



Leonhardt[®]
We define precision.

Filigree, complex, reliable
in toolmaking and
mould construction





for over 50 years

From engraver to full-service provider!

April 1 1960: *Sitting at the kitchen table, today's senior proprietor Günter Leonhardt decides to set up the company with a surface area of 12 m² for production. These facilities are extended to 45 m² as early on as 1963. Leonhardt moves into an entirely new dimension in 1965 with its first complete injection mould tool for model railways. In 1970 a new facility is built at Mozartstraße 24, with a surface area of 335 m². At this time the Leonhardt has a workforce of nine people. In the same year the first injection tool is produced for high-performance ceramics. The company moves into the area of CNC milling with 4-axis technology in 1987. Dr. Wolfgang Leonhardt takes over the company in 1992 and it becomes one of the first engraving specialists in Germany to be certified according to DIN ISO 9001 in 1996. From 1999 the family enterprise moves into 5-axis simultaneous milling, taking over the company JATT with a workforce of eight from 1998 to 2000 and from this point onwards develops and produces model*

railways. Leonhardt once again sets the benchmark in 2003, this time in machining without cutting when it introduces 3D laser technology – a new development at the time. In connection with the unique Golden Bible project the company adopts the technique of ultrasonic machining in 2005. Leonhardt wins bronze in the EuroMoldAward in 2006.

In 2008 Leonhardt takes up microprocessing in the area of electrical discharge machining, including EDM polishing and wire-cut EDM with wire diameters of up to 0.02 mm. The company's innovative strength is officially recognised for the first time in 2009 when it is awarded the TOP 100 seal of quality. In 2010, the proprietor and workforce proudly look back on their eventful 50-year history. Sibling company Leroxid[®] is founded in 2011, and Leonhardt receives the EuroMold Award in gold for wear-resistant mould inserts made of the EDM-machinable high-performance ceramic Dimacer[®]. In 2012 production space at the main premises is expanded by 140 m². The company's trade fair newsletter and the Dimacer[®] information film win an SPE Automotive Award in 2015. Acquiring DIN ISO 9100 certification in 2016, Leonhardt becomes a partner to the aerospace industry; for the fourth time it is named one of the hundred TOP innovative SMEs in Germany.



Company founder
Günter Leonhardt



The first workshop – even then it had a high-voltage current supply



Expansion of production space to 45 m²



A new era begins with the construction of new facilities in Mozartstraße



A profile milling machine dating back to the 1970s



The large workshop with a surface area of 335 m² designed to house a constantly growing machinepool



A CNC milling machine with 4-axis technology



A new CNC wire-cut EDM machine is lifted in over the roof



State-of-the art technology requires highly qualified staff



5-axis simultaneous milling is one of our core capabilities



The expanded Mozartstraße site on Hochdorf industrial estate



Proprietor
Dr. Wolfgang Leonhardt



TOOLMAKING IN TOP FORM

You're looking for: A service provider for filigree, complex and geometrically sophisticated components? You're not content with one-off production stages and require comprehensive solutions? Cost-effective production manufacturing processes for products with a sophisticated design increasingly require the development of multi-component moulds.

We offer: In 1992 Leonhardt already took the step from subcontracting to becoming an integrated problem-solver. Over a period of several decades we have built up our capabilities, invested in modern machinery and demonstrated the courage to innovate. With our highly qualified staff, we now develop and produce filigree, complex tools and components to very high precision standards. One of our particular strengths is micromachining. We specialise in highly complex solutions: from light technology and optics in the automotive industry through to precision mechanics and medical technology. We attach priority to size accuracy, functionality and reliability. And we support you as a partner from development through to the finished product.



Our machinery – high-tech in all its facets.

Our machines are oriented entirely towards maximum precision – whether for 5-axis simultaneous HSC milling, 4-axis wire-cut and die-sink EDM, complete ultrasonic machining, 3D laser machining or measuring. This is why we believe that Makino, Hermle, Zeiss and other well-known brand names are not just necessary investments but a fundamental requirement for consistent quality at the very highest level.

From the initial idea through to volume production.

We are able to handle the manufacture of highly complex tools up to approx. 500 kg as well as 3D engraving, polish milling, filigree structures and high-gloss polishing. And we are more than just a contract manufacturer: over a period of more than 50 years we have established our standing as an integral technology service provider. As a problem solver we are able to participate early on in the planning phase, making that vital extra contribution to the success of ambitious projects.

