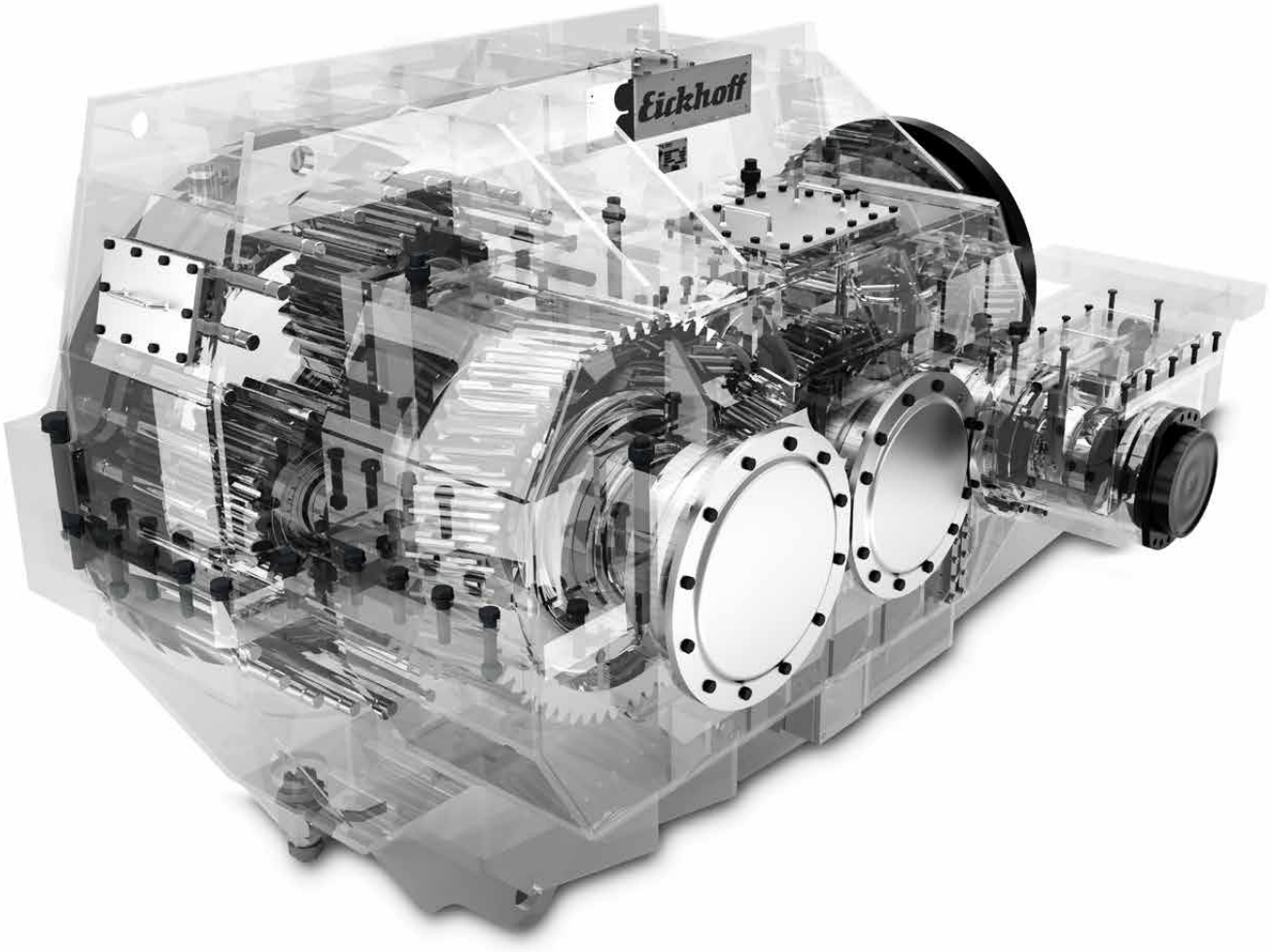
