

# LX Series



**LX 151 / LX 251**

**Dynamic 5-axis high performance  
blade machining center**

# Unrivalled efficiency in blade machining

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**StarragHeckert again sets a new standard with the LX series in the 5-axis machining of turbine and compressor blades for power generation equipment and turbo machinery. The current LX generation will continue to exceed the demands of the sector for years to come by the consistent use of state-of-the-art technology.**

## **Unrivalled system flexibility**

Market requirements were systematically analyzed and implemented during the refinement of the LX. Thanks to a system of highly useful options, the LX is an extremely flexible piece of precision high-performance milling technology.

## **Unique B-axis**

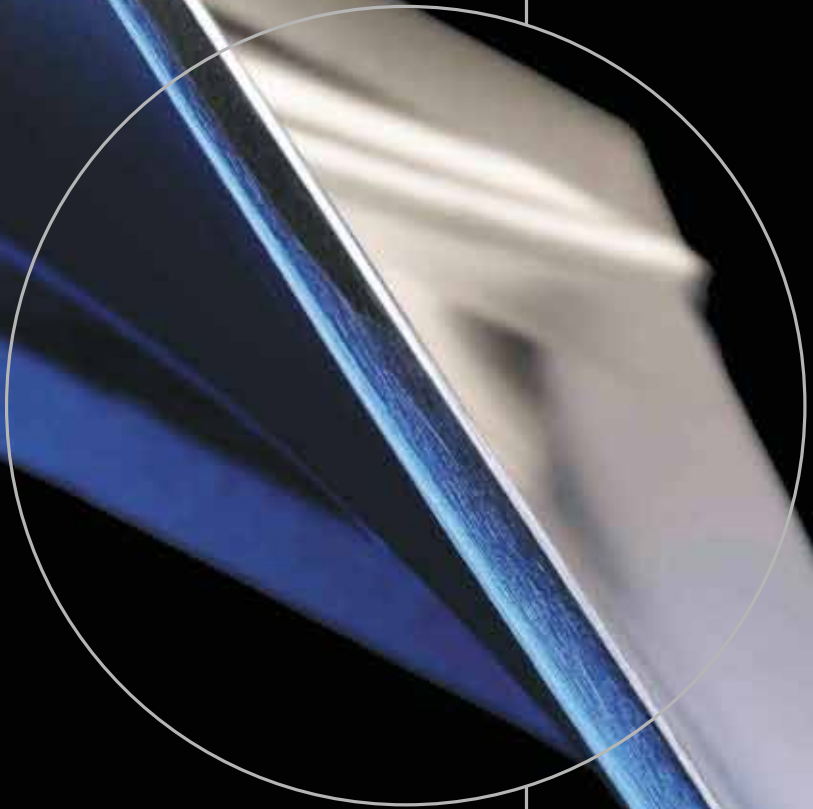
The patented B-axis has been long-tried and tested in the marketplace. The tool pivots in the center of the axis, reducing compensation movements during the milling process.

## **Customer-specific solutions**

Customer-specific solutions are the central focus at StarragHeckert. Our solutions are always tailored to individual manufacturing requirements. An experienced technical team supports customers with a comprehensive range of engineering services.

This includes the manufacturing of prototypes and small batches, or even process optimization, facilitated in our CPE (Center of Production Excellence). It is always our goal to guarantee that customers can start production immediately upon machine delivery.

# LX Series



The LX application specific design significantly increases efficiency.

The LX guarantees that even future challenges in blade machining will be implemented without constraint.

## Innovation in performance

### **Machinery dynamics – highest precision and productivity**

StarragHeckert machines are developed mechatronically from the design phase onward to achieve the desired configuration. Drives and control components are defined jointly with the machine mechanics, resulting in significantly higher metal removal rates and extraordinary machining dynamics.

Dynamic loads created by the highly efficient machining process, which could ordinarily cause part distortion, were considered in the machine design phase and specifically minimised. Five dynamic parameter sets are available, a reduction in feed rate is not necessary, thereby saving time.

The corresponding parameter values of an individual axis are quantitatively determined by simulation and a specially developed measuring process. The advantage: the machine dynamics are not reduced as a whole, but selectively, resulting in the highest possible productivity for the required precision of the workpiece.

### **High-performance cutting technology**

A marked increase in productivity is the result of using the latest technology. For example, an increase in efficiency by reducing production costs and/or machining hours is achievable through the uncompromising application of HPC technology.