A powerful team – capable of meeting any challenge.

We are proud of our staff and we actively promote their creative potential and professional development. And we are able to ensure that our expertise and vast experience is used entirely to the benefit of our customers. We provide advice and support even in tough situations – even when delivery times are very tight. Put us to the test!



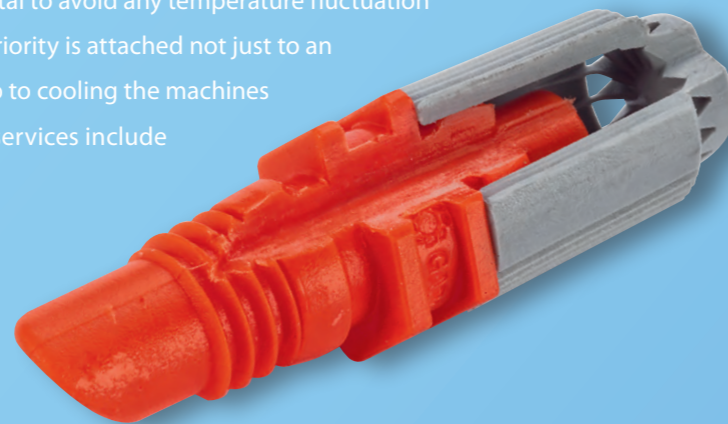


PIONEER IN THE AREA OF MICROMACHINING

You're looking for: An expert service provider offering process stability in the production of functional microstructures or micro-components for a range of different applications? You draw on a wide range of materials and come from a high-tech industry such as medical technology, aerospace or the optical industry? If so, you are involved in the megatrend of miniaturisation.

We offer: Mould construction has a key role to play in the efficient mass manufacturing of micro-components and micro-structures. Due to our longstanding experience in the field of engraving, we are very familiar with the creation of microstructures and filigree components produced to the very lowest tolerances. We have an air-conditioned production environment for this purpose and machinery that meets the very highest precision standards. Since it is vital to avoid any temperature fluctuation whatsoever during the machining process, top priority is attached not just to an air-conditioned production environment but also to cooling the machines and using the appropriate media. Our range of services include the following:

- EDM polishing to a precision of $\pm 2 \mu\text{m}$
- Wire-cut EDM with a 20- μm wire
- HSC milling with 0.1 mm ball cutters
- 3D laser machining



Micromachining expertise.

Wire-cut EDM with a 20 μm wire diameter, 10 μm inner radiuses and 20 μm for slits – this is the level of precision we handle on a daily basis. In the area of die-sink EDM we achieve accuracies of up to 2 μm with a surface finish of $R_a = 0.06 \mu\text{m}$. We leave our mark when it comes to micromilling, too: our company has successfully realised corner radiuses of 20 μm .

Precision is our trademark.

Our company has a well-established tradition of high tech. Conventional techniques and cutting-edge technologies go together to ensure you achieve the greatest possible benefit, while at the same time maintaining cost efficiency. For this reason we never compromise when it comes to choosing the right technology. We make sure the materials, technologies, machines and equipment required are all perfectly harmonised.

Freeform surfaces with simultaneous machining.

Our machining methods are especially beneficial in the fields of aerospace and fluid power technology. In addition to 5-axis simultaneous milling we offer ultrasonic-supported 5-axis grinding technology and the 3D laser machining method. This has the advantage that even the most filigree components can be produced to maximum precision.





EDM MACHINING OF HIGH-PERFORMANCE CERAMICS



Leroxid[®]
Erodierbare Keramik

A Leonhardt e. K. brand

You're looking for: Highly wear-resilient functional parts for use under high tribological, mechanical and thermal stress? You wish to combine the components with steel, so you need materials that have a similar thermal expansion coefficient to that of steel? EDM-machinable ceramics are an excellent option for this type of application due to their property profile and wear resilience.

