with the thick-film coating.

In addition to the design challenge that had to be overcome, the engineers also needed to work up solutions to accelerate the development process so that the 50-plus new hydraulic pump systems could benefit from a rapid market launch. The goal here was to minimise the time required between the calculation stage and release of the product, including the manufacture of new casting moulds.



DESIGN TASK

Considering the pump design in use at that time, it is clear at which points design interventions were required in order to create a thick-film coated pump.





RAPID MARKET LAUNCH

The engineers worked up innovative solutions for the new pumps on the basis of the TRIZ methodology. TRIZ is a Russian acronym for an approach that translates as “Theory of Inventive Problem Solving”. This is a methodology toolkit for dealing successfully and creatively with design challenges. The team used a combination of TRIZ methods to implement the complex design requirements of the new pumps.

In addition to the work using TRIZ, the business invested in new technologies that made it possible to accelerate the engineers’ work. The overall outcome was that the 50 new hydraulic pump systems could be developed to a market-ready state in a comparatively short time. The project was systematically implemented using Creo, a modern 3D CAD software that facilitates rapid product innovations and maps out all design and construction phases, including the completed product, within the software itself.

The maximum possible pump efficiencies are calculated on the basis of simulation software for numerical flow mechanics. The genre is known as CFD (computational fluid dynamics) software, and it enabled the construction team to predict the flow behaviour of liquids using calculation methods and thereby optimise the hydraulics. The resulting implications in design terms were beneficial for the rapid modelling of new casting moulds.

These were then produced in two machining centres using CAD/CAM technology. One of these two centres was a new acquisition and was instal-

led directly in the company’s own mould-making area to minimise distances. Additive manufacturing, by means of an additional purchase of 3D printers and 3D sand-printed parts, was also used in the prompt creation of impeller prototypes and mould components.

BENEFITS OF THE HPC THICK-FILM COATED PUMP HYDRAULICS

The results of the engineers' work can be seen in the possibilities created by such HPC thick-film coated pump hydraulics:

- No seizing due to corrosion in the centring seats between the individual cast parts, making disassembly straightforward when required.
- No corrosion in the O-ring seat of the mechanical seal caused by a leak beginning above it
- No seizing or caking due to corrosion in the impeller seat during prolonged downtime
- No more corrosion residues in other system components



TOTAL PROTECTION

Parts of the intermediate casing that come into contact with the respective medium are reliably protected against corrosive attacks.





“With the design solution of the HPC thick-film coated herborner series of pumps, we have fulfilled our customers’ requirements. We have created a generation of pumps that are in a whole new league when it comes to resource and energy efficiency.”

Wolfram Kuhn, Managing Director,
at Herborner Pumpen since 1989

05

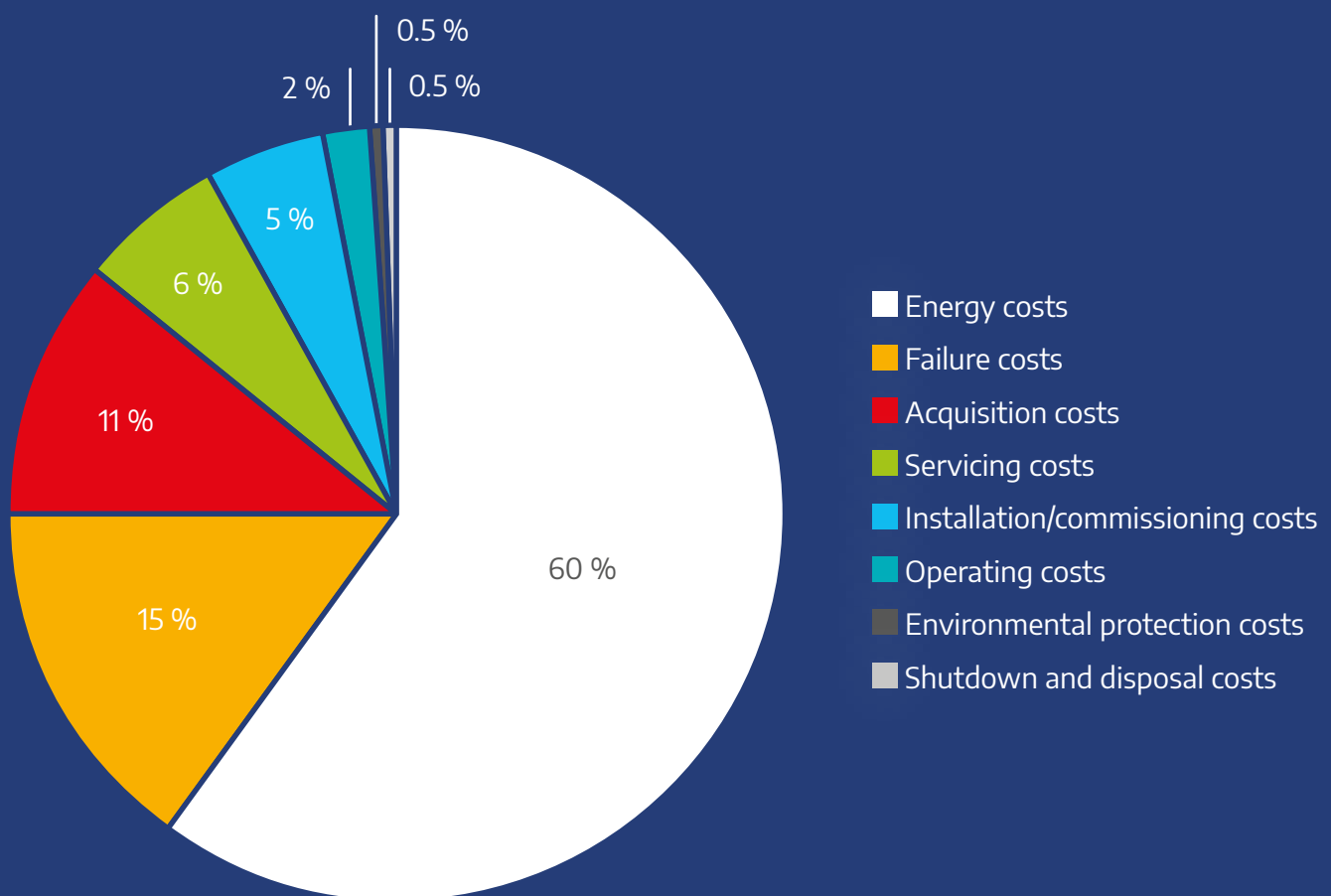
ENERGY-SAVING POTENTIAL OF HPC-COATED PUMPS

“Society’s goal of minimising energy consumption

is always an important consideration in the development of our products. The aim is to make the life cycle costs as low as possible for our customers.”

