

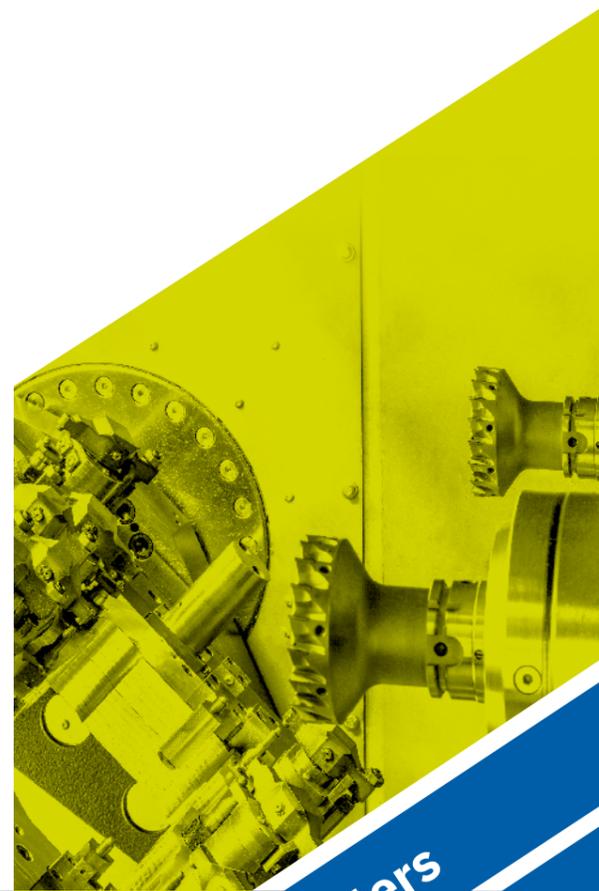


LiCON ^{MT}

modular machining centers

LIFLEX Machining Centers and Automation

**Economical Solutions
for Advanced Machining Tasks**



Machining Centers

Automation

Process Technology

Diagnostics / Services



40%
Less Power
Consumption



01. Machining Centers S. 4 | 02. Automation S. 12 | 03. Process Technology S. 16 | 04. Diagnostics / Services S. 22

Engineering Developments and Manufacturing Solutions from Germany for the World for More Than 50 Years.

Rely on LiCON.

Two unusual years are behind us. With a lot of commitment and improvisational skills, we have managed to support our customers in the usual manner, even under difficult conditions. Reason enough to take stock of the situation, to pause for a moment and to present you with the latest news from the LiCON world.



My sincerest thanks go to our customers, our suppliers and to our great LiCON team, which despite many adversities has developed

us into what we are today: a solution provider for advanced machining and associated automation equipment.

I wish you enjoy our LiCON Performance Magazine and gain lots of new insights. We look forward to your inquiries.

Winfried Benz

Winfried Benz, Managing Director



LiFLEX I Single-Spindle
LiFLEX II Twin-Spindle
LiFLEX IV Four-Spindle
LiFLEX GigaLine Large and Dedicated
Options for Loading Configurations
i- and i³-Technology
Motor Spindles

LiFLEX Machining Centers

**Our Claim: Our Machines
Perform at a Maximum Level
the Whole Life Cycle.**

This is ensured by a team of highly qualified specialists from the development of all relevant components to in-house production and long-term service support.

LiFLEX machining centers can be used for all known alloys and are designed to fit best cost-benefit ratio. Depending on several factors, primarily performance, costs and energy consump-

tion, linear drives as well as ball screw drive are used, where appropriate. Replacing the typical coolant by minimum quantity lubrication, energy savings can be further increased. Different loading options and the LiCON i³-Technology for independent offsetting of both spindles and thus extra high precision are some of the unique features which represent a significant added value for our customers.

LiFLEX Machining Centers

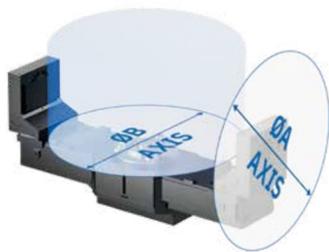


**Modular Machine Tool Kit
for Flexible Machining Solutions**



LiFLEX I
Single-Spindle Machining Centers
Single-Spindle – Even for Large Cubic Workpiece Sizes

LiFLEX single-spindle machines are mainly used in a 5-axis configuration. To avoid reclamping errors, large-scale cubic workpieces mainly made of aluminum, are also completely processed in one clamping. For this reason, the workpiece must be able to be positioned appropriately in the working area. The LiFLEX series offer correspondingly large diameters for the rotation of the fixtures in the A and B axes.



strokes:	x up to 1 600 mm y up to 1 800 mm z up to 800 mm
dynamics:	linear / ball screw drive, up to 150 m/min
tool change:	double gripper / pick up
interference cubes:	from 765 / 700 mm to 2 300 / 1 850 mm (A- / B-Axis)



LiFLEX II
Twin-Spindle Machining Centers
**Spindle Distances of 400 mm up to 1 500 mm,
Twin-Spindles Capable of High-Precision Machining
Quality**

With the LiCON i³-Technology, both spindles can be corrected independently without effecting spindle stiffness. Temperature sensors in conjunction with associated algorithms reduce the influence of different temperatures on the position accuracy of the spindles in the machining process. For extreme demands on the position accuracy of the motor spindle in relation to the fixture, touch probes can also be used.



strokes:	x up to 1 500 mm y up to 700 mm z up to 650 mm
dynamics:	linear / ball screw drive up to 140 m/min
tool change:	double gripper / pick up
interference cubes:	from 765 / 499 mm to 1 600 / 1 199 mm (A- / B-Axis)



LiFLEX IV
Four-Spindle Machining Centers
High Productivity in Reduced Floor Space

Four LiFLEX motor spindles work in unison. To ensure that all four motor spindles exhibit the same behavior in the machining process, the entire machine has had its dynamic behavior optimized. Thermal influences on position accuracies have been minimized. The identical conditions regarding rigidity ensure a reduction in cycle time as well as a consistently high machining quality in continuous operation.



strokes:	x up to 375 mm y up to 500 mm z up to 500 mm
dynamics:	ball screw drive, up to 60 m/min
tool change:	pick up
interference cubes:	from 600 / 244 mm to 750 / 374 mm (A- / B-Axis)



