



Diamantové pásové pily
EXAKT

CELKOVÝ PŘEHLED



Diamond Band Cutting Technology

The Challenge

- › Requirements & expectations

EXAKT Technology

- › Models
- › Diamond Bands
- › Cutting Technology CP / CL

Pathology / Anatomy Application

- › Examples

Industrial Application

- › Examples

THE CHALLENGE

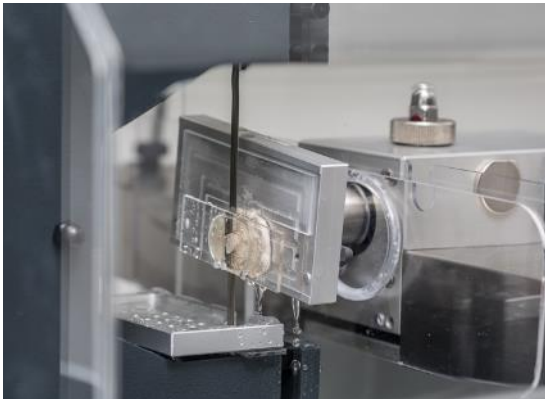
CHALLENGES

WHAT MAKES A CUTTING SYSTEM EFFICIENT?



PROCESS REQUIREMENT:

- › Ability to cut a wide variety of different materials and material combinations
- › Precise and reproducible
- › Safe for the operator
- › Cutting process improves the surface quality of the samples
- › Little cutting loss
- › Process should be as fast as possible
- › Reduced resp. minimal cost per cut



MATERIAL CHALLENGES

WHAT MAKES CUTTING SO DIFFICULT?



- › Surface quality
 - Surface planarity
- › Molecular architecture
- › Compounds: Material interfaces
- › Expansion / tension
- › Minimal material loss
- › Thermal stress
- › Geometry / shape

MATERIAL DIVERSITY

WHAT CAN BE CUT?



Examples: General Applications

- › Very hard, monocrystalline aluminium oxide
- › Very hard, but brittle, e.g. wolfram
- › Soft and elastic, e.g. polyethylene
- › Soft and tend to smearing, e.g. monocrystalline Aluminium, copper or titanium



Examples: Histology & Pathology

- › Hart and soft tissue
- › Fresh or embedded tissue
- › Bone / bone with implant
- › Combinations of tissue, bone, implant

YOUR ADVANTAGES AT A GLANCE



- › **PRECISE** – CUT IN MICRON (μ)
- › **SAFE** – NO RISK OF CUTTING DAMAGE
- › **VERSATILE** – ANY MATERIAL & COMPOUND
- › **PERFECTED** – FLAWLESS SURFACE QUALITY
- › **EFFICIENT** – LITTLE KERF LOSS
- › **ECONOMIC** – LOW OPERATIONAL COST



EXAKT TECHNOLOGY

EXAKT DIAMOND BAND SAWS

300 CL&CP	310 CL&CP	311 CL Industry
		

EXAKT DIAMOND BAND SAWS

302



312



DIAMOND BAND / BORON NITRIDE BAND



Special characteristics:

- › Distortion-free / corrosion free stainless steel
- › Single diamond layer, nickel embedded
- › Different band thicknesses and grain sizes
- › Minimized kerf-loss

DIAMOND BAND SPECIFICATION & KERF LOSS

Band (thickness / grain)	300	302	310 / 311	312	Kerf loss (approx.)
0.1 / D32	Option	n.a.	n.a.	n.a.	190 µm
0.1 / D46	Option	n.a.	n.a.	n.a.	
0.1 / D64	Option	n.a.	Option	n.a.	280 µm
0.2 / D46	Option	n.a.	n.a.	n.a.	
0.2 / D64	Option	n.a.	Option	n.a.	380 µm
0.2 / D91	Option	n.a.	Option	n.a.	460 µm
0.2 / D126	n.a.	Available	n.a.	n.a.	
0.3 / D91	n.a.	n.a.	Option	n.a.	
0.3 / D126	n.a.	n.a.	Option	n.a.	
0.3 / D151	n.a.	n.a.	Option	Available	760 µm
0.3 / D182	n.a.	n.a.	Option	n.a.	

BORON NITRIDE BAND FOR INDUSTRIAL APPLICATIONS

Band (thickness / grain)	300	302	310 / 311	312	Kerf loss (approx.)
0,2 / B91	Option	Option	Option	n.a.	460 µm
0,3 / B151	n.a.	n.a.	Option	n.a.	730 µm

About Industrial Diamond:

The so-called industrial diamonds are artificially manufactured diamonds. The diamond is the hardest material we know on earth. Materials are measured according to their hardness and can reach a maximum of level 10 on the Mohs scale.

Diamond tools are sometimes unsuitable for machining steel, as they can convert to graphite at the high temperatures during the process and the carbon atoms can diffuse into the steel.

About Cubic boron nitride (CBN)

Cubic boron nitride (also known as β -boron nitride) is one of the hardest materials and is the second hardest cutting material after diamond. The material therefore has high abrasion resistance combined with very good thermal conductivity and chemical resistance. Machining tools made from CBN therefore wear out much more slowly than ordinary cutting materials made from corundum or silicon carbide. The result: a much higher shape and dimensional accuracy of the workpieces. In addition, extremely hard materials can always be processed reliably. Microcrystalline CBN grades do not wear out as a whole, but form new sharp cutting edges under increasing pressure. Unlike diamond, using CBN there is no carbon migration into the steel even when exposed to temperature. With CBN even tough and hard steels such as HSS steel, hot and cold work steel work well.

BORON NITRIDE VS DIAMOND

GUIDELINE FOR INDUSTRIAL APPLICATIONS

This table shows common applications (materials) and is a guideline to select the cutting band according to the material to cut.