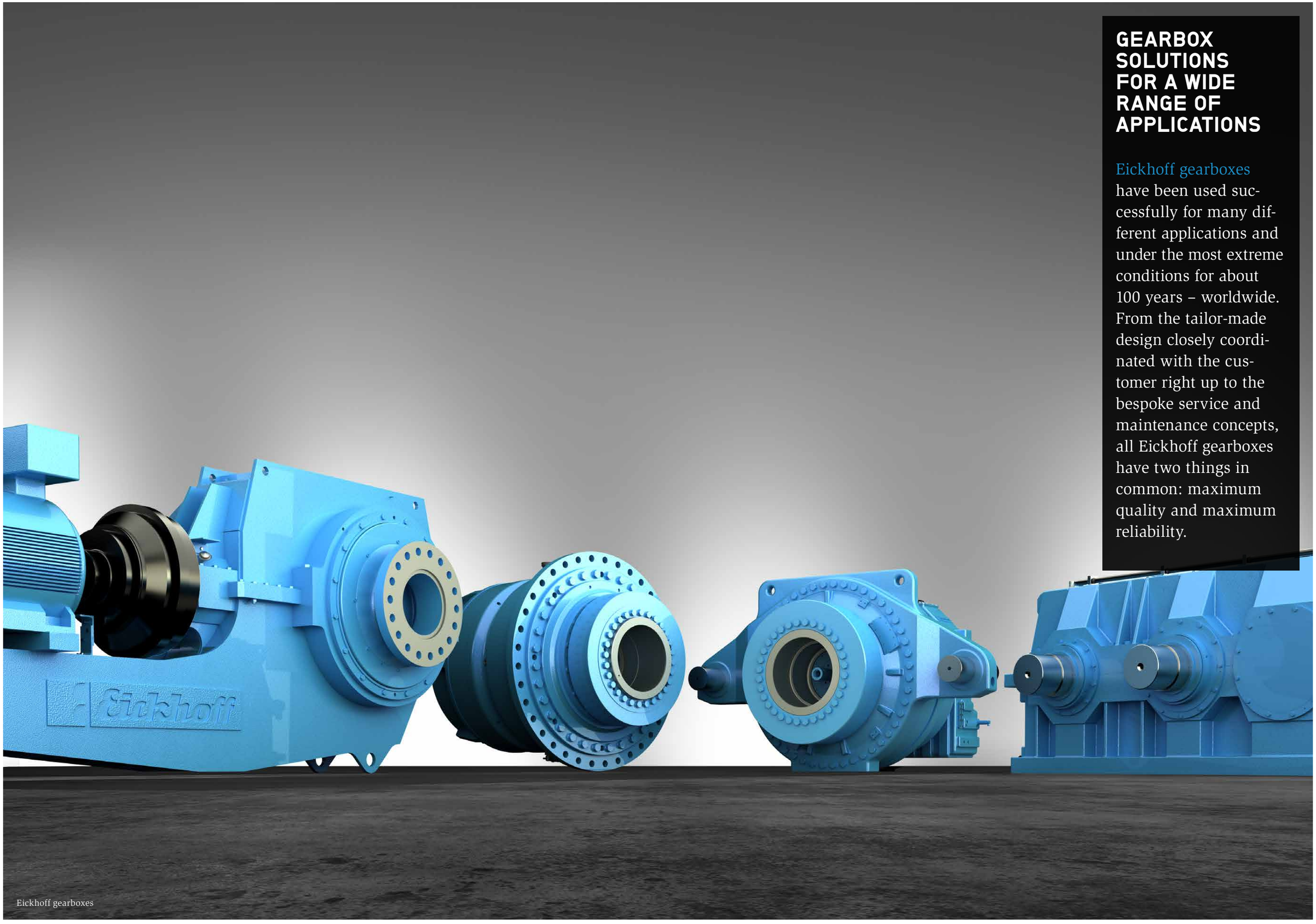
CONTROLLING LARGE FORCES EFFICIENTLY