We offer: In collaboration with our sibling company Leroxid[®] we produce semi-finished products and functional parts for you made of the EDM-machinable high-performance ceramic DIMACER[®]. Developed together with the Institute for Manufacturing Technologies of Ceramic Components and Composites at the University of Stuttgart, this material is based on an aluminium oxide matrix. Tiny titanium carbide particles ensure electrical conductivity. DIMACER[®] is characterised by a high degree of hardness, sound mechanical strength and fracture toughness. The hardness and elasticity of the ceramic can be varied within certain limits. Thanks to decades of experience in ceramics processing, we are able to guarantee functional parts made with reproducible precision here, too.



Protecting GRP tools.

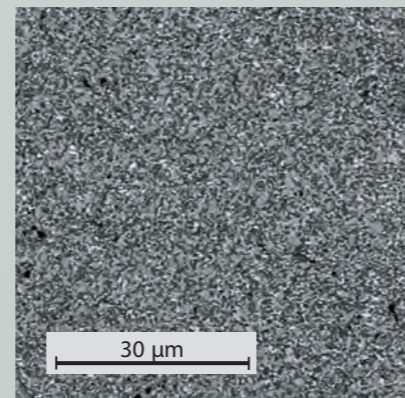
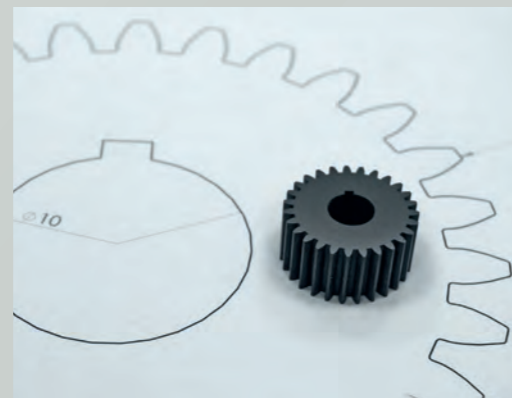
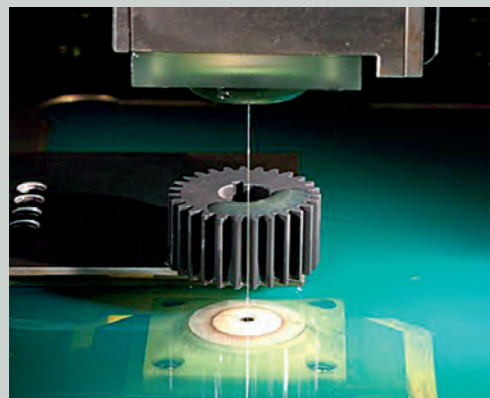
DIMACER[®] is excellent for protective inserts in injection moulds for processing abrasive materials such as fibreglass-reinforced polymers. Here, DIMACER[®] ensures a much extended service life, with significant reductions in maintenance work or alternative investments.

Micro-components subjected to extreme stress.

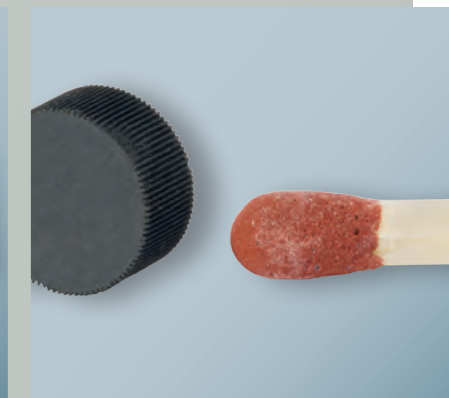
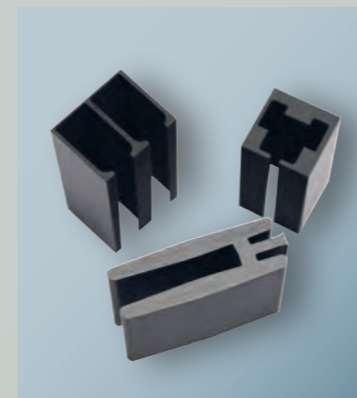
Component miniaturisation means that acting loads are concentrated on much smaller areas. Conventional materials quickly reach their limits here. DIMACER[®] comes into its own where lasting reliability is required or where powerful frictional forces are at work, for example in watches or other items involving precision mechanics.

Making the most of the property profile.

The material's property profile make it interesting for a wide range of other applications, too. DIMACER[®] cogs are installed in pumps for aggressive media, for instance. The aerospace industry also uses this high-temperature-resistant ceramic.