**Body-in-White-
Complete Processing**



LiFLEX GigaLine
Large and Dedicated
Machining of Large and Complex Workpieces

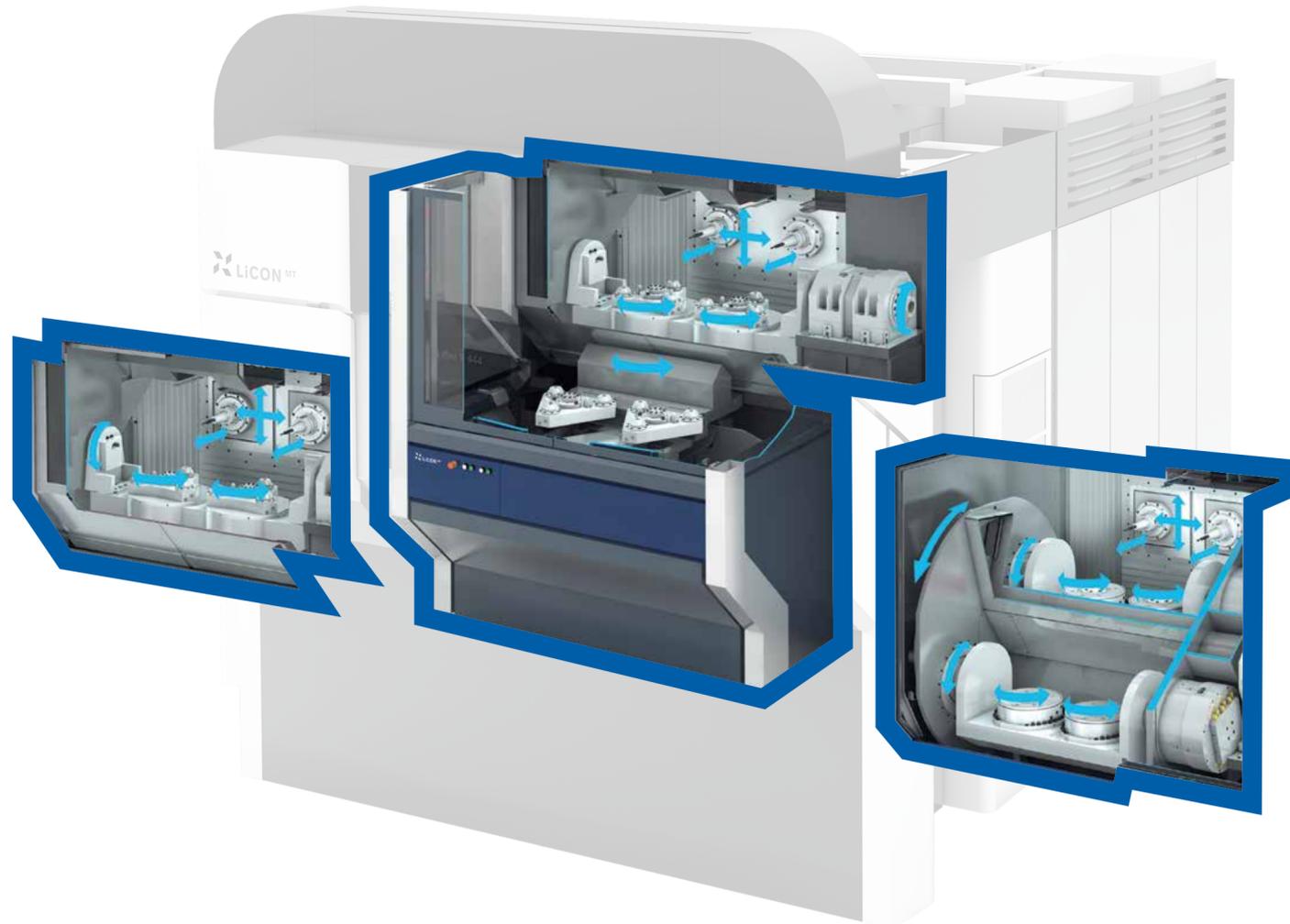
The trend in design of automobile chassis using light-weight structures is still ongoing. To reduce assembly work further, more and more large workpieces – mainly made of die casts – are being utilized.

The machining of these complex structural workpieces takes place on large, usually 5-axis machining centers. The existing LiFLEX modular system enables a tailor-made configuration for such large giga machining centers both single-spindle and twin-spindle. In order to be able to machine large-cubic workpieces completely in one clamping, the workpiece must be able to be positioned appropriately in the working area. The LiFLEX GigaLine offers machines with a correspondingly large rotation diameter up to 2 300 mm for fixtures in the two rotation axes A and B.

strokes:	x up to 4 500 mm y up to 1 800 mm z up to 800 mm
dynamics:	up to 150 m/min
tool change:	double gripper / pick up
interference cubes:	to 2 300 mm / 2 000 mm (A- / B-Axis)

LiFLEX Options for Loading Configurations

Each Process Has a Best Fit Loading Option.



Direct Load

DL

The direct load version requires only one fixture per motor spindle and is used when the loading and unloading times take only a fraction of the machining time.

Pallet Changer

PC

For shorter machining times and frequent changeover operations, the pallet changer is recommended. Rapid changeover is possible by means of zero-point clamping systems.

Double Trunnion

DT

As an alternative to the pallet changer, the double trunnion can also be used for concurrent loading.

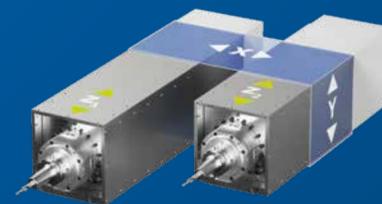


LiCON i- and i³-Technology

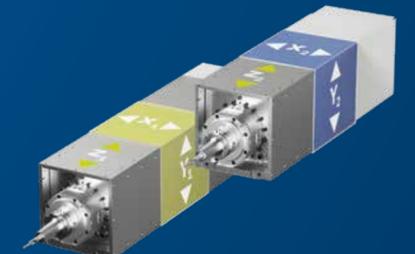
Highest Precision

i Standard feature of LiFLEX twin-spindle machines: independent in Z-axes

i³ Twin-spindle machines for high-precision machining tasks: independent in X-, Y- and Z-axes



Is a twin-spindle as productive as two single-spindle machining centers? The answer related to LiFLEX is "yes". Digitally optimized machine structures ensure that both spindles can utilize complete machining performance on the workpiece without detrimental influences.



With the LiFLEX i³-technology, both spindles can be corrected independently, without reducing the spindle stiffness in all three axes – X, Y and Z. Temperature sensors in conjunction with associated algorithms reduce the influence of different temperatures on the position accuracy of the spindles in the machining process. In the case of extreme demands on the positioning accuracy from motor spindle to fixture, additional touch probes can be used at intervals for automatic fine correction.

LiFLEX Motor Spindles

High-Performance Spindles Produced In-House
Plus Sensors for the Decisive Added Value



Motor Spindle – The Key Component for an Efficient Machining Process

A wide range of different LiFLEX motor spindles with up to 500 Nm torque and a 6-bearing configuration offers both the necessary conditions for machining light metals as well as for machining of materials that are difficult to machine.

All motor spindle types are equipped with sensors for vibrations and temperature. The recorded acceleration values are used for permanent monitoring of the machining process as well as to protect the machine against overload. In addition, the acceleration values can be used in combination with the LiCON specific LAVA software modules to optimize the machining process.

For more information on LAVA, see page 24.



To a Long Spindle Life! Test Cells at LiCON.

LiFLEX motor spindles only use components that meet the highest quality standards. In addition, each motor spindle is tested in an automated 100 percent test on test cells specially developed by LiCON for this purpose.

100% Tested Quality

40%
Less Power
Consumption

The greater the travel distances in the working area of a machine, the more likely linear motors are used in LiFLEX machining centers. Although these offer a considerable advantage in terms of drive speed, they also have a significantly higher power consumption as compared to ball screw drive. With currently rising energy prices, this is clearly reflected in operating costs.

