

# LASER LINE PRECISION

All-in-one laser precision machining of diamond tools



## Key parameters

The LASER LINE PRECISION replaces previous methods for grinding and eroding ultra-hard materials, such as PCD, CVD-D, CBN and MCD through the use of lasers. It holds rotation symmetrical tools of up to 200 mm diameter and up to 250 mm length as well as indexable inserts from 3 mm inside diameter and up to 50 mm perimeter diameter.



Grinding



Eroding



Laser



Measuring



Software



Customer Care

## EWAG

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The origins of EWAG date back to 1946 when the company manufactured precision tool grinding machines for the Swiss watch industry. Today the EWAG product range includes manual machines for grinding and regrinding tools as well as the production of small precision parts, CNC tool grinding machines for grinding as well as laser machines for indexable cutting inserts and rotationally symmetrical tools made from carbide.

EWAG is part of the UNITED GRINDING Group. Together with our sister company, Walter Maschinenbau GmbH, we consider ourselves to be a supplier of systems and solutions for the complete machining of tools and can offer a wide range of products, including grinding, rotary eroding, laser machining, measurement and software.

Our customer focus and our global sales and service network of company-owned locations and employees has been appreciated by our customers for decades.

# LASER LINE PRECISION

The LASER LINE PRECISION is the perfect machine for getting started with laser technology for modern tool manufacturers. The latest laser technology in the green-wavelength range provides efficient machining results in the commercially available diamond cutting materials, such as CBN, PCD, MCD and CVD-D. The EWAG Laser Touch Machining<sup>®</sup> Process can be used to achieve very complex geometries with excellent surface quality. The LASER LINE PRECISION is probably the most compact laser production center for diamond tools in the world.



Laser



Software

# LASER LINE PRECISION at a glance

## Application

- All-in-one machining of blades, cavities and chip grooves followed by labelling in one clamping operation
- Indexable inserts from 3 mm inside diameter and up to 50 mm circumscribed diameter
- Holds rotationally symmetrical tools of 0.5 to 200 mm in diameter and of up to 250 mm in length
- CBN, PCD, MCD and CVD-D materials
- Sharp blades and inner edges

## The machine

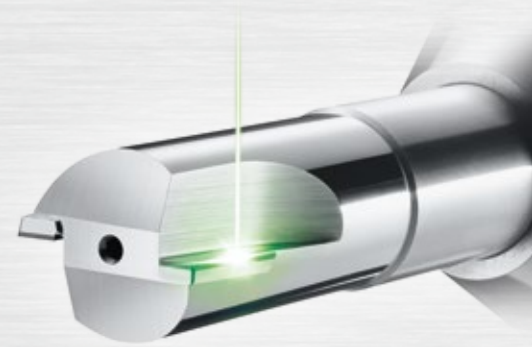
- Short-pulse laser with pulses in the nanosecond range
- Low-vibration cast-iron machine bed
- 5-axis CNC tool machine plus overlaid 2-axis CNC laser beam guide
- Direct drives in the linear axes
- Torque motors for B and C axes
- Automatic HSK 63 interface
- Integrated laser output measurement and monitoring (IPC)
- Automatic focus position detection
- Automatic calibration of CNC/optical axes
- Integrated 3D measuring probe
- FANUC control unit, the global standard
- Automation peripheral equipment includes FANUC 6-axis robot



LASER LINE PRECISION – Using short-pulse laser technology in the green-wavelength range (532 nm) enables superhard materials, such as PCD, MCD, CVD-D and CBN, to be machined efficiently.