Boron Nitride	Diamond
Alloy / Tool steel	Ceramic
Die Steel	Glass
Ball Bearing Steel	Rubber & Plastic
High Temperature materials on nickel and cobald basis	Non-Ferros metal (e.g. Al, Mg, Cd, Co, Cu, Ni, Pb,Sn, Zn, Ag, Au, ..)
Nickel alloy	Ferrite
Stainless Steel	Steel with low hardness
Chilled Casting	
Hard alloy on nickle/cobald basis	
Powder Coating with iron material	

EXAKT 300/310

SPECIAL FEATURES

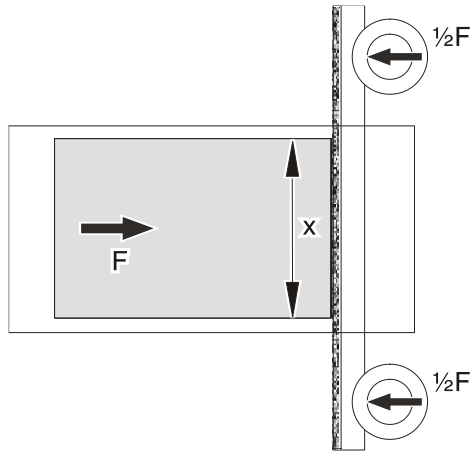


Special features with precision parallel control system:

- › Precise adjustable feed force (weight)
 - Minimum thermic or mechanical material stress
- › Precise adjustable sample infeed
 - Achieve thin section cuts below 100µm in increments of 10µm
 - Optional use for digital micrometre gauge for even higher precision
- › Variety of different sample mounting devices
 - Clamps for different sample shapes & sizes
 - Vacuum plate for specimen slides
- › Optional CL or CP mode

EXAKT 300 / 310

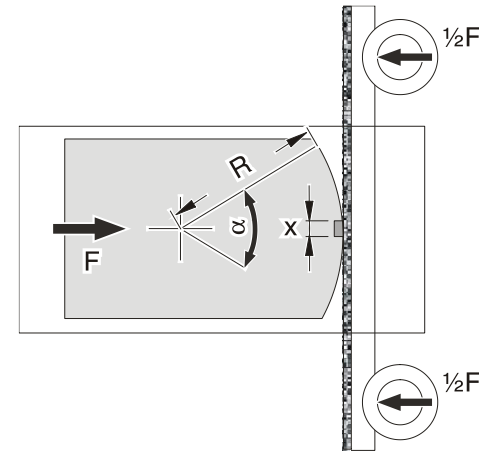
CONTACT POINT (CP) VS CONTACT LINE (CL)



CONTACT LINE (CL)

The sample is in a fixed position

- › Linear contact between sample and band
- › The more contact between sample and band
 - › the more force is necessary to cut
 - › the more hydrodynamic friction
- › This results in increased wear on the band
- › Chips tend to block the diamonds, more frequent band cleaning necessary



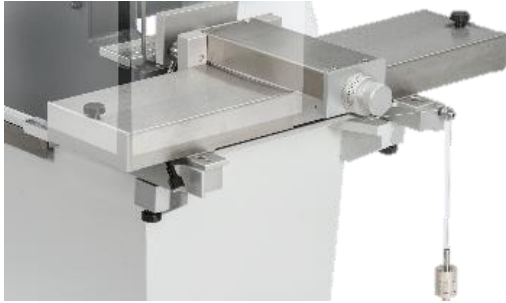
CONTACT Point (CP)

The sample is oscillation

- › Punctual contact between sample and band
- › Little contact between sample and band,
 - › less force to cut
 - › Less hydrodynamic friction
- › Longer life time of diamond band, up to 10 times
- › Up to 10x faster cutting
- › Chips do not block the band, less cleaning

EXAKT 300/310 CL & CP

PRECISION PARALLEL CONTROL SYSTEM



CL - Precision Parallel Control

- › Very low friction with constant feed-force (gravity)
- › Sample adjustment in increments of approx. 20 μm and a total distance of 35 mm

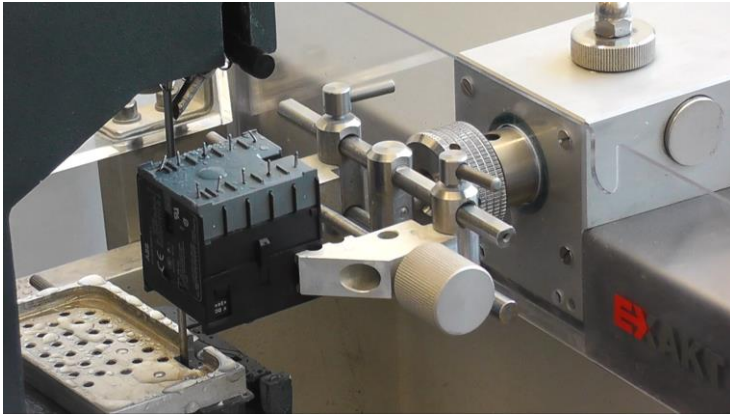


CP – Precision Parallel Control

- › Sample arcing and oscillation (14° / 28° / 56°)
- › Option: Automatic Positioning Assistance Device

EXAKT 300 / 310

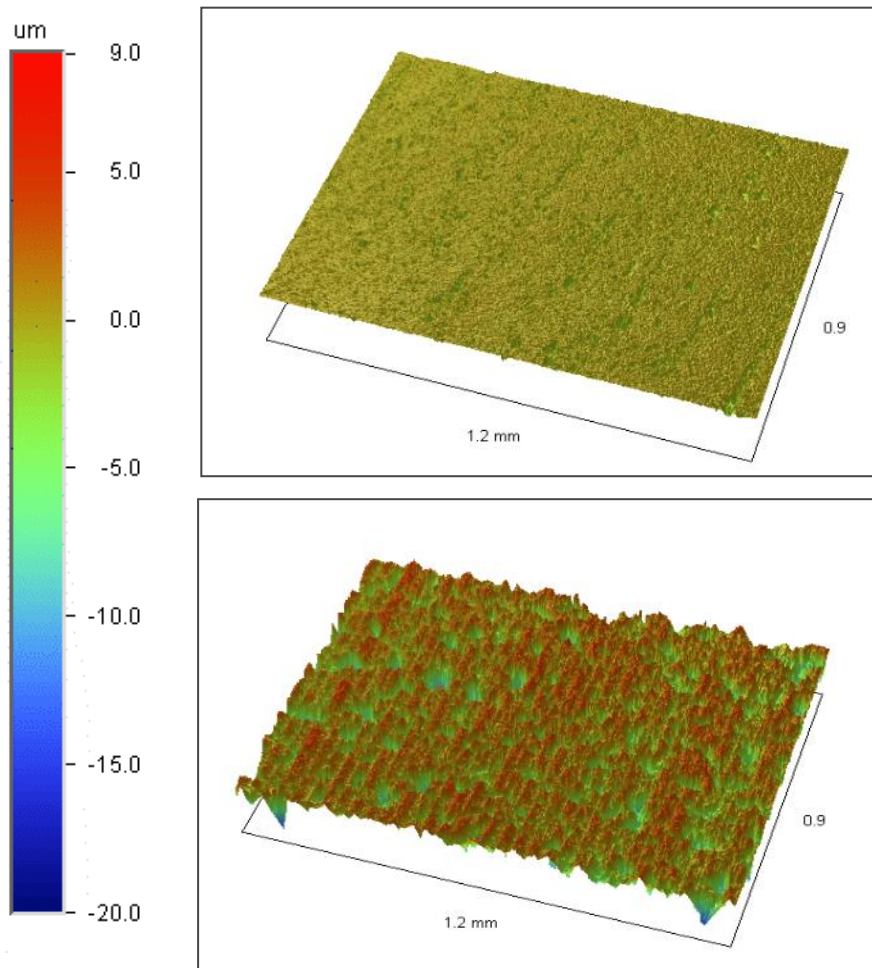
ADVANTAGES OF CONTACT POINT (CP)



