

Automotive



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Discover Efficiency

In production, efficiency means a machining process that is perfectly tuned to the requirements of the components from beginning to end. Precision tools are the key to faster, more precise, and cost effective processes. This is particularly true in the automotive sector, where tools are fast becoming the main pillar of large volume production.

Here at LMT Tools, we have developed a special tool package for you, our customers, that combines the range of services offered by leading experts in the field and is the perfect fit for every production requirement worldwide:

- LMT Belin is your specialist for fine finishing tools and tools for composites and plastics.
- LMT Fette is a market leader in the development of gear cutting tools and thread rollers and provides state-of-the-art tool solutions for threading and milling.
- LMT Kieninger is your partner for complex project engineering tasks and an expert in both special tools and mold and die making.
- LMT Onsrud supplies the latest solid carbide tools for processing composites and light metals.

Based on these components, LMT Tools develops tool solutions for processing not only lightweight construction materials and steel materials, but also composites and stacks for the aerospace industry. Our portfolio is complemented by services such as project management, tool services, tool management and training programmes. With this, LMT Tools guarantees an overall service package that includes everything from the planning phase to the successful production of large volumes.



Automotive

Tool solutions that will change technology

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Lightweight construction, downsizing, alternative drives – there is hardly another industry facing similar challenges to the automotive sector. As a result, the production process is continuously changing as well. Precision tools play an important role in this context.

Example downsizing: Engines are getting smaller and lighter. This is the only way to comply with the more stringent emission laws. And it does not mean that the motors are less powerful – it may even increase performance. High compression combustion processes inside the cylinders make this possible. The performance of high compression engines, in fact, is even beginning to prompt manufacturers to reduce the number of cylinders in them.

This development ultimately affects all components. However, aside from becoming smaller, components also need to be stronger in order to sustain the high speeds and temperatures they are faced with. This is why construction processes employ high-strength materials and new geometrical shapes with an emphasis on stability.

For the tools, this development is a real challenge: While they must be able to process the complex geometry exactly, they also often have to sustain increased temperatures due to the hardness of the material. This environment requires exactly the kind of know-how LMT Tools has to offer. Our specialists develop tool solutions and strategies for large volume production. They make a significant contribution to lowering the costs of your production processes and fulfilling your ever-increasing quality requirements. In addition, our specialists are very familiar with the production processes in the automotive industry. As they incorporate this know-how in ongoing projects, they become pioneers in the development of new production solutions.



Automotive components

Customized tool solutions for every component

Over the next few decades, experts expect an increasing diversification of the automotive industry. This means different drive concepts, a broader model range and more flexible value-added chains.

This development also changes production. On the one hand, manufacturers have to process a larger number of different components and variants of components at a single location. On the other hand, the performance, functional density and complexity of these components is increased significantly.

The key to guaranteeing efficient production processes in the future are the tools. This is why LMT Tools develops high-performance tools that are precisely tailored to automotive components and the production requirements of the user.

This page provides an overview of the components LMT Tools offers tool solutions and know-how for. On the following pages, we will look at selected components in more detail.

Engine

How smoothly and efficiently an engine runs, depends on these components. When the components are processed with quality tools the component quality is at its highest.

- Manifold
- Injection tube
- Crank shaft
- Camshaft
- Connecting rod
- Turbocharger
- Cylinder head
- Cylinder crankcase
- etc.

Transmission

Transmission components are becoming more and more complex, smaller and stronger. The tools used by LMT Tools guarantee efficient large-scale production processes.

- Gear housing
- Gear shafts
- Gear wheels
- Clutch housing
- Oil filter housing
- Oil sump
- Steering housing
- etc.

Car body

Sheet metal, aluminum, plastic or composites: LMT Tools provides tools for all kinds of materials.

- Fittings
- Interior paneling
- Hood
- Frame parts
- Sillboard
- Spoiler
- Doors
- Door hinges
- etc.

