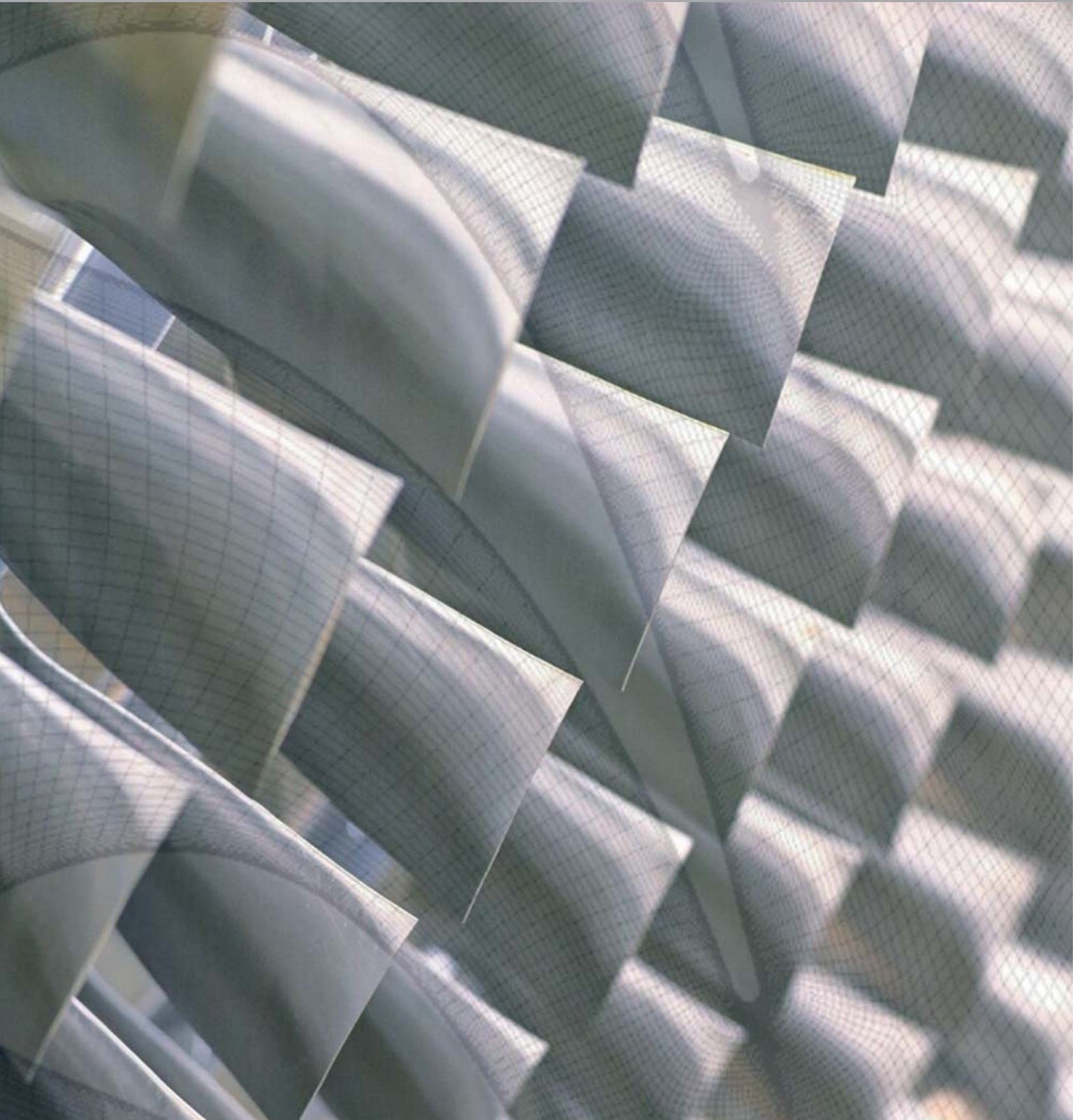


Leistritz TurboSolutions

Components for Compressors and Turbines





Leistritz AeroSolutions

Zero Tolerance for Error

The Wright brothers caused a sensation in 1905: they achieved the first long-distance flights of up to 45 km with their »Flyer III«. Mankind had come closer to its dream of flying – even though intercontinental jets or expeditions into space were still utopian.

In the same year, Paul Leistritz founded a company to manufacture turbine blades and profiles of the highest quality in Nuremberg.