Eickhoff
ANTRIEBSTECHNIK

GEARBOX SOLUTIONS FOR A WIDE RANGE OF APPLICATIONS

Eickhoff gearboxes have been used successfully for many different applications and under the most extreme conditions for about 100 years – worldwide. From the tailor-made design closely coordinated with the customer right up to the bespoke service and maintenance concepts, all Eickhoff gearboxes have two things in common: maximum quality and maximum reliability.



Eickhoff gearboxes

CONTROLLING LARGE FORCES EFFICIENTLY WITH ROBUST GEARBOXES

You need powerful, hard-wearing gearboxes to move heavy loads. Therefore, Eickhoff gearboxes are especially popular for applications in clinker mills in the cement industry, stretch levelling plants in the steel industry, for bucket wheel excavators in the mining of raw materials and for onshore wind turbines.

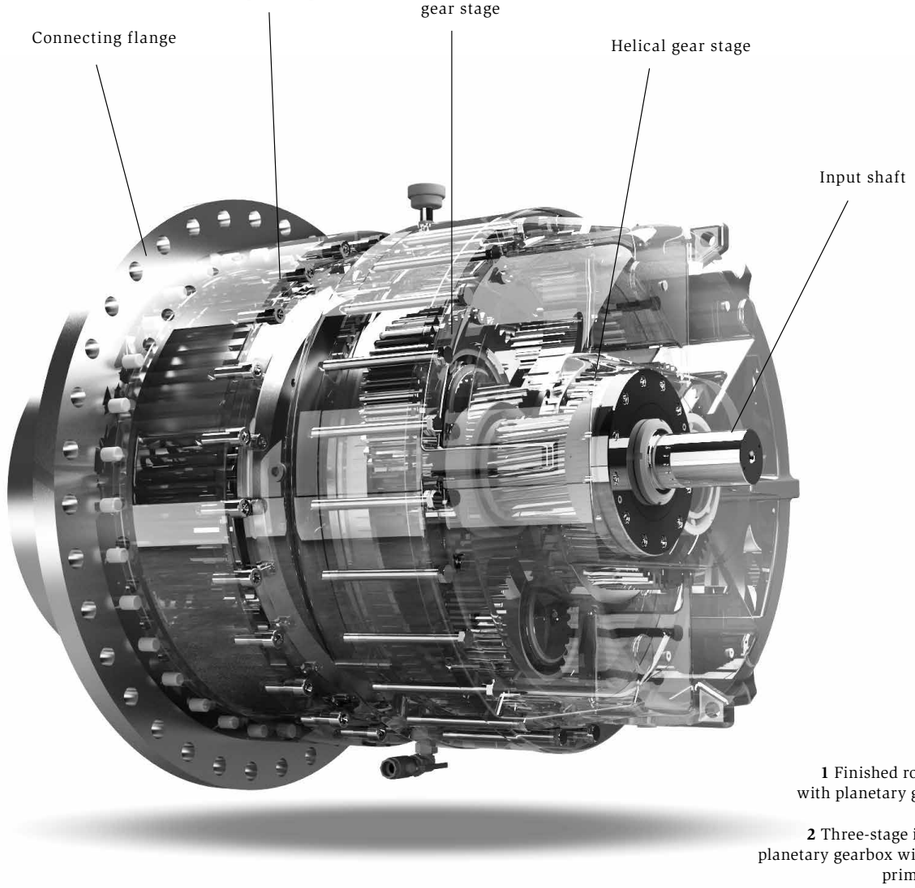
Inside our gearboxes, loads are distributed over several planetary gears for maximum power density

THE HEART OF EVERY DRIVE

The story of Eickhoff gearboxes has begun underground. Right from the very start, we developed compact gearboxes for the really tough operating conditions to which our mining equipment was exposed. Ever higher power densities but at the same time maximum operational safety was the challenge, especially for large planetary gearboxes. Over the years, Eickhoff engineers transferred this experience to other sectors, right up to the market of the future: wind turbine gearboxes. We even set up an independent subsidiary to serve the needs of this market: Eickhoff Wind Power GmbH.

Flexible modification of gearboxes to match individual customer requirements is an established principle at Eickhoff, even during the draft design phase. That enables us to reduce the interfaces – something our customers regard as very beneficial. In the next step our engineers configure the gearbox using our own design software. The good durability, reliability and performance of our gearboxes is ensured through the selection of the materials and the associated quality control measures, backed up by the special expertise of the Eickhoff foundry and our hardening and machining departments.