**Susanne Jung, Sales Management / Marketing
and authorised signatory,
at Herborner Pumpen since 1989**



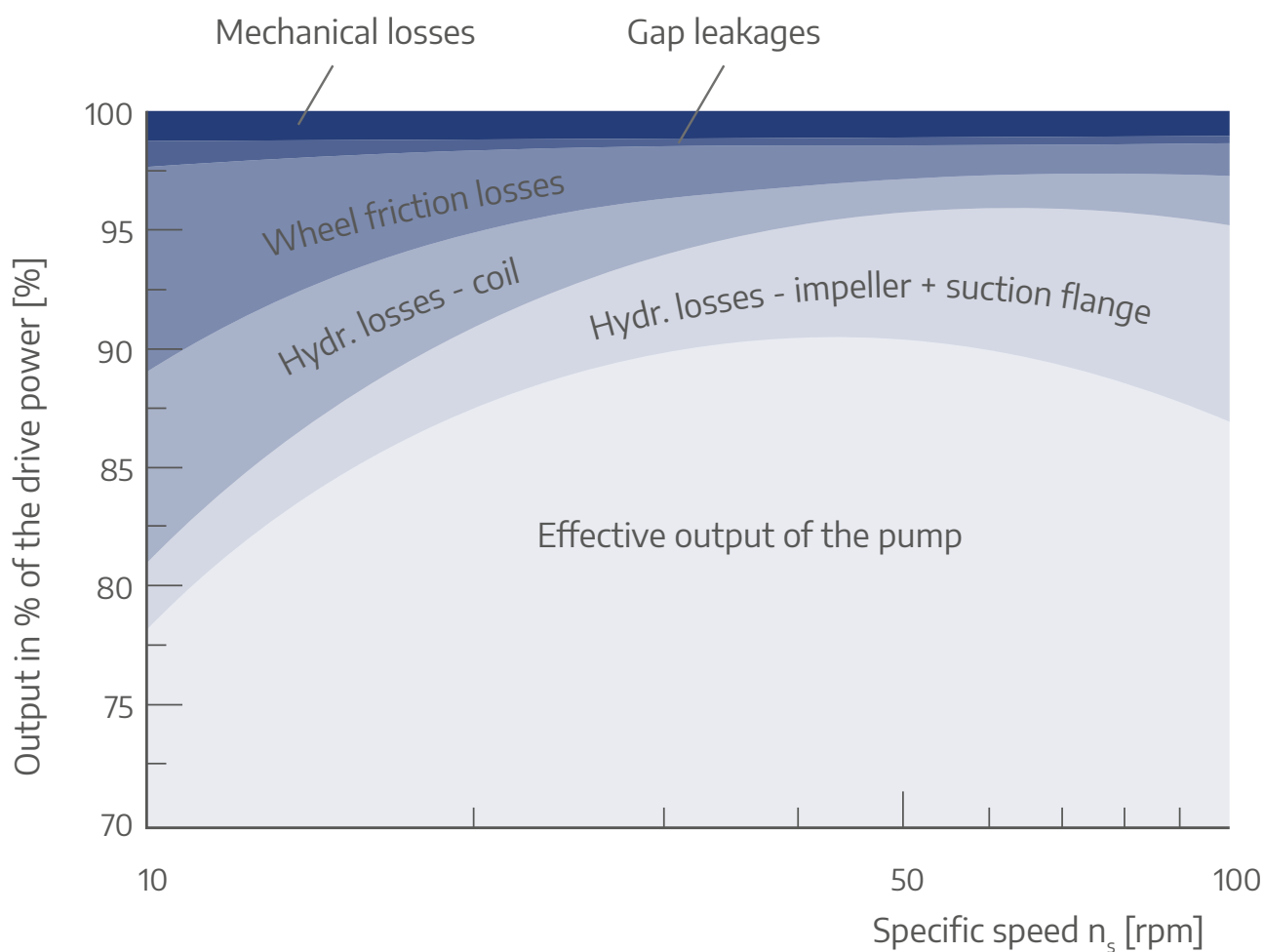


LIFE CYCLE COSTS OF A CENTRIFUGAL PUMP

A responsible and economical attitude to the use of energy is the watchword of our times. The impact of using energy-efficient pumps can be illustrated by means of an analysis of the life cycle costs of centrifugal pumps.

- Calculated over the lifetime of a pump, 70 per cent of the costs that arise can be attributed to the area of energy.
- Just 12 per cent of the life cycle costs are due to the purchase price of the pumps.

From this we can conclude that, when developing a modern generation of pumps, energy efficiency should be at the centre of the considerations.