CL vs CP – What makes CP superior

- › Less deformation of the sample
- › Better surface quality
- › Much faster cutting process
- › Better chip transfer
- › Lower thermic impact
- › Lower cost per cut

CP AND CL COMPARISON SURFACE QUALITY



CP-Modus

Best possible surface quality

Ra: 0.22 μm

Rq: 0.36 μm

Rt : 4.72 μm

CL-Modus

Rougher surface compared to CP

Ra: 1.86 μm

Rq: 2.53 μm

Rt : 29,06 μm

Material: fused silica / edge length: 1.2 x 0.9 mm / height scale: 29 μm

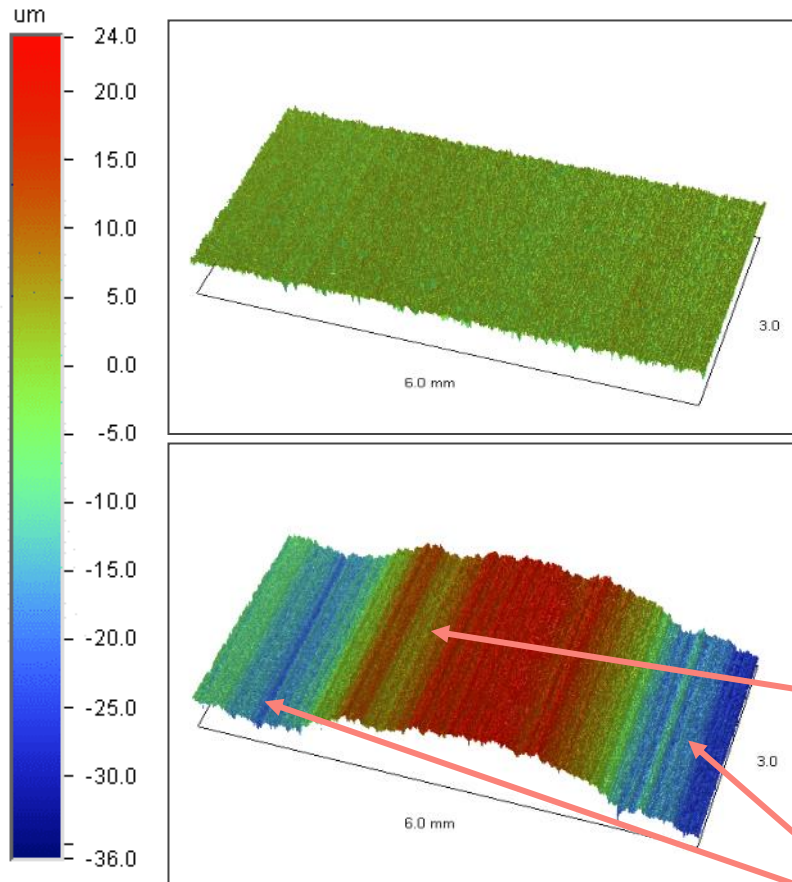
COMPARISON OF DIFFERENT CUTTING SYSTEMS



Criteria	Band	Wire	Rotary	Annular
Bigger physical sample dimension	++	++	-	--
Low hydrodynamic friction	+	++	--	--
Minimum / fine adjustable feed force	++	+	-	-
Low kerf loss	++	++	+	+
Planarity of surface	++	-	++	++
Surface roughness	++	-	++	++

BAND VS WIRE

COMPARISON SURFACE QUALITY



Diamond Band Cutting System

Ra: 1.74 μm

Perfect surface quality and planarity

Diamond Wire Cutting System

Ra: 13.01 μm

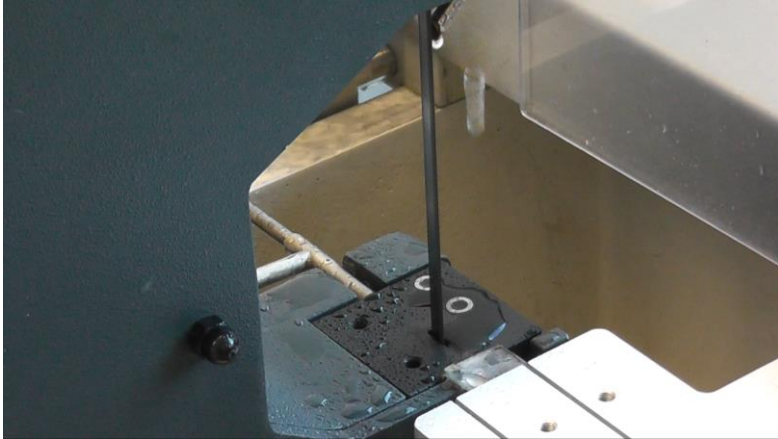
Resulted by:
Clogging of cutting wire

Resulted by:
Reverse direction of cutting wire

Material: fused silica/ edge length: 6 x 3 mm / height scale : 60 μm

EXAKT 300 / 302 / 310 / 311 / 312

SAFETY FIRST – NO CUTTING DANGER !!!



The safest way for precise cutting

- › If you touch the band, nothing will happen to your finger
- › Unlike “butcher saws” or other traditional cutting systems, a diamond band is more like a grinder – and safe!