## Software

- EWAG LaserSoft combines laser and machine control
- Direct 3D CAD/CAM interface
- Fastest programming starting with the shell contour (e.g. DXF)
- Simplest definition of laser removal paths
- Various User Levels available
- Simple program structure using standardized modules
- Management of laser status, hardware, tools, production and order processing



### Short-pulse laser in green-wavelength range (532 nm) with perfect erosion properties

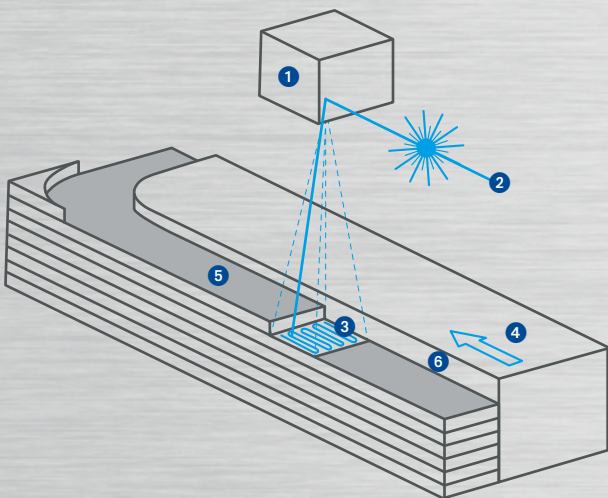
Usage of a short-pulse laser system is ideal for machining superhard materials. Due to the short application time of the laser pulse, the laser energy can be fed into the tool before plasma effects (plasma shielding) are produced in the machining area. The use of a halved wavelength (532 nm) instead of the conventional wavelength (1,064 nm) leads to a doubling of the photon energy in the machining area. The erosion rate can thus be increased with the same laser output. The shorter wavelength is also advantageous for machining diamond materials due to the increased absorption properties, especially in semi-transparent CVD-D materials.

Thanks to the unique 7-axis kinematics concept, the LASER LINE PRECISION machines highly complex geometries in just one clamping operation. The optional 6-axis robot guarantees ultimate productivity during minimally manned multi-shift operation. The LASER LINE PRECISION and the robot are coordinated via FANUC control technology.

### EWAG Laser Touch Machining®

Tangential laser beam machining generates top-quality cutting edges and cutting geometries in an efficient manner. In this process, the surface is shaped with the outer surface of the laser beams. The cutting groove is produced by the repetitive hatching pattern of the laser scanning unit and by the simultaneous travel movement of the CNC axes. This unique, patented machining technology is marketed under the brand EWAG Laser Touch Machining® (LTM®).

- 1 2D scanning unit; moves the beam in the X/Y plane
- 2 Laser beam
- 3 Repeating 2D pattern (hatching)
- 4 Workpiece movement via 5-axis CNC (X/Y/Z/B/C)
- 5 Machined erosion paths
- 6 Final geometry/free surface



# Laser precision machining of diamond tools





- Effortless precision machining
- Extremely fine laser focus diameter (15 µm)
- Ideal for inner edges and radii
- Crack-free, sharp diamond blades
- All-in-one machining of blades and chip groove geometries

### Economical all-in-one machining of cutting tools

The growing requirements for state-of-the-art diamond cutting tools now mean laser precision machining is indispensable. Wear-resistant, crack-free, top quality tool blades with defined blade edge structures made of MCD, CBN, CVD-D or coarse-grained PCD can no longer be manufactured using conventional methods like grinding or eroding. Complex cutting contours and narrow tool tolerances require a precise, effortless and flexible machining solution.

The LASER LINE PRECISION is specially designed for state-of-the-art laser precision machining and production of diamond tools. Any cutting contours, clearances and 3D machining of chip groove geometries can be performed in one clamping operation. The integrated short-pulse laser in the green-wavelength range (532 nm) enables particularly efficient machining of diamond materials. Since the wavelength is half that of the standard market length, the focus diameter is also halved to 15 µm. This makes the LASER LINE PRECISION the first choice when it comes to elaborate, complex contour tools with ultimate precision and extremely sharp cutting edges..

CBN applications



PCD applications



PCD applications



CVD-D applications



# A distinguished performance package



- Distinguished machine concept
- Ergonomic machine design
- Integrated automation solution
- Sturdy laser technology for 24/7 production
- Compact laser production system

## Distinguished machine concept

The intelligent kinematics concept with 5 CNC axes and an overlaid 2-axis laser beam deflector guarantees the highest possible flexibility in all-in-one machining of highly complex tools. The LASER LINE PRECISION promises a fully automated process all the way from the blank to the finished part in one clamping operation.