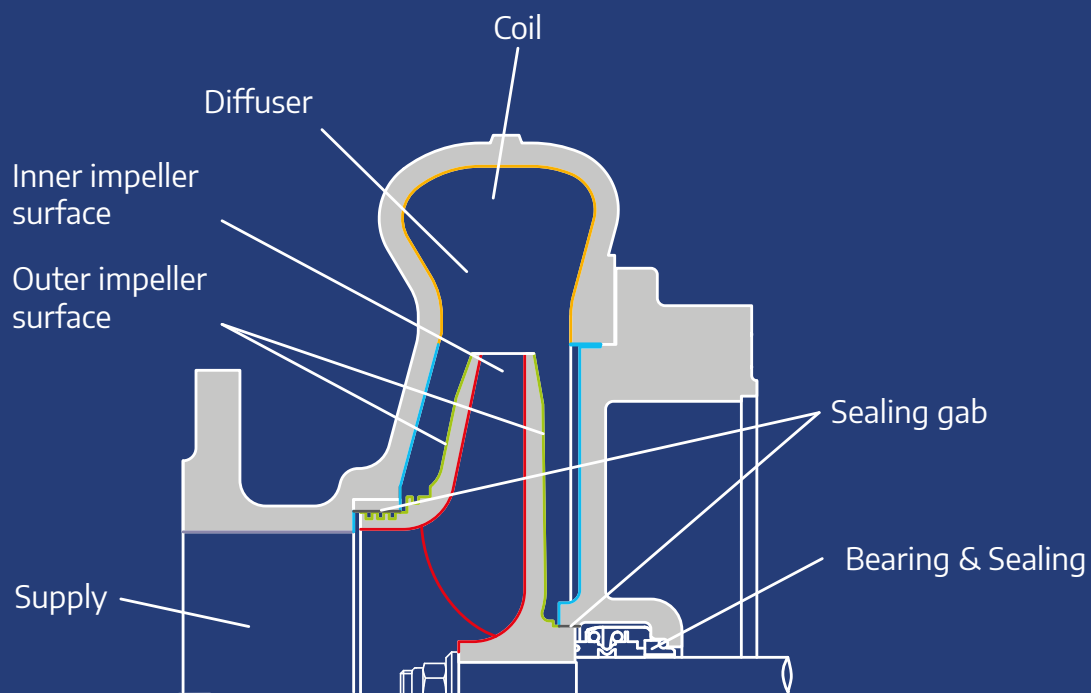
OUTPUT SUMMARY OF A CENTRIFUGAL PUMP

In light of this, it is worth taking a look at the output summary of a centrifugal pump. This shows that, depending on the size and design of the pump (and, accordingly, on the specific speed n_s), it is possible to increase the effective output if the losses that arise as a result can be reduced.

EFFECTS OF THE DESIGN ON THE EFFICIENCY

The impact that smooth component surfaces have on the efficiency of centrifugal pumps was revealed in 2001 as part of a study by the European Commission (Study on improving the energy efficiency of pumps). The study differentiated between the following types of loss:

- Hydraulic losses:
 - Friction losses
 - Impeller and suction flange
 - Coil
- Volumetric losses (gap leakages)
- Mechanical losses



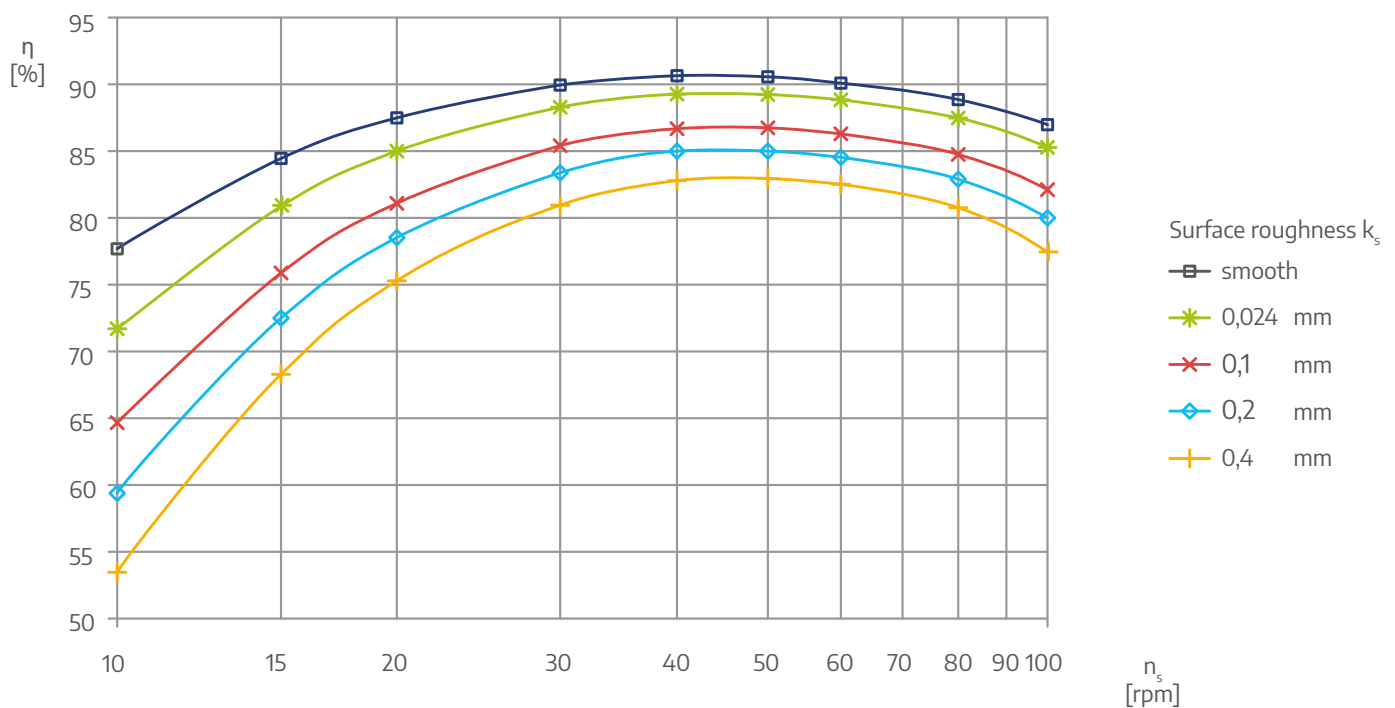
(Based on CETIM, Reeves, David T., NESA, Technical University Darmstadt (2001). STUDY ON IMPROVING THE ENERGY EFFICIENCY OF PUMPS, European Commission February 2001, p. 37)