The utopias of that era have long become a reality. Leistritz has made its contribution to this development: modern aircraft and rocket engines use components from Leistritz throughout the world. With the advancement in technology, Leistritz drives to meet the demands of the individual components.

Leistritz AeroSolutions

Complex Geometries with Tight Tolerances

Ever since the first jet engines were built, Leistritz has been a partner for various aero-engine manufacturers in the development and production of engine components with difficult to machine materials such as high-temperature steels, titanium and nickel-based alloys. This work focuses on compressor blades and disks, whose aerodynamic, complicated geometries with tight tolerances and maximum material requirements are a very special challenge.

Today, Leistritz is one of the biggest manufacturers of different aero-engine components, blades, disks, Blisks/IBRs, casings and structural parts.

The way we think and act revolves around finding optimum solutions to problems with maximum efficiency: from the moment we start machining the raw material through to the delivery of the ready-to-assemble product. Millions of successful applications provided to the market is evidence of our performance.





Casing and structural parts



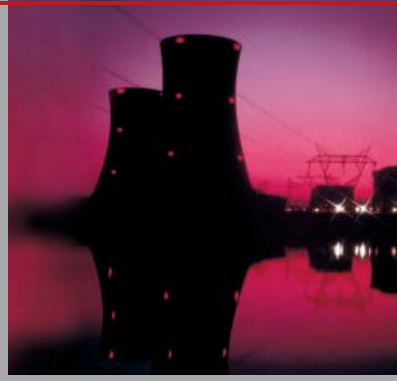
Ready-to-assemble compressor blades



Precision-forged compressor blades

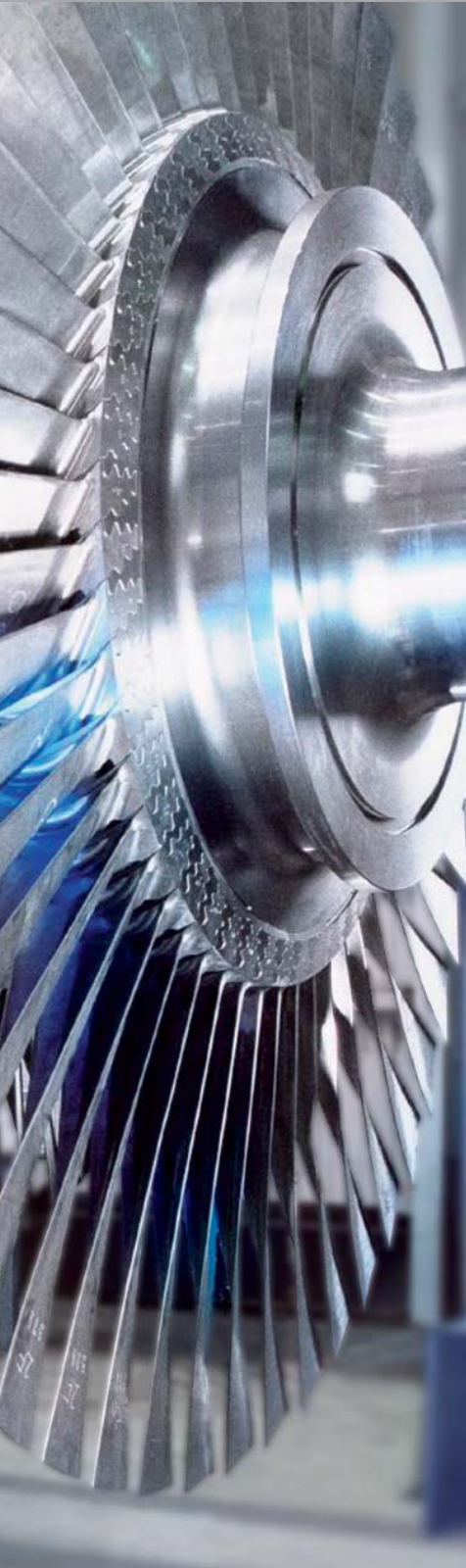
Disks and Integrally Bladed Rotors (IBRs/
Blisks)





Leistritz PowerSolutions

Maximum Efficiency



Power stations help satisfy mankind's most important basic needs: power means light, power means warmth and security. The permanent availability of power is an obvious requirement of today's standard of living.