## Ultimate process stability

The compact, sturdy laser source is integrated in the air-conditioned control cabinet and guarantees stable laser beam properties around the clock. All optical components are water-cooled and guarantee a stable process environment.

## Most compact laser machine

The LASER LINE PRECISION is probably the most compact laser production system in the world with integrated automation for state-of-the-art production of diamond cutting tools. Thanks to its minimal set-up area of 4.5 m<sup>2</sup>, it can also be installed in confined spaces. A great deal of importance was placed on an ergonomic machine design during machine development.





### HSK 63 interface

The highly accurate tool holder is decisive for a precise machining result and it is compatible with a wide range of clamping devices on the market.



### Clamping indexable inserts

Indexable inserts can be clamped with a clamping station or using a nail clamp.



### Automation of cylindrical workpieces

The double gripper of the robot automatically feeds the cylindrical workpieces, e.g. drills and milling cutters, from pallets.

- Low-maintenance linear drives
- HSK 63 tool interface
- 3D measuring probe
- Automatic calibration of CNC/ optical axes, laser output and focus position



### Automatic calibration

The machine calibrates itself for highly accurate machining. Both the 5 CNC axes and the 2 optical axes of the deflection system as well as the laser output and the focus position are measured exactly in an automatic process.



### 3D measurements

Soldering errors are detected via an integrated 3D measuring probe and the plate position is automatically compensated in LaserSoft, the laser software from EWAG. The exact plate height is also detected in order to accurately readjust the focus position.

# Flexible automation

- HSK-63 holders with 8, 16, 24 or 52 places
- Shaft tools in WALTER standard pallets (2, 8 pallets)
- Indexable inserts handling; customer-specific or with pallet stacker
- Space-saving robot integration
- Profitability, even for small batch sizes



## Robot integration

The efficient EWAG rotating drum solution for integration of a FANUC 6-axis folding-arm robot with various gripper systems enables automatic multi-shift operation. Laser machining cells and robot cells have a beam-proof design and are integrated to save space. Transformer substations and automatic part detection also support automatic operation.

## Customer-specific tool handling

Tool handling in the LASER LINE PRECISION is tailored precisely to customer requirements: indexable inserts can be clamped automatically in series or in alternating series. Rotating tools can be loaded automatically via HSK 63 tool holders or via the double gripper head. Rack and pallet systems, including automatic pallet stacker solutions, are available.

## Triple gripper

In order to reduce change times to a minimum, indexable inserts are inserted using a triple gripper head on the FANUC robot. The robot detects the tool and the allocated clamping system; the gripper takes the tool from the pallet and transfers it to the clamping station in the correct, precise machining position.

# How to get optimum use out of the LASER LINE PRECISION

In order to get optimum use out of your laser processing machine we offer a customised training session. At the end of the training session you are given a certificate showing the training has been successfully completed. This provides you with evidence of the solid practical training your employees have received.

The training lasts one week and is held on the EWAG site in Switzerland. It consists of the following modules:

## **Module 1, Laser principles:**

General laser technology, structure of a laser system, principles of optical systems and properties of laser beams.

## **Module 2, Laser ablation:**

Erosion mechanisms in 2D and 3D erosion, properties of short and ultra-short laser pulses, differences in machining quality.

## **Module 3, Machine structure:**

Description of machine-model constraints of EWAG LASER LINE series, technical questions such as general operation and maintenance of the machine.

## **Module 4, CAD/CAM:**

Basic tool-production skills and basic machining data for machining your geometries. Training on a simple geometry, direct implementation in the course.