EXAKT 300/310 CL & CP + 311 CL OVERVIEW



300 CL



300 CP



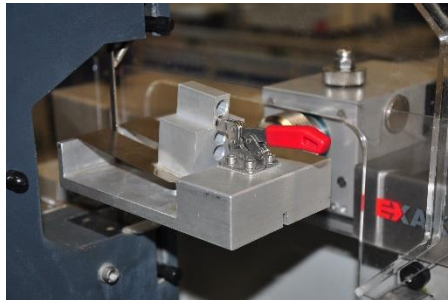
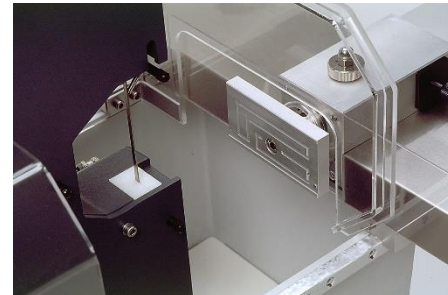
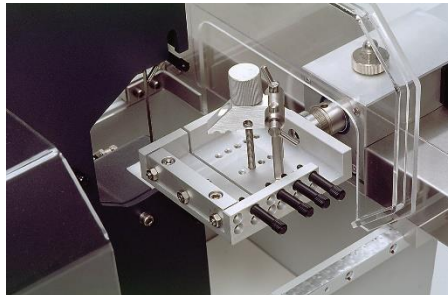
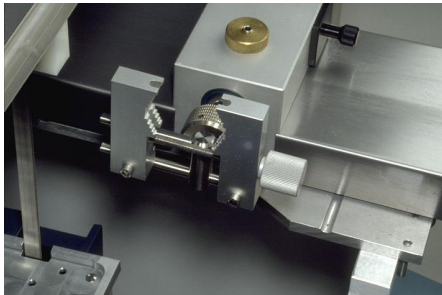
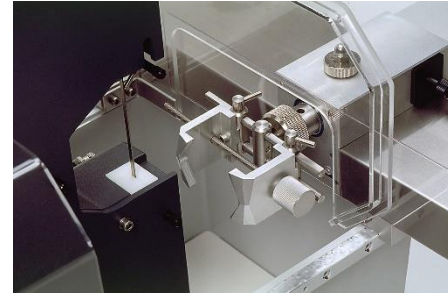
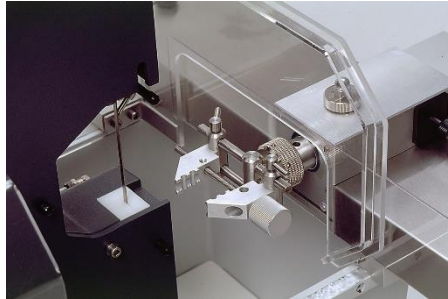
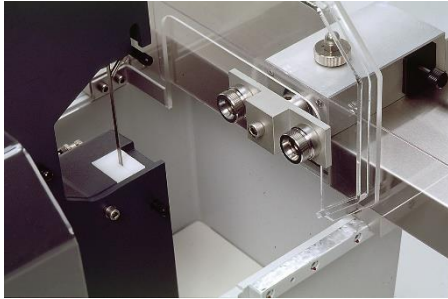
310 CP



311 CL

EXAKT 300/310/311

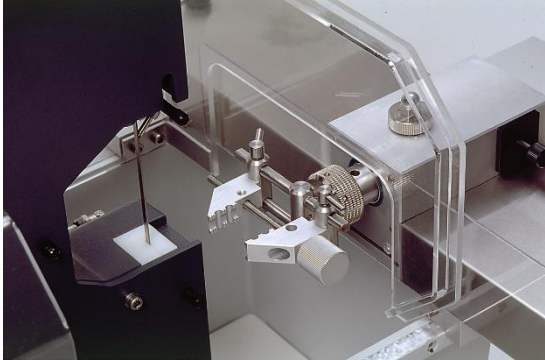
OVERVIEW SAMPLE HOLDER / FIXATION



... to be extended

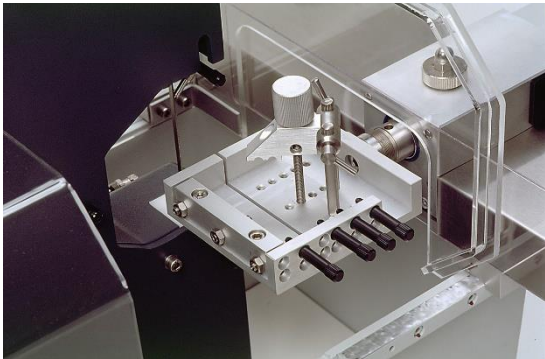
EXAKT 300/310/311

OPTIONAL SAMPLE HOLDER / FIXATION _ 1



Base-Clamp-Unit with Standard Clamps

- › Standard clamping system for different shapes
- › EXAKT article 32100

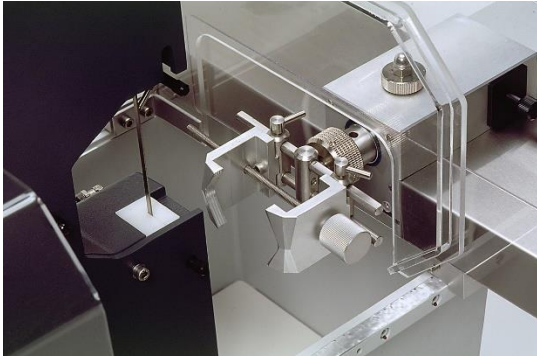


Universal Fixture for 90° cut incl. clamp set

- › The right fit for diverse different sample shapes
- › EXAKT article 32600

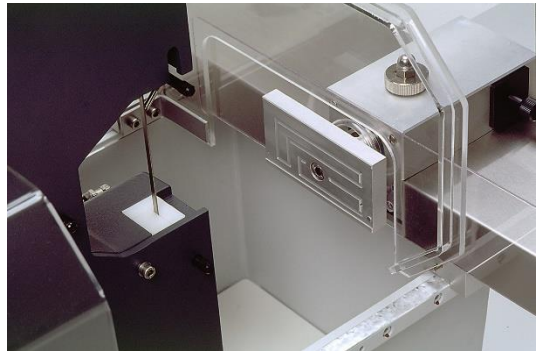
EXAKT 300/310/311

OPTIONAL SAMPLE HOLDER / FIXATION _ 2



Screw-Clamp-Unit for rounded objects

- › 110 mm long
- › To hold round-shaped samples
- › EXAKT article 32110

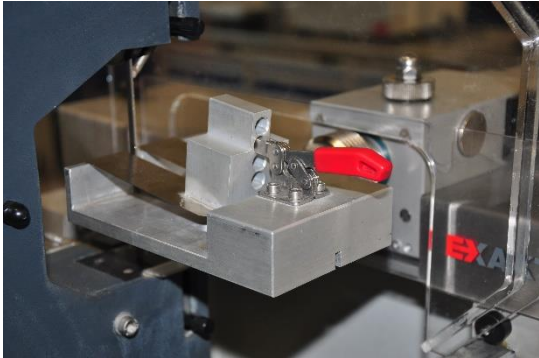


Vacuum plate

- › To precisely hold specimen slides
- › Two sizes: (100 x 50) and (76 x 25) mm
- › EXAKT article 33200 (big) , 33300 (small)