In order to maintain this standard, concepts are required that continuously improve the use of available resources. If we can increase the efficiency of a turbine, then we can also make an important contribution to environmental protection.

Ever since its foundation in 1905, Leistritz has been closely associated with turbine development. We began by manufacturing blades and profiles for steam turbines, which have remained one of our main products to this day.

Leistritz PowerSolutions

Broad Product Range Meets Every Need

8



Many years of experience in the use of all relevant manufacturing technologies are the foundation for the excellent reputation of Leistritz products on the global market. Our range of products now goes far beyond blades and profiles for steam turbines. For example, we also produce blades and other components for modern gas turbines and axial compressors. We either produce the pre-shaped blanks ourselves or order these from reliable partners with the corresponding know-how, e.g. the precision cast blanks needed for hot gas components or specific coatings. This means that Leistritz as a contractor can fulfill every requirement placed on a finished part.

In most cases Leistritz supplies ready-to-assemble parts for the turbine.





Variable vanes for gas turbines

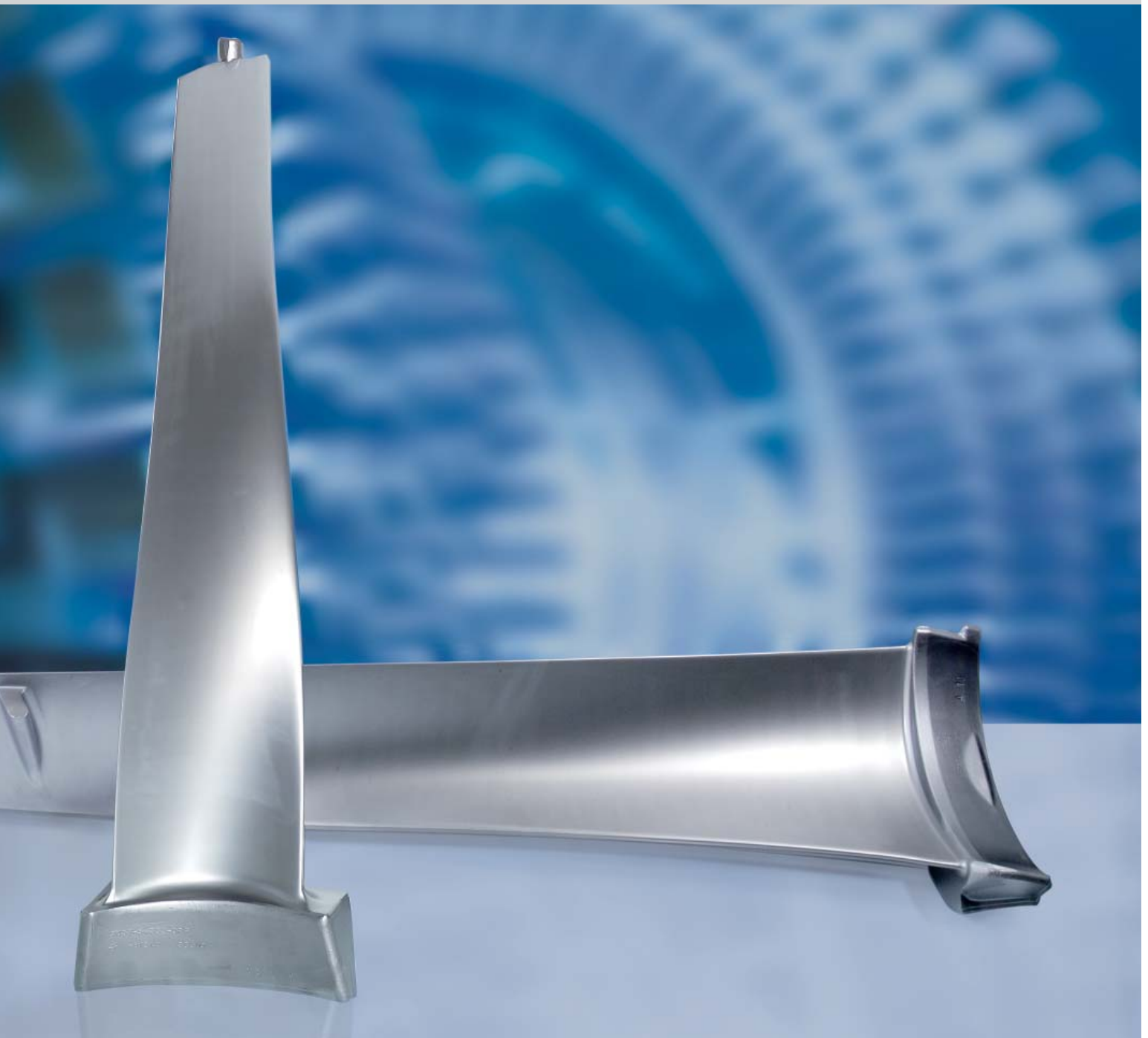


Selection of blades for gas and steam turbines



Steam turbine blades

Forged LP steam turbine blades



Leistritz ECM

Electrochemical Machining

Absolute Precision



The Leistritz Electrochemical Machining method (ECM) has proven itself through maximum precision and repeating accuracy for the production of difficult, three-dimensionally twisted airfoils. ECM can be used to machine all electrically conductive materials – irrespective of their metallurgical properties and strength. We have constantly improved this technology. The airfoils and platforms of rotor