With the most recent expansions in the twin-spindle range at spindle distances of 1 080 mm, 1 200 mm and 1 500 mm, **innovations based on ball screw drives** have been developed. These innovations make electricity savings of more than 40 percent possible with less than just three percent output loss. Another way to save energy costs is the **minimum quantity lubrication** offered by LiCON. At the customer's request, this can be installed instead of a conventional cooling lubricant system. In this way, the usual cooling lubricant pumps with generally high power consumption can be dispensed with.

1. Raw Material Buffer
2. Robot on Seventh Axis
3. Machining Center
4. Deburring Cell
5. Cleaning Device
6. CMM
7. Surface Inspection
8. Finished Material Deposit



02

LiCON Automation

Only one Interface: LiCON.
Reach Out to Us.

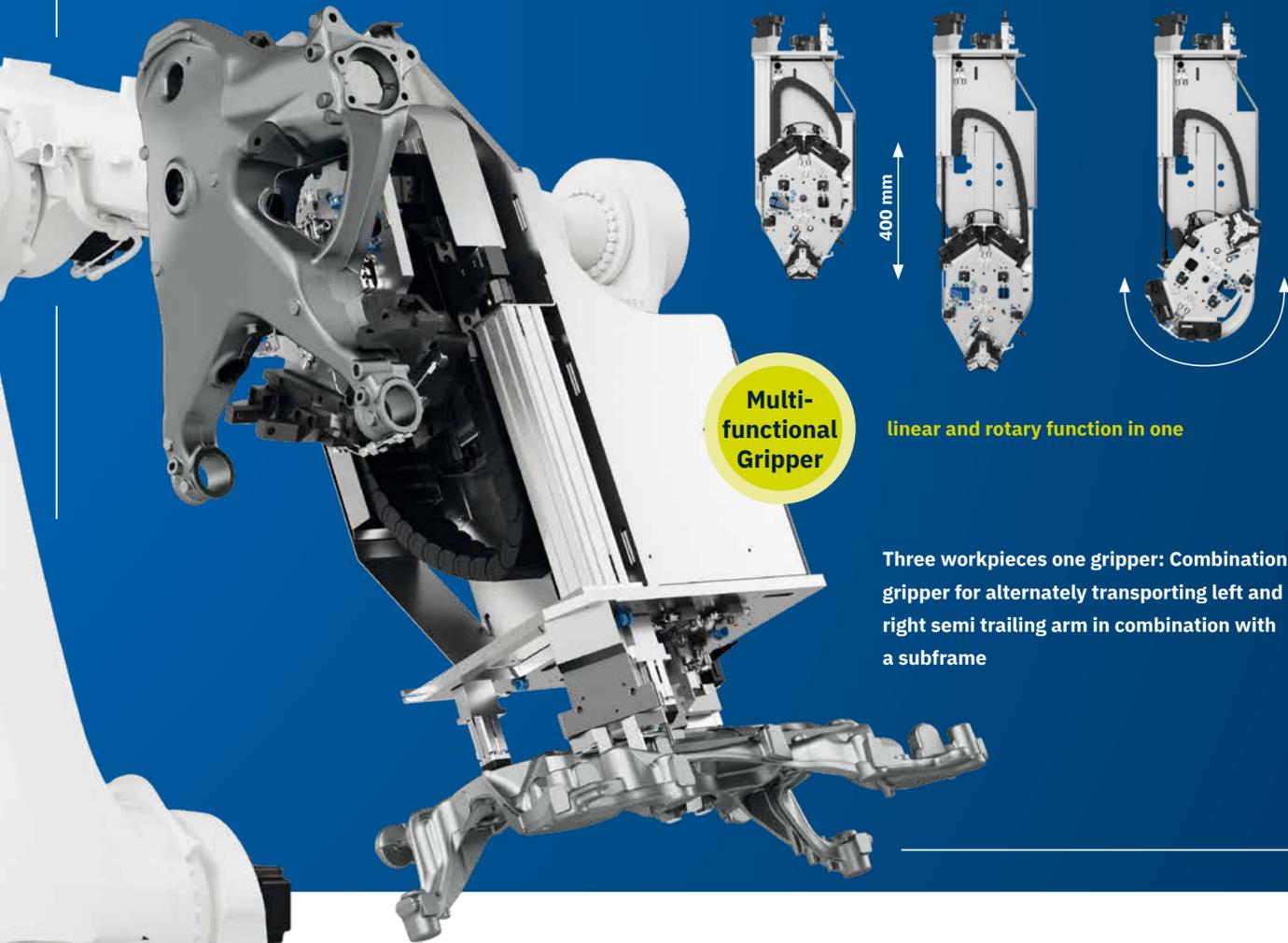
The economic compulsion to reduce personnel costs in series production and thus the need for an increased use of automated manufacturing solutions is rising increasing.

LiCON provides complete manufacturing solutions for the multi-stage processing of the blank into a finished part in the automated process. LiCON engineers focus not only on software development for controlling the automated plant network but also on the development and manufacture of the associated control system as well as all relevant mechanical components.

We follow the principle of “one face to the customer“: standard components, such as conveyor belts, and specific equipment, e.g., cleaning systems and deburring cells, are sourced from partner companies and integrated into the overall network in terms of control technology. The LiCON gripper technology for process-reliable transport of workpieces as well as the LiCON stacking cell for holding raw and finished parts right at the line perfectly complement the manufacturing solutions.

LiCON Workpiece Gripper

No Gripper Is the Same as The Other – Always Application-Related and Tailored to the Fixture



Multi-functional Gripper

linear and rotary function in one

Three workpieces one gripper: Combination gripper for alternately transporting left and right semi trailing arm in combination with a subframe

Perfect Combination: Robots and LiCON Workpiece Gripper

A central component of many automation solutions is the use of a 6-axis flexible robot. Compared to linear portal gantries with limited degrees of freedom, robots also offer the necessary flexibility for changing applications. Depending on the application, these robots combined with LiCON workpiece grippers are positioned stationary in front of the machining center, or the robots also take over logistical tasks and transport

the workpieces via a seventh axis. The seventh axis can be mounted directly to the floor. For reasons of better accessibility, the seventh axes can be placed on supports and thus reach into the machine tool from above.

For highest process reliability, it is essential that the workpiece-specific grippers are developed in close coordination with the design of the fixture. Therefore, the design and manufacture of both the fixture and the grippers are carried out in-house.