EXAKT 300/310/311

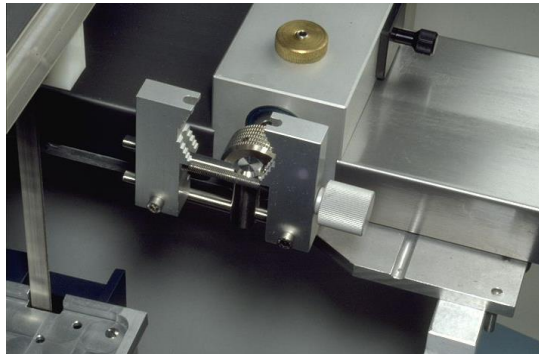
OPTIONAL TOGGLE LEVER SAMPLE FIXATION



Universal fixture with toggle lever

- › Designed to hold seals, elastomer or similar flexible samples
- › E.g. door seals for cars

- › EXAKT article 32860

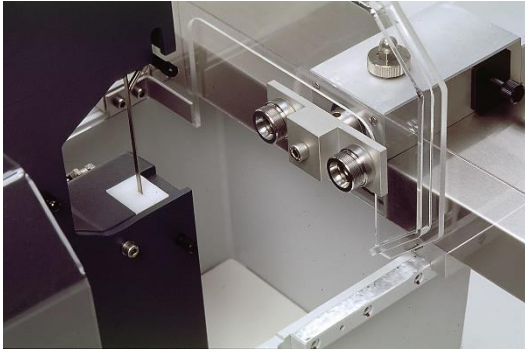


Long Object Clamp Set

- › EXAKT article 32580 + Base-clamp unit 32120 (long) or 32300 (short)

EXAKT 300/310/311

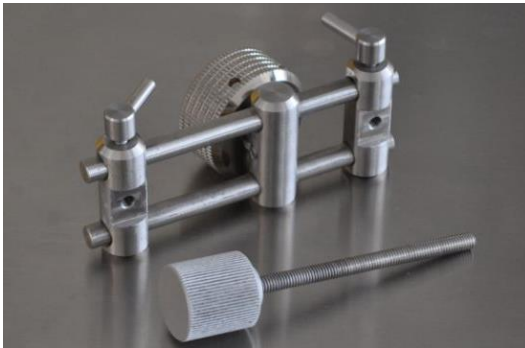
OPTIONAL SAMPLE HOLDER / FIXATION _ 3



Two-Point-Holder

- › To install e.g. 2 short base clamp units

- › EXAKT article 32400



Base Clamp Unit

- › To install different clamp system
- › Suitable for article 32500, 32550, 32580,

- › EXAKT article 32120 (long) and 32300 (short)

EXAKT 300/310

OPTION – FEMUR TABLE



Femur Table

› Longitudinal section cut

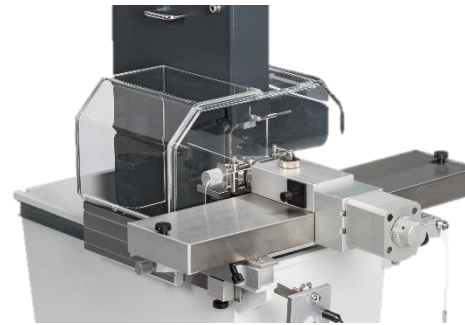
› EXAKT article 36062

EXAKT 300/310

SPLASH GUARD OPTIONS



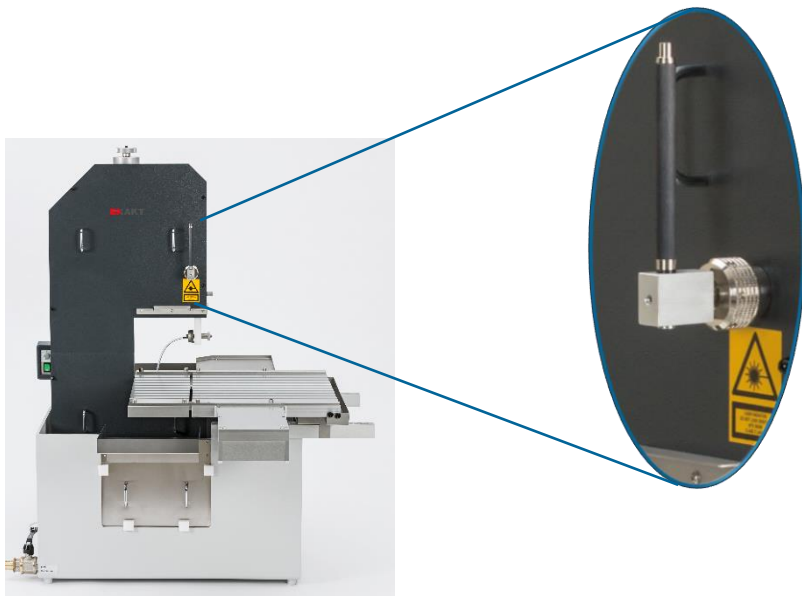
Splash Guard with flexible plastic sheets



