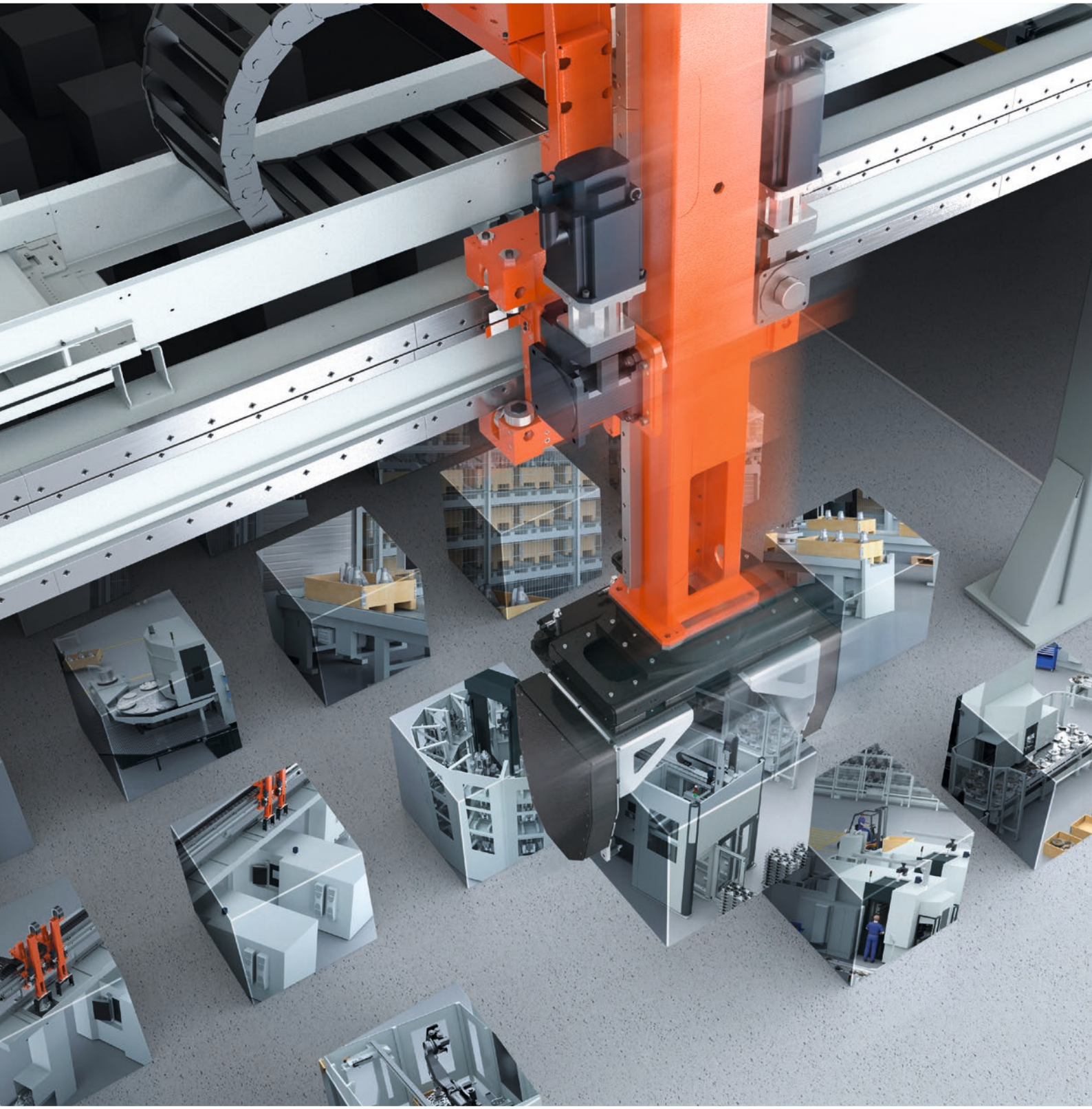
Innovative Solutions for Your Production

Liebherr Automation Systems



LIEBHERR

Liebherr –
Your Partner for Automation Systems

Kempten plant

Employees in the Kempten plant

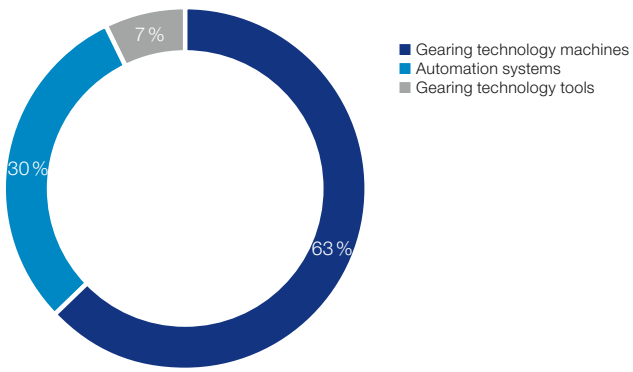
Liebherr-Verzahntechnik GmbH offers a comprehensive range of machine tools, tools, and automation systems. The independent business unit of the Liebherr Group employs approximately 1350 employees at the production sites in Kempten, Ettlingen, Bangalore (India), Saline (USA), Seoul (South Korea), and Turin (Italy).

Since the 1970s the automation systems division has been supplying turnkey production facilities for mechanical production and automates highly efficient production cells and assembly lines in collaboration with well-known machine manufacturers.

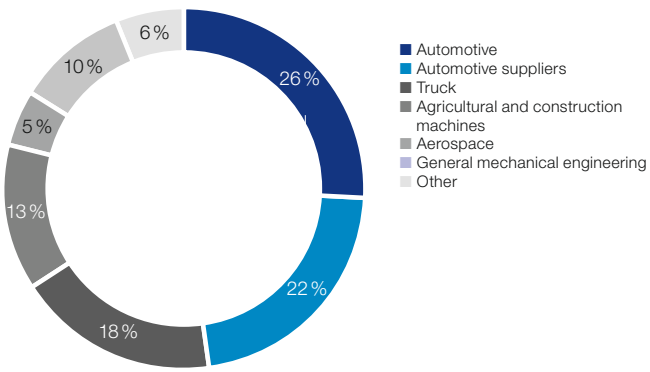
Thanks to the high level of in-house vertical integration, the majority of mechanical production, sheet metal forming, paintwork, and component assembly takes place directly at the Kempten site.

Liebherr automation systems currently supply facilities to the value € 65 million all over the world every year. 90 % of the deliveries are sent to manufacturing companies outside the Liebherr Group. The proportion of exports here is 75 %.