## **Module 5, Cutting edges:**

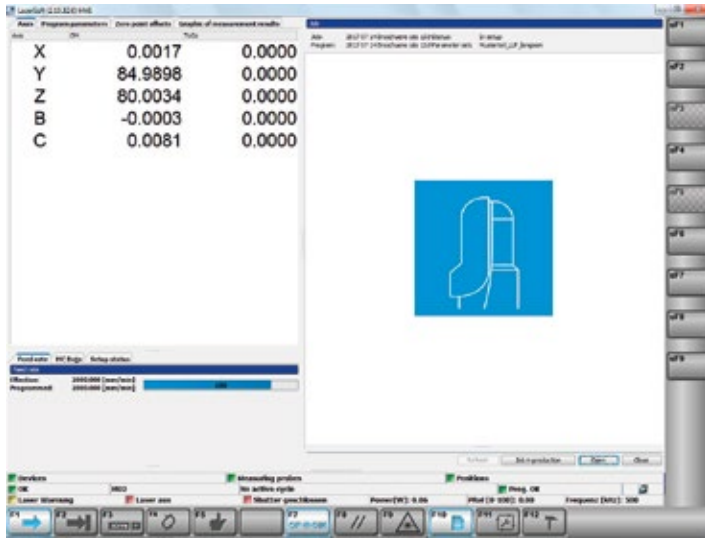
Creation of a typical cutting geometry, direct application on a typical workpiece.

## **Module 6, Advanced strategies:**

Generation of negative chamfers, chip breakers and labelling of workpieces.

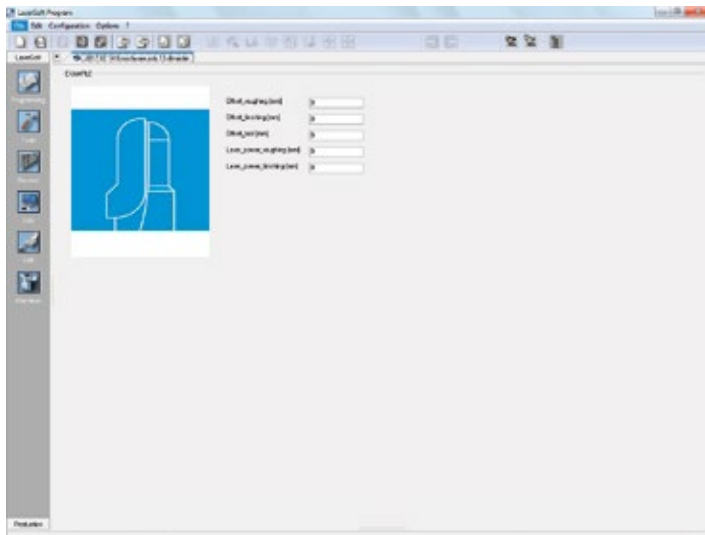


# EWAG LaserSoft Technology



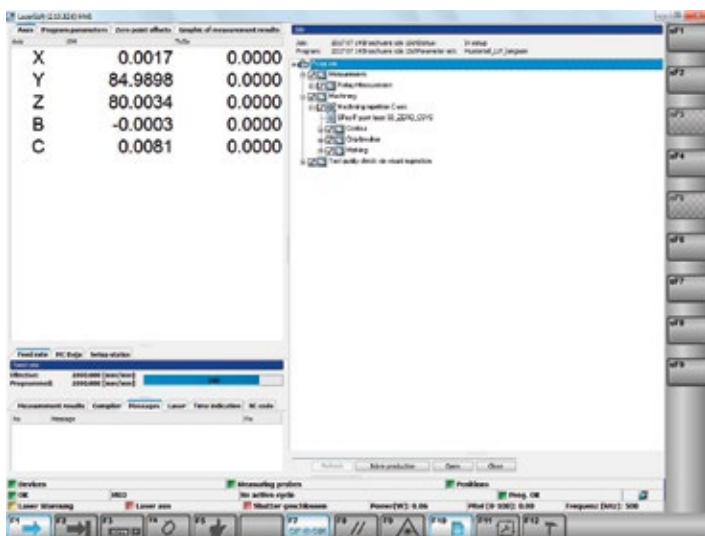
## BASIS Level

Intended for users with no knowledge of laser machining, e.g. the second or third shift.