SURFACES THAT AFFECT EFFICIENCY

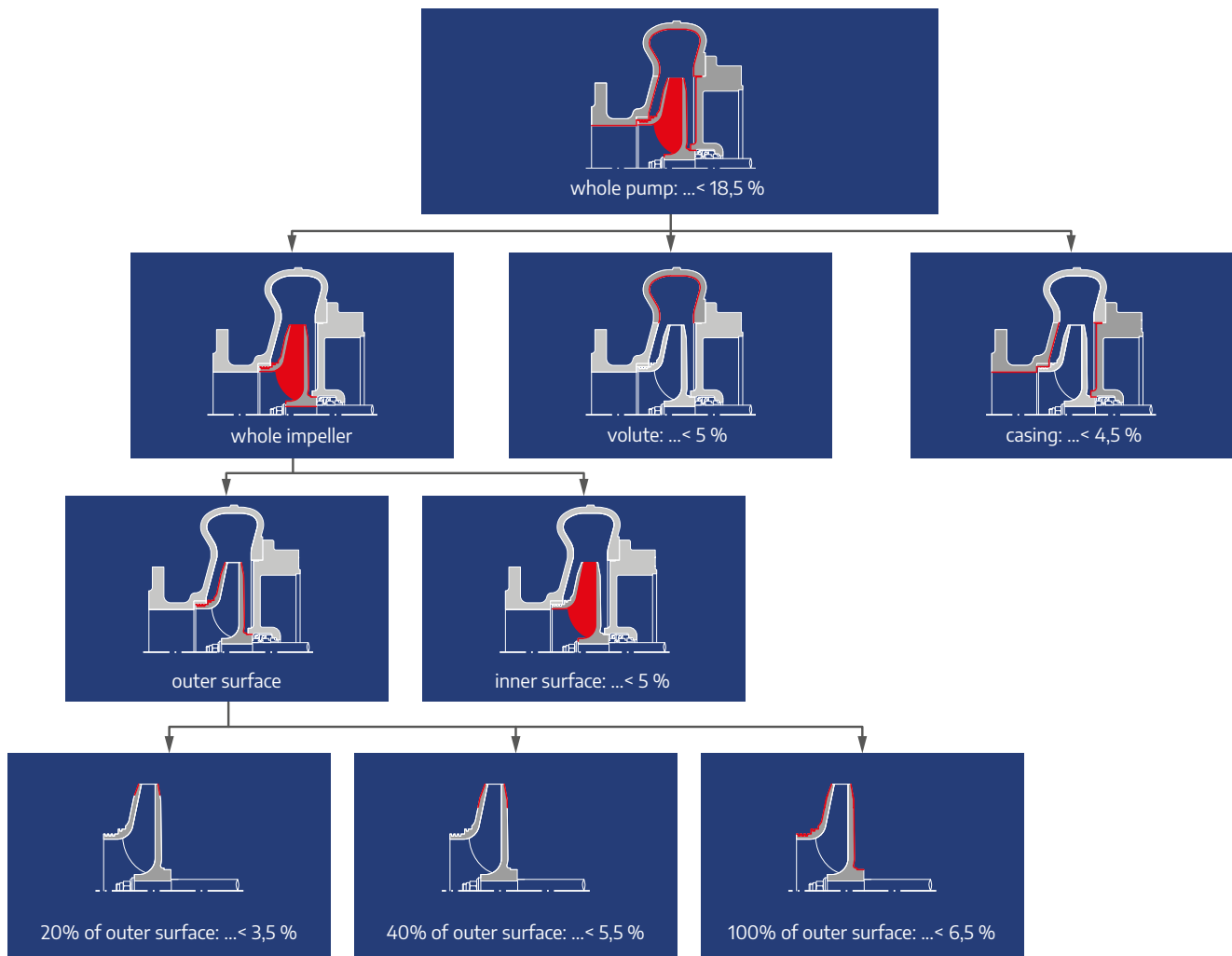
The study defined particular surfaces of the pump interior and determined the associated savings potential.

IMPACT OF THE SURFACE ROUGHNESS

The results from the study document how efficiency changes with different degrees of surface roughness. The smoother the surface structure of the pumps, the greater the efficiency of the centrifugal pumps turned out to be.



(Based on CETIM, Reeves, David T., NESA, Technical University Darmstadt (2001). STUDY ON IMPROVING THE ENERGY EFFICIENCY OF PUMPS, European Commission February 2001, p. 38)