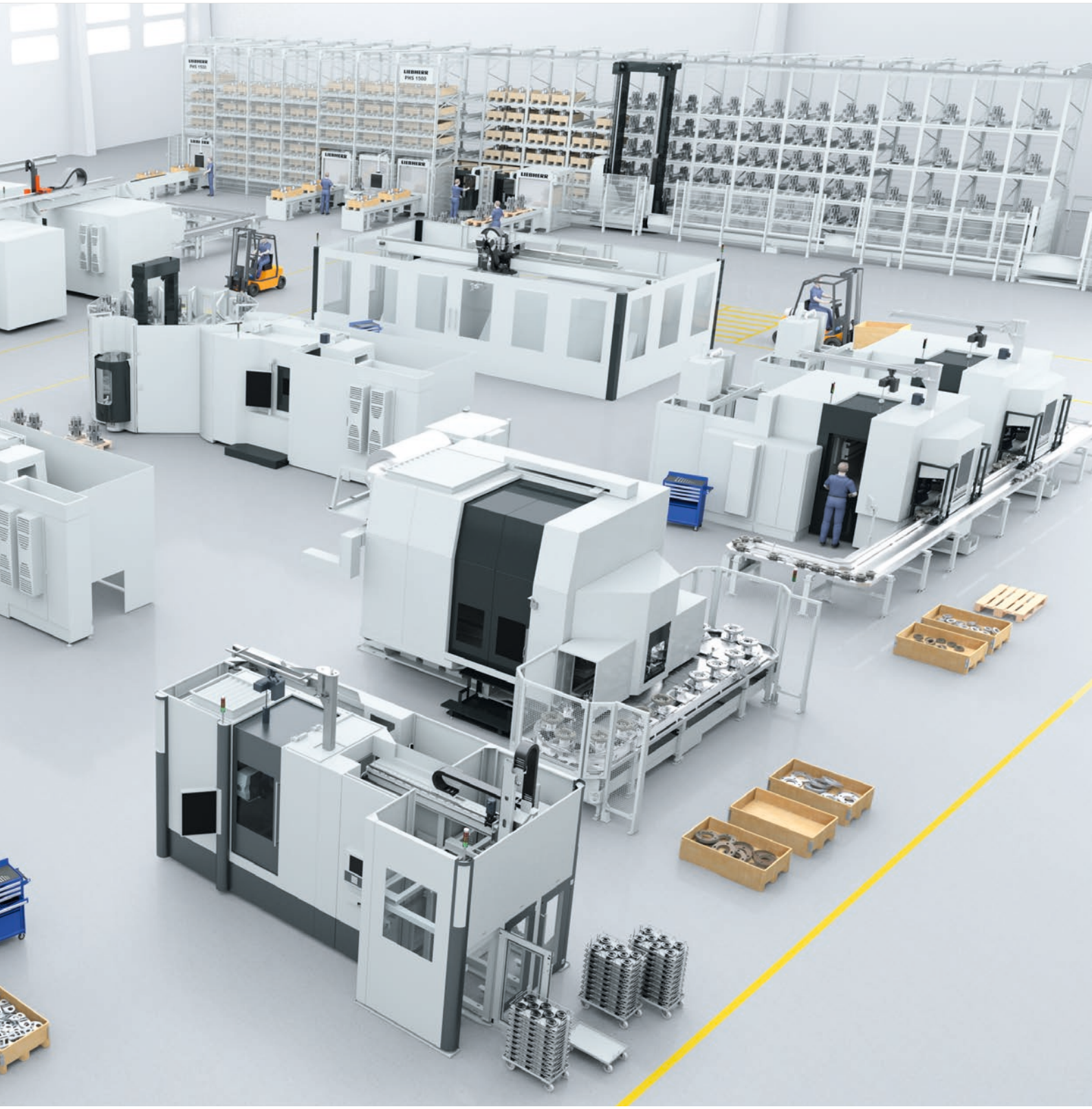
Sales per Business Unit of Liebherr-Verzahntechnik GmbH



Sales according to Industry of Liebherr-Verzahntechnik GmbH



Economical Automation Systems



Gantry Robots

Ford engine block line

Ford engine block line

LP 100

LP 200

LPR 200

LP 2000

Liebherr gantry robots can be deployed in a variety of ways: For transporting, palletizing, goods handling, loading and unloading, or storing. Linear robots in five sizes and gantry area robots in three sizes for workpiece weights from 0.5 kg to 1,500 kg perform a wide range of automation tasks. Liebherr offers a modular system for all sizes with which the automation system can be adapted to the respective application, e.g. cylinder head, engine block, or gear unit manufacturing.

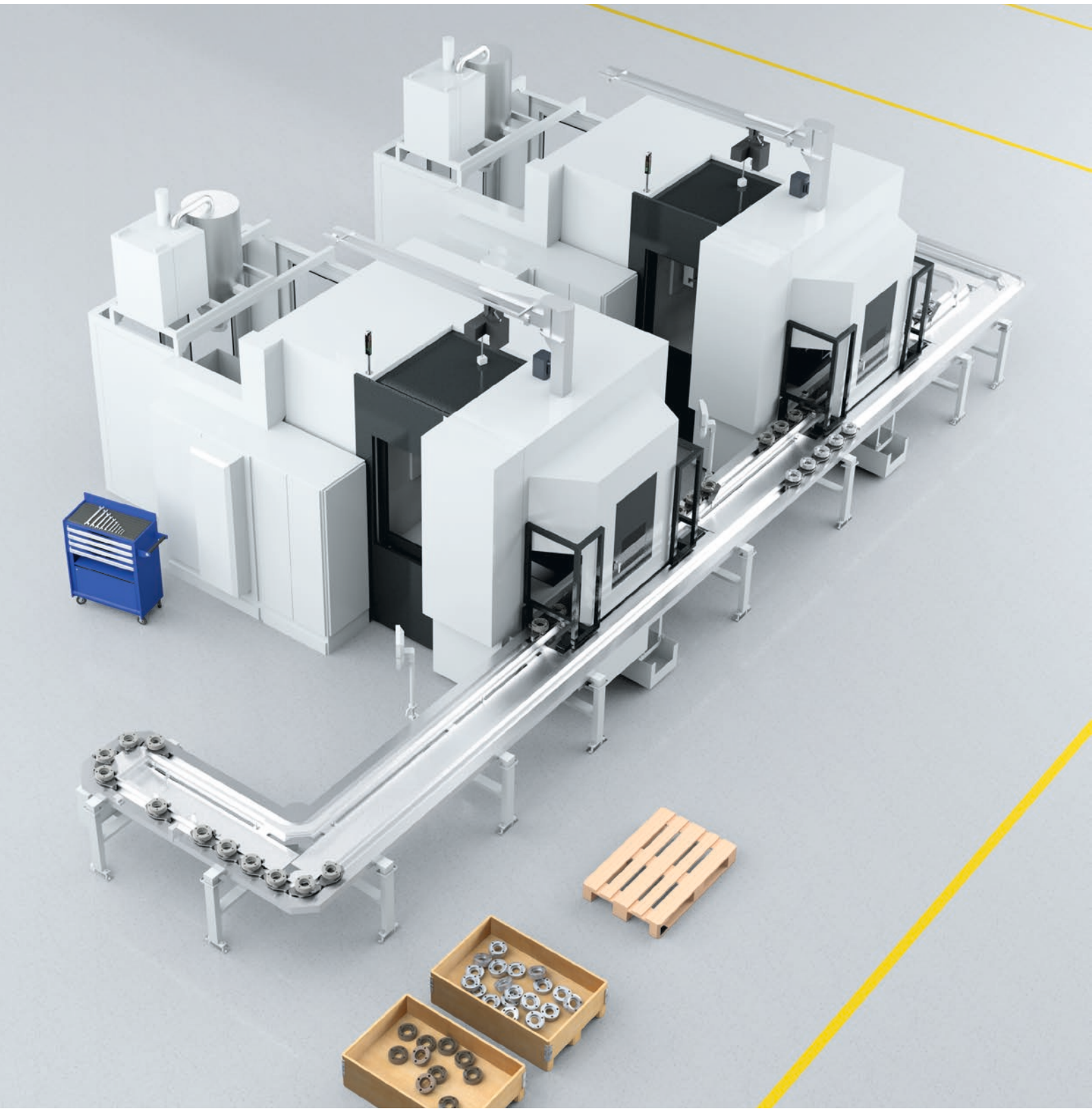
Linear Gantry Robot	Payload (kg)	Traverse Speed X (m / min) (High Speed)	Acceleration X (m / s²) (High Speed)
LP 10	40	240	5
LP 20	240	180	4
LP 100	280	180 (300)	2.5 (4.5)
LP 200	600	180	3
LP 2000	1,500	120	2

