



KLINGELNBERG

DRIVE TECHNOLOGY



Market Leadership in Gear Technology Built on Tradition, Expertise and a Passion to Perform

The Klingelberg Group is one of the world's leading companies in the development and manufacture of machine tools for the production of bevel and cylindrical gears and measuring centers for rotationally symmetrical work-pieces and gears. Additionally, Klingelberg produces spiral bevel gears to order – using its own technology, with the highest level of precision.

The origins of the engineering company date back to the year 1863. Up to date family Klingelberg is invested as an anchor shareholder of the company. With continuous efforts to maintain the highest levels of quality and reliability in its products and services, Klingelberg has successfully established itself as a market leader. A strong team of R&D engineers worldwide and some 100 registered patents are hard evidence of our company's unique capacity for continuous innovation.

Customers from the automotive, commercial vehicle, aerospace, wind power, mining and marine industries have been relying on Klingelberg for decades to provide them with gear technology solutions for their business. Klingelberg designs and manufactures its products at facilities in Switzerland, Germany and Hungary. With many additional sales and service offices worldwide, the company is best positioned to serve the global market.

Manufacturing Facilities



Zurich, Switzerland



Hueckeswagen, Germany



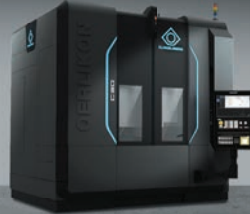
Hueckeswagen (Winterhagen), Germany

HÖFLER
CYLINDRICAL GEAR TECHNOLOGY

KLINGELNBERG
PRECISION MEASURING CENTERS

OERLIKON
BEVEL GEAR TECHNOLOGY

KLINGELNBERG
DRIVE TECHNOLOGY/CUSTOMIZED BEVEL GEARS



Competences:

- Klingelberg is the only provider of machine tools and measuring centers for gear production, that also manufactures bevel gears itself. For decades, the synergies and solutions arising from this unique product portfolio have been helping our customers to stay ahead
- The Klingelberg Group distinguishes itself through extremely close cooperation with customers and partners, the highest levels of product quality and absolute adherence to delivery schedules
- With manufacturing facilities in Switzerland, Germany and Hungary as well as regional sales and service offices, Klingelberg has a truly global footprint
- Total consideration for the environment is an absolute priority for the company, as documented by our DIN EN ISO 14001 certification and affiliation to the "Blue Competence Initiative" of the German Engineers Association (VDMA)



Ettlingen, Germany



Győr, Hungary

KLINGELNBERG DRIVE TECHNOLOGY IN GERMANY



The biggest machines in the world for making bevel gears are located at Klingelnberg's manufacturing facility in Hueckeswagen (Winterhagen)



Klingelnberg's in-house heat treatment facility in Hueckeswagen



Competences:

- Lean management and production principles
- Flexible production capacity of over 2,000 gear sets per year
- Leading gear and measuring technology developed and built by KlingelInberg
- Heat treatment facility with 18 furnaces and a capacity of 140 tonnes per month
- Application of KlingelInberg's own calculation software "KIMoS" (KlingelInberg Integrated Manufacturing of Spiral Bevel Gears) throughout all gearing relevant process steps
- Certification according to DIN EN ISO 9001, DIN EN ISO 14001

The World's Most Efficient Production Line for Large Bevel Gears

In 1923 KlingelInberg became the first company in the world to employ a continuous face-hobbing process for the manufacture of made-to-order bevel gears at its facilities in Hueckeswagen, Germany. The key to the company's success has always been a high level of innovation complimented by close partnerships with customers and suppliers.

In 2008, the Drive Technology Division was moved from its original location in the center of Hueckeswagen to a brand new purpose-built facility at the Winterhagen West 2 Industrial Zone just 5 km away. Today, spiral bevel gears with a diameter of up to 3,000 mm are manufactured there using state of the art technology.

With around 100 employees and a flexible annual capacity of over 2,000 gear sets, the facility in Winterhagen provides the setting for the most efficient large bevel gear production line in the world.



Manufacturing facilities in Hueckeswagen (Winterhagen)

BEVEL GEAR SETS MADE IN GERMANY



Maximum loading capacity and reliability are of the utmost importance in maritime gear technology



Bevel gears in stone crushers are subjected to enormous impact loads and deflection forces



Bevel gear sets used in wire mills reach circumferential speeds of over 100 m/s

Gear Components for the Toughest Jobs: Bevel Gear Sets from Klingelnberg in Germany

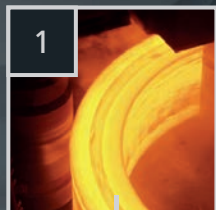
Stone crushers, hydroelectric turbines, ship propulsion – the applications for large bevel gears are varied and the requirements are huge. Producing gears to handle input powers of up to 10 MW and changing static and dynamic loads requires the highest level of experience and production know-how.