blades and stator vanes for high-power engines, gas turbines and compressors are manufactured on purpose-built ECM systems: aerodynamic profiles with complex geometries and the thinnest of edges from all conceivable alloys with a high dimensional accuracy and outstanding surface quality.

We produce the convex and concave sides of airfoils, platforms as well as the leading and trailing edges using ECM technology – from both solid material and pre-forged blanks – in a single operation. The same applies for single blades as well as airfoils on so-called »Blisks« or »IBRs«.

What's more, ECM is also an economic and efficient method for machining structural parts such as flanges, rings and casings.



Leistriz ECM machine for compressor blades



EC Machining of a disk



EC Machining of a Blisk/IBR

Detail showing ECM of compressor airfoils



Leistritz Forging

Economical Performance

For many years Leistritz has been a core supplier to the Power Generation Industry, providing precision forging technology on a total cost competitive basis. Our portfolio today comprises precision-forged, finish-machined and envelope-forged compressor and turbine airfoils for a wide range of gas and steam turbines.

As a qualified and technologically advanced supplier for engine disks to the aerospace industry, our product range comprises a wide selection of disks from the cool front to the hot end of an engine. Nickel-based and titanium alloys including the most advanced and challenging materials form part of our daily work. A most modern disk manufacturing line, advanced machining capabilities and Europe's largest isothermal press are assets for the markets of today and tomorrow.

We are continuously improving the technological competence and process efficiency. State-of-the-art processes produce a finished gas path with ongoing efforts to keep subsequent machining operations to the economical minimum.