## STANDARD Level

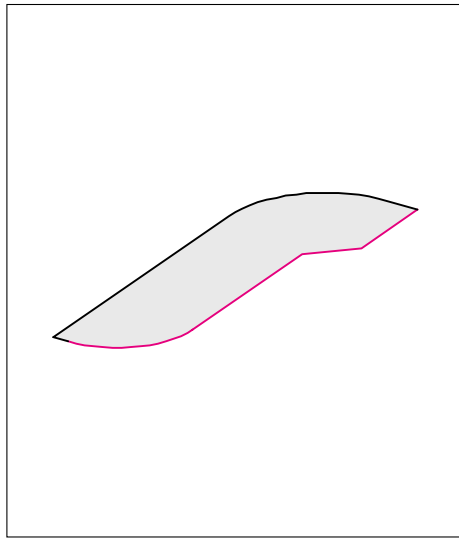
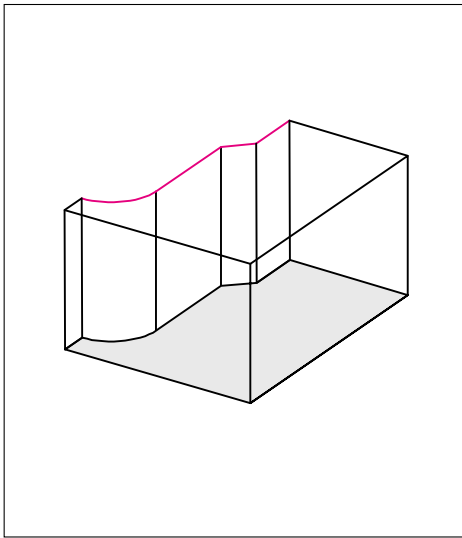
Ideal for regular users with knowledge of tool machining. Pre-defined calibration and setup data of the machine parameters, which are specified by the HIGH Level user, can be modified.



## HIGH Level

The surface for the machine operator trained by EWAG with existing knowledge in the design of tools and laser-based machining procedures. The HIGH Level user sets up new tools and can perform modifications on the tool and laser parameters.

# From the contour to the tool

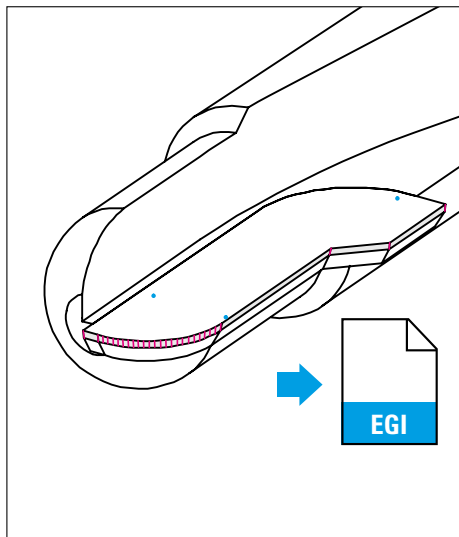
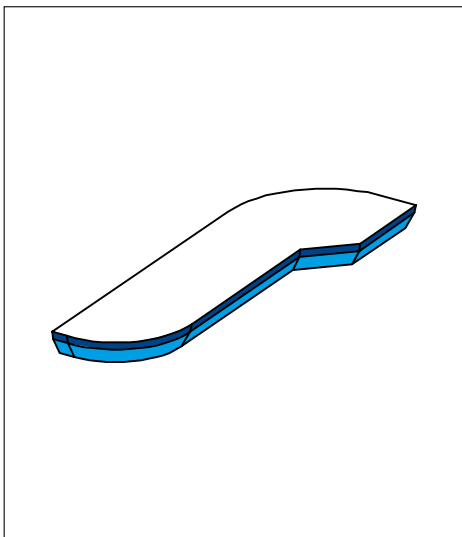


### New tool idea

The idea for a new tool typically arises from a desired workpiece contour, e.g. from a contour to be milled. This profile is often described as a 2D contour line (marked in red) in the form of a file in DXF format.