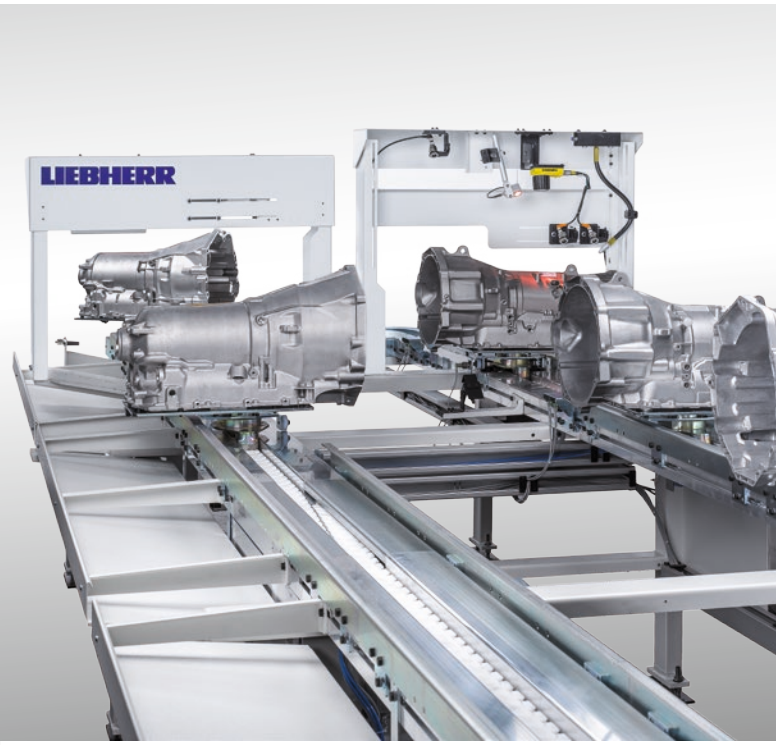
Other weights available upon request

Gantry Area Robots	Payload (kg)	Traverse Speed X (m / min)	Acceleration X (m / s²)	Traverse Speed Y (m / min)	Acceleration Y (m / s²)
LPR 20	240	180	240	120	3
LPR 200	600	180	180	120	3
LPR 2000	1,500	180	120	120	2

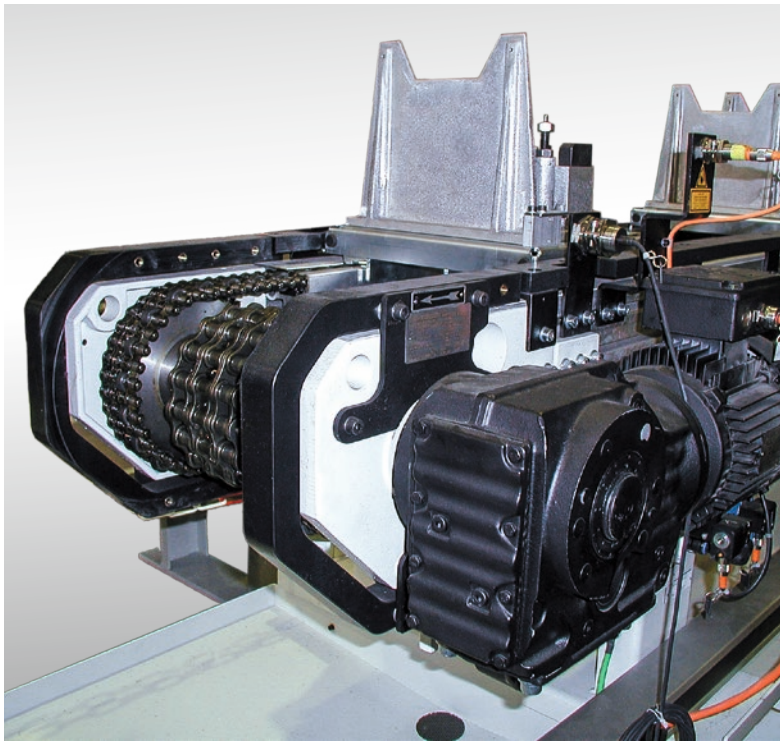
Other weights available upon request

Conveying Systems





Plastic Chain Conveyor



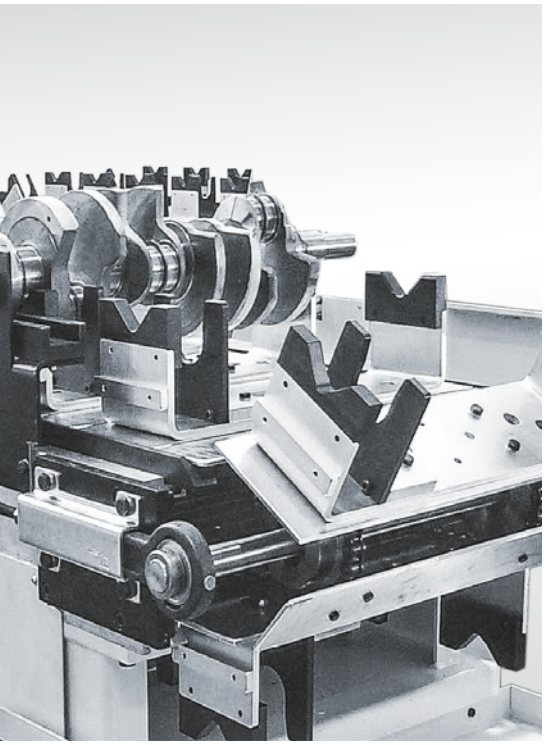
Pallet Accumulating Conveyor

Liebherr conveyor systems are adapted to the form, position, weight, and size of the parts range, as well as the material. Standardized assembly groups provide an ideal enhancement to the program.

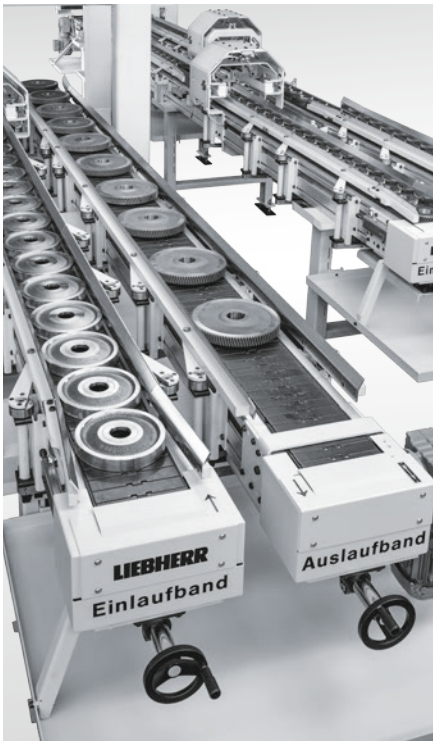
Plastic Chain Conveyor (KKB)
Plastic chain conveyors from Liebherr are designed to transport any number of irregularly shaped workpieces without them coming into contact with each other. The workpieces are transported on pallets. Provides optimal solution for multiple machine cells with buffering requirements. Allows for flexible layout configurations.