Precision-forged compressor blade

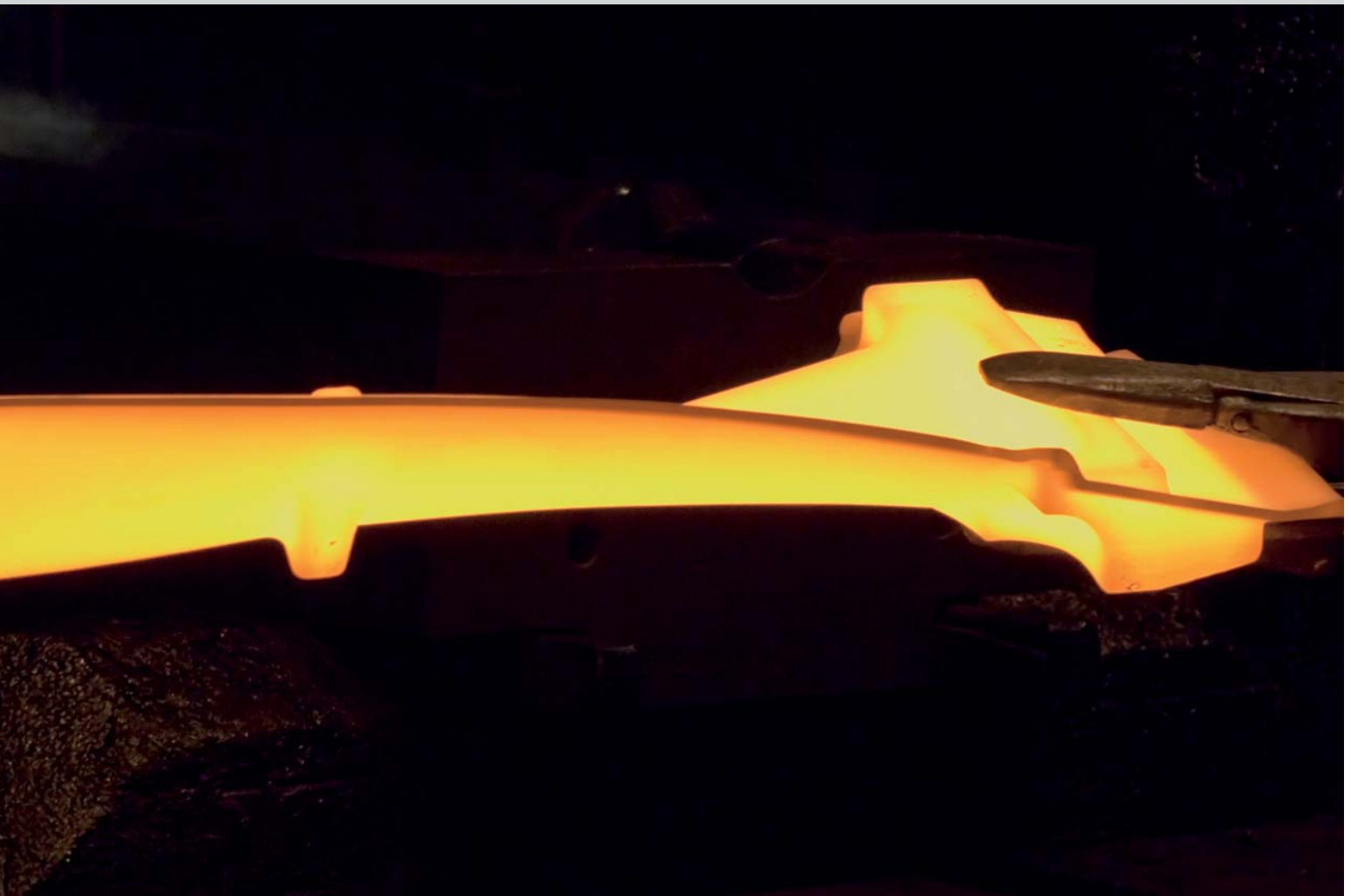


Fully automated heat treatment



Isothermal forging of an engine disk

Envelope forged LP steam turbine blade



Leistritz Mechanical Machining

Challenging Designs – Our Passion



State-of-the-art technologies for machining are used at Leistritz to manufacture turbine components from bar stock material, forgings and investment cast blanks.

Leistritz always has the right solution – be this for turning disks and Blisks or milling and grinding structural parts and blades: the latest generation of multi-axis machining centers as well as custom-developed special machines are used to satisfy the highest customer demands on product geometries. Computer-assisted simulation makes an important contribution to a stable process development.

Special peening, etching and vibro-grinding processes are available for the surface finish of our products.





Close contour turning of an engine disk



5-axis milling of a steam turbine blade



Creep-feed-grinding of a fir tree root

5-axis milling of a vane cluster



Leistritz Engineering and Quality Management

Ensuring Dependable Processes

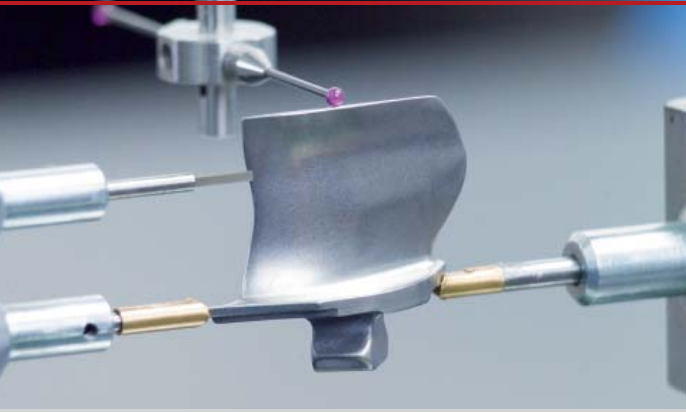
Reliable power supplies and safe mobility. These are the services provided by our customers – and in the end we all trust in these. The perfect performance of our products. This is what our customers have to rely on. This is the guideline for our quality management.

We define and organize our quality assurance measures in close cooperation with our customers, the manufacturers of jet engines and turbines. In this way we can guarantee that our products will do their job perfectly – to the benefit of us all.