### Laser Pro 3D

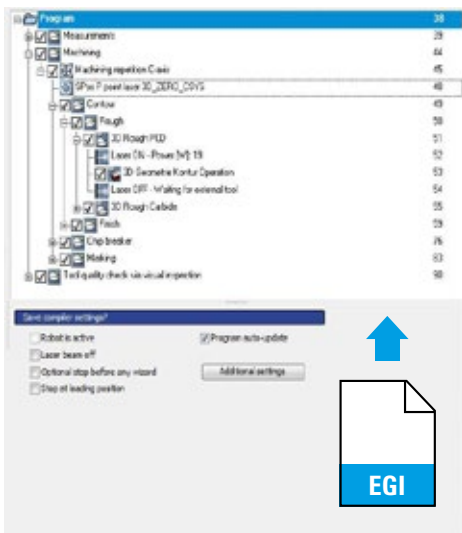
In a first step, the desired contour line is supplemented with the remaining contour lines of the PCD plate to be soldered in.



The clearance angles are now being modelled. Axial or radial angles of the plate are not required for this process.

Next, three measurement points for the measurement of the solder error are set directly in the 3D model (blue points). These are then saved in a file (in EWAG EGI format).

Next, the CAM calculations are performed and the corresponding pathway points (red points) are also saved in a file (EGI format).



### EWAG LaserSoft

Now a setup program is created on the machine (HIGH Level). The measurement points and the CAM pathways are now linked directly as machining file.

### Finished tool

After the production of the tool, it can be viewed directly on the machine for visual inspection under the integrated camera.

## FANUC control unit, the global standard



- Multi-processor system – high system security
- FANUC bus for digital drives – fault-free communication
- CNC and robots from a single manufacturer – no interface problems

With the FANUC control unit, EWAG relies on the global standard of control technology. For the user, this means the highest degree of reliability, availability and operating comfort.

# Customer Care

WALTER and EWAG deliver systems and solutions worldwide for all areas of tool machining. Our claim is based on ensuring maximum availability of our machines over their entire service life. For this we have thus bundled numerous services in our customer care program.

From "Start up" through "Prevention" to "Retrofit", our customers enjoy tailor made services for their particular machine configuration. Around the world, our customers can use helplines, which can generally solve a problem using remote service. In addition to that, you will also find a competent service team in your vicinity around the world. For our customers, this means:

- Our team is close by and can quickly be with you.
- Our team will support you to improve your productivity.
- Our team works quickly, focuses on the problem and its work is transparent.
- Our team solves every problem in the field of machining tools, in an innovative and sustainable manner.



## Start up

Commissioning  
Extension of the guarantee



## Qualification

Training  
Support for production



## Prevention

Maintenance  
Inspection



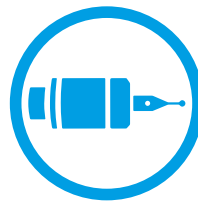
## Service

Customer service  
Customer advice  
Helpline  
Remote service



## Digital Solutions

Remote Service  
Service Monitor  
Production Monitor



## Material

Spare parts  
Replacement parts  
Accessories



## Rebuild

Machine overhauling  
Refurbishing of assemblies



## Retrofit

Conversions  
Retrofitting parts  
Taking machines back

# Technical data, dimensions

## Mechanical axes

X axis	440 mm
Y axis	140 mm
Z axis	170 mm
Rapid motion <sup>1)</sup>	15 m/min
B axis	± 110°
C axis	∞

## Optical axes

Max. scanning field size	50 x 50 mm <sup>2</sup>
Max. beam deflection speed	10 m/s

## Laser source

Performance of industrial short pulse lasers	Standard
Wave length	532 nm
Beam profile and quality	TEM <sub>00</sub> (M <sup>2</sup> < 1.5)

## Accuracy

Linear resolution	0.0001 mm
Radial resolution	0.0001°

## Smoke gas suction/filter system

Volume flow	170 m <sup>3</sup> /h
Low pressure	2,800 Pa
Dust filter/Filter module	HEPA H14