Klingelnberg experts prove their competence and flexibility on a daily basis in mastering these challenges to find the optimal solutions for our customers. From the first sketch right up to providing support with assembly, all steps of the development and production stages are closely aligned with customer requirements.

Solutions:

- Highly skilled experts for calculation, design, simulation and optimization of bevel gear drives
- Klingelnberg's unique Closed-Loop concept for large bevel gears guarantees not only quality but also absolute transparency throughout the production process
- One process under one roof: from the design, through production, right up to assisting with assembly at the customer site
- Rapid und uncomplicated order management with flexible manufacturing facilities and supporting administration
- Best possible lead times with raw material held on stock
- Documentation of all process parameters throughout the production process
- Certified by all well-known classification societies with Manufacturing Survey Arrangements (MSA) in place
- Comprehensive range of measuring systems for detecting and documenting macro and micro geometries of even the very largest components
- Optimal contact pattern design and tooth-flank modifications to compensate for gear set deflections under load

Bevel Gear Production Process Chain



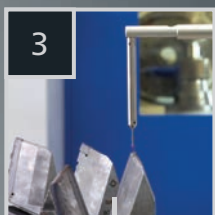
Forging

The huge demands on raw material quality from customers and classification societies are complimented by Klingelnberg's own material purchasing regulations.



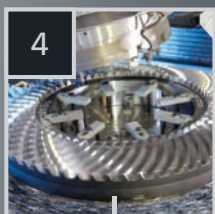
Mechanical processing

State of the art CNC technology is used to carry out turning and grinding operations on the gear sets.



Tooling set-up

Precise and fully automatic tooling set-up is performed by Klingelnberg CS machines in accordance with the KIMoS calculation.



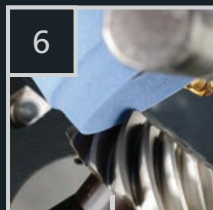
Gear cutting

The world's largest C 300 face-hobbing machine cuts the gears according to target data. Final machining of the tooth-flanks by the HPG method, uses the most modern tooling available in a closed-loop process.



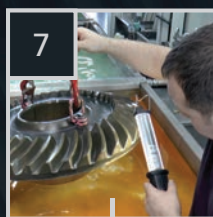
Heat treatment

The Heat treatment is one of the most important processes for achieving the highest quality levels in gear production. Extensive experience and metallurgical know-how is required.



Gear grinding

Bevel gears with a diameter of up to 1,100 mm are finished using the economical grinding procedure. This allows for a high degree of freedom in defining the tooth-flank topography.



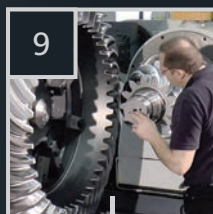
Testing for grinding burns

For quality assurance purposes all ground gears are tested for grinding burns.



Topography measurement

Klingelnberg's most modern groundbreaking measuring center technology checks the quality of the gears and measures the topography.



Contact pattern test

The gear sets are rolled of on a testing device to document the contact pattern and simplify the final assembly process for the customer.



Final inspection

At the end of the process chain all relevant dimensions are checked again during final inspection. Final acceptance is accompanied by the classification society wherever required.

Gear Components for the Reliable Performance: Bevel Gear Sets from KlingelInberg in Hungary

Over more than a decade, the ever-increasing demand from the market for high quality products at lower prices led KlingelInberg to produce bevel gears up to a diameter of 500 mm in Gyoer, Hungary.

Thanks to the most modern machines available and a team of highly qualified experts, exactly the same quality standards are met in Hungary as KlingelInberg sets itself in Germany. With around 35 employees, KlingelInberg Hungary can produce well in excess of 10,000 gear sets a year. High precision gear sets from the facility in Gyoer are used in the automotive and utility vehicle industry as well as in agricultural, industrial and heavy plant applications. High-tech gear components for motorsport in general and especially for Formula 1 are developed and produced in close collaboration with KlingelInberg in Germany.