Pallet Accumulating Conveyor (PSB)
Pallet accumulating conveyors also serve to transport any number of irregularly shaped workpieces without them coming into contact with each other. Here, too, transportation of the workpieces is on pallets. Empty pallets are returned on the underside of the conveyor to save floor space. Provides optimal solution for moving large parts between operations, with excellent buffer capacity.

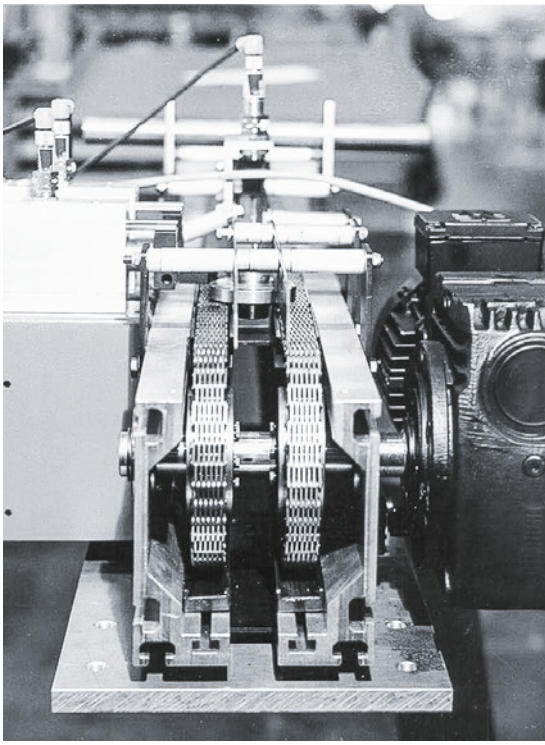
Conveying Systems



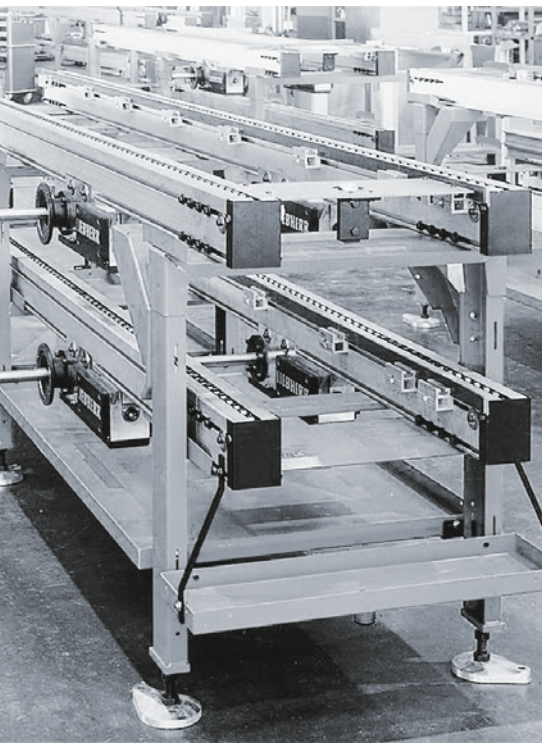
Indexing Chain Conveyor (TKB)
Indexing chain conveyors are used to transport parts on workpiece carriers. Carriers are fixed to the drive chain and conveyed based on the cell sequence.



Hinged Chain Conveyor (SKB)
The hinged chain conveyors are designed to transport workpieces with an even surface, e.g. pinion / gear wheel. Depending on the scenario, multi-track versions are also possible. By joining individual belt sections, hinged chain conveyors can be extended to any length.



Tooth Chain Conveyor (ZKB)
The toothed chain conveyors are designed to transport workpieces with an uneven surface, e.g. pins or collars. By joining individual belt sections, tooth chain conveyors can be extended to any length independently of cycles.

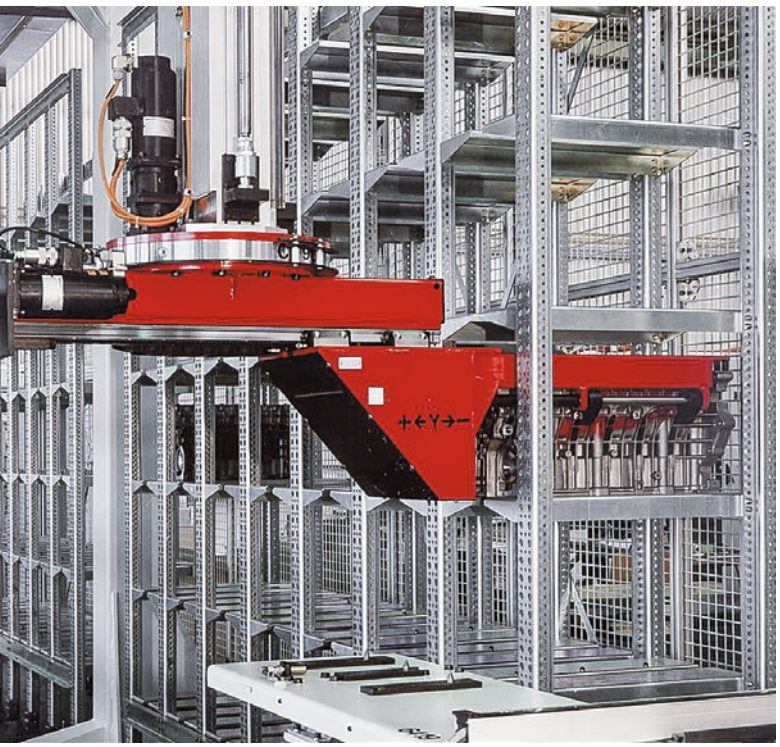


Accumulating Conveyor (SFB)
Accumulating conveyors are designed to transport workpieces either directly or on pallets. By joining individual belt sections, the transport length can be extended to any length. Ideal conveyor solution for assembly or adapter plate processes.

Drag Frame Conveyor (SRB)
Drag frame conveyors are designed to transport parts with an even surface, e.g. pinion/gear wheel, hubs, or rings. The workpieces are dragged by a frame that is connected to a chain. Transportation is either directly on the transport conveyor or indirectly via workpiece carriers. The prism-shaped mountings mean that, generally, no interchange parts are necessary.

Friction Roller Conveyor (FRB)
With friction roller conveyors, workpieces can be transported directly or on pallets. In this case, the transport length can be extended as required by joining individual conveyor sections. The friction rollers are designed to not damage the part surface during transport.

Storage Systems



Shelf Magazine System

Decoupling Module

Storage systems for workpieces can be deployed in a variety of ways: Whether it is for loading/unloading function, decoupling module, in-process buffers or automated storage retrieval system.