Our production employs computer-assisted high-tech plant; flexible, high-precision CNC machining centres coupled with CAD, CAM, CAQ and ERP systems guarantee effective and efficient workflows. After delivery, our service teams carry out maintenance on your premises to ensure trouble-free operation. On request, we can offer our customers complete overhauls as an additional service.



1 Finished roller press with planetary gearboxes

2 Three-stage industrial planetary gearbox with helical primary stage

Milestones

- **1920s:** Gearbox technology already installed in the first machines for coal-mining applications
- **1950s:** Gearboxes for underground applications, e.g. chain conveyors
- **1970s:** First gearboxes for customers outside the mining industry
- **1990:** First wind turbine gearbox for 50 kW output
- **1994:** First contract for serial production of wind turbine gearboxes for 600 kW output
- **1998:** First gearboxes for outputs exceeding 1 MW
- **1999:** Start of production of 1.5 MW gearboxes
- **2000:** First 2.5 MW gearboxes are dispatched
- **2001:** First 3.6 MW gearbox for offshore applications
- **2002:** Commissioning of a 5 MW test bench
- **2003:** Development of serial gearboxes for high loads
- **2004:** EGOMS (Eickhoff Gearbox Online Motoring System) certified by Allianz Zentrum für Technik
- **2006:** Environmental test chamber with rated load testing capability
- **2008:** Annual production of wind turbine gearboxes exceeds 1,000 MW for the first time
- **2009:** Eickhoff Wind Power production plant goes into operation
- **2011:** Development of planetary gearboxes for a new cement clinker mill concept
- **2016:** Track record reached: 16,000 MW for wind turbine gearboxes

SERVICE: QUALITY AND SPEED

Our service network with more than 100 specialists in eight service centres worldwide offers the best conditions for optimum gearbox maintenance. All European sites where our gearboxes are in operation are quickly reached from our headquarters in Bochum in the west of Germany. Customers with plants outside Europe are supported at all times by our subsidiaries through local representatives.

Comprehensive, competent support is what distinguishes Eickhoff service teams. That is why your first port of call when it comes to service is our engineering office. Our experienced specialists listen to your enquiries and initiate the necessary measures without delay.

Regardless of manufacturer, our service technicians carry out videoscope inspections and status assessments on site and produce meaningful service reports for the most diverse gearbox types. One method we employe is EGOMS, our structure-borne sound and vibration measurement system, which allows both mobile and stationary service crews to investigate gearboxes online. This analysis can be used by our service teams to plan tailored measures that are then carried out in agreement with the customer.

Working closely together with our customers, we develop smart solutions for the trouble-free operation of their gearboxes. With 100 years of experience, we are of course able to deal with the products of many other manufacturers as well.

Faulty gearboxes are repaired in our workshop. The Eickhoff quality management system applies to repairs to the same extent as it does to new gearboxes and guarantees the quality of all spare and repaired parts. Gearbox assembly and also testing under load are carried out within the serial production procedures. Following repairs, a gearbox therefore complies with the current state of the art and is covered by an appropriate Eickhoff warranty.

The high Eickhoff quality standards also apply to original replacement parts. We manufacture many parts ourselves and that means we are in the position of being able to supply parts at short notice for those not stocked.

Eickhoff, working in close partnerships with its customers, can therefore offer bespoke service solutions in order to achieve the best possible plant availability. Those solutions include delivery times for replacement gearboxes which are geared exactly to a customer's requirements, 24/7 support, accurate planning and stocking of spare parts, damage reports, fixed-price agreements and much more besides.

1 Preparations for further use

2 Measuring to establish reuse potential

SUCCESS STORY: NEW WEIR DRIVES ON THE NECKAR

We have completed many hydraulic steelwork projects, which makes us a capable partner when it comes to providing drive solutions to customer specification. In the spring of 2007 we were awarded a contract by Germany's Federal Waterways & Shipping Authority for a large-scale overhaul of the drives for the weir at Untertürkheim in Stuttgart. The tender covered eight new drives for raising and lowering the new gates.