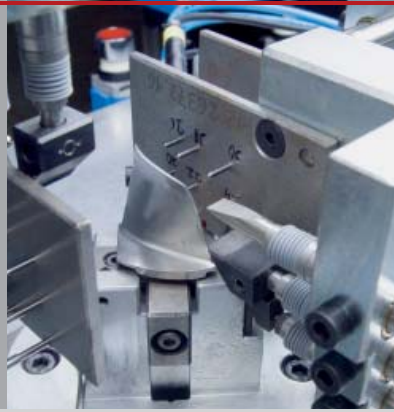
Quality assurance begins with the planning of production methods and defining stable processes. Constant monitoring of all manufacturing processes and the documentation of the necessary tests are a matter of course for us.

When we deliver our products they have already passed the most stringent of tests. For a long life.





CMM measuring of a compressor blade

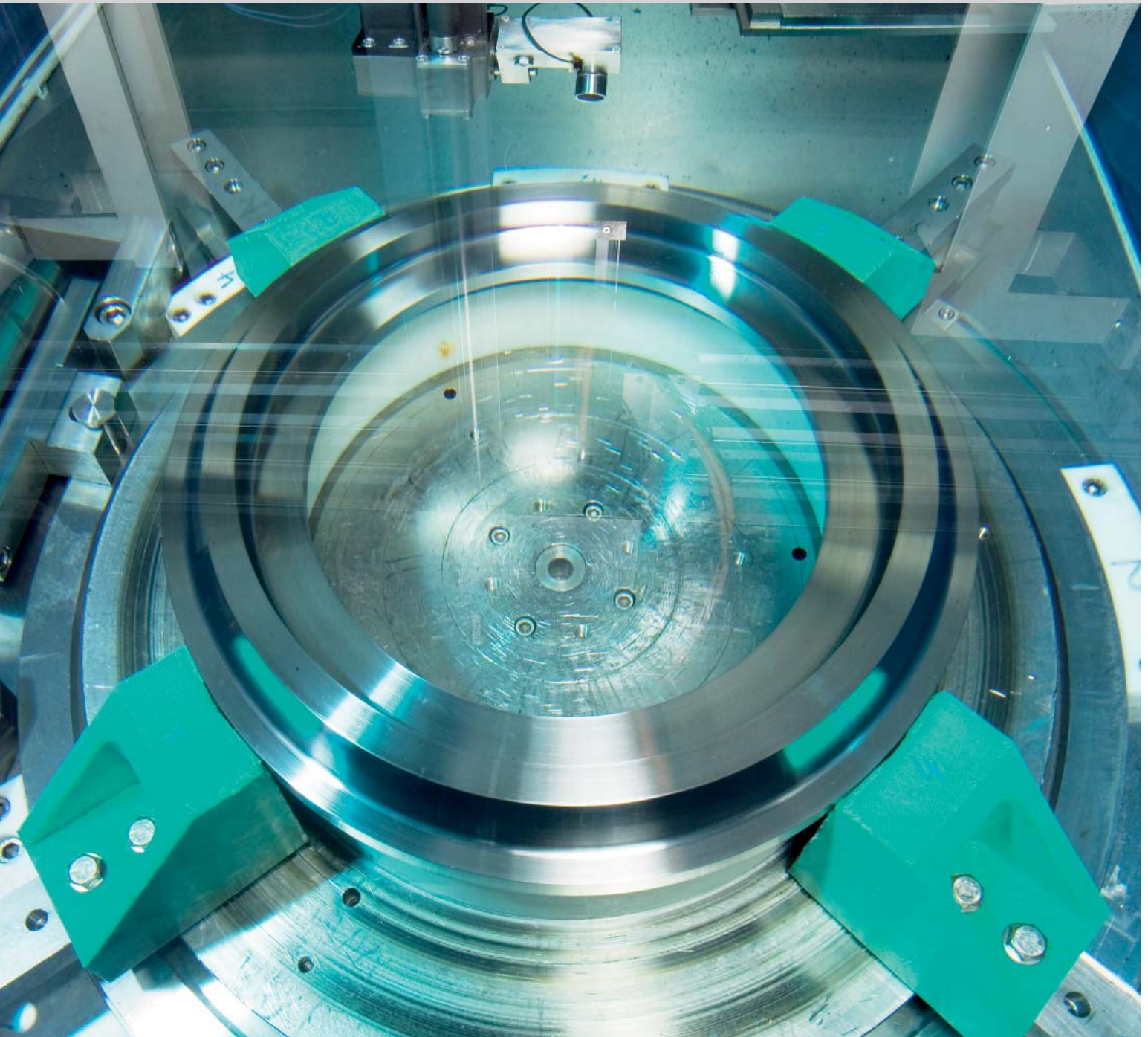


Final inspection of a compressor blade



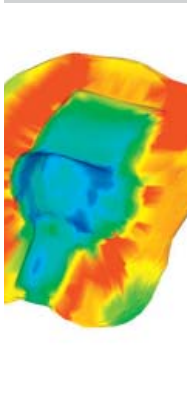
CMM measuring of a Blisk/IBR

Ultrasonic testing of an engine disk



Leistritz Research and Development

Shaping the Future



Forging

High-performance materials that are difficult to shape, i.e. ultra-high temperature titanium and nickel alloys or titanium aluminides, make special demands on forging technology. One indispensable tool is the numerical deformation simulation to ensue an optimum temperature guidance whilst observing the necessary level of deformation. The development of weight and cost-optimized forged parts is a pacesetter for the introduction of new materials and constructions.

Thanks to the development of superplastic forging in isothermal conditions we come very close to the final contour. Compressor blades can thus be manufactured from the brittle titanium aluminide (TiAl). Even complex geometries can be produced such as Blisk forgings with preformed airfoils.

The goal, apart from the obvious savings in raw materials, is to minimize the machining work on these difficult materials.



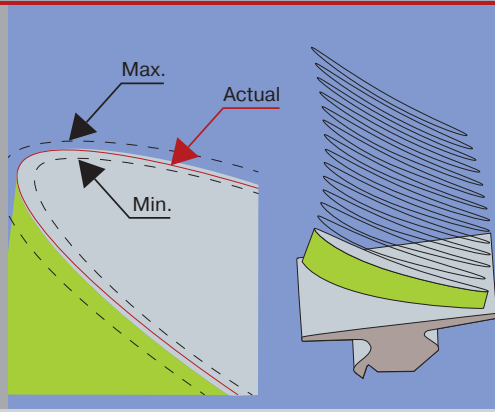