Drive train

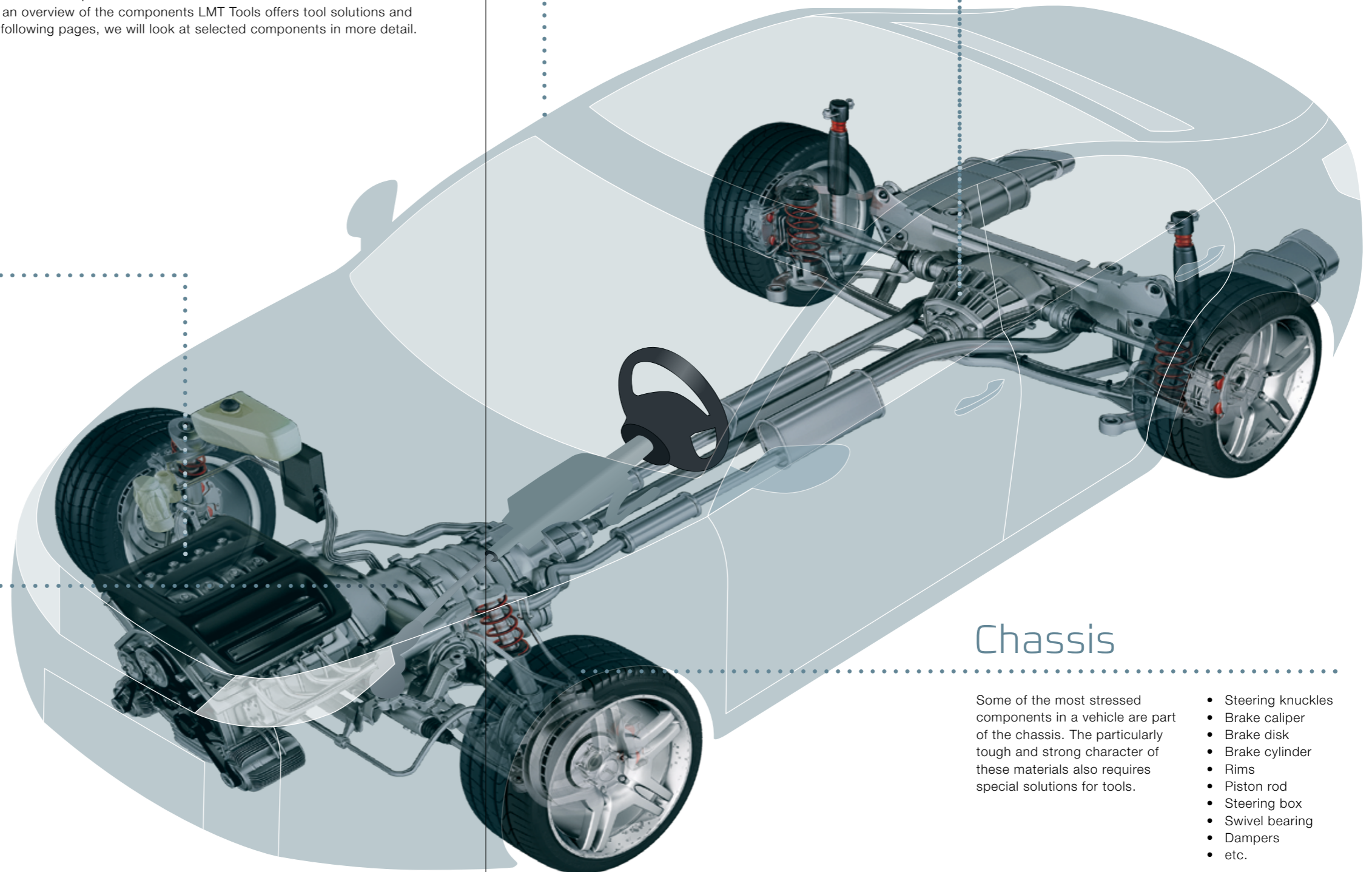
Lightweight construction is changing the components and materials in the drive train. LMT Tools develops tools with a special geometry, cutting materials and coatings for this purpose.

- Drive shaft
- Differential housing
- Power train
- etc.

Chassis

Some of the most stressed components in a vehicle are part of the chassis. The particularly tough and strong character of these materials also requires special solutions for tools.

- Steering knuckles
- Brake caliper
- Brake disk
- Brake cylinder
- Rims
- Piston rod
- Steering box
- Swivel bearing
- Dampers
- etc.



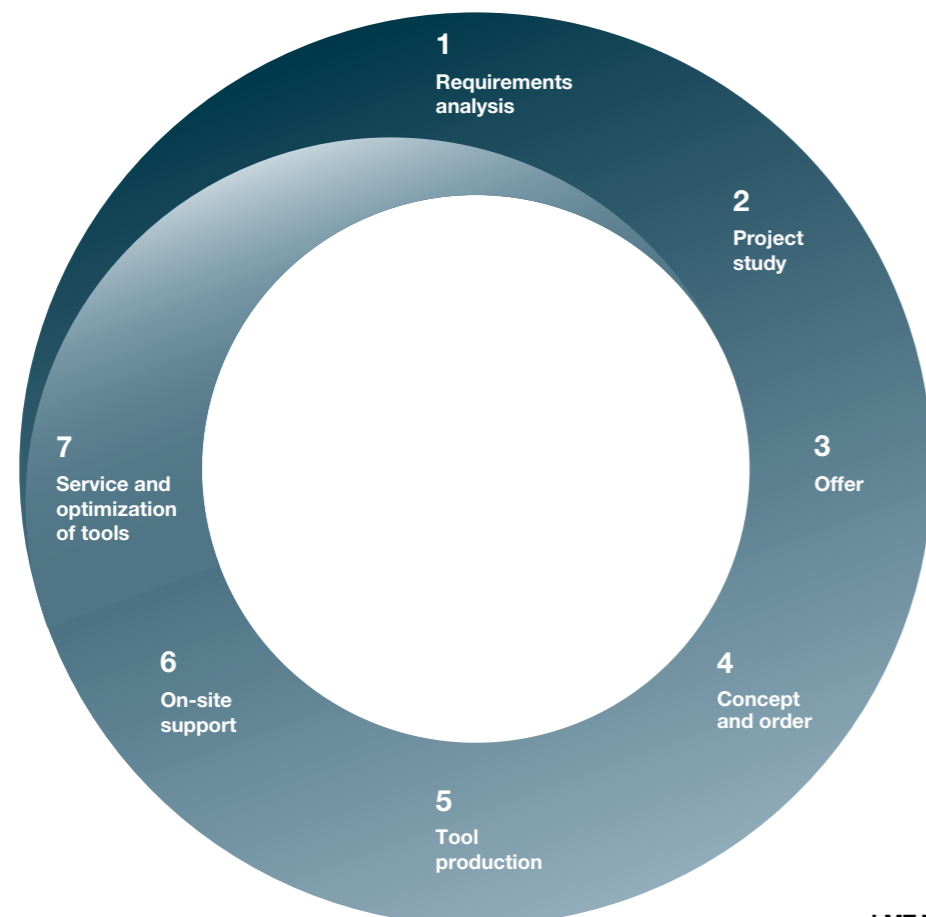
Project management

Finding the perfect production system

Automotive components are becoming more and more complex. At the same time, processing of these components is expected to become more streamlined. Without a comprehensive tool strategy it is hardly possible to reach this goal. Most processes also include a system of special tools, production steps and processing methods. A perfect coordination is crucial.