Untertürkheim weir dates from 1923, has four openings and is located downstream of Stuttgart's inland port on the River Neckar. It includes a road bridge that links the Stuttgart suburbs of Wangen and Untertürkheim. A breakdown in one of the old drives in 1998 caused one of the gates to jam. The head water level could no longer be guaranteed; water flowed away over the jammed gate and made it necessary to clear the inland port completely.

The refurbishment concept involved draining two channels in each of the three construction phases in order to renew the intermediate piers and weir plant buildings. One left- and one right-hand version of the gearbox had to be accommodated in each building. Lightweight steel was used for the new weir plant buildings with their stylised ship's bow architecture. However, the architect's design resulted in the space for the new gearbox units being severely restricted. In addition, the axis for the chain sprocket wheel was fixed. Our engineers proposed a solution with a five-stage helical worm gearbox in order to comply with the times and forces associated with raising and lowering the gates. Power transmission in the gearbox is via one static, self-locking worm gear stage and four helical gear stages. The search for the solution resulted in the gearbox with type code EWSZ-750. Taking into account the technical requirements and the limited space, a gearbox was designed which half enclosed the chain sprocket wheel so that an access space of 800 mm wide was still possible between the left- and right-hand gearboxes.

The gearbox casing consists of two parts, each made from a high-quality Meehanite casting. This material is characterised by its higher strength and lower section sensitivity. The top and bottom parts of the housing are identical, i.e. the left- and right-hand versions can be fabricated with one model. Reducing the differences results in cost- and time-savings in production, and therefore benefits for our customers. Our service crews were on hand to ensure that our gearbox units were installed on time.

The festive inauguration of this ambitious project took place on 11th June 2013. So the refurbished weir at Untertürkheim not only links two Stuttgart suburbs, but also guarantees – through our drives – that the head water level can be controlled and floodwaters discharged for the coming decades as well.

Untertürkheim weir

No. of gearboxes:	8 drive units
Gearbox weight:	5.6 t
Transmission ratio:	7,526 : 1
Direction of rotation:	clockwise/ counterclockwise
Gearbox width:	1,132,5 mm
Gearbox length:	4,178 mm
Oil capacity:	160 l

1 Rebuilding works at Untertürkheim weir: removal of old, open gearboxes and installation of new weir drives

2 Installing a weir drive in the plant building

PLANETARY GEARBOXES

Eickhoff Antriebstechnik GmbH, a leading company in gearing technology, has a range of industrial planetary gearboxes that ensure innovative solutions to match the individual requirements of customers. Our tried-and-tested planetary gearboxes, distinguished by their compactness, ease of servicing and power density, are available in eight different types and 19 different sizes. The optimised toothing combined with our high-quality materials help ensure a quiet-running, fatigue-resistant gearbox design with a long service life.

Key quality factors are the production of the gearbox components on modern machinery in our own plant and the production of the castings in our own foundry. Our planetary gearboxes are available with helical, bevel or worm gear primary stage and cover rated torques from 220.5 to 7280 kNm. Other rated torques are available on request to match the many different applications where our gearboxes are used.

Our customers can therefore choose from a first-class range of industrial planetary gearboxes with many possible options. Our encouragement is the faith placed in us by our customers due to our many years of experience in the development and production of planetary gearboxes.

- **Long-lasting and robust with high safety margins**
- **Versatile due to designs to match the applications**