## Others

Power consumption at 400 V/50 Hz	approx. 11 kVA
Weight incl. robot cell	approx. 4,000 kg

## Tool data

### Automatic clamping system for indexable inserts

Min. inner circle of indexable inserts <sup>2)</sup>	3 mm
Max. circumscribed circle of indexable inserts <sup>2)</sup>	50 mm

### Automatic clamping system for rotationally symmetric tools

Interface	HSK 63 A
Max. diameter of rotating tools <sup>2)3)</sup>	200 mm
Max. tool length <sup>2)3)</sup>	250 mm

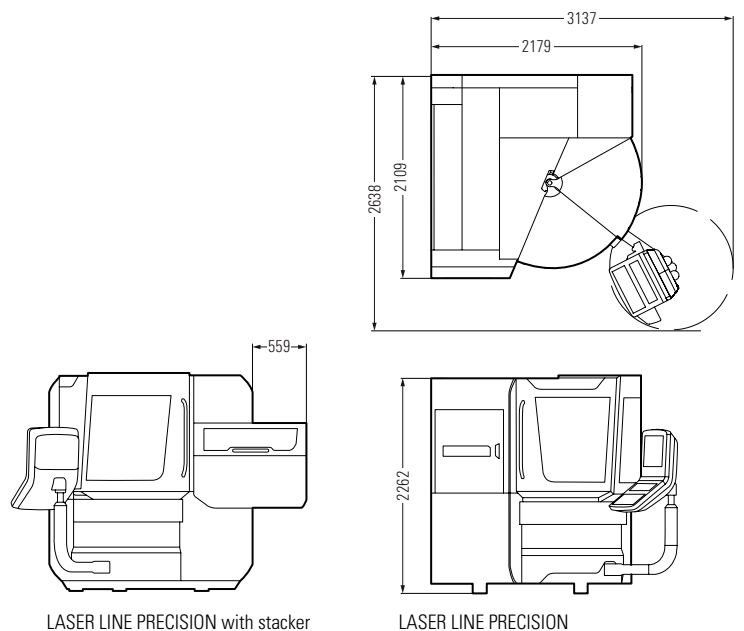
## Options

- Water reverse-flow cooling unit
- Automation with FANUC robot
- HSK 63 rack
- Pallets for rotating tools
- Pallets for indexable inserts
- Pallet changers
- Pallets for double-gripper tools
- Customised clamping solutions
- Shaft tools using double grippers and WALTER pallet system

## Services

- Training session LASER LINE PRECISION
- Development of customised tools

All brands marked with ® are at least registered as a basic brand in Switzerland or in Germany, legally qualifying them to carry the symbol.



<sup>1)</sup> Linear max. CNC speed in X/Y, this is limited to 5 m/min.

<sup>2)</sup> The maximum tool dimensions depend on the type of tool and its geometry, as well as the type of machining.

<sup>3)</sup> From surface contact HSK 63 interface.

Subject to modifications due to technical progress and errors. No guarantee is provided for this information.



# Creating Tool Performance

WALTER and EWAG are globally acting market-oriented technology and service companies, and are system and solution partners for all areas of tool machining. Our range of services is the basis for innovative machining

solutions for practically all tool types and materials typical for the market with a high degree of added value in terms of quality, precision, durability and productivity.



## Grinding – Grinding of rotationally symmetrical tools and workpieces

WALTER machines	Use	Materials	Tool dimensions <sup>1)</sup> max. length <sup>2)</sup> / diameter
HELITRONIC ESSENTIAL	P R	HSS HM C/K CBN	255 mm / Ø1 – 100 mm
HELITRONIC MINI POWER	P R	HSS HM C/K CBN	255 mm / Ø1 – 100 mm
HELITRONIC MINI AUTOMATION	P R	HSS HM C/K CBN	255 mm / Ø1 – 100 mm
HELITRONIC RAPTOR	P R	HSS HM C/K CBN	280 mm / Ø3 – 320 mm
HELITRONIC POWER 400	P R	HSS HM C/K CBN	520 mm / Ø3 – 315 mm
HELITRONIC VISION 400 L	P R	HSS HM C/K CBN	420 mm / Ø3 – 315 mm
HELITRONIC VISION 700 L	P R	HSS HM C/K CBN	700 mm / Ø3 – 200 mm
HELITRONIC MICRO	P R	HSS HM C/K CBN HSS HM C/K CBN	120 mm / Ø0.1 – 12.7 mm 120 mm / Ø3 – 12.7 mm