The complexity of a component and how expensive its production will be is already decided during its construction and project planning phase. Sometimes changing the production processes can significantly lower the costs. Another important factor is the development of the processing strategy. The goal is to complete the component with as little tools and intermediate steps as possible. The results are secure processes, a higher quality and lower costs.

Our experts at the LMT Tools competence center in Lahr have the right know-how for this task. As technology partners for users and machinery producers they develop customized solutions for complex machining processes. They manage projects beginning the development of functional specifications and detailed tool drawings all the way to the development of the tools and on-site support when production begins (see diagram). One example of their success is the streamlined series production of steering knuckles of a large car manufacturer, who began using special and combination tools. As a result, processing tasks could be combined, significantly lowering production costs.



LMT Tools project management

Project study

When a project begins, the LMT Tools engineering experts start by creating the functional specifications. Based on this document, they develop a detailed project offer, including conceptual drawings for tools, information on processing strategies and 3D models and collision analyses.



Tool development

Newly developed special tools make it possible to increase the performance of many systems and production processes significantly. Our specialists specifically optimize the interaction of the main body, cutting edge geometry and cutting material for the corresponding task at hand.



Tool production

Depending on the application, the LMT Tools competence centers LMT Belin, LMT Fette, LMT Kieninger and LMT Onsrud – work together to produce special tools. All complete systems, if requested, are produced in series and ready to use in the quantities the customer requires.



On-site support

The global LMT Tools service network guarantees continuous support. This service is provided from the initial commissioning to the start-up phase and also for optimizing existing production processes. Moreover, our experts develop appropriate service concepts together with our customers.



Cylinder crankcase

Large volume production – accurate down to the last micrometer

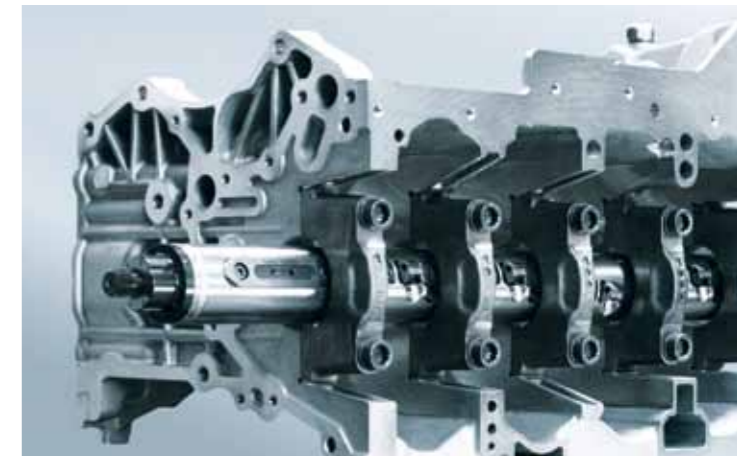
Extreme forces are at work inside the cylinder crankcase. The component has to sustain increasing specific forces, such as a high ignition pressure and speed. Only when processed precisely down to the last micrometer can it be guaranteed that the engine is efficient and runs smoothly.

This has the following implications for the cylinder bore: The processing quality required here is almost unparalleled in industrial production. During the process, a defined surface quality and perfect roundness must be achieved. Another challenge in large volume production are nano surface coatings with which an even more compact and lightweight housing can be built. The results very much depend on the precision tools that are used. They must guarantee short processing times as well as a high level of process reliability and quality.

To realize this, our engineers are developing custom-fitted tool solutions for processing cylinder bores, flat surfaces and bearing bores. The geometry, cutting material and coating of the indexable insert that are used are matched to the maximum strain. In this way we were able, for example, to improve the cutting speed for roughing cylinder bores or the surface quality of their finish. The LMT Tools experts are able to draw on substantial knowledge in processing bearing bores. The tools are equipped with automatic blade compensation – the process is carried out without interruption, thus lowering cycle times.



The geometry of the **cylinder crankcase** must be processed precisely down to the last detail – the efficiency of the engine depends on the result.



Top left

Cylinder bore roughing

Setting the pace for shorter processing times: Indexable inserts with multiple cutting edges help create shorter cycle times during roughing. Adjustable systems or monoblock tools are available.

Top right

Finishing the cylinder bore

The end result must be a bore with a perfect surface and cylindrical shape. To achieve this, the tools from LMT Tools guarantee grooveless processing during each phase of the process (including the return path). The semi-finishing and finishing processes are carried out with a single tool.

Bottom left

Finishing the cylinder head divider plate

Defined surfaces and burr-free components are the main goals during face milling processes. LMT Tools secures this level of quality with the help of adjustable cutting blades and a high number of teeth. Cooling is achieved by means of emulsion, air or minimum quantity lubrication.