1 CPNHX-244 gearbox

Technical data

No. of stages
2 – 5

Sizes
19

Rated output torque
220 – 7,280 kNm

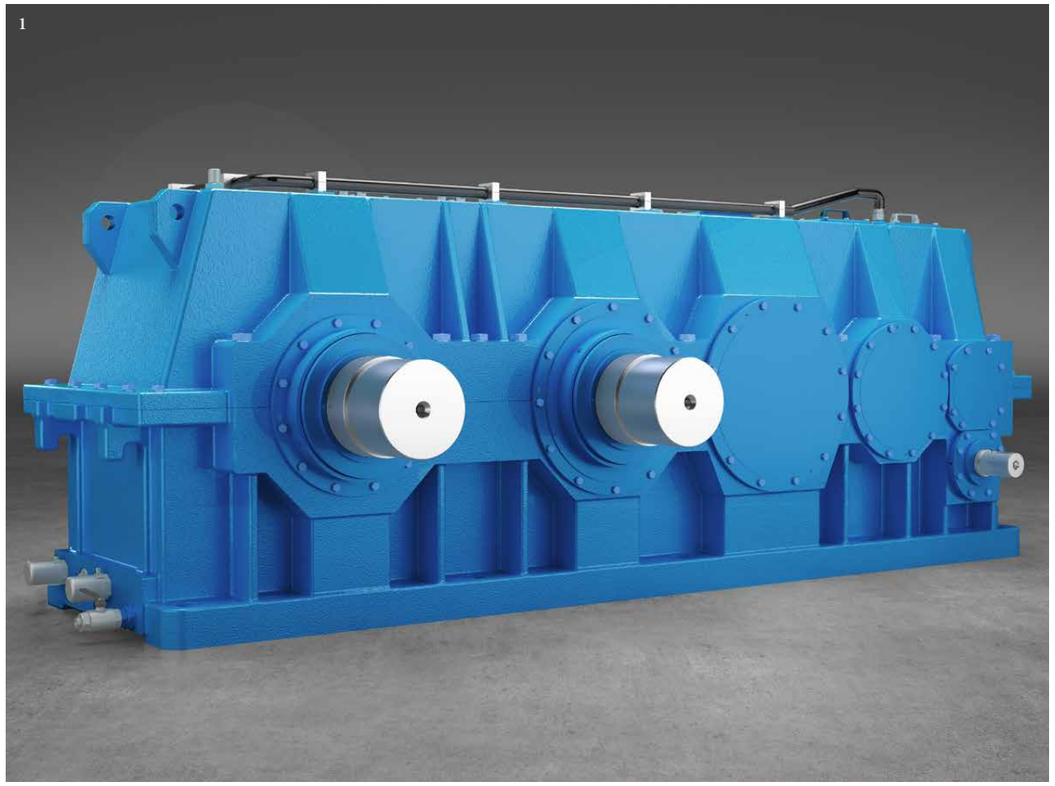
Weight
1 - 50 t

Transmission ratio
20 - 10,000

Length
1,300 – 4,500 mm

Output shaft type
Hollow shaft: with shrink disc and internal toothing
Solid shaft: with parallel key, external toothing or flanged shaft

Outer diameter
600 - 2,300 mm



HELICAL GEARBOXES

The Eickhoff range of helical gearboxes has advanced to become the optimum solution for a wide range of applications in industry. Our expertise in the development and production of helical gearboxes enables us to offer our customers unique engineering and well conceived designs. The foundation for this is the standard gearbox designed according to a modular principle which is then modified to suit customer requirements exactly. The helical gears we use are hardened and ground and have milled protuberances. Optimum tooth design is guaranteed through computer design software.

Eickhoff can be seen as the gear wheel driving research and development. Furthermore, we cooperate with numerous renowned institutes so that our gearbox development never stands still. For example, the finite element method is used to identify highly stressed components and improve the range of helical gearboxes.

- **Gearbox casing available in steel, cast steel and as a casting**
- **Suitable for temperatures down to –50 °C**

Technical data

No. of stages
1 – 4

Weight
0.4 t – 12.5 t

Sizes
16

Length
350 – 3,000 mm

Rated output torque
10 – 780 kNm

Width
160 – 1,000 mm

Transmission ratio
1– 500

Height
300 – 2,000 mm

Output shaft type
Hollow shaft: with shrink disk and internal toothing
Solid shaft: with parallel key or flanged shaft