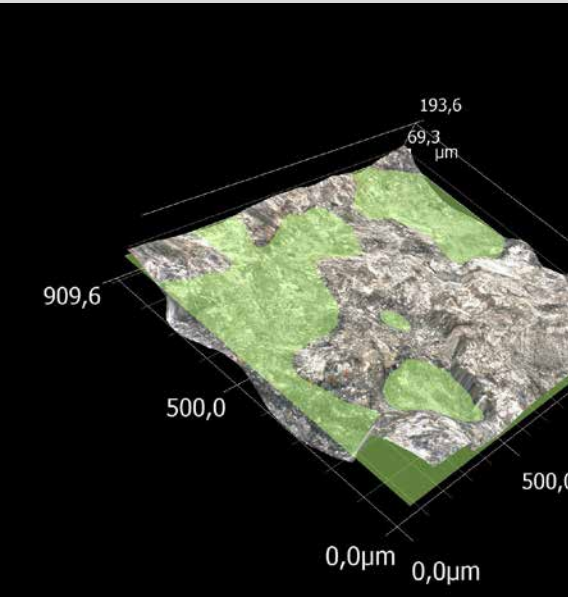
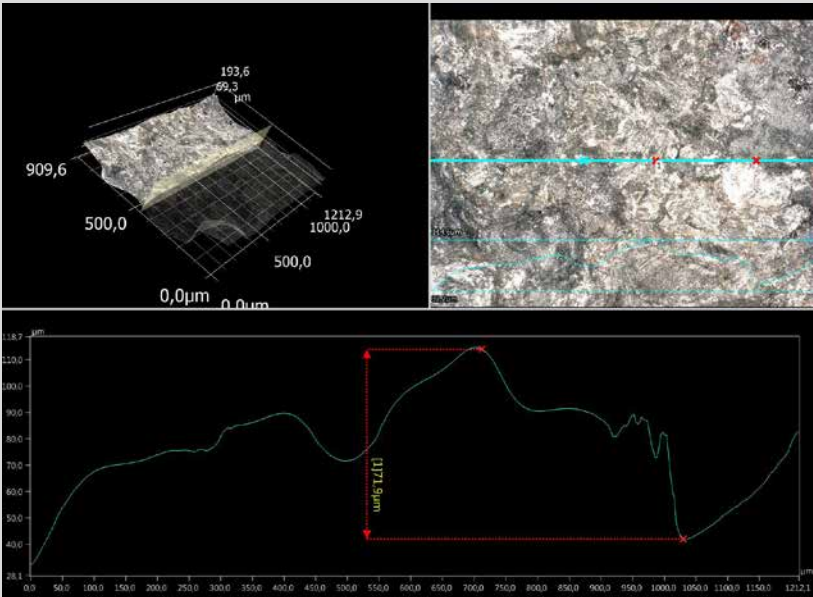
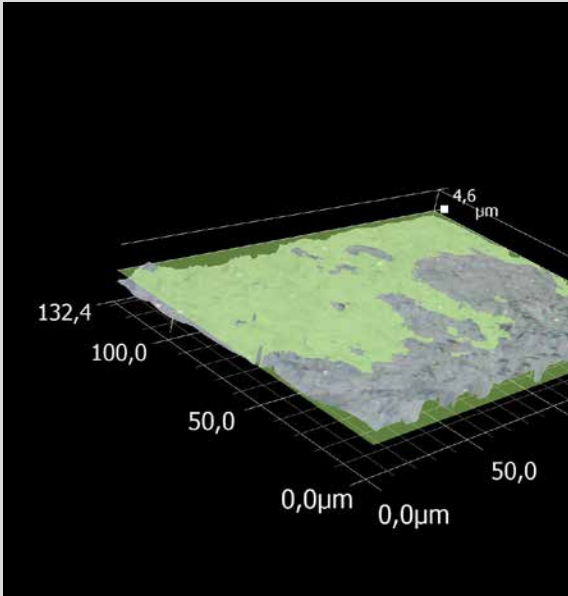
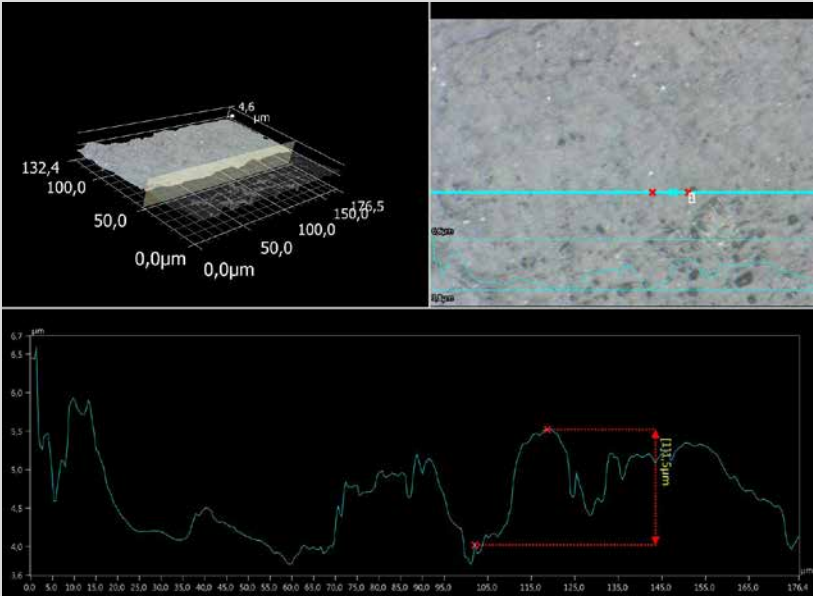


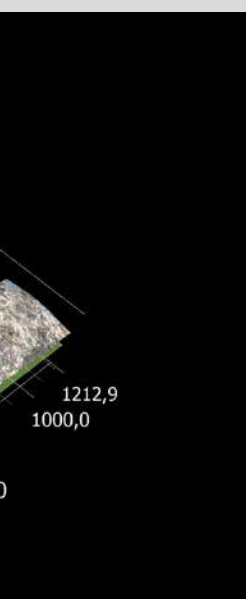
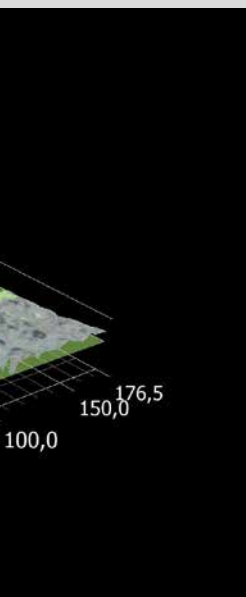
(Based on CETIM, Reeves, David T., NESA, Technical University Darmstadt (2001). STUDY ON IMPROVING THE ENERGY EFFICIENCY OF PUMPS, European Commission February 2001, p. 41)

MAXIMUM EFFICIENCY POTENTIAL

Using the example of a medium-sized pump (180 m³/h), the study (Study on improving the energy efficiency of pumps) quantified the efficiency potential of individual components and entire pump zones. Taken together, the efficiency potential of the pump as a whole amounted to as much as 18.5 per cent.

EFFECT OF THE COATING





The effect a smooth thick-film coating has on the surface structure was visualised by Herborner Pumpen with the aid of a special microscope. The upper set of images show the roughness of HPC-coated cast parts. In comparison, the lower set of images show a corresponding cast part without this coating. The effect of the HPC thick-film coating in improving the surface smoothness can clearly be seen.

INCREASE IN ENERGY EFFICIENCY

Carrying out their own comparative measurements within the company, Herborner Pumpen reviewed the scientific findings of the 2001 “Study on improving the energy efficiency of pumps” using coated and uncoated pump hydraulics.