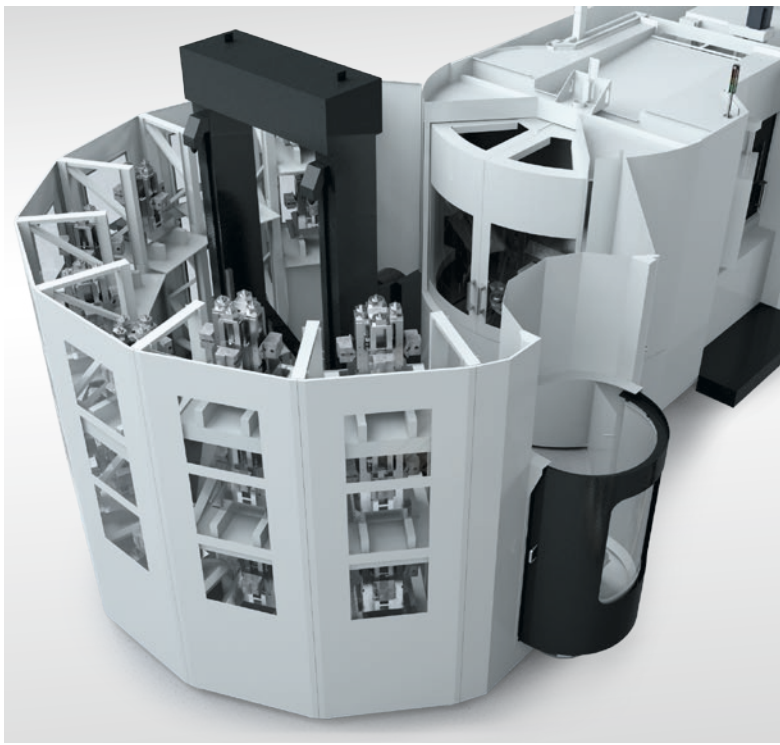
Palletizing Cell (LPC)
The palletizing cell provides an ideal means to implement decoupled automation systems for gears or other small parts. The LPC employs basket technology to standardize the manufacturing logistics for loading/unloading and material transport.

Shelf Magazine System
The shelf magazine system combines fixed workpiece supports with a gantry loading system. Here, the shelf magazine can be loaded either from the top or from the side. Thanks to the modular design, the complete system can be extended and, depending on the layout, enables storage based on the principle of "first in – first out".

Decoupling Module (EKM)
The decoupling module serves as a means of storing and decoupling on flexible production lines. It features a high storage capacity with small surface area requirement and is suitable for a very wide range of workpieces and production concepts. The workpieces are placed on pallets in the decoupling module and made available via pull-out mechanisms for the robotic palletizers or robot systems to allow loading and unloading. A manual loading and unloading drawer for measured parts can be incorporated if required. With the integrated control system and standardized Liebherr software, the EKM can easily be implemented into any production system.

Video:
LPC 3400

Pallet Handling System

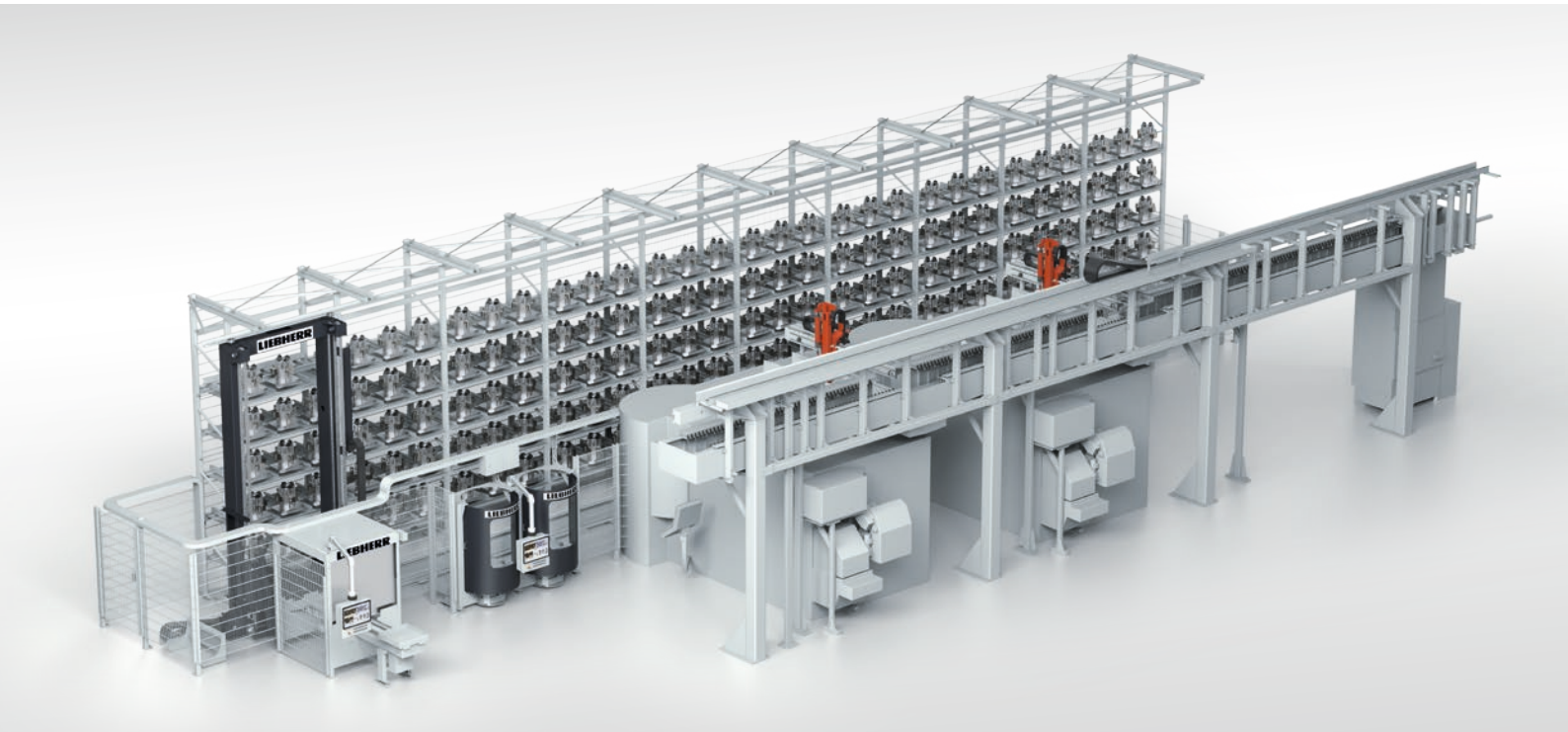


Liebherr pallet handling systems are deployed to automate processing centers in the area of individual part production and small batch production. The basis is a workpiece clamped on a machine pallet. The cell concept enables pallet loading in parallel to machine processes, and can include resource and order planning. The customer benefits from increased productivity and lower labor costs. Pallet handling systems from Liebherr are offered in two versions: as a rotation loading system (RLS) or as a linear loading system (PHS). Both versions have a modular design and can be adapted to the respective requirements of the manufacturing concept.