High-performance spindles with high torque, precisely adjusted performance and speed, makes the LX tremendously efficient. Optimized machine kinematics, when moving and processing smaller components, provides exceptional results, due largely to the inherently rigid construction of the LX, as well as the superb damping of all its components.

### **Milling strategies for efficient complete machining**

StarragHeckert developed milling strategies that allow for the extraordinary metal removal rates for all materials, including trouble-free machining of forging blanks. These strategies are also particularly useful for the finish machining of different geometries in precision forged blades with special configurations, like snubbers, etc.



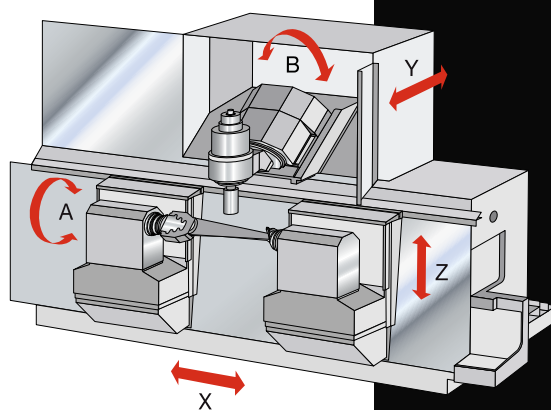
*Turbine blade machined from solid billet*



*Low pressure steam turbine blade*



*Precision forged aero engine fan blade*



*Axis configuration of the LX*

Every investment in technology must yield a measurable customer benefit. At StarragHeckert this premise is our central focus; as the market leader, this focus keeps us committed and driven to new heights in innovation.

### **Efficiency – not just a slogan**

The LX fulfils increased demands for process stability and availability. It is our goal to provide the means for customers to manufacture ready-to-install blades at the lowest cost per unit. Consistently high precision, the greatest possible contour precision and outstanding surface quality – and in the shortest milling time – all of these combined enable an efficiency level that pays for itself.

### **Optimal stability is a precondition**

The mono-block, polymer concrete machine bed design provides optimal damping of components, low vibration and stable machining. The superb static and dynamic properties allow very high feed rates.

The rigid machine bed coupled with the high natural frequency of the base components guarantee excellent stability even during the heaviest machining. Further more, the symmetrical drive power, regardless of workpiece dimensions, has a superior effect on tool life.

### **Precision machining of high-tech blades**

The patented LX axis design forms the basis for a balanced distribution of masses. Independent control of the tip and root stations presents completely new possibilities in blade manufacturing. A versatile, modular and combinable clamping system, with torque compensation during the machining process, fulfils the most demanding manufacturing requirement.

The new LX generation of machines guarantees consistent reproducibility of workpieces, which is critical when manufacturing aerospace engine fan blades.

## **Investment in perfection**

Specially developed measuring cycles for workpieces and tools guarantee consistent precision. Other unique features include the thermal stability of the symmetrical machine bed, as well as the temperature compensation for areas with excessive heat build-up.



*Good accessibility to the machine modules*

### **Trend setting maintenance concept**

The reduction in maintenance frequency and the resulting increase in machine availability positively impacts efficiency. Direct, quick access to all machine components reduces operational maintenance time and cost.