Bottom right

Fine-machining the crankshaft bearing bore

Maximum surface quality and roundness, minimal cycle times: Tool systems from LMT Tools stand for long-lasting perfection in the finishing of bearing bores. Wear and tear is compensated for with the help of automatically adjustable cutting blades.

Cylinder head

The challenge of downsizing

Eight-cylinder engines are reduced to six cylinders, six-cylinder engines to ones with four or even three cylinders – the engines in the automotive industry are shrinking. This changes the requirements to the cylinder head, which is also becoming smaller. The precise machining of the complex geometry becomes a difficult task.

When experts talk about the “thermomechanical challenges” in modern engines, they are also – and specifically – referring to the cylinder head: There are not many other components that the highly compressed combustion process with its extreme temperatures puts this kind of pressure on. Developers are therefore starting to use new materials and modified geometries to guarantee the stability and tightness of the cylinder head. And long with that, another trend is emerging: Just like the entire engine, the component tends to become smaller. This means that the surfaces and bores to be processed are also smaller.

The cutting tools that are used therefore assume an especially important role: they must be able to guarantee extremely precise processes while machining the valve seat, injector bore and camshaft bearing bores – and all that while ensuring short cycle times. To achieve this goal, the LMT Tools experts are working to further develop milling systems, cutting materials and tool cooling systems. They also work closely with the people who use these systems. The cooperation begins during the development phase of the component and continues until an efficient processing strategy has been developed.



Developers are using new materials to make sure that the **cylinder head** is able to withstand extreme temperatures.



Top left
Pilot bore for the camshaft bearing channel

The pilot bore of the bearing channel must provide a high-precision base for the finish. For this purpose, LMT Tools develops PCD or carbide combination tools for drilling – including cooling and chip removal.

Bottom left
Finishing the injector bore
Perfect surfaces despite small diameters: The fine-machining of the injector bore is a special task for multi-stage solid carbide tools with brazed cutting edges made of polycrystalline diamond (PCD).

Top right
Finishing the camshaft bearing channel bore
The requirements for the finish are high. The accepted bore tolerance, for example, is only a few micrometers. LMT Tools manages to secure this quality with just two tools. Reamers with single or multiple cutting edges are available to perform the task.

Bottom right
Finishing the valve guide and seat
The finishing of the valve guide is performed in the micrometer range. These extreme values can be realized with the reamers from LMT Tools that feature single or multiple cutting edges.

Engine components

Special challenges for heat-resistant materials

In modern motors, the intake air is compressed even more due to the use of high performance turbochargers. This improves the efficiency of the fuel combustion. The strain this puts on this and other components is obvious. But what does it mean for your chipping processes?

Manufacturers use the high compression combustion process to increase the engine capacity of their models to new dimensions. Powerful petrol and diesel engines sometimes even include several turbochargers. Inside these engines, the impeller turns at a rate of up to 290,000 revolutions per minute. As a result, extremely high temperatures occur, which developers counter with stable, highly heat-resistant materials.

Cutting these materials, however, is a challenge. It puts an unusual high strain on tool substrates and cutters. At the same time, the connection of a turbocharger must be processed with a face cutter to make sure it is perfectly even. Our LMT Tools engineers have therefore created the necessary cutting edge geometry and special cutting materials for highly heat-resistant materials. Their philosophy: The component determines the development strategy. As a result, there are now individual tool solutions for different components, such as oil pump or valve body assembly.



The "control center" of the automatic transmission: Small deviations during the processing of the **valve body** assembly influence the switching behavior.



The auxiliary components of the engine, like the **oil pump**, shift into the focus of the developers. The oil is transported with a more and more accurate dosage and more efficiently.



Top left
Face milling the valve body assembly

Defined and burr-free surfaces are the goal when face milling this component. The process is carried out using LMT Tools milling systems with exchangeable cartridges with a high number of teeth. The blades are made of polycrystalline diamond (PCD).

Top right
Reaming the oil pump

In an oil pump, precise connections are essential. This is why the accepted ISO tolerance for processing oil pumps is minimal. Steel or solid carbide tools with multiple cutting edges from LMT Tools secure this level of quality.

Bottom right
Milling the turbocharger flange surface

The flange surface with its defined surface quality must be processed in a single step. This is done using high-performance cutting materials that are specially developed for the highly heat-resistant materials used here.



The connection elements of the **turbocharger** must be perfectly even after they have been processed. Otherwise the necessary tightness cannot be guaranteed.

Transmission and clutch housing

Thin wall structure – complex shape

Automatic transmissions with eight gears or more are now standard. This ensures that the engine speed range is always ideal, which in turn helps lower fuel consumption in passenger cars. But the weight of the gearbox still needs to be reduced. To achieve this, thin-walled housings are used – a highly sensitive task for the cutting tools.

More components, less weight in total? What sounds impossible is now becoming reality in the production of transmissions. Every single component is designed with a lower weight. The housing is a good example: Heavy casting materials are more and more often replaced by aluminum components. In addition, the external shape is becoming slimmer. To make sure they remain stable, engineers are developing new geometries that are optimized to withstand a high strain.

The thin-walled and complexly shaped housing requires the highest precision during each milling and drilling process. Deviations can be a threat to the stability or functionality of these components. This is why LMT Tools uses friction tools, tap drills and face cutters that achieve a high surface quality and minimum tolerances. The vibration behavior of these tools, for example, is constantly optimized, and the cooling systems are enhanced further – fine-tuning for the gearbox housing.