The outcome verified the conclusions of the study initiated by the European Union. The internal measurements confirmed the theoretical potential for optimisation in relation to smooth surfaces in pump hydraulics. The new her-

borner generation of pumps, with their smooth surfaces courtesy of the HPC thick-film coating, demonstrated efficiency improvements of between three and 15 per cent on the test stand.

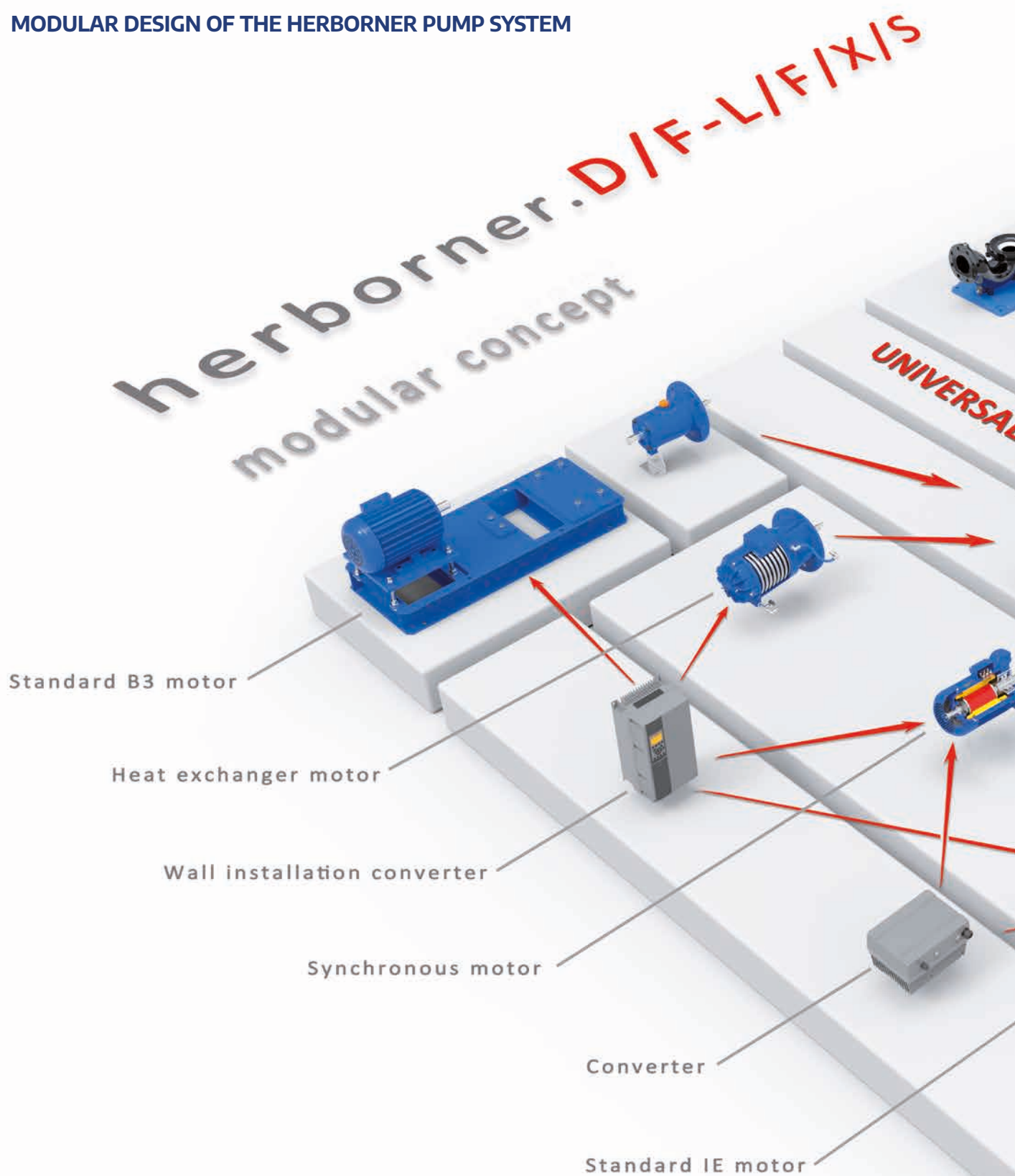


INCREASE IN RESOURCE EFFICIENCY

In addition to the increase in energy efficiency, completely covering the hydraulics with the HPC thick-film coating had a striking impact on resource efficiency. The results of the investigation show that, since 2012, there has been no further need for superior pump material in pool water with lower concentrations (up to 1000 mg/l chloride ions). The BLACKEDITION version with HPCplus coating is even resistant to saltwater at concentrations of up to 30,000 mg/l chloride ions. The result is to minimise the situations in which bronze and stainless steel pumps are needed. These now only play a role in exceptional cases, and stainless steel pool attractions are no longer exposed to corrosion products. The same applies to corrosion damage to the pump components, the occurrence of which is close to zero.



MODULAR DESIGN OF THE HERBORNER PUMP SYSTEM





“With the HPC thick-film coated pumps, we have made a major contribution to energy and resource efficiency, and our customers appreciate this. Now, 90 per cent of the pure-water pumps we sell are coated.”

Susanne Jung,
Sales Management / Marketing and authorised signatory,
at Herborner Pumpen since 1989

06

HERBORNER.NEO – THE TECHNICAL BENCHMARK

**“For a few years now,
I’ve been driven by the
idea of building the most
energy-efficient pumps
ever.**

Thanks to the digital expertise and advanced coating options available in our company, this is now possible. This makes me proud of our company and offers our customers the maximum opportunity to save energy and resources.”