Splash Guard with Perspex

EXAKT 300/310

LASER – AIDED SAMPLE ORIENTATION

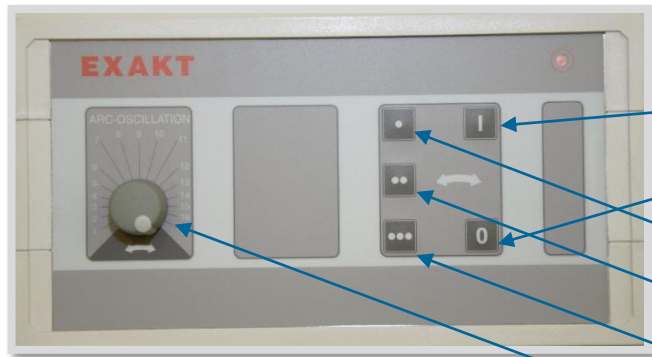


LASER orientation

- › Supports precise positioning of the sample to the cutting band

EXAKT 300/310 CP

CP - CONTROL UNIT



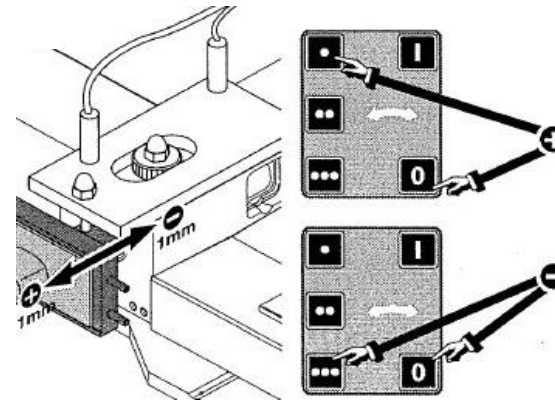
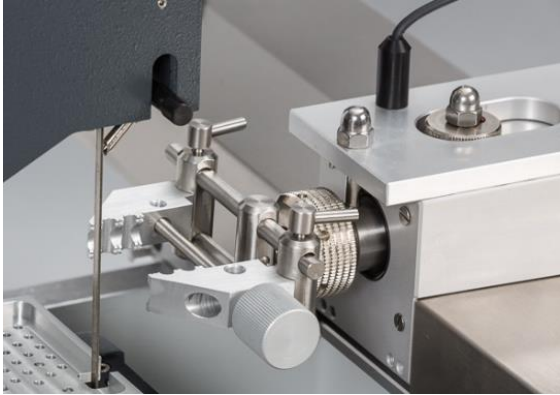
Features

- › Start arcing motion (smallest angle 14°)
- › Stop arcing motion
- › Oscillation / arcing motion ($\pm 7^\circ$)
- › Oscillation / arcing motion ($\pm 14^\circ$)
- › Oscillation / arcing motion ($\pm 28^\circ$)
- › Oscillation speed



EXAKT 300/310 CP

AUTOMATIC POSITIONING ASSISTANCE DEVICE



Pushing the **0**-button and **1-Point**-button simultaneously positions the sample forward 1mm **+**.

Pushing the **0**-button and **3-Point**-button simultaneously retracts the sample 1mm **-**.

Automatic Feed in Steps

- › Automatic sample positioning
- › Sensors controlled with existing arcing control unit

Features

- › Automatic sample positioning in 1 mm steps
- › Manual override in 10 μ m steps

EXAKT 300/310 CP DIGITAL MICROMETRE



Digital micrometre positioning

- › Precision of $< 20\mu\text{m}$
- › Handling via magnet on the parallel system
- › Possible cuts of $\sim 100\mu\text{m}$

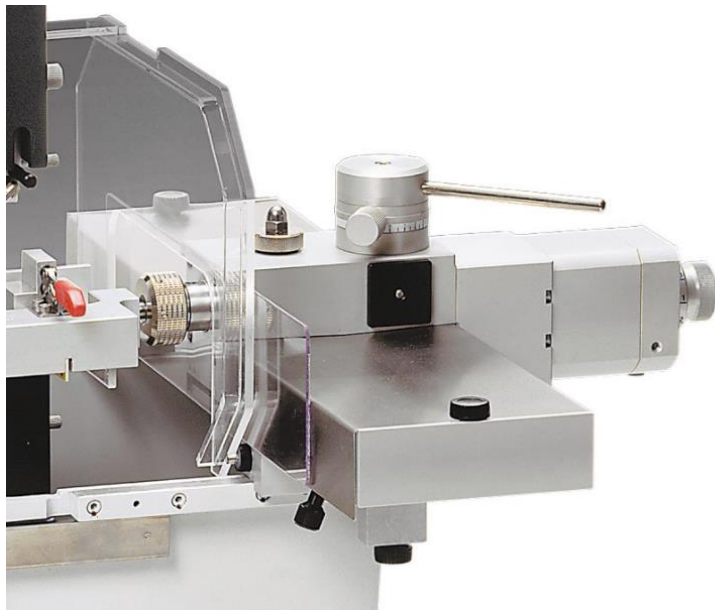
EXAKT 300/310/311/312 PRESSURE REGULATOR



Pressure regulator

- › Ensures constant water flow to the sample
- › Secures good cooling and lubrication during the cutting process

EXAKT 300/310 CP- PROFILE MANUAL SAMPLE POSITIONING



Manual Feed 300CP/P Sample Positioning

- › Fast way to cut one slice
- › Adjustable from 0 – 5 mm

EXAKT Article 1000750

EXAKT 311 CL

INDUSTRIAL APPLICATION



EXAKT 311 CL

- › For industrial applications
- › Based on the EXAKT 310 CL
- › Big working table to accommodate big samples or parts
- › Different holder / clamps available

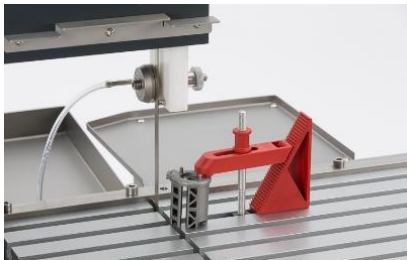


EXAKT 311 CL SAMPLES HOLDER / FIXATION



Clamping Device Set

- › To fix a wide variety of parts in different shape and size on the working table
- › EXAKT Article 32865