New materials and “slimmer” structures mean that cutting tasks related to the **gearbox housing** are becoming more and more demanding.



Top left

Initial fine-machining of the bearing bore

This is a task where a minimum deviation from the tolerances can only be guaranteed with the help of a multi-stage fine-machining process. The first step is to use single-blade reamers from LMT Tools that are equipped with special blades made of polycrystalline diamond (PCD).

Bottom left

Performing drilling tasks on the housing

The cutting materials of the solid carbide tools play an important role in the drilling of the housing. LMT Tools develops custom-fitted solutions for processing different materials.



Top center

Finishing the bearing bore

The finish with monoblock or indexable insert tools ensures the necessary surface quality. The blades are made of PCD material.

Bottom center

Tap drilling work on the housing

The threads are created with an extremely short cycle time. The modular tap drills and thread formers from LMT Tools also guarantee a high service life, thus securing permanently reliable processes.



Top right

Face milling the housing

High processing speed and maximum quality – the requirements the face milling process for the housing must fulfill can be quite demanding. LMT Tools develops particularly stable low-vibration tools with soldered blades for this purpose.

Bottom right

Reaming the housing

The surface is processed at high speeds and with an accuracy of one-thousandth of a millimeter. This is why our tools feature PCD blades and are equipped with an internal coolant supply.

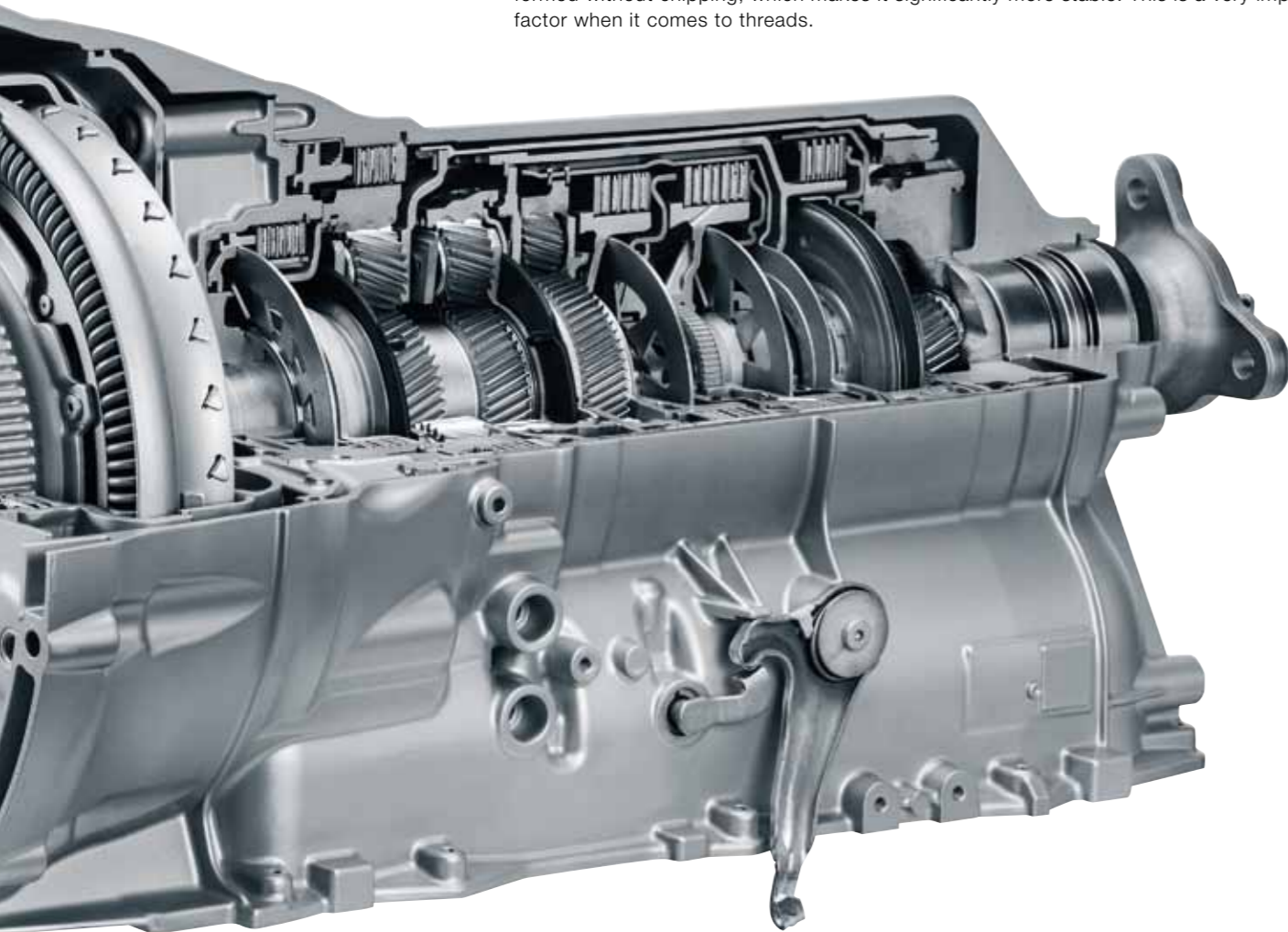
Gear cutting and thread components

Getting your large-scale production processes up to speed

Large-scale production is the key in the automotive industry – large quantities of transmissions and engines are required. Reducing the machining times while securing a high level of process reliability is therefore essential.