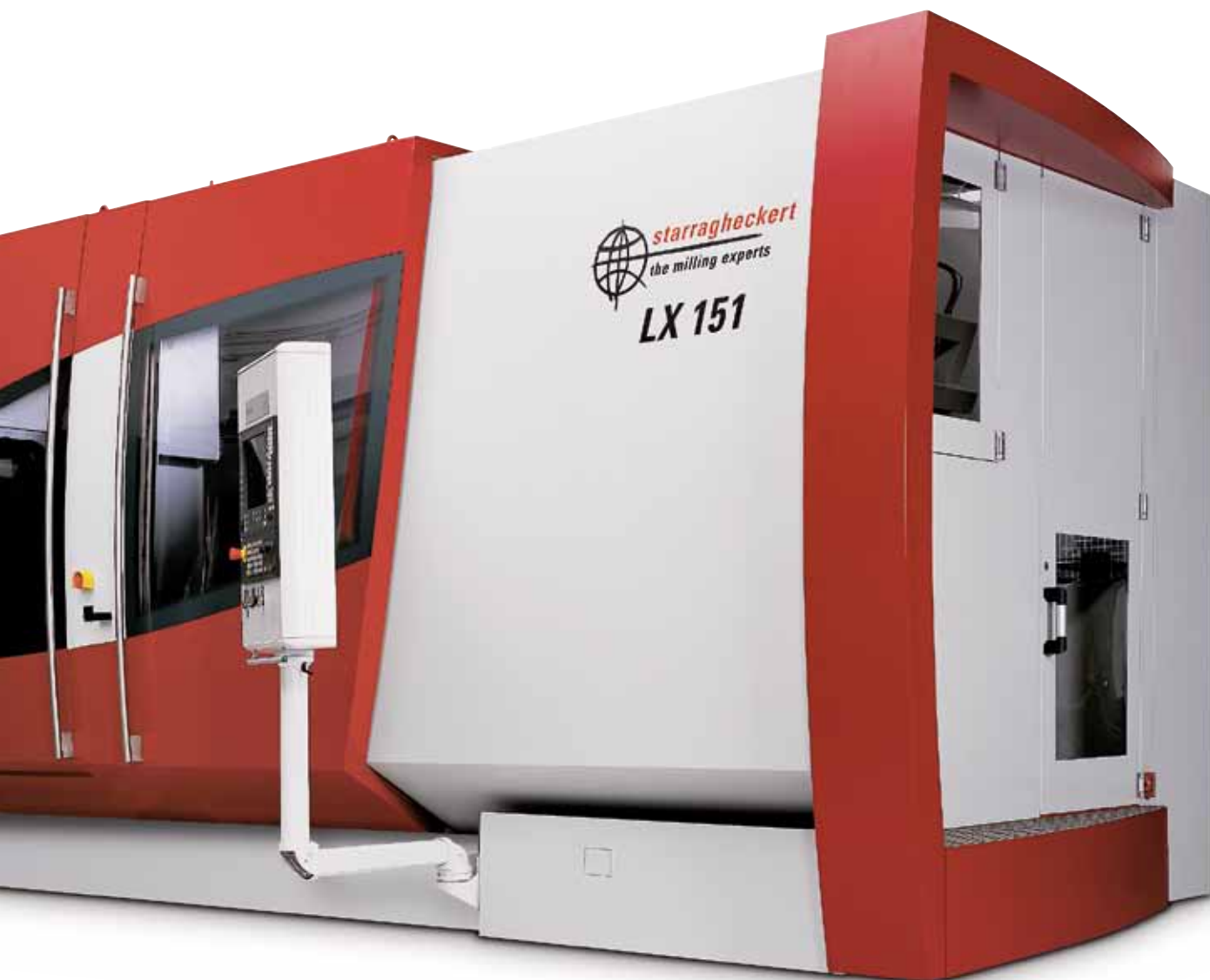
Combined with the StarragHeckert scheduled maintenance programme, maintenance periods are convenient and customer driven.

### **Progress through experience**

For decades StarragHeckert has led the market in 5-axis milling of extremely complex turbine blades. These are generally milled out of extremely difficult-to-machine materials. This has made us a leading global technology supplier for 5-axis and multi-spindle machining centers. Profit from our many years of extensive experience.







Operator-friendly, compact and ultra modern, the LX Series setting new standards of design and performance.

It is one thing to be the technological leader; the true challenge, however, is to maintain that position. Our success is founded in the deep conviction that even “perfect” technological solutions can still be optimized.

## Focus on technology

### Machine assembly with revolutionary, patented axis arrangement

- Symmetrical axis arrangement ensures an optimal distribution of the masses for all workpiece dimensions
- Minimized and balanced movement of the masses
- High acceleration, jerk and Kv factors result in excellent stability
- Short distribution of forces increases rigidity, leading to stable ratios during the machining process. These factors have been proven in real-time simulation during the machine development phase
- All base frame components are designed using FEM analysis for maximum rigidity

### Unique patented B-axis

- A tilted stable rotary B-axis mounted on the Y-axis slide
- Elimination of X-axis linear compensation movements in the workpiece
- All rotary axes intersect around the tool center point
- No transfer of coupler forces from other axes
- Harmonious component behaviour through optimal dynamic parameter settings are relative to each other
- Highest possible surface finish quality