EXAKT 311 CL COMPACT CLAMPING SET

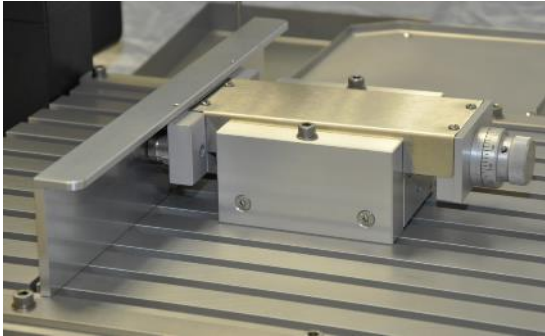


Compact Clamping Set E 311

- › Professional metall clamping tool set
- › EXAKT Article 32864

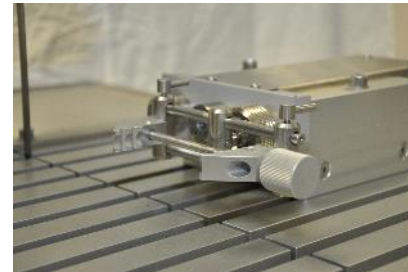
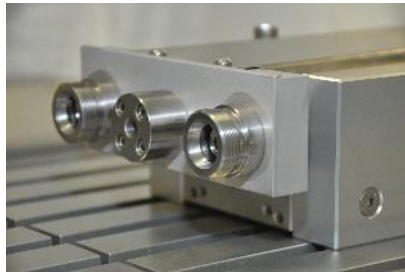
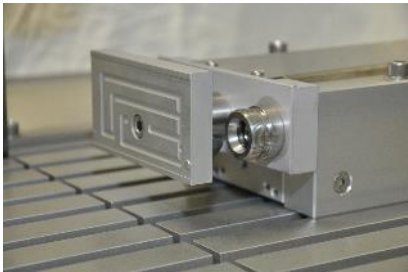
EXAKT 311

CL - TAILSTOCK



Tailstock

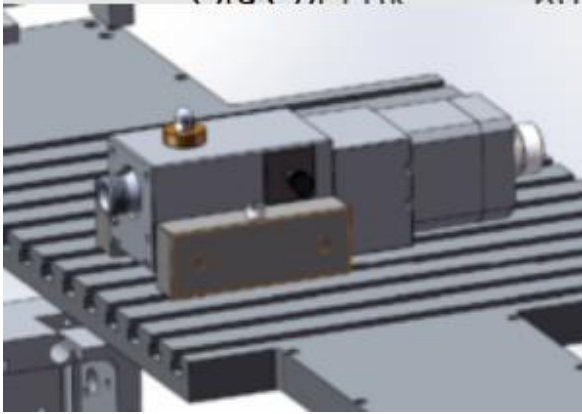
- › To use different sample fixation tools on the 311 working table.
- › EXAKT Article 36281



Optional sample fixations for tailstock

EXAKT 311

CP - TAILSTOCK



Tailstock

- › To use different sample fixation tools on the 311 working table.
- › With control system for CP oscillation
- › EXAKT Article 36282

Optional sample fixations for tailstock

EXAKT 311 <-> 310 CONVERSION

USE OF PARALLEL CONTROL SYSTEM & TABLE



311 to 310 CP conversion

- › Possible on machine base 36002 (E 311)
- › Easy change between 311 working table and 310 CP precision parallel control system
- › EXAKT Article 37021

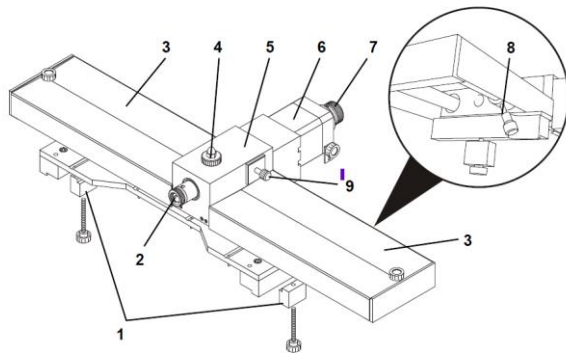


Fig. 2 Parallel table CP (Contact Point)

EXAKT 312 DIAMOND BAND SAW PATHOLOGY



EXAKT 312

- › Developed for the requirements of pathology today
- › Freehand cuts down to 1 mm possible
- › No risk of injury to the operator
- › Mobile and universal use
- › Very easy to operate

EXAKT 312

EASY TO OPERATE

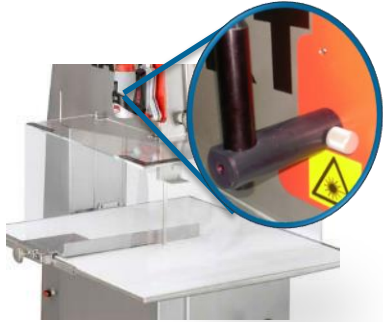


EXAKT 312

- › Tool less band replacement
- › Automatic band tension adjustment
- › According to latest safety requirement (EN ISO 13849-1)
- › Adjustable band speed
- › Stainless Steel design – fast to clean and hygienic



EXAKT 312 OPTIONS



LASER aided Sample Orientation

- › Supports precise positioning of the sample to the cutting band
- › EXAKT article 38074



Splash guard

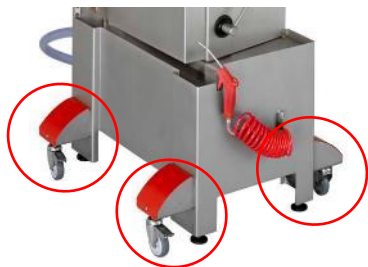
- › Control water splashing
- › Available in two sizes (small is included as standard)
- › EXAKT article 38082



Cutting Guide

- › Manual adjustment for parallel cuts, including scale
- › Available in two sizes
- › EXAKT article 38072 and 38073 (100mm rip fence)

EXAKT 312 OPTIONS



Mobility Set

- › Removable castors to move device easily
- › EXAKT article 38079



LED Light

- › For optimal illumination of the workspace
- › EXAKT article 38080



Water Cleaning Pistol

- › Fast cleaning of working table and the entire system.
- › EXAKT article 38070

EXAKT 312

OPTIONS



Cutting Guide 200 mm

- › Large rip fence for veterinary and anatomic application
- › Only available with the large splash guard
- › Art. No 38075

EXAKT 302 DIAMOND BAND SAW PATHOLOGY



EXAKT 302

- › Developed for the requirements of pathology today
- › Freehand cuts down to 1 mm possible
- › No risk of injury to the operator

- › Bench top diamond band saw

EXAKT 302

EASY TO OPERATE

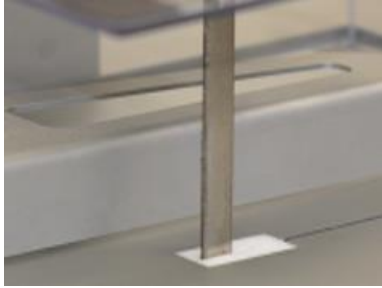


EXAKT 302

- › Tool less band replacement
- › Manual band tension adjustment
- › According to latest safety requirement (EN ISO 13849-1)
- › Single band speed
- › Stainless Steel design – fast to clean and hygienic