Typical microstructure on the EDM-machinable ceramic DIMACER[®]





ELABORATE AND SKILFUL ENGRAVING



IN PERFECT SHAPE HIGH-SPEED MILLING

Manual or CNC engraving.

Admittedly, “moving into the third dimension down the data highway” sounds rather futuristic. But that’s exactly what’s happening: we take your data in all common formats and use it to create lettering and symbol electrodes or even three-dimensional form engravings on irregular freeform surfaces. On request we provide approach dimensions for electrodes to be fed into the EDM machine.

Even the most demanding projects are dealt with right away.

3D engravings and engraving electrodes within the microscopic range are all part of our day-to-day work. Whether in the technical or the artistic field – we process your items on CNC engraving machines with up to four axes. Suggestions and computer print-outs are provided in advance.

Treasures in gold.

It was our specialists that produced the embossing tools for the cover of the “Golden Bible”. The 3D contours were pierced by hand in plaster models according to the traditional method using visual templates. The data was generated by laser scanner and then applied to the embossing plates using CNC technology – an entirely unique assignment.



Range of services:

- Standard interfaces
VDA, IGES, STEP, STL, DXF, Parasolid
- Support for product development
- Approach dimensions for electrodes
- 4-axis roller engravings
- Embossing plates of all kinds
- Engraving on commonly used tensioning systems
- High-quality manual work, e.g. punching
- Part size: 500 x 400 x 200 mm

Milling – a core capability.

With highly qualified staff and premium-class machines, HSC simultaneous milling is one of our core capabilities. Highspeed spindles with rotational speeds of up to 40 000 rpm enable efficient milling of freeform surfaces. We can even execute hard machining of steels at 65 HRC to maximum precision.

Efficiency of time and cost.

With HSC milling alone we create surface finishes that meet the very highest standards. This significantly reduces or entirely avoids any extra cost and effort involved in subsequent surface finishing. This means that production of electrodes for ECM machining or subsequent manual polishing stages are no longer required, for example.

Wide range of machines.

From a tried-and-tested 3-axle CNC milling machine through to a 5-axle simultaneous HSC machining centre, our equipment is bound to have the optimum solution to meet your needs. We machine workpieces up to a size of 500 x 500 x 300 mm.

Range of services:

- High-speed cutting (HSC)
at up to 40 000 rpm
- Hard milling up to 65 HRC
- 5-axis simultaneous milling
- 5-axis ultrasonic machining
- Conventional profile milling up to 1:10
and enlargements up to 3:1
- Part size: 500 x 500 x 300 mm





OUR CLASSIC – EFFICIENT WIRE-CUT EDM



A BRILLIANT POLISH – FOR TOTAL REFLECTION

Wire-cut EDM:

maximum precision with 0.02 mm wire.

We offer perfect mastery of wire-cut EDM to maximum precision, with a wire diameter of 20 µm for example. In the 3D area we also have unlimited possibilities thanks to our CAD/CAM programming system.

Die-sink EDM:

we get things into shape.

Die-sink EDM gets even hardened steels into the desired shape. Filigree contours included: we are able to machine corner radiuses of 5 µm to an accuracy of ± 2 µm. Since this is only possible using high-end machine technology, our chosen brand for die-sink EDM and EDM polishing is Makino. Surface finishes of $R_a < 0.1 \mu\text{m}$ are standard as far as we are concerned.

Range of services:

- Wire-cut EDM, also in 3D
- Part size: 380 x 250 x 200 mm
- Wire diameter of 0.25; 0.1; 0.07; 0.05 and 0.02 mm
- EDM polishing with $R_a < 0.1 \mu\text{m}$
- Short delivery times for wire-cut and die-sink EDM
- Precision up to ± 2 µm
- Collection and delivery service on request

Superb surface finish.