LiCON Stacking Cell

Reduced Costs Thanks to Automated Production Cells

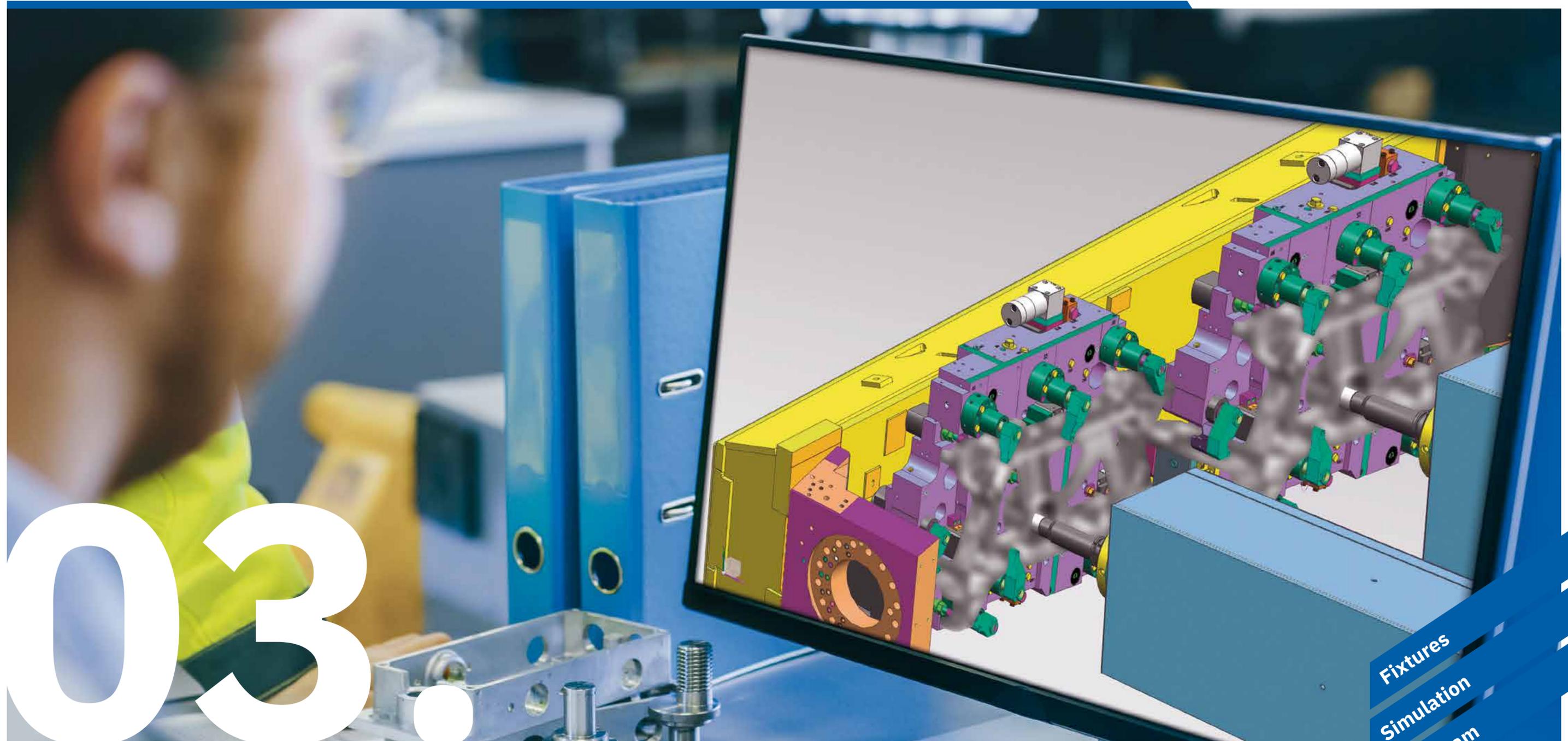


- Compact Workpiece Storage
- Modular System with Standard Modules
- High Storage Capacity with Low Space Requirements
- Flexible Use for Different Workpieces
- Typical Autonomy of 8 Hours (1 Shift)

Autonomous Production Operation for Further Cost Reduction

Particularly in the case of smaller cubic workpieces, enormous productivity advantages can be achieved by stocking a higher number of raw parts and buffering finished parts directly at

the line. This is possible with the LiCON stacking cell. With the LiCON stacking cell, the production line can run without personnel for several hours. Thus, in addition to other automation solutions from LiCON, it ensures a further increase in the autonomy ratio of the total production time.



03

Fixtures
Simulation
NC Program

LiCON Process Technology

Machine Tool, Fixtures and Cutting Tools in Harmonic Interaction

Process-reliable fixtures in combination with simulation programs insure highest component quality.

In addition to the machine tool and the cutting tools, the fixtures also have a significant influence on the machining quality and the achievable cycle times. Therefore, LiCON leaves nothing to chance here, but develops and manufactures all fixtures workpiece-specifically in-house. Thanks to know-how and experience, LiCON have already implemented a wide variety of complex fixtures.

With the help of simulation programs, the machining points in the fixture, which are often difficult to control spatially, can be represented together with the corresponding cutting tool. Due to simulation, machining points that are difficult to access can be checked precisely in the NC program and thus, highest machining quality can be insured.

LiCON Fixtures

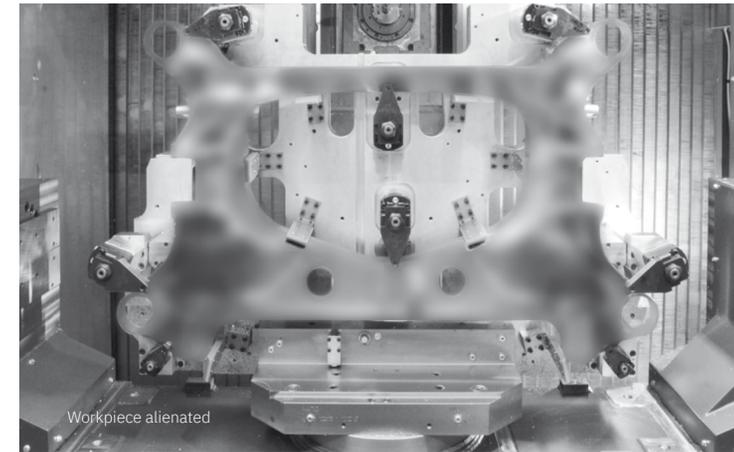
100 Percent Manufactured In-House

The workpiece and the specified machining strategy are the essential cornerstones for the design of the fixture.

Window fixtures are mainly used for 5-axis machining. For 4-axis machining, multi-part fixtures are often used. After a tool change, several workpieces can be machined one after the other. This reduces the ratio of non-productive time and increases the overall output. Where necessary, the fixtures can be extended with additional functions, e.g., for aligning the workpiece in the fixture. Basically, care is taken to ensure that as few fluid lines as possible are routed on the outside of the fixtures, but that the media transport is achieved via deep-hole drillings.

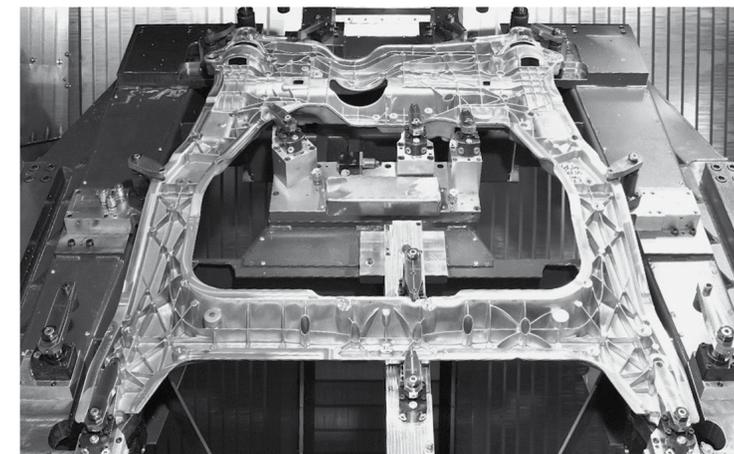
Motor Cycle Frame

Motorcycle frame consisting of a welded steel construction is completely machined in one clamping – twin-spindle with 1 200 mm spindle distance. 20 clamps and 23 movable support elements are used to align the component in the fixture in accordance with the drawing and to clamp it safely during the process.