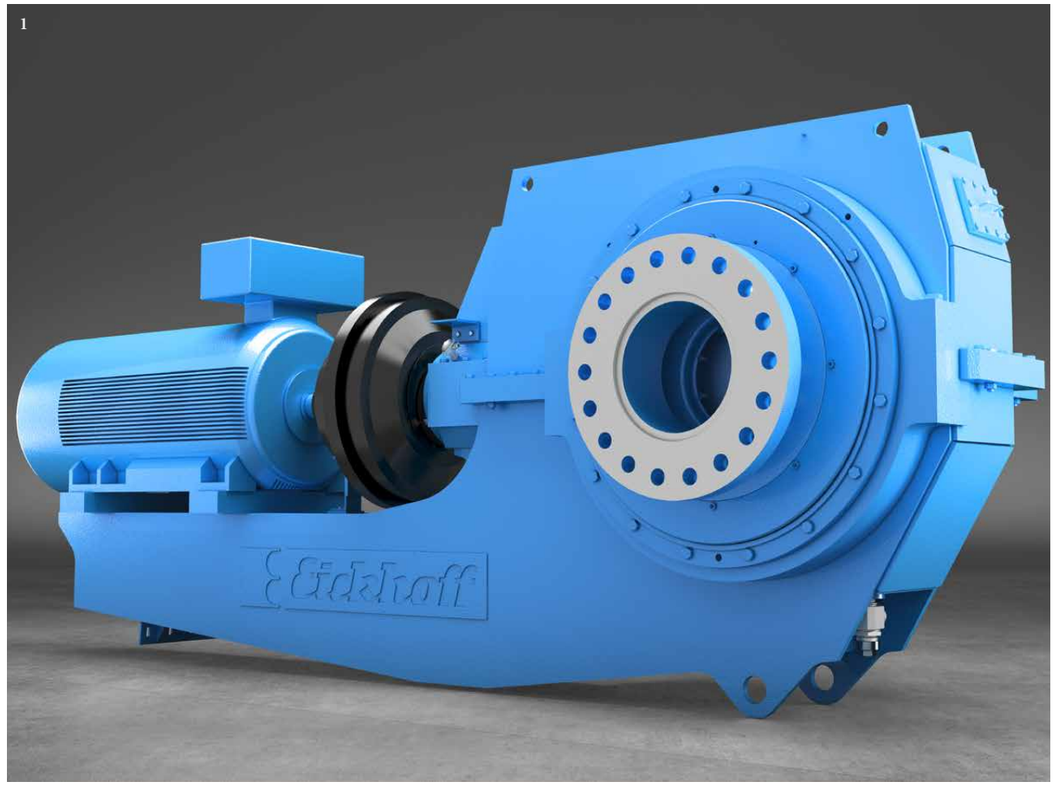
1 DNZ-765/1000II gearbox

BEVEL–HELICAL PLANETARY GEARBOXES

Besides the planetary and helical gearboxes, we also offer our customers combinations of our gearboxes with bevel or worm gear stages to suit particular applications. These custom products help us to provide optimum solutions for the most diverse gearing applications and hence serve the different needs of customers. Eickhoff gearboxes are characterised by their maximum flexibility, excellent robustness and the use of the very latest technology. Our hard-wearing, highly reliable products can be used profitably in extreme operating conditions worldwide, e.g. in the cement and steel industries and in open-cast mining.

Successful, partner-like cooperation with our customers from planning to production and commissioning plus continuous support over the entire service life of the product are our priorities. And, of course, the high quality demands we place on every one of our products.

- **Bespoke combinations of various gearbox stages**
- **Customised to suit the respective application**
- **The robustness and reliability so typical of Eickhoff**
- **For applications in open-cast mining, cement and steel industries, etc.**



Technical data

No. of stages
2 – 5

Sizes
19

Rated output torque
220 kNm – 7,280 kNm

Transmission ratio
20 – 10,000

Output shaft type
Hollow shaft: with shrink disk and internal toothing
Solid shaft: with parallel key, external toothing or flanged shaft