### Highly dynamic rotary axes

- The rotary axes are directly driven by state-of-the-art torque motors
- Guarantees the most precise positioning
- High torque even at low speed
- Highest possible rigidity for maximum dynamics
- Power transmission free of backlash and extended service intervals
- No mechanical component wear
- Driven tip station with controllable torque

### High-torque milling spindle

- StarragHeckert developed main milling spindle unit
- Hybrid bearings
- Spindle with vector-controlled asynchronous motor
- Through-spindle and tool coolant supply
- Micro lubrication for dry machining (optional)
- Spindle temperature monitoring
- Optimized cooling system for thermal stability
- Optimized design to reduce the mass of the spindle



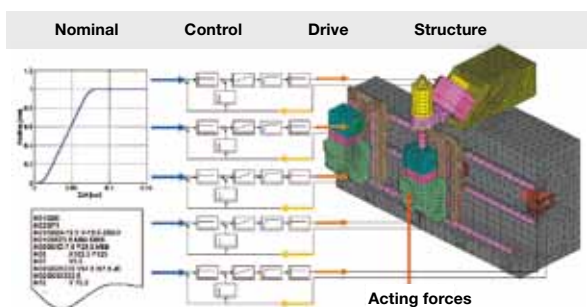




- Short acceleration and deceleration times
- Highest possible metal removal rates for its size
- HSK-A 63 tooling system
- Improved safety via forced clamping at high speeds

## High-performance Siemens CNC control

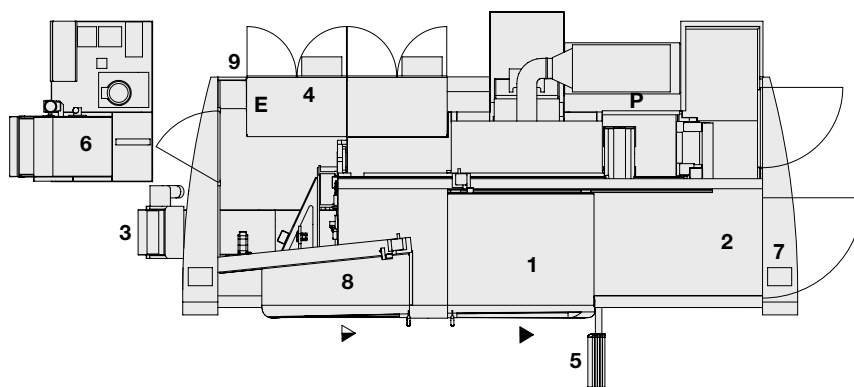
- Easy to operate
- Dynamic 5-axis machining for processing of free form surfaces or geometries
- Compression function to control any jumps in acceleration during transition from one line block to another
- During 3D, HSC and HPC – machining, specific algorithms, interpolation concepts and, if applicable, smoothing functions are features that are regarded as crucially important
- Typical requirements for 5-axis machining with the Siemens 840D are the result of years of collaboration with Siemens R&D
- Simple call-up of customer-defined machine parameter sets for optimal milling process



Coupled mechatronic simulation

# Technical Data

- 1 Working area
- 2 Tool magazine / Tool changer
- 3 Chip conveyor
- 4 Electrical cabinet
- 5 Operator panel
- 6 Coolant supply unit
- 7 Tool loading / unloading station
- 8 Workpiece set-up station
- 9 Main switch
- E Electric power supply
- P Air supply
- Main operating position
- Auxiliary operating position

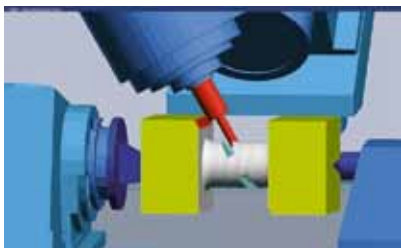
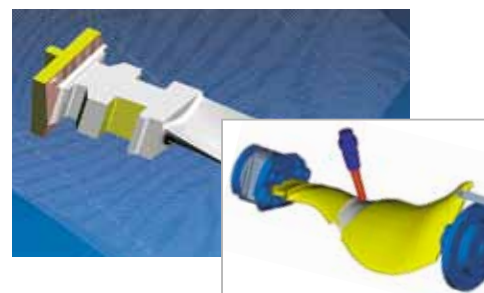