## Eroding – Electrical discharge machining and grinding of rotationally symmetrical tools

WALTER machines	Use	Materials	Tool dimensions <sup>1)</sup> max. length <sup>2)</sup> / diameter
HELITRONIC DIAMOND EVOLUTION	P R	HSS HM C/K CBN PKD	185/255 mm / Ø1 – 165 mm
HELITRONIC RAPTOR DIAMOND	P R	HSS HM C/K CBN PKD	270 mm / Ø3 – 400 mm
HELITRONIC POWER DIAMOND 400	P R	HSS HM C/K CBN PKD	520 mm / Ø3 – 380 mm
HELITRONIC VISION DIAMOND 400 L	P R	HSS HM C/K CBN PKD	420 mm / Ø3 – 315 mm



## Software – The intelligence of tool machining and measuring for production and regrinding



## Customer Care – Comprehensive range of services



## Grinding – Grinding of indexable inserts

EWAG machines	Use	Materials	Indexable inserts <sup>1)</sup> Inscribed / circumscribed circle
COMPACT LINE	P R	HSS HM C/K CBN PKD	Ø3 mm / Ø50 mm



## Laser – Laser machining of indexable inserts and/or rotationally symmetrical tools

EWAG machines	Use	Materials	Tool dimensions <sup>1)</sup> max. length / diameter
LASER LINE ULTRA	P R	HM C/K CBN PKD CVD-D MKD/ND	250 mm / Ø0.1 – 200 mm
LASER LINE PRECISION	P R	CBN PKD CVD-D MKD/ND	250 mm / Ø0.1 – 200 mm

EWAG machines	Use	Materials	Indexable inserts <sup>1)</sup> Inscribed / circumscribed circle
LASER LINE ULTRA	P R	HM C/K CBN PKD CVD-D MKD/ND	Ø3 mm / Ø50 mm
LASER LINE PRECISION	P R	CBN PKD CVD-D MKD/ND	Ø3 mm / Ø50 mm



## Measuring – Contactless measurement of tools, workpieces and grinding wheels

WALTER machines	Use	E1-Value	Tool dimensions <sup>1)</sup> max. length / diameter
HELICHECK ADVANCED	M	(1.8 + L/300) µm	420 mm / Ø1 – 320 mm
HELICHECK PRO	M	(1.2 resp. 1.4 + L/300) µm	300 mm / Ø1 – 200 mm
HELICHECK PRO LONG	M	(1.2 resp. 1.4 + L/300) µm	730 mm / Ø1 – 200 mm
HELICHECK PLUS	M	(1.2 resp. 1.4 + L/300) µm	300 mm / Ø0.1 – 200 mm
HELICHECK PLUS LONG	M	(1.2 resp. 1.4 + L/300) µm	730 mm / Ø0.1 – 200 mm
HELICHECK 3D	M	(1.8 + L/300) µm	420 mm / Ø3 – 80 mm
HELISET PLUS	M	–	400 mm / Ø1 – 350 mm
HELISET	M	–	400 mm / Ø1 – 350 mm

**Use:** P Production R Regrinding M Measuring

**Materials:** HSS High speed steel TC Tungsten carbide C/C Cermet/ceramics CBN Cubic boron nitride PCD Polycrystalline diamond CVD-D Chemical vapour deposition MCD/ND Monocrystalline diamond/natural diamond

<sup>1)</sup> Maximum tool dimensions are dependent on the tool type and geometry, as well as the type of machining.

<sup>2)</sup> From the theoretical taper diameter of the workpiece holder.







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