Innovations such as additional hybrid engines, dual-clutch transmissions or 9-speed automatic transmissions all stand for an increasing number of gearwheels that perform their duties in the car. This development goes along with a constant pressure to further optimize processes. The goal is to make large-scale manufacturing of gears faster and, because of that, also cheaper. In this environment, the SpeedCore hobs from LMT Tools show what they can do. They make it possible to increase the cutting speed – and productivity – significantly.

The EVOline rolling head from LMT Tools is an innovation of similar quality. It is used for processing the many external threads that are located, for example, in the area of the drive train. This is a tool that is very easy to handle and very robust. In less than a second processing is finished – a speed that is typical for the different rolling systems of LMT Tools that also play a central role in the processing of the threads of piston rods for dampers or injectors for diesel injection systems. They have an obvious advantage: The material is formed without chipping, which makes it significantly more stable. This is a very important factor when it comes to threads.



Modern transmissions contain an increasing number of **gearwheels**. They are produced in large volumes, which is why the costs per part must be as low as possible.



Top left

Hob cutting gearwheels

Where large volumes are produced, every second counts. SpeedCore is a new system that includes cutting materials, coating and tool design and guarantees the highest level of productivity. Further strengths are its easy handling and high level of process reliability on both new and existing machines.

Bottom left

Chamfering gearwheels

With the patented ChamferCut LMT Tools has revolutionized the chamfering of gearwheels. This is a cutting process that creates an even chamfer with an exact definition. The ChamferCut is very flexible in its application. It can be used as a tool system in combination with a hob cutter or separately on a deburring unit – ChamferCut guarantees highest quality results at maximum efficiency.

Top right

Axial-type rolling with EVOline

Many different external threads in a car must be produced quickly while ensuring a high thread strength and reliable processes. This also applies particularly to piston rods, which are fitted in suspension components. The EVOline axial rolling heads meet the requirements of these safety-relevant components daily in mass production.

Bottom right

Rolling external threads

The most sturdy threads are rolled – and that at a high speed. Three rolling methods are available: Axial type rolling is the universal method for threads of every length. Radial type rolling can be used to produce threads within a single revolution of the rolls. The plunge rolling method is applied using a tangential-type rolling head, which means profiles, for example, can also be rolled behind a workpiece shoulder.

Steering and chassis components

Maximum precision for stability and safety

In the area of the chassis and steering many innovations have occurred. Electronics and lightweight construction make the vehicles safer and more economical. However, the constant development pressure also affects the production processes of core components.

The car of the future will take over many tasks of the driver. Driving errors should become a thing of the past. Examples of this development are innovations such as assistance systems, an active chassis or an electric steering system. This also affects core components besides simple electronics like steering knuckles, brake caliper or steering box. Their geometry is becoming increasingly complex. This is why they have to be chipped with a microscopic accuracy.

Our LMT Tools specialists react to this trend by continuously developing the special tools for steering and chassis components further. This includes spherical cutters with a particularly low vibration and a new blade arrangement and milling and drilling systems with lasered chip breakers. These components allow for an optimal chip break and low cutting forces. In other words: Productivity increases significantly.



Some of the most stressed components in a vehicle are the **steering knuckles**. Their material is very tough and difficult to process.

The density and stability of the **steering box** depends on precisely machined bores and connection elements.

Finishing the steering knuckles

After multiple fine-machining steps, the material exhibits an extraordinary surface quality and a complex geometry. The polycrystalline diamond (PCD) blades used in the process are equipped with lasered chip breakers for this purpose. This prevents chip break during drilling.



Milling the spherical cap on the steering knuckle

During ball-end milling the geometry of the tool is imprinted in the workpiece. This is why the shape of the LMT Tools milling systems is developed at a very high level of precision with the help of CAD tools. The arrangement of the blades is another important factor. It ensures a soft and therefore smooth cut.



Milling the brake caliper with the necessary clearance

The deep groove on the component must be processed quickly and accurately – a perfect task for the PCD spherical cutter. The LMT Tools tool has a very large amount of teeth. This facilitates a particular low-vibration cutting process.



Finishing the steering tube

The main bore of the steering tube is created at a precision in the micrometer range – and that while keeping an eye on roundness and cylindrical form. Our developers from LMT Tools are putting the focus on multi-stage reamers with multiple blades and guide strips made of polycrystalline diamond (PCD).