		LX 151	LX 251
<b>Working Range</b>			
Max. distance between centers *	mm / inch	855 / 33,7	1355 / 53,3
Swing Diameter	mm / inch	400 / 15,7	400 / 15,7
Max. workpiece length **	mm / inch	700 / 27,6	1200 / 47,2
<b>Strokes</b>			
X-Axis	mm / inch	1100 / 43,3	1600 / 63,0
Y-Axis	mm / inch	400 / 15,7	400 / 15,7
Z-Axis	mm / inch	400 / 15,7	400 / 15,7
A-Axis (Root Station)	degrees	360 / 360	360 / 360
AA-Axis (Tip Station)	degrees	360 / 360	360 / 360
Swivel B-Axis	degrees	+/-50	+/-50
<b>Axis Feeds and Rapid Traverse</b>			
Linear Axes X Y Z	m/min / ipm	50 / 1968	50 / 1968
Rotary Axis A	rpm	200	200
Rotary Axis B	rpm	60	60
<b>Positioning Accuracy to (VDI/DGQ 3441)</b>			
Linear Axes P	mm / inch	0,009 / 0,00035	0,009 / 0,00035
Linear Axes Ps	mm / inch	0,005 / 0,00020	0,005 / 0,00020
Rotary Axes P	degrees	0,003	0,003
Rotary Axes Ps	degrees	0,001	0,001
<b>Main Drive / Motor Spindle</b>			
Power at 100% duty	kW / hp	28,0 / 38,1	28,0 / 38,1
Torque at 100% duty	Nm / lbs-ft	181,0 / 133,5	181,0 / 133,5
Speed	rpm	18000,0	18000,0
Tool taper		HSK-A63	HSK-A63
<b>Tool Deposit / Chain Magazine</b>			
Max. tool weight	kg / lbs	6,5 / 14,3	6,5 / 14,3
Max. tool diameter	mm / inch	150,0 / 5,9	150,0 / 5,9
Max. tool length	mm / inch	250,0 / 9,8	250,0 / 9,8
Tool locations / max. number of tools		24 (optional 62)	24 (optional 62)
Tool change time (Double Gripper)	sec	8,0	8,0
<b>Workpiece Changer / Adapter Changer</b>			
Max. workpiece diameter	mm / inch	400,0 / 15,7	400,0 / 15,7
Total weight (part and fixture)	kg / lbs	80,0 / 176,4	80,0 / 176,4
Workpiece change time	sec	approx. 30	approx. 30
<b>Dimensions / Weight</b>			
Weight	kg / lbs	18000,0 / 39682,8	23000,0 / 50705,8
Length x Width x Height	mm / inch	6100 x 2800 x 2800 / 240 x 110 x 110	7130 x 2800 x 2800 / 281 x 110 x 110
Safety Concept		CE-compliant	CE-compliant
<b>CNC-Control</b>			
		Siemens 840D	Siemens 840D

## Focus on customer advantages

### CAM System RCS 7

The precision and efficiency of turbine blade production depends largely on the effective performance capabilities of the CAD/CAM software being used to program the blades. The StarragHeckert RCS 7 CAD/CAM software sets new standards in this area. All blade-specific applications and data can quickly and easily be handled, making programming faster and resulting in the reality of a “shorter time to market”.



### SAM (Service Assistant Module)

SAM is an expert service system developed by StarragHeckert for the total monitoring of the machine. Statistics, maintenance plans and documentation through to the guided visual fault diagnostics results in an enhanced problem diagnosis, which intern results a rapid service response time.

Sensors and actuators are monitored online in real-time. The customer is actively supported though the online diagnostic system during the fault finding process. The “totally transparent machine” has become reality.

### Engineering at its best

In our Centre of Production Excellence, StarragHeckert offers our customers the possibility to test and optimize new and demanding machining processes whilst waiting for their own StarragHeckert machine to be build. With our own in-house tool manufacturing facility, it is possible to keep the required time to an absolute minimum. Together with our own CAM system this translates into a measurable added value. The customer receives an optimized and tested NC program, together with detailed tooling lists and operational sequences, enabling production start to begin within the shortest possible period of time.



### Customer-specific tooling development

For decades, StarragHeckert has been known for supplying leading edge customer-specific turnkey solutions. A substantial contribution to this technology has been the development and manufacture of our own specialized tooling. These tools are thoroughly tested in our CPE and modified to suit the required application, thus contributing considerably to the optimization of the machining process. The customer benefits from the perfect compiled package consisting of machine, tooling, software and know-how.



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