Solutions:

- Flexible production capacity of over 10,000 gear sets
- Manufacturing and quality assurance according to the highest international industry standards
- Leading gear and measuring technology developed and built by KlingelInberg
- Application of KlingelInberg's own calculation software "KIMoS" throughout all gearing relevant process steps
- Best possible lead times with raw materials held on stock
- The Closed-Loop concept is used for quality assurance but also guarantees absolute transparency throughout the production process
- Certification according to DIN EN ISO 9001, DIN EN ISO 14001

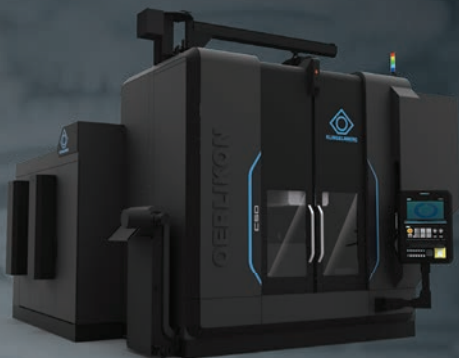


Highest power density for high revolutions through efficiency-optimized design

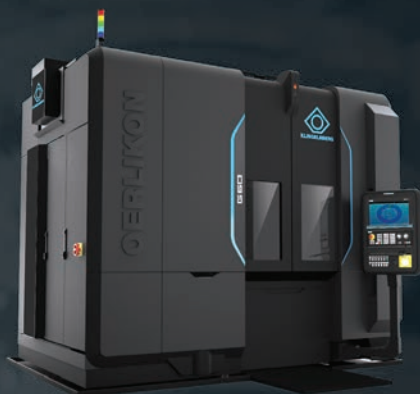


Automotive applications require extended lifetime and noise-optimized designs

Lean Production with the Latest Generation of Klingelnberg Technology



Oerlikon Bevel Gear Cutting Machine C 50



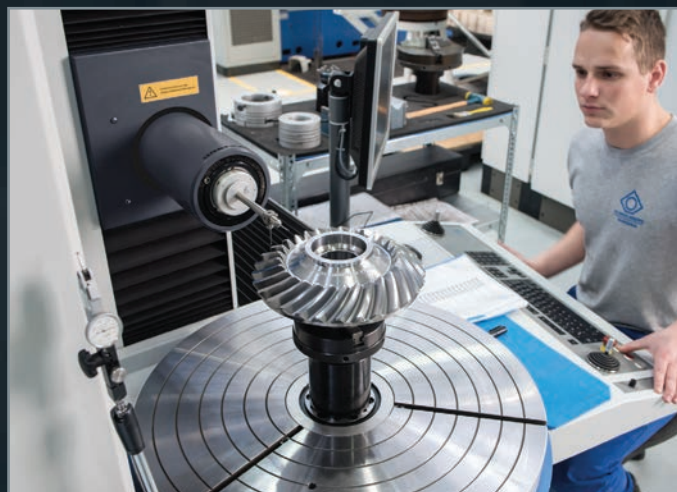
Oerlikon Bevel Gear Grinding Machine G 60



Klingelnberg Precision Measuring Center P 65



Manufacturing facilities in Gyoer, Hungary



Measuring pitch, runout and topography on a Klingelnberg Precision Measuring Center P 65



Quality assurance is the highest priority



KIMoS Software is used for the design, analysis and evaluation of the gearing and is the interface between planning and production

Perfect Service: From the First Idea up to Tailor-Made Solutions

Klingelberg stands for highest precision and worldwide unrivalled solutions. This success is based on intensive work and identification with our own products. From the initial consultancy during the concept phase right up until assistance with assembly, Klingelberg helps its customers every step of the way, or wherever required. The company sees itself not only in a manufacturing role, but in that of a service provider.

Our readiness to support the customer also extends to situations where things have run less smoothly than planned. In case of gear failures in the field, our technical customer support team and in-house materials laboratory are available to carry out analysis-work and establish the root cause. Through this work suitable measures can be determined to avoid failure repetition.

Competences and Services:

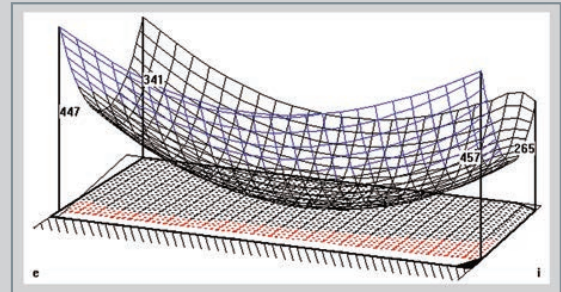
- Based on a production simulation, the in-house KIMoS software is applied for the design, analysis and evaluation of the gearing geometry and lays down the production parameters
- With consideration to the relative positioning of crown wheel and pinion, the contact pattern can be optimized by making targeted modifications to the micro geometry of the tooth
- In addition to target data from a production simulation, actual data taken from measurements can also be used for analysis
- Assembly constraints such as retractability of a pinion can be considered in the early design phase and can be checked using simulations
- Klingelberg participates actively in national research groups (e.g. FVA) and on international projects and norm committees together with customers, technical universities and research institutes

Technological Service Provider Right up to the Last Detail

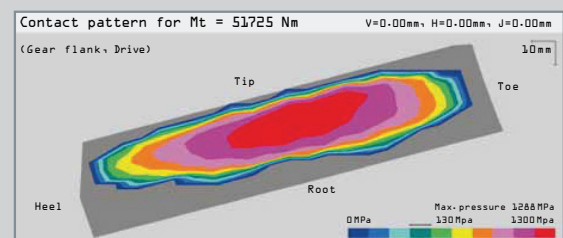
Detailed calculation and analysis before, during and after production

The tooth-flank geometry forms the basis for tooth-contact analysis. This can be optimized using deflection parameters which are derived from a static and dynamic summary of the system. Targeted modifications of the tooth-flank form compensate the deflection to achieve an optimal load contact pattern.