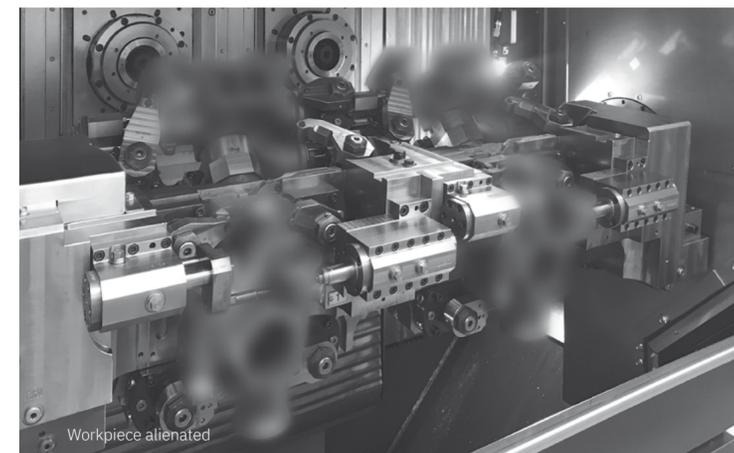
Engine Cradle

Engine cradle made of cast aluminum for an electric car is completely machined in one setup. Here, the component is machined upright. This requires an interference area in both A and B of 1 600 mm.



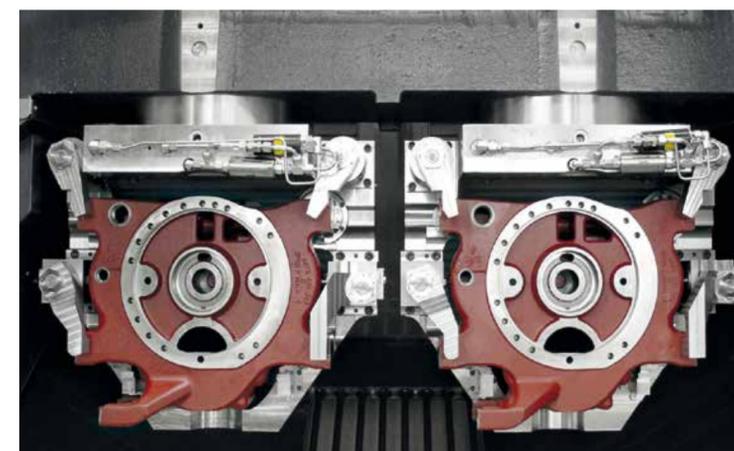
Structural Component

Structural component made of die cast aluminum for an electric car with a width of 1 155 mm and a length of 1 070 mm is clamped at 16 clamping datums and completely machined in a single clamping operation.



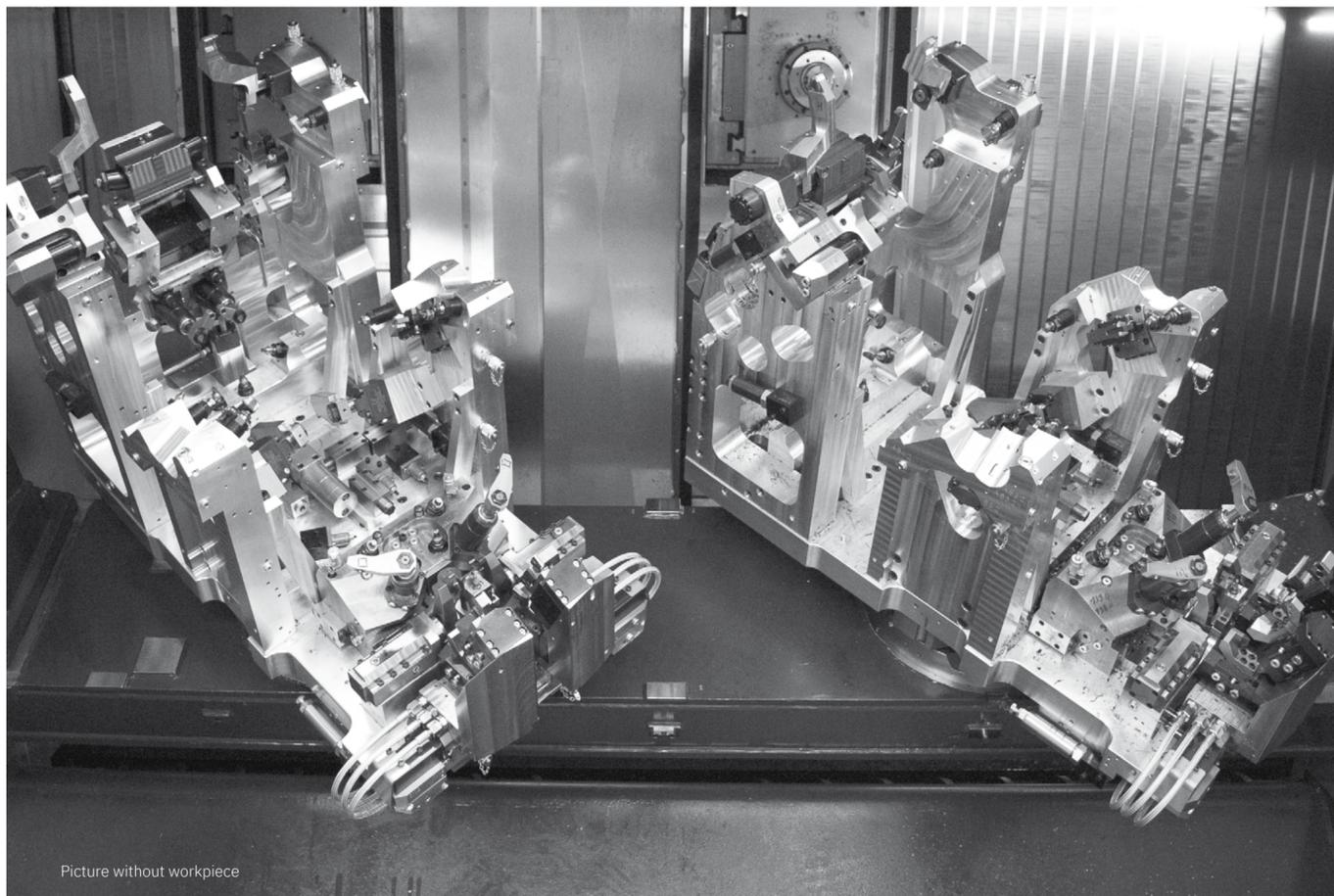
Exhaust Manifolds

The workpiece made of heat-resistant steel requires high cutting forces. Machining is carried out on twin-spindles and 4-axes in two setups. Loading, unloading and reclamping are automated via a robot gripper.