Rotary Loading System (RLS)
Rotary loading systems from Liebherr are distinguished by their high storage density in relation to the footprint and are designed for one to two processing centers. In combination with the Liebherr rotary storage tower (RST), the storage areas can be configured individually to meet specific needs. The rotary loading system is available in two sizes and designed for transport loads between 800 and 1,500 kg.

Rotation Loading System	Workpiece Diameter (mm)	Transport Load (kg)
RLS 800	600/800	800
RLS 1500	900/1,300	1,500

Video: Rotary Loading System (RLS)



Pallet Handling System PHS PRO

On the linear-type pallet handling system, the modular design allows for multiple machines and expandable set-up and storage areas. The PHS can be extended to manage raw, in-process and finished part inventory. All of the requirements of a modern production system can be integrated. The linear system is manufactured in four sizes for transport loads between 500 kg and 13,000 kg.

Pallet Handling System PHS Allround

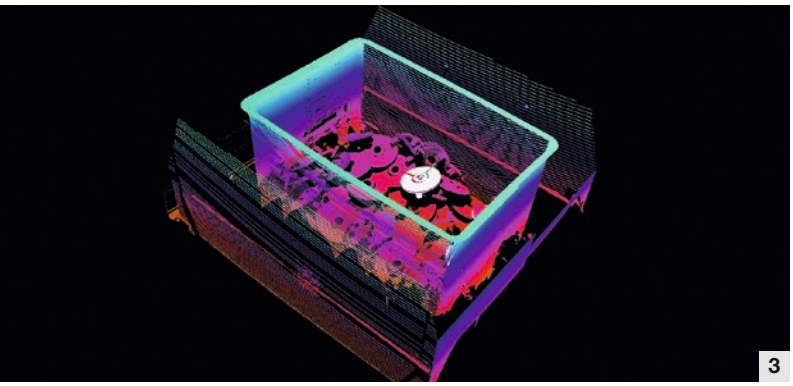
The pallet handling system PHS 1500 Allround makes it possible for customers to implement multiple CNCs and complex inventory tracking, and parallel / serial manufacturing strategies. This can result in reduction to your part costs, and increase your competitiveness.

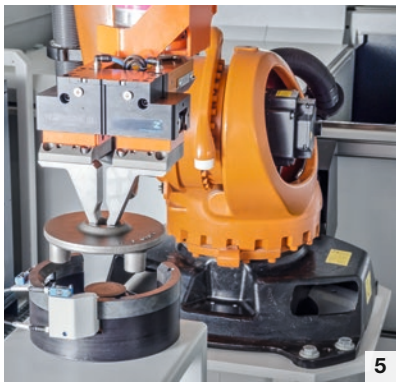
Pallet Handling System	Workpiece Diameter (mm)	Transport Load (kg)
PHS 750 PRO	1,000	500 / 700 / 1,000
PHS 1500 PRO	1,150 / 1,700	1,500 / 2,000 / 2,500
PHS 3500 PRO	1,900 / 2,400	3,500 / 5,000 / 6,500
PHS 10000 PRO	3,000 / 3,500 / < on request	10,000 / 13,000 / < on request

Pallet Handling System	Workpiece Diameter (mm)	Transport Load (kg)
PHS 1500 Allround	1,400	1,500

Video: Pallet Handling System PHS PRO

Robot Integration





1 Requirement · 2 Visual data acquisition and evaluation
3 Object identification and selection · 4 Collision-free parts removal · 5 Object positioning

As a turnkey supplier of complete production lines, Liebherr covers all process steps from blank to finished part from a single source. In the area of robot applications, Liebherr performs parts handling, palletizing / depalletizing, and bin-picking tasks.

Parts Handling
In parts handling Liebherr performs loading tasks for a wide range of machine tools. In recent years solutions from machining centers, turning machines, gear cutting machines, rotary transfer machines through to grinding machines have been implemented here. The robot cells are always designed specifically for the requirements in close cooperation with the customers.

Palletizing
Liebherr uses 2D and 3D vision systems to perform palletizing and depalletizing tasks. Whether it be to detect and grip unsorted parts from Euro pallets or transport presorted parts in blisters.

Random Bin Picking
"Random bin picking" replaces complicated sorting systems, heightens productivity, and relieves the strain on personnel. In order to be able to remove unsorted workpieces from a transport container, a complex interaction between image recognition system, software, and robot is required. Based on the range of parts, all steps required for the process complement each other so that an optimal removal and positioning result is achieved.

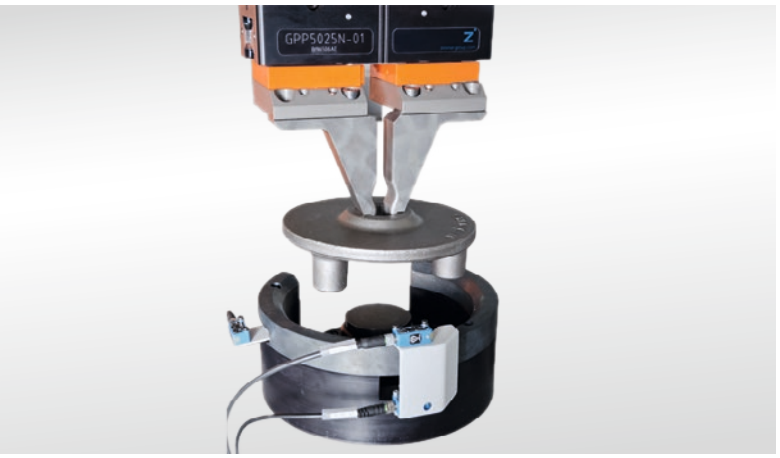
Reliable 3D object detection systems record the data visually and evaluate it. Depending on the requirement, Liebherr works with different 3D vision systems.

Video:
Bin Picking

Additonal Equipment

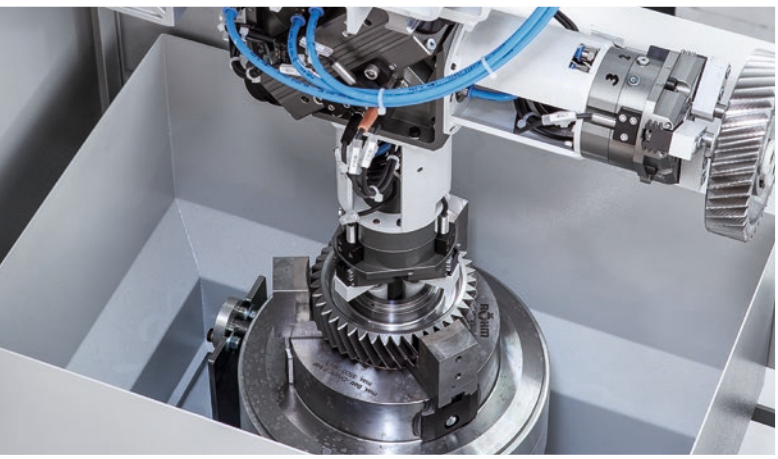
To set up production lines to solve complex tasks, Liebherr supplies not only basic components, but also all of the necessary additional equipment, e.g. for the labeling, detection by camera systems, orientation, or spinning of oil-covered parts and discharge of measured parts (SPC station).

Statistical Process Control (SPC)
The statistical process control is a fixed element of any production line in modern production systems. Liebherr supplies these modular-based stations for discharge and inclusion.