**Sascha Korupp, Technical Director and authorised
signatory, at Herborner Pumpen since 1991**

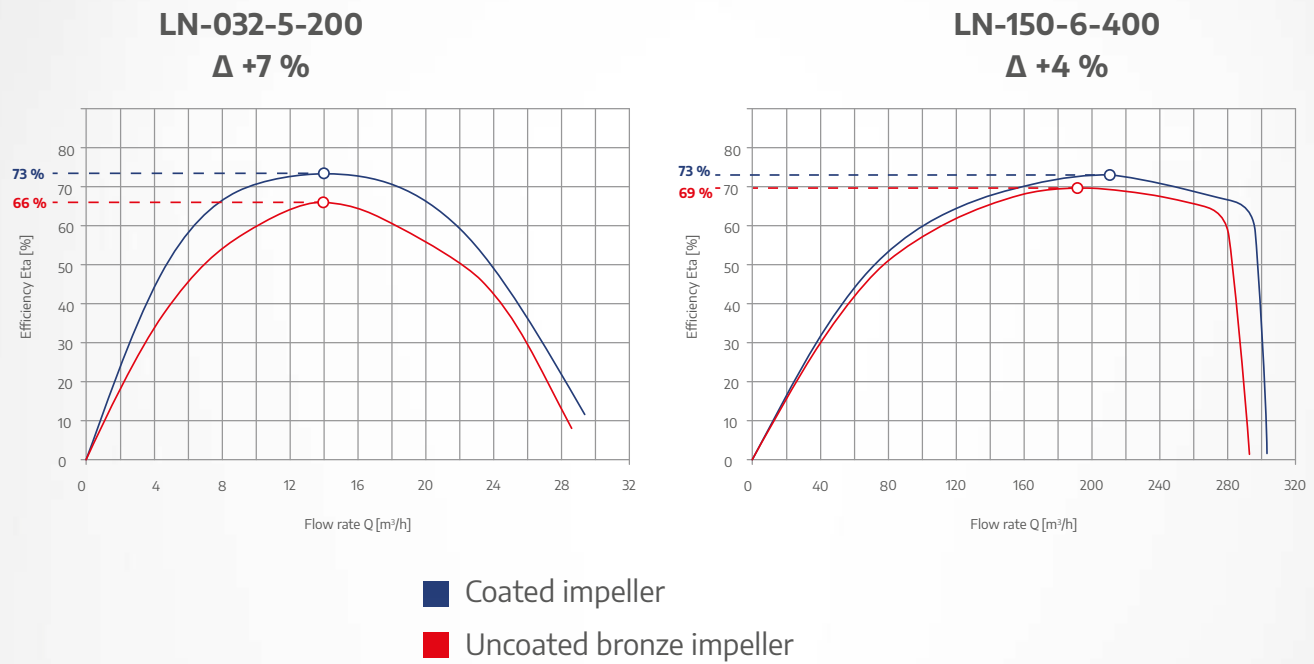


ENERGY AND RESOURCE EFFICIENCY DOWN TO THE FINE DETAILS

From the very beginning, the developers were faced with the challenge of raising the energy and resource efficiency of the new generation of pumps to a previously unimagined level. However, for the herborner series of coated pumps, these efforts were far from over. Instead, the experts set the goal of optimising the energy consumption of the pump hydraulics even further. This necessitated an enhanced system analysis. In terms of the highest achievable energy efficiency, the engineers defined a set of important conditions:

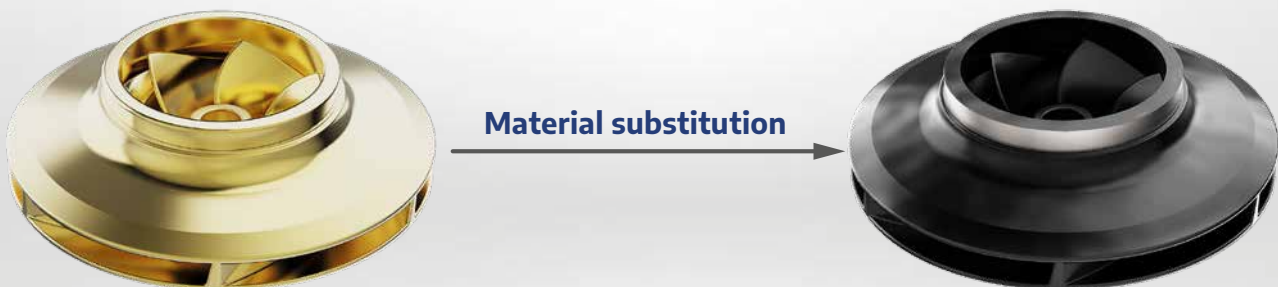
- With their experience-based knowledge of the benefit in energy terms of coated pumps, the experts concluded that the as yet uncoated impeller should also be provided with a coating. The consequence: material savings of bronze, the resource previously used for this. That means that, as well as increasing efficiency, the coating of the impeller counts towards the resource efficiency of the herborner pump series, and is therefore also a key factor in avoiding the use of so-called “conflict minerals” which increasingly plays a role in the design of politically-aware purchasing requirements.
- To achieve maximum energy efficiency, centrifugal pumps fundamentally need the entire impeller diameter for which the hydraulics are calculated. However, due to other duty points, this cannot be machined using the corresponding equipment as this would impair the efficiency.
- The use of the largest impeller diameter to operate the pump within the physical capacity of the pump hydraulics, i.e. within the performance map of the pump, requires the connection of a frequency converter for speed control.
- The inclusion of frequency converters enables the use of what are known as synchronous motors from the highest efficiency class IE5 (ultra-premium efficiency class).
- The use of speed-controlled pumps to actuate duty points in a performance map – instead of on individual pump characteristic curves like usual – requires a new pump selection program.

The energy benefit of coated pump impellers is clear when you compare the measurement results for coated and uncoated impellers against one another.



Aluminium multi-alloy bronze

GG / GGG + HPCplus coating



The use of impellers with full diameter and HPCplus coating forms the basis of the new pump coating.

To achieve the development goals in terms of energy and resource efficiency, a joint ring – known as an L-section ring – is required at the design level for the new generation of pumps. This is firmly mounted on the neck of the impeller. Made from corrosion-resistant material, the high-efficiency ring reduces the gap leakages on the suction side, thereby reliably and effectively protecting the fit surface in the sealing gap.