Housing for Low-Floor Buses

The workpiece, made of GJS 400, weighs 55 kg and is machined on a 5-axis bridge upright in one setup completely to flipover.

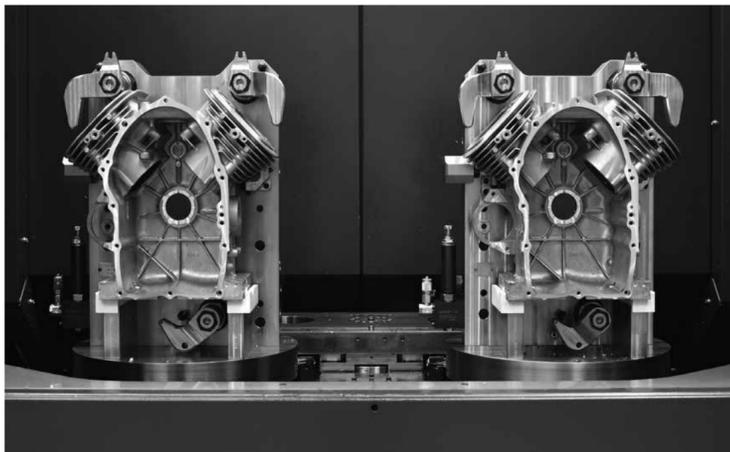




Picture without workpiece

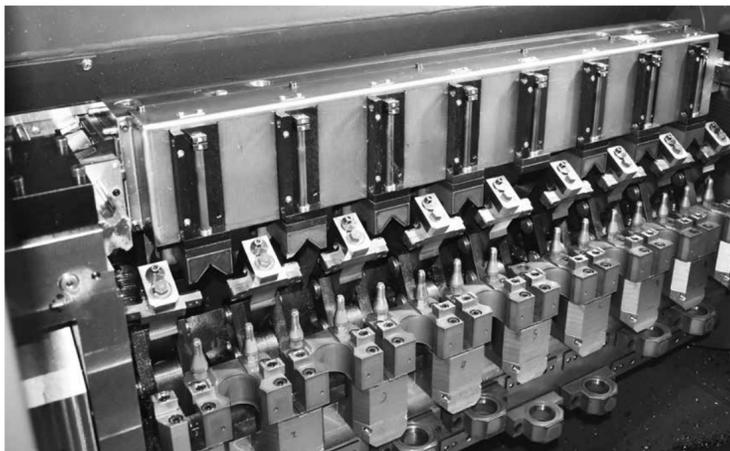
Side Rail Made of Die Cast Aluminum

With the extended dimensions of the permissible maximum interference diameters of both rotating axes, even oversized workpieces can be accommodated in these spaces and completely machined in one setup.



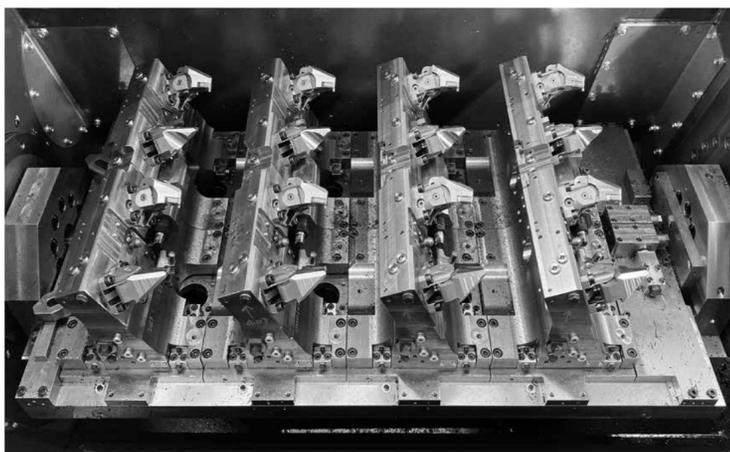
Crankcase for Two-Cylinder Combustion Engine

The fixture allows 5-axis complete machining on five sides.



Tie Rods

For machining tie rods made of forged steel an 8-part fixture has been built. An integral component is an adjustable rotary alignment for the workpieces.

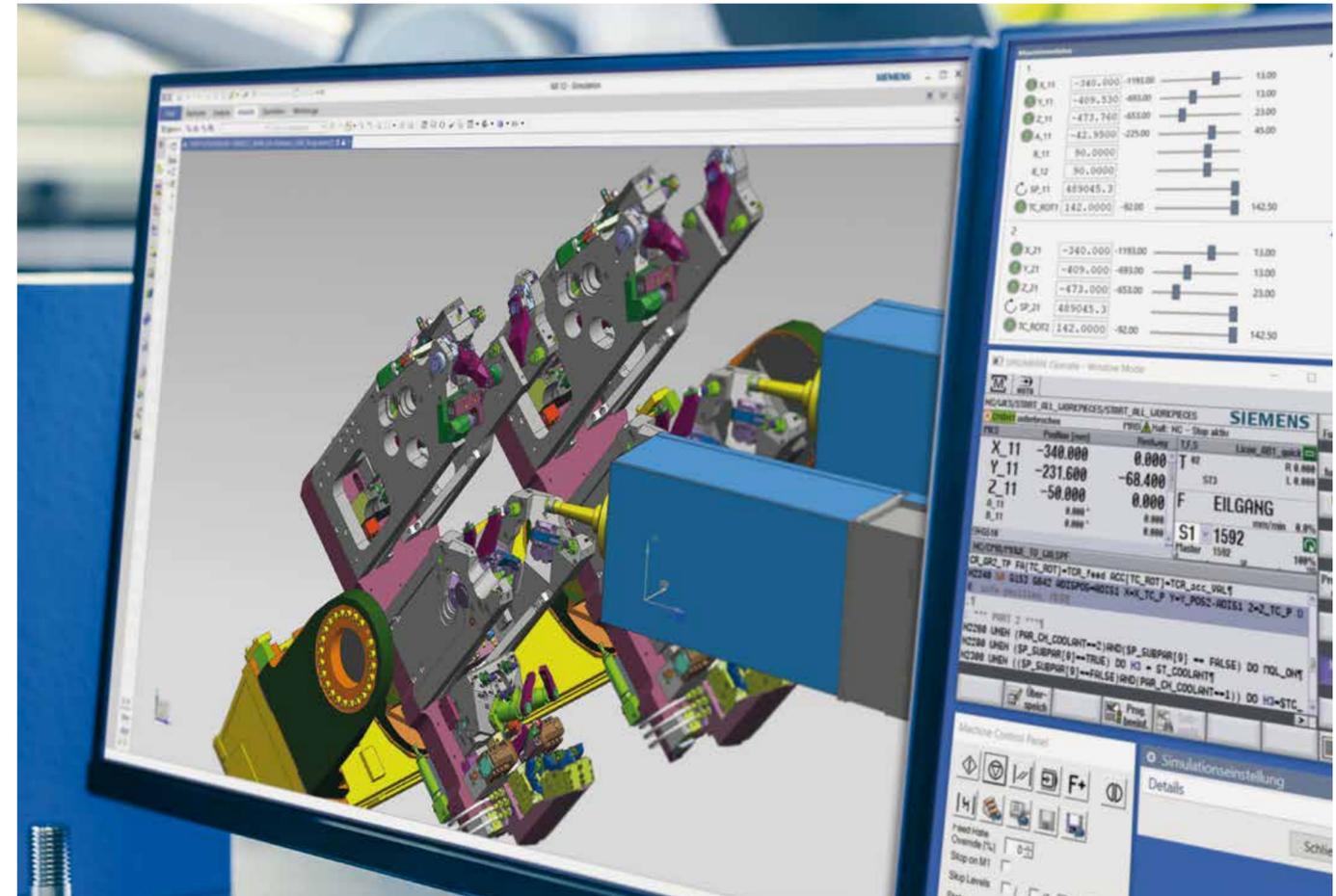


Hinges

For the highest output possible, door hinges are machined with four spindles on a clamping bridge with two times four clamping nests.