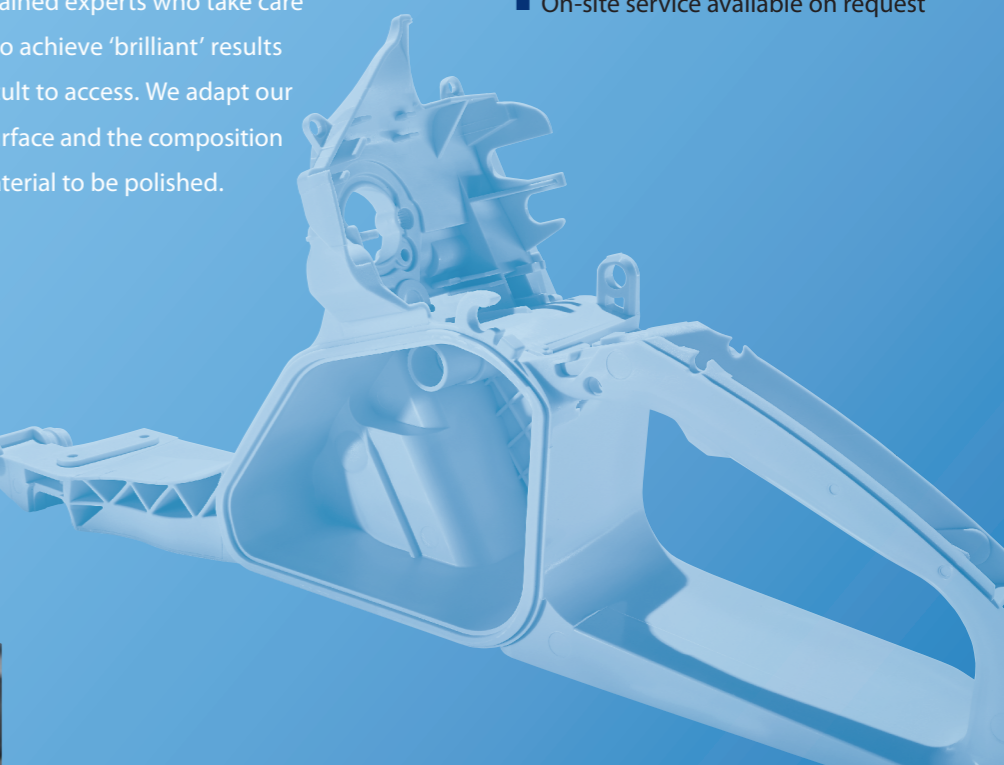
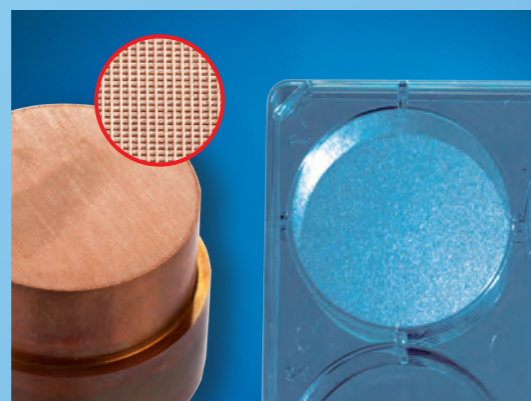
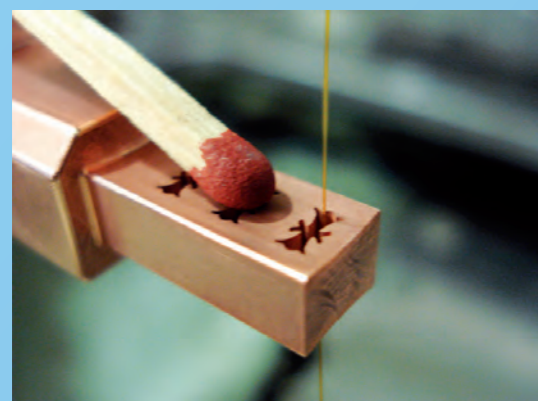
Excellently pre-machined surfaces hugely reduce the effort required to apply mould cavities in EDM polishing. We are able to achieve surface finishes of $R_a = 0.06 \mu\text{m}$. Optical lenses and reflectors can be produced in this way with the utmost process reliability.

Manual precision work.

Our company employs specially trained experts who take care of manual polishing, allowing us to achieve 'brilliant' results even with moulds which are difficult to access. We adapt our method to the properties of the surface and the composition of the alloy components in the material to be polished.