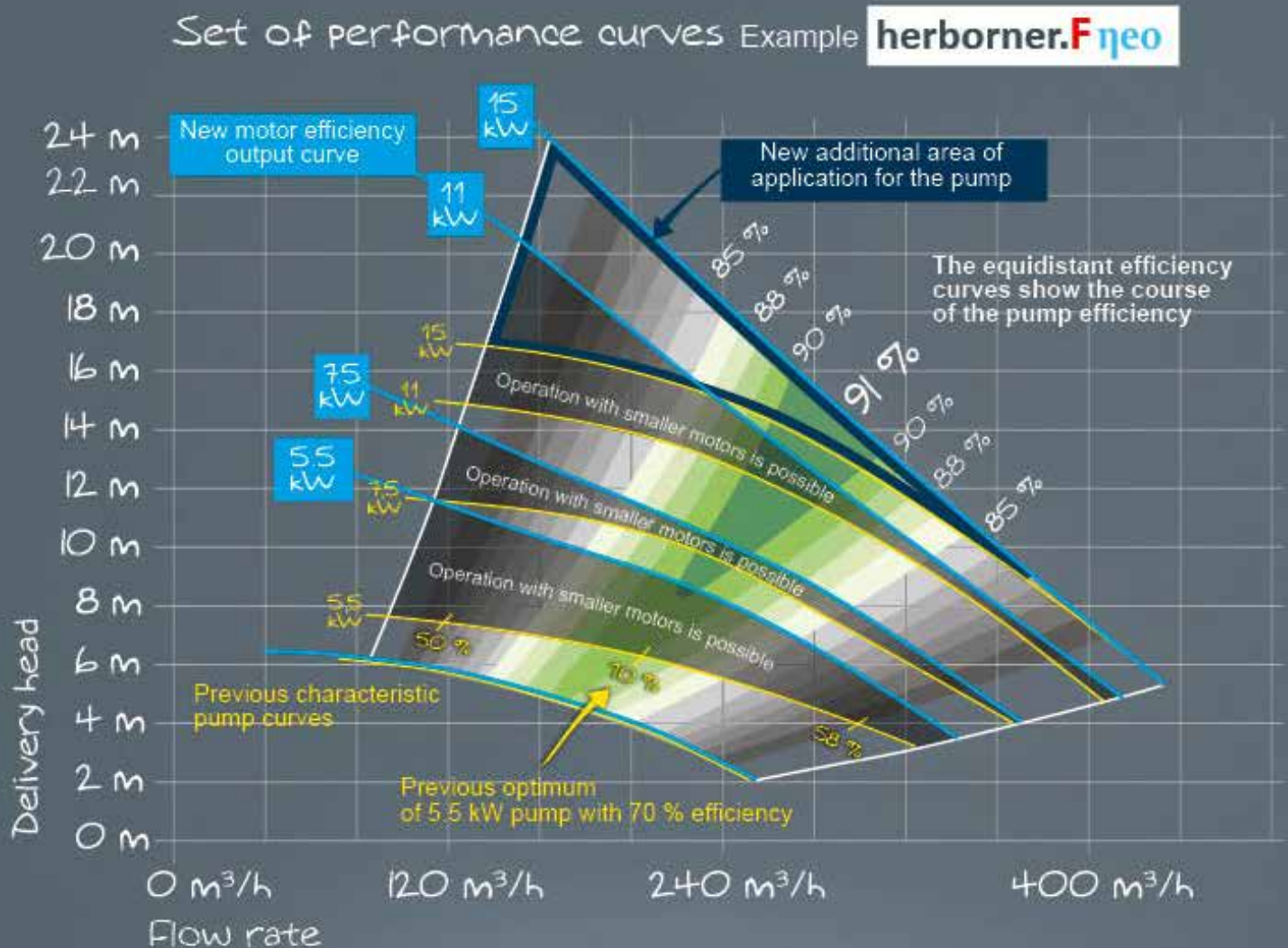
HERBORNER.NEO – MAXIMUM SYSTEM EFFICIENCY

The precision and effectiveness of the herborner.neo, down to the finest detail, lead to previously unknown energy and resource efficiency. A wealth of individual optimisation measures ensures that customers will benefit from the maximum possible system efficiency.

- Pump casing, intermediate casing and cover with smooth HPC thick-film coating (inside and outside)
- Impeller protector
- For gap minimisation HPCplus-coated impeller with full impeller diameter
- High-quality stainless steel shaft with reinforced, relubricatable ball bearings
- Ultra-premium efficiency motor (IE5) with frequency converter

With all the technical optimisations of the herborner.neo, our services were also improved. The optimum pump hydraulics for the respective application can thus be selected within the new pump performance maps using a customer-oriented pump selection program developed by our in-house software department using the designation PAHN AI.





POTENTIAL OF THE HERBORNER.NEO

- The efficiency of comparable hydraulics with machined impeller diameters is 20 per cent lower (yellow lines).
- The utilisation of the available motor power as a result of the frequency conversion makes it possible to use smaller drives.
- The newly created pump performance map means that additional operating ranges of the pump can be achieved above the rated speed range of the motors.

POTENTIAL OF THE HERBORNER.NEO

For those responsible at Herborner Pumpen, the energy and resource efficiency of the herborner.neo construction series is completely beyond dispute. When it came to the lasting impact of the new generation of pumps, however, the makers in Hessen were hard-pressed to quantify it. That is why the company management made the decision, three years after market launch, to find out what energy-saving potential had been realised by the herborner.neo units already sold.



“Pumps from the herborner.neo construction series offer enormous savings potential that we present to customers through calculations. It is self-evident that, with longer pump running times and the life-time of a pump from Herborner, customers will turn to these energy-efficient products to unlock the maximum savings potential.”

Roger Discher, Sales Representative,
at Herborner Pumpen since 2002

MISSION

We design and manufacture the world's most innovative pumps with the highest quality to make our clients' operations more effective, eco-friendly and profitable!



www.herborner-pumpen.com