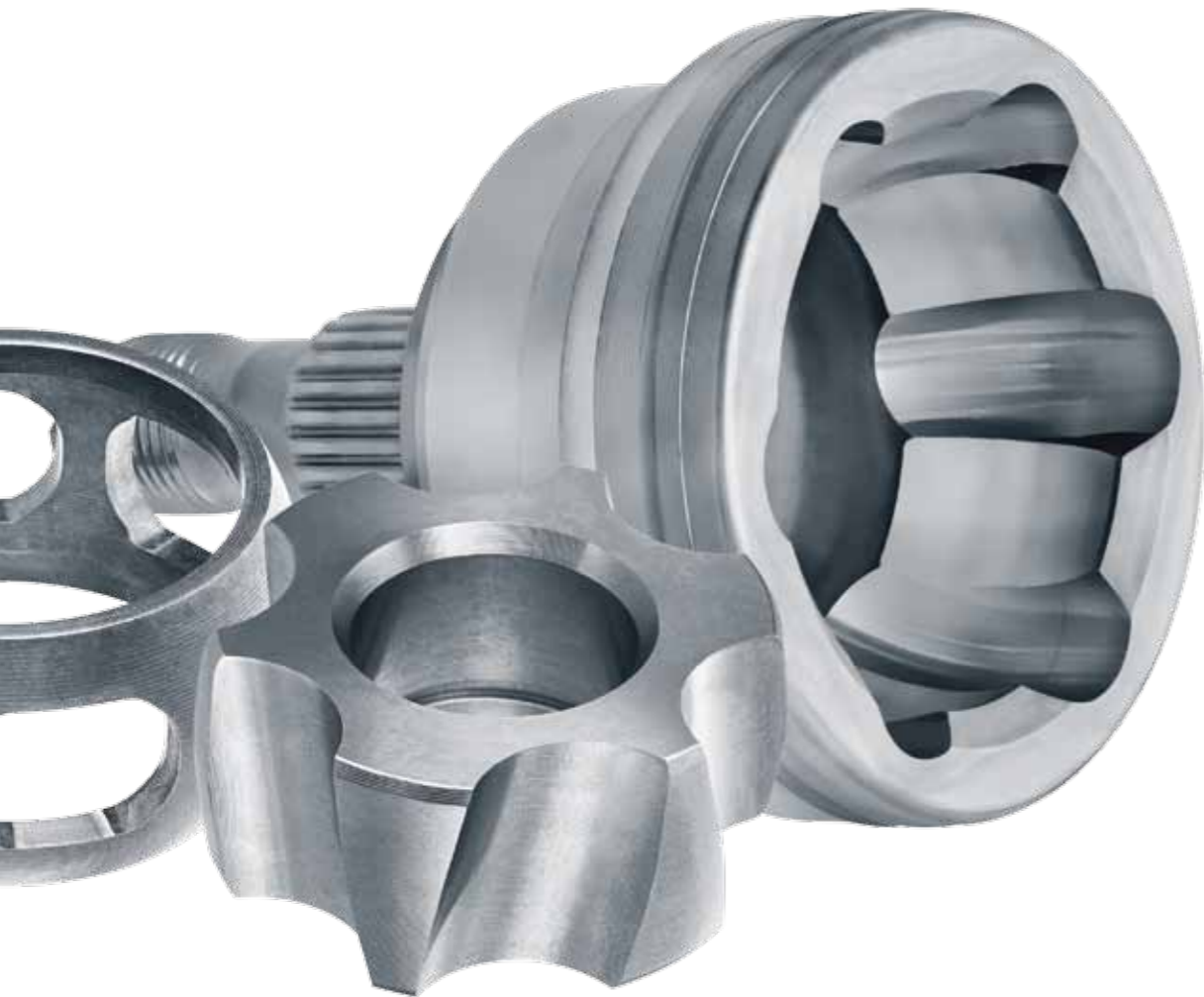
Universal joints

Individual solutions for the perfect geometry

The transmission of engine power largely depends on the synchronized drive shafts: They transmit, for example, the torque from the differential to the wheels and also allow for the movement of the wheel suspension and the steering of the wheels. The main components of these drive shafts are universal joints.

There are many designs, but they all have one challenge in common: Almost all the components of these joints – such as the so-called bell or the hub with the corresponding ball paths – have a very hard surface. Processing their complex shapes, including the osculation, path clearance and angle of contact requires a fair amount of production engineering know-how and a lot of experience in machining hard materials.

Due to this challenge many users have trusted in time-consuming grinding processes for years. Currently, however, the use of the much more efficient hard milling process is gaining more and more popularity – innovative tools make this possible. LMT Kieninger is one of the pioneers in this area. The company develops all the tool types required for milling these joints. The cutting edge geometry and substrate, for example, are developed to match the desired geometry perfectly. This does not mean, however, that the general tool development at LMT Tools is getting less attention – an optimal wear-and-tear behavior, a high level of stability and maximum repeat accuracy are just a few results.



The complex shape of the **components of the joints** can be processed very efficiently when hard milling processes are employed.

Hard milling the ball path

The hard machining of the ball path is a high-precision process that is carried out with the help of the insert system from LMT Tools. The geometry of the blades and milling cutters are adapted perfectly to the ball path geometry with the help of CAD tools.



Milling the ball cage windows

Costs per part in focus: Components like the ball cage are created as part of large-volume production processes. Here, the efficiency of the hard milling processes as compared to grinding processes becomes evident. Thanks to their precise section points, the tools from LMT Tools stand for smooth rotation and a high level of repeat accuracy.



Soft milling the ball path

The same standards are applied to soft-machining: Our experts carefully select and develop the geometry of the cutting edges and the cutting edge type. They are thus able to guarantee short processing times, an optimal wear-and-tear behavior and increasing service life.