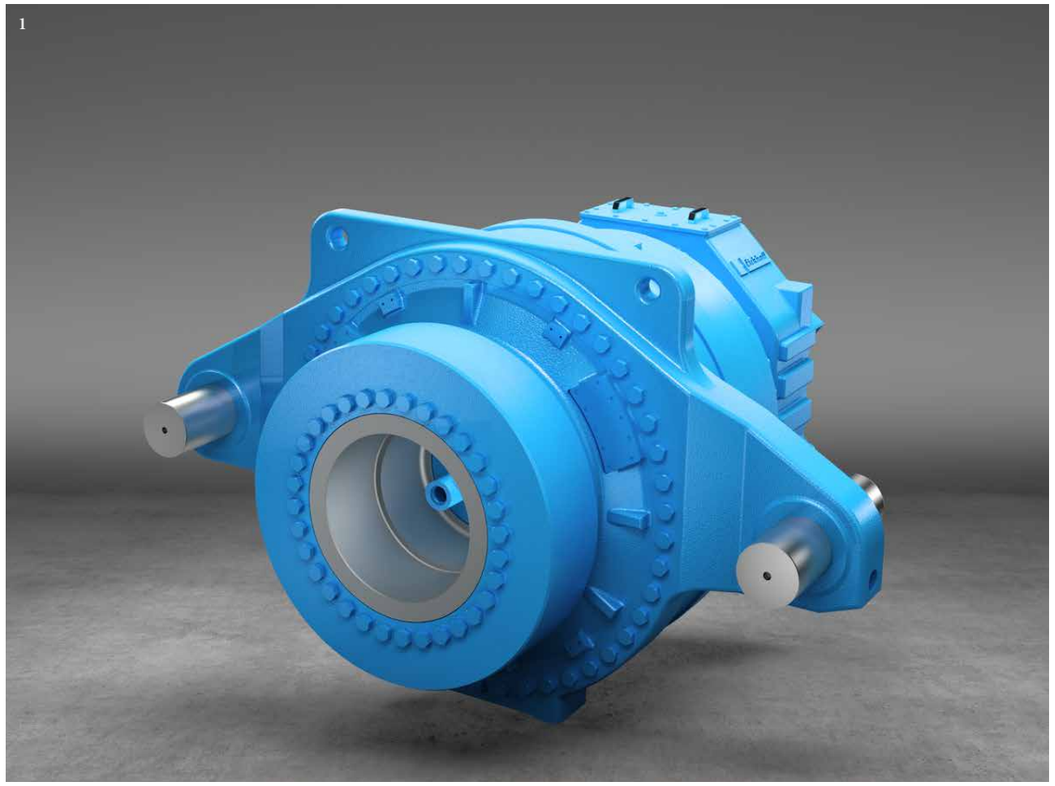
Weight
1 – 60 t

Length
Adapted to suit available installation space

Width
Adapted to suit available installation space

Height
Adapted to suit available installation space

1 DPKFZ-214 gearbox



WIND TURBINE GEARBOXES

Eickhoff's technical expertise and experience in the wind turbine gearbox sector has been playing a part in the development of innovative and efficient wind power concepts for our customers throughout the last 20 years. As a key element in the drive train, our high-performance, high-quality gearboxes, optimised for production and cost-savings, are impressive due to their maximum robustness, maximum reliability, long service life and extremely compact design. They are designed to suit the customer's specification and the respective requirements exactly with a high power density.

Our 5 MW test bench and environmental test chamber help us to verify compliance with the quality demands of our customers. All tests are logged precisely. For example, we test all prototype gearboxes under representative loading conditions and, if required, also subject them to a temperature of –40 °C (–40 °F) to check their low-temperature suitability. In addition, we offer our customers bespoke service and maintenance concepts, which enable them to reduce their operating costs and at the same time optimise their plant availability by way of faster reaction times.

- **Compact design and high power density**
- **Production optimised for cost-savings**
- **Robustness and reliability tests on our own test benches**
- **Cold-weather suitability tested down to –40 °C (–40 °F) in our own environmental test chamber**

Technical data

Generator output
1.5 – 3.8 MW

Length
2,170 – 3,200 mm

Rotor diameter
70 – 131 m

Outer diameter
1,570 – 2,085 mm

Torque range
934 – 3,380 kNm

Design
PPS, PSS

Transmission ratio
71.8 – 135.75

Model variations
50Hz, 60Hz, CCV, NCV, HCV

Weight
15 – 36.5 t

Wind turbine classes
IEC I, II, III

1 EICOGEAR 2,5

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