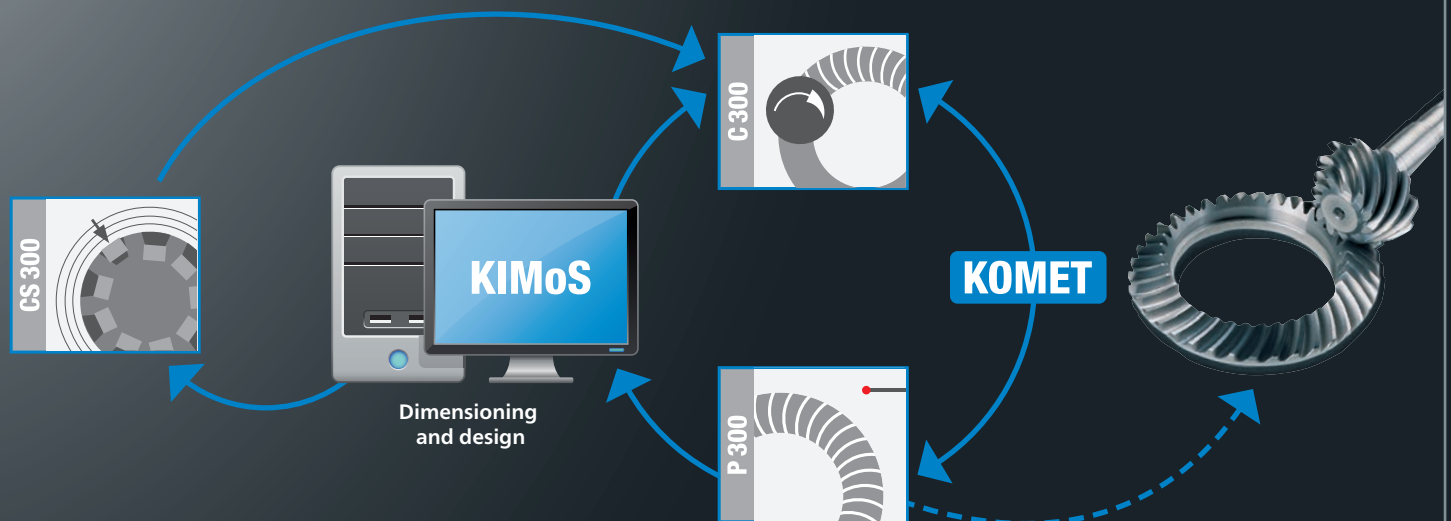
Using powerful simulation tools, a high degree of planning accuracy can be achieved at a very early stage of the design process. Therefore, by eliminating unnecessary iterations the product-development process can be shortened significantly.



EaseOff: tailored modification of the micro geometry



Tooth contact analysis: loaded contact pattern



Precision and quality thanks to the Klingelnberg Closed-Loop:

With the latest generation of machines, the Closed-Loop concept has also proven itself in the production of large bevel gears. This insures that all characteristics of the gear sets can be manufactured inside the smallest tolerances. A central production database and networked machining centers form the centerpiece of the Closed-Loop concept. The data sets developed by the KIMoS software are fed into this system for use in the production process.

KLINGELNBERG Service

The Klingelberg Group is a world leader in the development and manufacture of machines tools for making bevel and cylindrical gears, and measuring devices for rotationally symmetrical work-pieces and gears. Additionally, Klingelberg produces made-to-order spiral bevel gears - using its own technology, with the highest level of precision. Development and production is carried out at the company's headquarters in Zurich (Switzerland), as well as in Hueckeswagen and Ettlingen (Germany) and Gyoer (Hungary).

Additionally numerous sales and service offices and agencies represent Klingelberg worldwide. With these foundations, Klingelberg offers its customers a comprehensive spectrum of services for the design, production and quality inspection of gears. These services include technical consultancy, analysis and of course support with assembly at the customer site.

KLINGELNBERG Solutions

Klingelberg solutions are used by customers in the automotive, truck, aerospace, agriculture, construction and marine industries alongside many others. A strong team of R&D engineers worldwide and some 200 registered patents are hard evidence of the company's unique capacity for continuous innovation.

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You can also find your local contact for sales advice at www.klingelberg.com/contact.