Range of services:

- CNC polishing up to $R_a < 0.1 \mu\text{m}$
- EDM polishing up to $R_a < 0.06 \mu\text{m}$
- Surface machining of print and injection moulds up to high-gloss $R_a = 0.05 \mu\text{m}$
- Component weight up to 500 kg
- Volume parts
- On-site service available on request





REVERSE ENGINEERING AND QUALITY ASSURANCE



RAPID PROTOTYPING – IMPRESSIVE SAMPLE PARTS

Scanning with a keen eye.

With our 3D laser scanner we reconstruct components and generate lost data. This enables fast repair or alteration of tools. Using reverse engineering and our special software we are able to re-generate the component surface as a CAD model based on point clouds. We can also digitalise design models.

Tactile measurement in the premium segment.

Our Zeiss 3D CNC measuring machine measures elements and contours to a high level of point density. This enables us to determine the current shape. The measurements are reliable, stable and also quick to carry out – and of course we provide you with all the relevant measurement protocols. We perform optical measurements with magnification up to 400x.

Range of services:

- Tactile 3D coordinate measurement in accuracy class 1.8 µm + L/300
- 3D laser scanner
- Reverse engineering to common specifications
- Extensive measurement protocols and initial sample test reports
- Damage and structural analysis using scanning electron microscopy
- Hardness tests according to Rockwell / Vickers
- Strength testing
- Density measurement
- High-precision contour and surface measurement

The fast way to the first component.

We use a variety of methods to turn existing CAD data into physical pieces quickly and directly without using manual workarounds or moulds. These include stereolithography as a widespread generative model-building process. This method has proved particularly effective for highly complex components.

Putting standards to individual use.

Whether stereolithography, laser technology or simultaneous milling, whether Rapid Prototyping or Rapid Tooling: once you have provided us with your data, we are able to produce components for use in preliminary and small-scale production – both quickly and economically. And that includes prototypes, of course!

Ceramics – an excellent option.

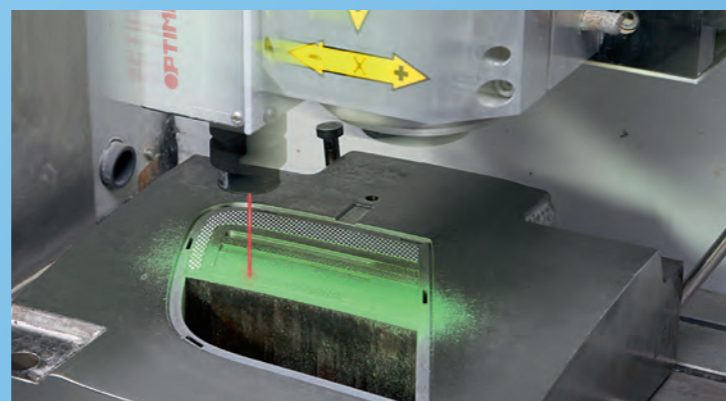
Prototypes made of metal and plastic are standard for us. But we also have several years of experience with EDM-machinable high-performance ceramics. We can use these to make pilot series as well as prototypes.

Range of services:

- Rapid Prototyping by means of stereolithography
- Rapid Tooling by means of FDM technology
- Expertise relating to unusual components
- Actual component accuracy ± 0.12 mm or 99%
- Component size: 400 x 350 x 400 mm
- One-off items through to pilot series

Range of materials:

- Plastic: ABS, PC, PEEK
- Conductive high-performance ceramics
- Aluminium
- Stainless steel
- Tool steel





ULTRASONIC MACHINING FOR HARD CASES



3D LASER MACHINING – FOCUSING ON ACCURACY

The final touch for ceramics and more.

5-axis ultrasonic machining is a particularly low-impact grinding and drilling process. In an ultrasonic machining spindle, vibrations are generated that make the diamond tool pulsate at rates of between 17 500 and 48 000 rpm. This method significantly reduces the mechanical forces and thermal stress acting on the workpiece.

Even the hardest material yields.

Whether non-ferrous metals that are difficult to machine, extremely hard steel alloys or hard metal, whether glass, corundum, ceramics or sapphire, whether metallic or other composites: ultrasonic machining gives parts the final touch. This enables excellent surface finishes of $Ra < 0.2 \mu m$ and miniature bores $\leq 0.05 \text{ mm}$.