Compressor blades of TiAl during solution annealing



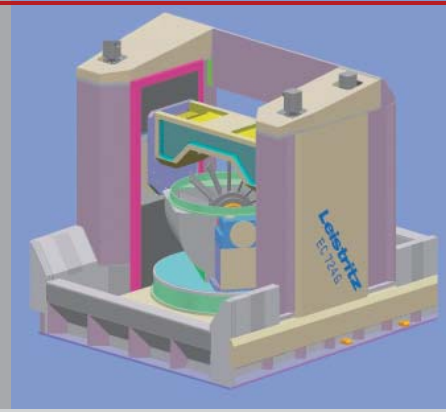
Isothermally forged Blisk from Ti6246



Process steps of a TiAl compressor blade



Development of an elliptical leading edge



3D model of an ECM machine



Assembly of an ECM machine

ECM

ECM is a key technology at Leisritz. Which is why the development of our own machines and systems is of crucial importance: from CAD planning through to machine assembly and software definitions. This allows us to realize component-specific solutions in the field of both classical ECM and the new pulse ECM methods.

ECM is predestined for the production of modern 3D geometries. One speciality is the perfection of this technology through to the mapping of specifically shaped, elliptical edges on airfoils for blades and Blinks. Another important aspect of our research work is the development of the ECM process for new materials such as titanium aluminide (TiAl).





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Leistritz Produkt Range



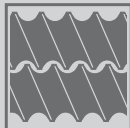
Leistritz Turbomaschinen Technik GmbH
Leistritz Turbinenkomponenten Remscheid GmbH
Leistritz Advanced Turbine Components, Inc.

Blades, Disks and Components
for Compressors and Turbines



Leistritz Pumpen GmbH

Screw Pumps and Systems



Leistritz Extrusionstechnik GmbH

Extruders



Leistritz Produktionstechnik GmbH

Tubing Technology / Metal Stamping
Machine Tools, Tools



Leistritz Thommen GmbH

Profile Rolling Machines and Rolling Tools



Leistritz Hydraulik GmbH

Lift Systems