A Significant Digital Value: Simulation and NC Program

Precise Movement of the Machining Tool Through Spatially Complex Fixtures in Real Time



Simulation of machining sequences enable an optimization of the cycle time.

Due to the trend towards the complete machining of complex workpieces in one setup, 5-axis machining strategies are usually required. The 5-axis machining allows machining on five sides of the workpiece. The larger the size of the fixture, the further the cutting tool and the motor spindle have to move into clearance spaces provided for this purpose in the fixture in order to reach low-lying machining points with the cutting tools.

Although LiFLEX machining centers allow a glance into the working area from the outside, the necessary view on the machining points is rarely possible. Machine model-specific post processors translate the machining task into the corresponding NC code.

For this reason, we use simulation programs that are able to simulate the machining sequence of the NC program. In addition, we use the simulation of machining processes to optimize cycle times and ensure the shortest possible travel distances of the motor spindles between tool change and workpiece.



LAVA
Services

Diagnostics and Services

Always Oriented to Your Requirements

LiCON Services

Make “Trouble Shooting” a Foreign Word

Your Applications Are in the Best of Hands:

- machine downtime
- complaints
- inquiries
- spare parts and installations
- technical issues

Fast Help Worldwide:

A globally operating service team supports our customers in both preventive maintenance and repairs.

In the event of malfunctions occurring on the machine, the remote diagnostics modules supplied as standard enable rapid root cause analysis.

Centrally Controlled:

By calling

+49 (0) 7392 962 208

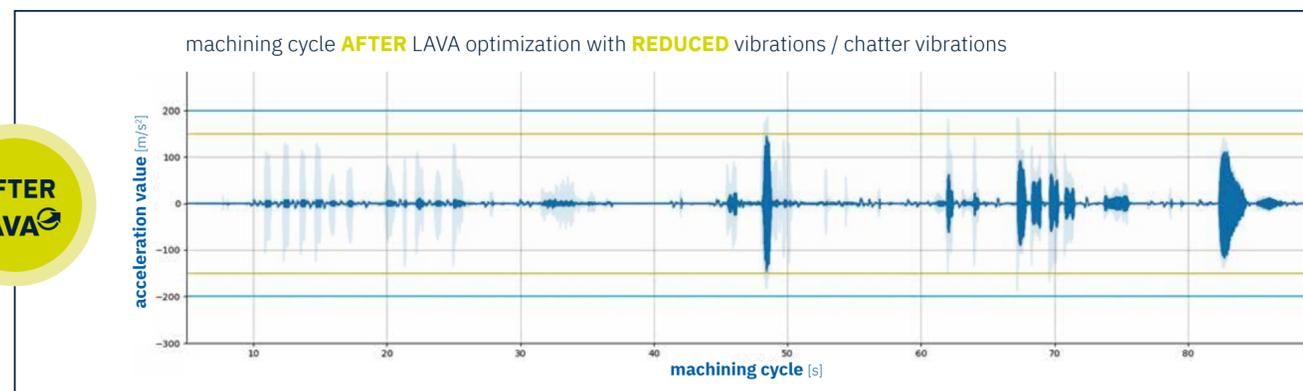
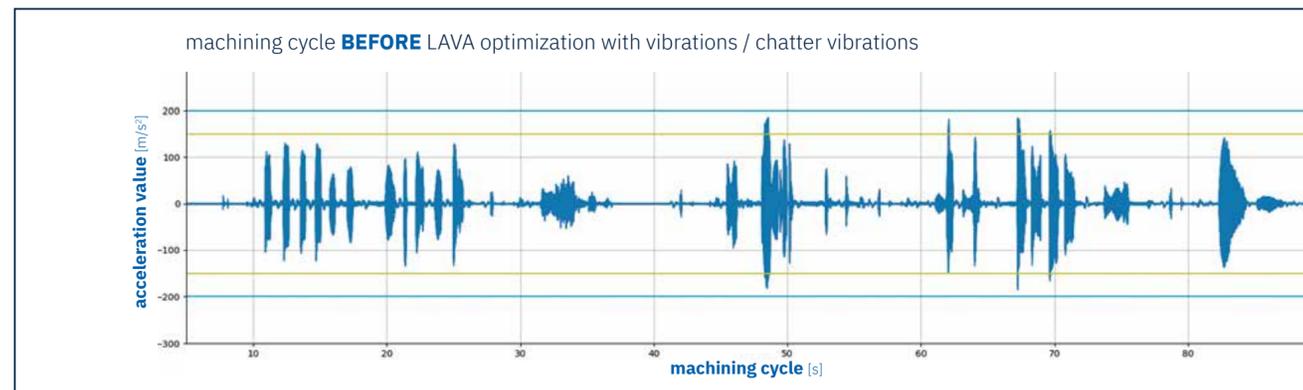
we are always available and will connect you with the appropriate contact person as quickly as possible.

Always Available
24/7

LAVA

LiCON Added Value Analysis

Better Digital Feeling for Machine and Process



AFTER LAVA

Machine and process-specific knowledge usually goes hand in hand with many years of professional experience. If experienced employees leave the company, this always means a loss of know-how. With LAVA software modules by LiCON you have a better understanding of machine and process, even if an experienced employee leaves the company.

To reduce chatter vibrations, tool tooth frequencies are often checked and changed in the hope that chattering will decrease.

This optimization strategy does not take into account the influence of the workpiece and fixture on the oscillating overall system. However, machine tools, fixtures and cutting tools form a complex overall system in terms of machine dynamics.