Tool services and tool management

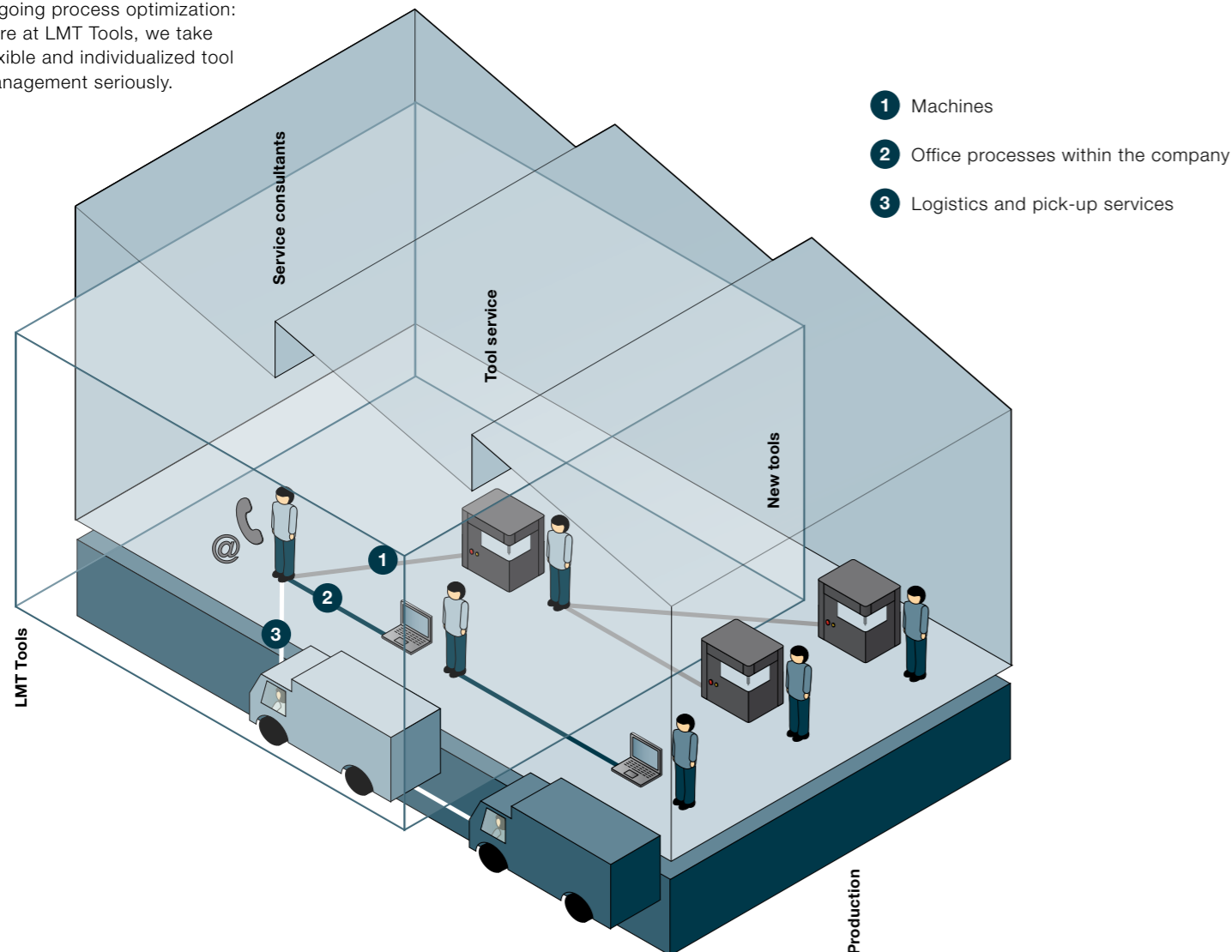
Efficient production processes – tailored to your requirements

The importance of precision tools in automotive engineering is often underestimated – and this is particularly true due to their relatively low purchasing price. Nevertheless, they form the interface between the workpiece and the machine and therefore have a big influence on the production process. As a result, the productivity of a site can be improved systematically by paying more attention to tool service and tool management.

One example is the production of gears: To guarantee an efficient process, hobs must repeatedly provide the same level of performance after their regular reconditioning including regrinding and coating. Service life and cutting parameters do not change and all production processes remain stable. This is why here at LMT Tools we guarantee our customers that our hobs and many other cutting tools will perform as new after reprocessing. This also includes the repair and refitting of PCD tools and thread systems.

But tool management is just as important: Only if a tool is available when needed where needed can a smooth production process be guaranteed and procurement costs lowered. A system of several steps that our experts have developed allows us to quickly match our services to the requirements on site: It includes everything from the most basic solution for current tool procurement to a complete service package where one of our teams will work with you to constantly optimize your processes. And of course there are many solutions in between - don't hesitate to contact us.

From tool procurement to ongoing process optimization: Here at LMT Tools, we take flexible and individualized tool management seriously.



LMT Tools service

Lower your tool costs: Our experts organize a service programme that includes everything from testing to regrinding, deburring and coating. The result is a reprocessed tool in manufacturer quality with the original key performance indicators.



Pick-up and delivery service

If you wish, our all-round technical service also includes picking up the tools and delivering them back to you – wherever you are. Logistic experts or our LMT Tools logistic partners take good care of your tools.



Our ebay@ tool dispensing system

Many of our customers in the automotive industry work with a variety of different tools. The ebay@ tool dispensing system ensures that the tools are always available. Our experts check the current stocks remotely. When necessary, they refill the ebay@.



LMT Tools training centers

If you are using machines and tools, it is important that you understand how to use them correctly if you want them to reach their full potential. To make this possible, our specialists offer seminars and training sessions where they present their current knowledge on different machining processes and tool applications – on gear cutting, rolling and milling.



Are you looking for the right tool solution for your component production or automotive project? Then don't hesitate to contact us:

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