Orientation Station
Modern production machines require that workpieces are loaded with the correct orientation. If the loading system is incapable of doing this, Liebherr offers ancillary orientation stations.

Camera Systems
With the aid of camera systems, labels and codes on the workpieces can be read and their information transferred to higher lever production management systems.

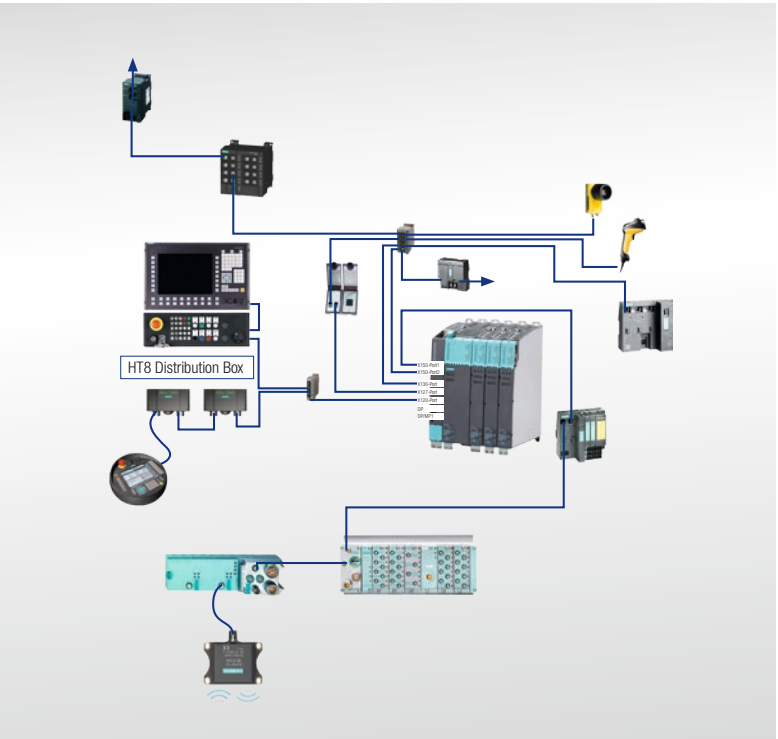


Centrifugal Station
To prevent the displacement or mixing of cooling lubricants, it is necessary for the workpieces to be cleaned automatically. Depending on the needs of the customer and the workpiece, different processes are employed. The Liebherr modules include centrifuging, vacuum, and blow-off stations.

Data Matrix Code (DMC)

Labeling Systems
With the high-quality labeling systems offered by Liebherr, digital combinations or codes can be lasered, etched, or engraved with needles on the workpiece.

Hardware and Software



Control Structure

Source	Condition	Aim
Infeed conveyor	Unmachined part	Machine OP10.1
	Rework	
	Unknown part	SPC station
Machine OP10	Finished part OK	Outfeed conveyor
	Test part	SPC station
	Reject	

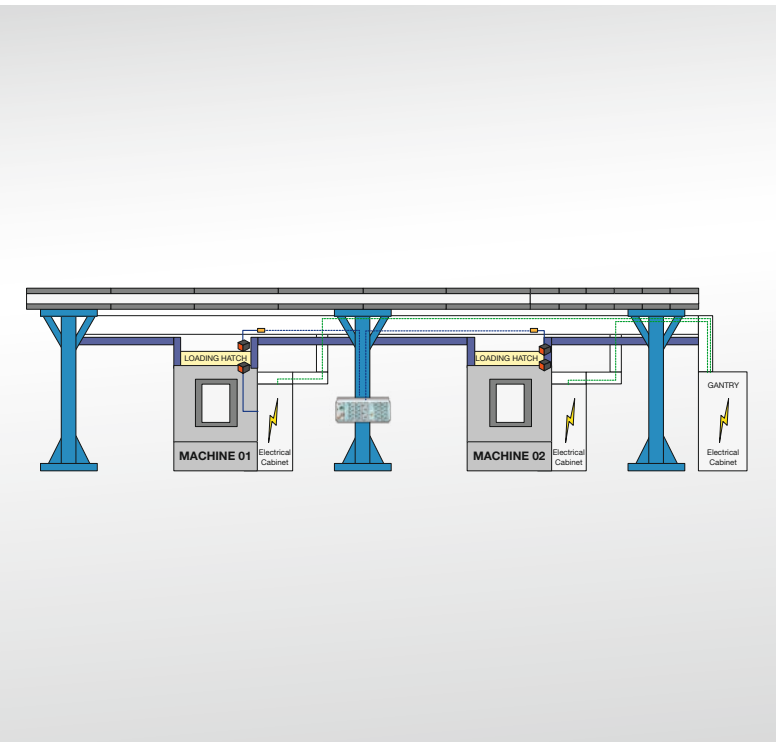
Source-Target View

Customer-Specific complete Solution based on Modular System

The comprehensive modular hardware and software modules ensure consistency between a mechanical function and the requisite hardware and software functions. Tested software modules with a functional description are configured as a complete solution according to the functions necessary for the process. Even before the award of contract, a detailed customer-specific process description (Sequence of Operation – SoO) is compiled.

Source-Target View

By means of a source-target view within the automation control system, associated processes are divided into small individual steps, this means that complex tasks are well structured.



Interface Definition

Liebherr Manufacturing System (LMS 4.0)

Standardized Interface

Various processing machines, control, or production planning systems can be integrated using a standardized software interface. This interface is the basis for short commissioning times as well as trouble-free operation and straightforward maintenance of the system during the entire product life cycle.

Additional Software Increases Process Reliability

Complex production systems require increased functionality in their software systems. With the Liebherr Manufacturing System (LMS 4.0), Liebherr offers user-friendly additional software which guarantees process reliability in a production or assembly line. The LMS 4.0 is able to record temporary parts tracking, as well as save specific data and make this available to all system-based users. The system offers a range of assessments and can be deployed, for example, so that correct adherence of the production process can be monitored.

Thanks to the extension with new functions such as "Production Monitoring App" and "Info Board App", the processes can be easily tracked on mobile end devices and interfaces.

Video:
LMS 4.0

Service and Locations

Training
We offer a comprehensive range of training courses both at the customer's premises and in our subsidiaries. The practical technical training courses are delivered by our experienced system technicians who are very familiar with the systems and applications owing to their many years of experience. These training courses enable you to help yourself and use systems safely in emergency situations, e.g. a power failure.

Customer Hotline and Remote Maintenance
Our experts on the customer hotline provide professional initial assistance when needed. Many faults can be eliminated with the support of our experts via remote access.

Global Presence and Spare Parts Availability
With our headquarters in Kempten and global subsidiaries, as well as service outlets, we guarantee a fast response time in order to be able to deploy a service technician to the customer's premises if necessary. A rapid replacement parts service is guaranteed thanks to the consistent modular system of the products and the use of basic components from well-known, global manufacturers. Original spare parts are stocked in the subsidiaries and can be delivered to your production sites within a short period of time. Included in the services offered are the provision of spare parts, inspections, maintenance, or modifications to systems.