Industries:

- Medical technology
- Semiconductor industry
- Automotive industry
- Optical industry
- Toolmaking and mould construction

Range of materials:

- Glass
- High-performance ceramics
- Metallic materials
- Corundum
- Silicon, germanium
- Composites

Clustered light as a productive tool.

Direct processing of CAD data applies the pulsed laser beam selectively onto the material, which is then removed in layers. The material does not melt, it evaporates. The focus of the laser beam allows a very high degree of accuracy. Even corners with a roundness of less than $50 \mu m$ are possible using this method.

When all else fails.

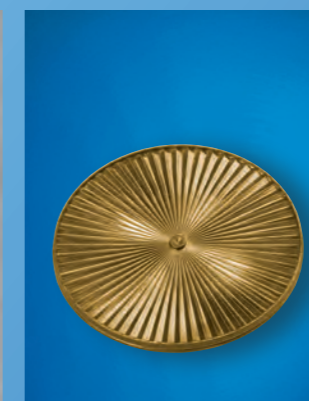
Laser is the sensible option whenever conventional machining reaches its limits. In particular, very hard, insulating or high-temperature-resistant materials such as Hastelloy, tungsten and aluminium oxide can be quickly shaped using laser technology.

For repair tasks.

We repair worn or damaged tools using laser cladding. After this, finishing and polishing processes are applied and the tools are quickly ready for use again. Give it a try!

Range of services:

- 4-axis laser cutting
- Laser cutting with draft angles
- Aspect ratio 1:2.9
- 3D laser engravings
- Laser cladding and high-gloss polishing





OUR TRACK RECORD REFLECTS OUR PASSION

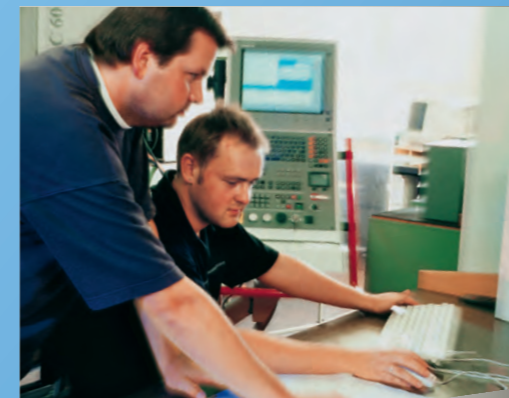
Corporate culture combined with innovative strength.

Leonhardt is one of the most innovative SMEs in Germany – this was the verdict arrived at in 2016 for the fourth time by a panel of experts presiding over the nationwide cross-sector comparative assessment “TOP 100”. The jury was especially impressed by our individually tailored system of innovation management. Numerous other awards reflect our innovative strength, including the coveted EuroMold Award in bronze and gold.



At the service of our customers.

Leonhardt regards itself as a modern service company. We offer top-class service underpinned by outstanding innovative strength. This has also enabled us to establish ourselves as a technology service provider and development partner. Numerous Leonhardt developments are patented. One example is a patent issued in 1996 for printing letters made of recyclable, food-safe plastic.



Documented quality.

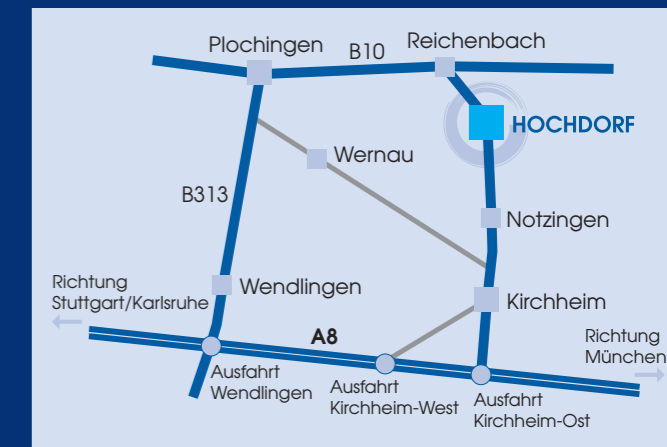
As long ago as 1996, Leonhardt was certified according to DIN ISO 9001, and in 2016 the company received the EN 9100 certificate for the aerospace industry. Leonhardt’s focus on quality and customer orientation is what guarantees its competitiveness and success: this is the force that drives the company forward.



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