A special application of LAVA is the consideration of the influences of the workpiece, the fixture, the cutting tool and the machining center. On the basis of this data, optimized cutting data is determined and thus achieved reduction of chatter

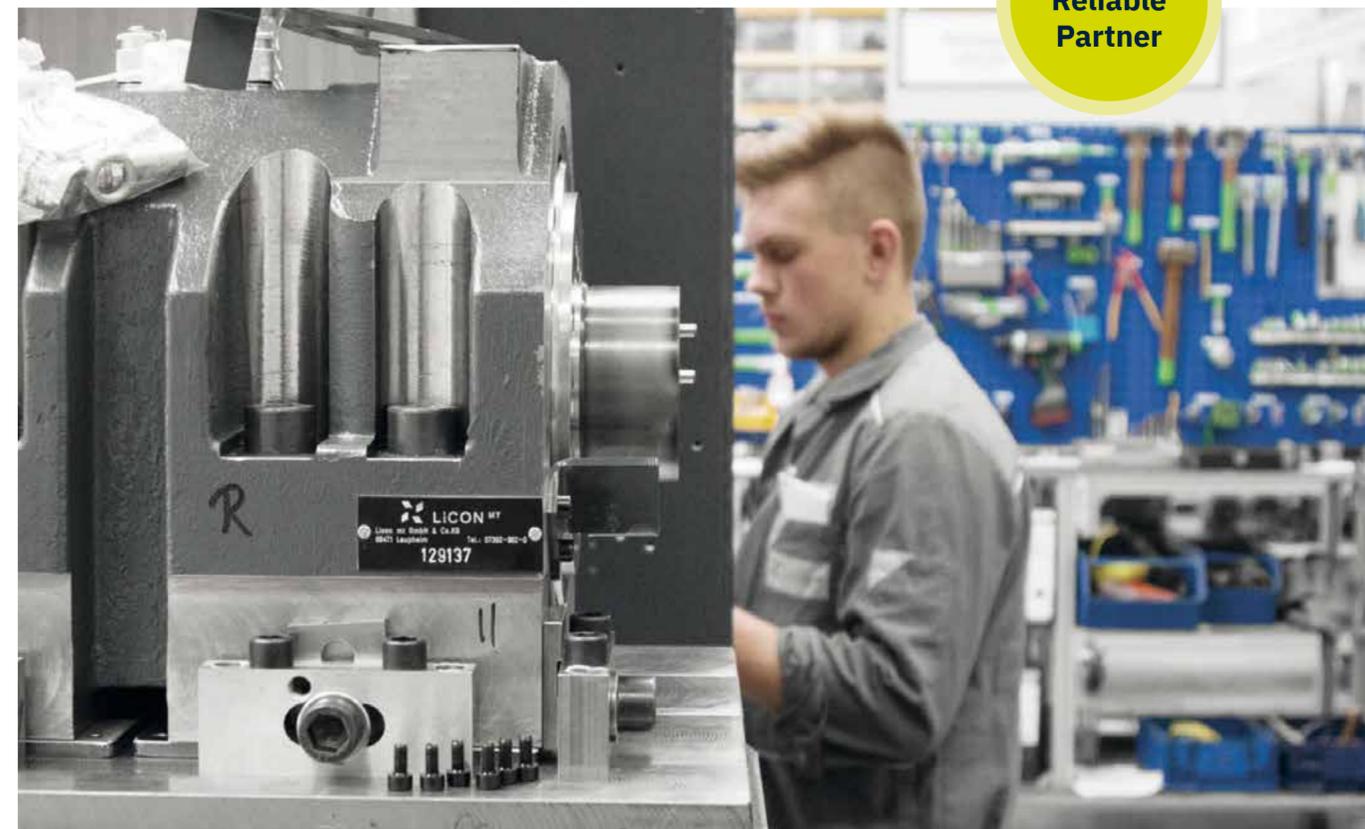
vibrations leads to extended tool life and correspondingly reduced tool costs.

Another application of LAVA is algorithmic compensation of thermal influences on the machine tool and component. Information about temperature changes in the machine tool is calculated algorithmically and necessary correction values are given to the corresponding axes.

LiCON Services

Lifetime Commitment – We Are with You and Your Machine for a Lifetime

Your Reliable Partner



Preventive Maintenance and Optimization

with LAVA

optimization of the machining process using simulation programs and advanced LAVA data analysis with the aim of:

- reduced cycle times
- lower tool costs

analysis of the machine condition (condition monitoring) on a regular basis

Maintenance

physical control of machine components
exchange of parts
repairs
attractive full-service maintenance contracts

Repair and Spare Parts

use of OEM components
manufacturer's guarantee
spindle loop service (exchange)
spare parts inventory worldwide

Training

best practice methods
adjusted to pre-qualification of the participant qualifications
conducted by skilled trainers

Our Customers

International and Innovative

Richard Neumayer



**“One Face to the Customer“
in All Trades**

«For a new automation cell, we were looking for a customized solution with the best combination of maximum space utilization and optimal use of all components in the cell. The advantage of working with LiCON was obvious to us. Thanks to decades of experience in mechanical engineering, LiCON can provide the required expertise for all the essential elements of automation. Despite a very tight schedule, the ramp-up of the complete production line worked well. With LiCON, we have a competent partner on which we can always rely on.»

Christoph Gremmelspacher
Department Manager Mechanical Machining
and Process Development Machining
Richard Neumayer



Forging and machining of steel and stainless steel components
Focus: Automotive industry, mechanical engineering and plant construction
Headquarters: Hausach, Germany
www.r-neumayer.de

Trace Die Cast



**Extremely High Level of
Production Efficiency**

«The speed at which projects could be carried out, and the extremely high level of production efficiency offered by the machines were the decisive factors for us. We are already looking forward to the fifth system from LiCON MT starting up in our production next week, and we have our eyes on further machines we'd like to purchase.»



Chris Guthrie
President
Trace Die Cast



Technology driven high-pressure die casting solutions for the engine, transmission and driveline components
Focus: Automotive
Headquarters: Bowling Green, Kentucky, USA
www.tracediecast.com

Tuopu Group



**Highest Machining Quality
in Serial Production**



«Tuopu Group as a technology-leading auto parts company has established a strategic partnership with the world-renowned equipment supplier LiCON to ensure the best quality performance and highest production efficiency of aluminum subframes. The LiCON machines are proving to be amazingly robust in series production with a consistent machining quality and output, so that we have purchased nearly 30 machines at our plants so far. We are looking forward to our further cooperation in the future.»

Lewis Pan
President Power Chassis System
Tuopu Group



Research, development and manufacturing of automotive chassis systems, interior systems, thermal management systems and intelligent driving systems
Focus: Automotive
Headquarters: Ningbo, China
www.tuopu.com

Bharat Forge Aluminiumtechnik



**Several LiFLEX Twin-Spindle
Machining Centers as a Standard
for Machining a Wide Range of
Workpieces**

«In order to catch up with the trend in the automotive industry towards lightweight chassis, we have recently made major investments in the aluminum forging technology and foundry of the starting material. We have also invested massively in the mechanical machining of forged parts. Here, we rely on the twin-spindle LiFLEX II 766 from LiCON as a standard solution for machining many different workpieces. We have already installed several machining centers of this type in our plants in Germany and the USA. To save energy and to better reuse the chips produced, we have decided on a machine configuration with minimum quantity lubrication instead of a conventional cooling lubricant system.»

Ralf Neumann
Sales Manager / Process Development Machining
Bharat Forge Aluminiumtechnik



Development and production of aluminum forging solutions
Focus: Automotive
Headquarters: Brand-Erbisdorf, Germany
www.bf-at.de

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Our experts are ready.

Your applications are in the best of hands.

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 **LiCON**^{MT}
modular machining centers