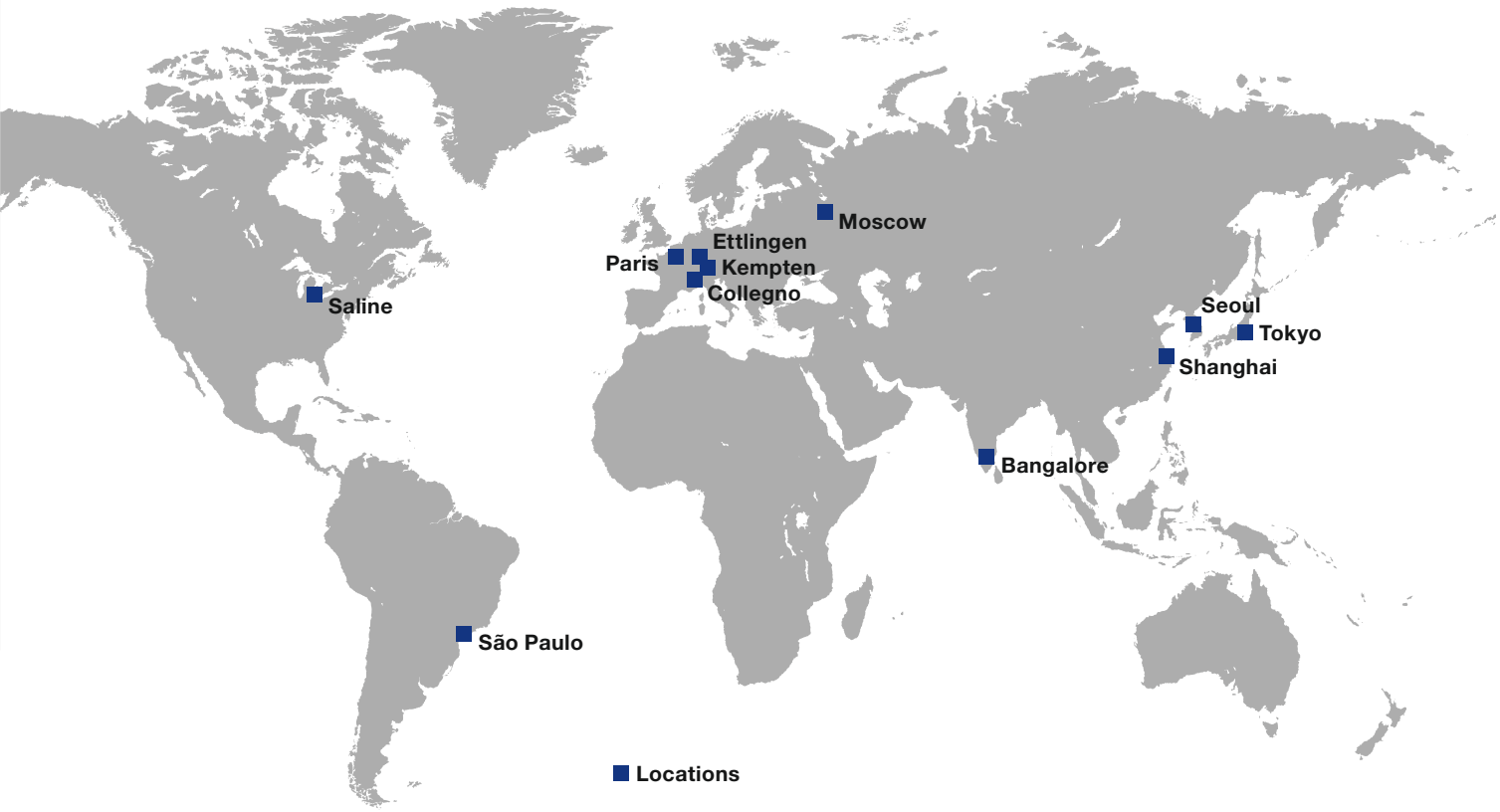
Service and Maintenance

Liebherr developed a system for optimizing repair and maintenance based on experiences with aerospace components within the Liebherr Group. As a result of this, maximum availability values and minimal total costs of ownership are achieved.

Most of the unexpected system failures can be avoided through preventive maintenance.

We also offer our customers optional "Wellness Checks" to minimize the risk of machine downtimes and secure the machine availability over the long term. Axles, gearboxes, cable drag, guides, carriages, as well as cables and hoses, are checked and replaced if necessary.

The system data is saved as a backup during each service and maintenance call in order to restore the status of the last maintenance if needed and thus quickly guarantee the restart of production.



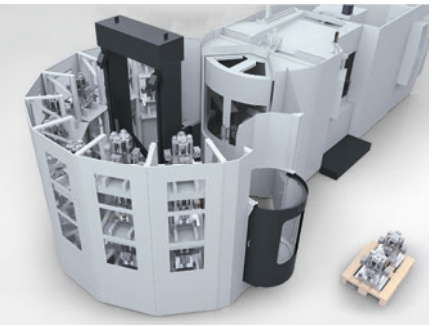
Locations of Liebherr-Verzahntechnik

- Liebherr-Verzahntechnik GmbH, Kempten, Germany
- Liebherr-Verzahntechnik GmbH, Ettlingen, Germany
- Liebherr-Utensili S.r.l., Collegno, Italy
- Liebherr-Verzahntechnik Paris, France
- Liebherr-Russland OOO, Moscow, Russia
- Liebherr Gear Technology, Inc. and Liebherr Automation Systems Co., Saline, USA
- Liebherr Brasil Guindastes e Máquinas Operatrizes Ltda., São Paulo, Brazil
- Liebherr Machine Tools India Private Limited, Bangalore, India
- Liebherr Machinery Service (Shanghai) Co. Ltd., China
- Liebherr Japan, Tokyo, Japan
- Liebherr Machine Tools and Automation, Seoul, South Korea

Machine Tools and Automation Systems from Liebherr

Liebherr employs roughly 1200 staff in the area of machine tools and automation technology and has production facilities in Kempten and Ettlingen (Germany), Collegno (Italy), Saline (Michigan, USA) and Bangalore (India). They are supported by expert and reliable marketing and service specialists at a large number of locations worldwide.

With over sixty years of industrial experience, Liebherr is one of the world's leading manufacturers of CNC gear cutting machines, gear cutting tools and automation systems. The company's innovative products are the result of pioneering ideas, highly qualified staff and state-of-the-art manufacturing systems at each of their locations. They are characterised by economy, ease of use, quality and reliability in combination with a high degree of flexibility.



System Solutions in the Area of Machine Tools
Included in the production programme are gear hobbing machines, gear shaping machines and generating- and profile grinding-machines, all noted for their high degree of stability and availability. Particular importance is attached to the energy efficiency of the machines.
Gear cutting machines from Liebherr are supplied to renowned manufacturers of gears and gearboxes and large-scale slewing rings worldwide. They are in demand primarily from the automotive and construction machinery industries and also increasingly from the wind power industry for the manufacture of gears for wind turbines.

High Quality Gear Cutting Tools
Liebherr manufactures high quality, precision tools for the soft and hard machining of gears and all Liebherr gear cutting machines are fitted with Liebherr tools. The range also includes Lorenz shaping tools and products customised for specific customer applications.

Automation Systems for a Broad Range of Applications
Liebherr has a wide range of products for linear robots, pallet-handling systems, conveying systems and robot integration for projects in all areas of production and can provide above-average availability of systems.

www.liebherr.com

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