EXAKT 302

INCLUDED FEATURES



Cutting Band

- › Cutting Band 0,2 mm / D126
- › Same width as 312 band – 12 mm !!
- › EXAKT article 34390



Splash guard

- › Control water splashing
- › Combination of perspex and plastic foil



Cutting Guide

- › Manual adjustment for parallel cuts

EXAKT 302 OPTIONS



LASER aided Sample Orientation

- › Supports precise positioning of the sample to the cutting band
- › EXAKT article 47074







Water Cleaning Pistol

- › Fast cleaning of working table and the entire system.
- › EXAKT article 47070

COMPARISON

EXAKT 302 VS EXAKT 312

	E 302	E 312
Band Speed Adjustment		
Tool less band replacement		
Stainless steel design		
Bench Top Model		
Water Cleaning Pistol (Option)		
LASER aided sample orientation (Option)		
Designed especially for the use in pathology labs		
Splash Guard		
No cutting risk - Very safe for the operator		
Easy to operate and clean		

TECHNICAL DATA

COMPARISON E 302 VS E 312

	E 302	E 312
Foot Print [mm]	600 x 850	1000 x 800
Height [mm]	720 – 740	1550
Weight [kg]	40	150
Cutting height [mm]	max. 110	max. 220
Cutting width [mm]	max. 185	max. 360
Band Speed [m/min]	1000 (50Hz) 1200 (60Hz)	200-1200
Drive Power [kW]	0,18	1,5



EXAMPLES FOR PATHOLOGY / ANATOMY APPLICATIONS

EXAKT DIAMOND BAND CUTTING PATHOLOGY / ANATOMY EXAMPLES



Human jaw bone

› Cut through tissue, bone, teeth



Human foot

› Cut through bone, tissue, cartilage tissue

EXAKT DIAMOND BAND CUTTING PATHOLOGY / ANATOMY EXAMPLES



Sheep Head

› Cross sectional cut through sheep's head



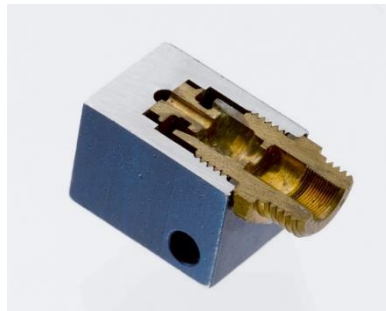
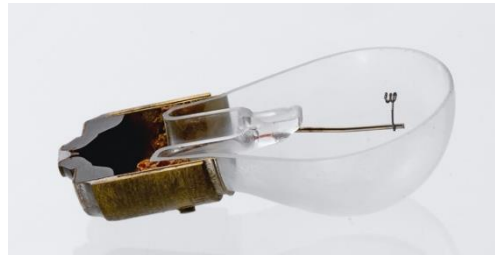
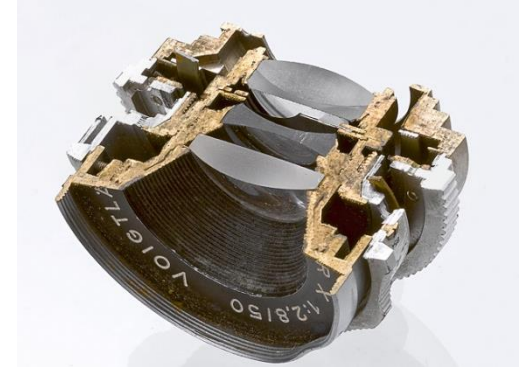
Femur

› Longitudinal section through femur



EXAMPLES FOR INDUSTRIAL APPLICATIONS

EXAKT DIAMOND BAND CUTTING INDUSTRIAL EXAMPLES

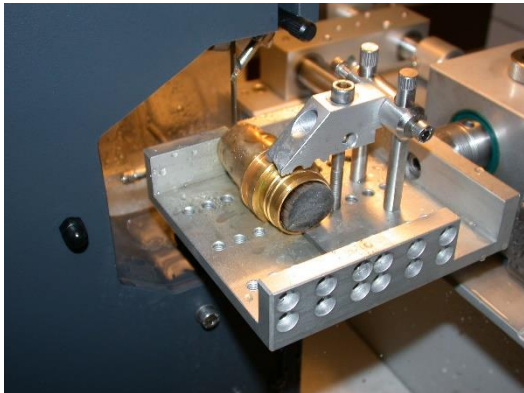


EXAKT DIAMOND BAND CUTTING INDUSTRIAL EXAMPLES



Concrete

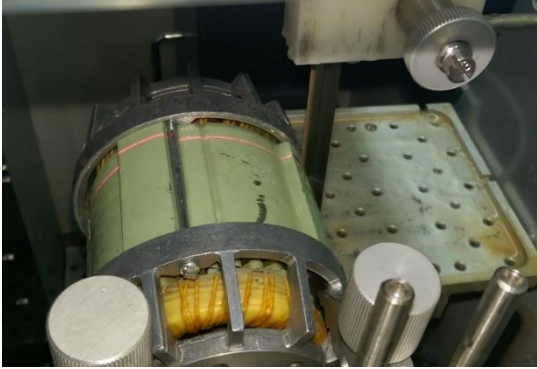
- › Combination of concrete, threaded rod and chemical dowel



Fibre optic cable

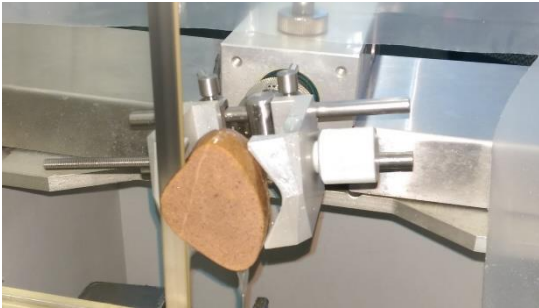
- › Encapsulated cable with multiple glass fibres

EXAKT DIAMOND BAND CUTTING INDUSTRIAL EXAMPLES



Motor

- › Material mix of steel, copper, plastic and other materials



Rock

- › Polished-like section cut of a rock

EXAKT DIAMOND BAND CUTTING INDUSTRIAL EXAMPLES



Mobile phone

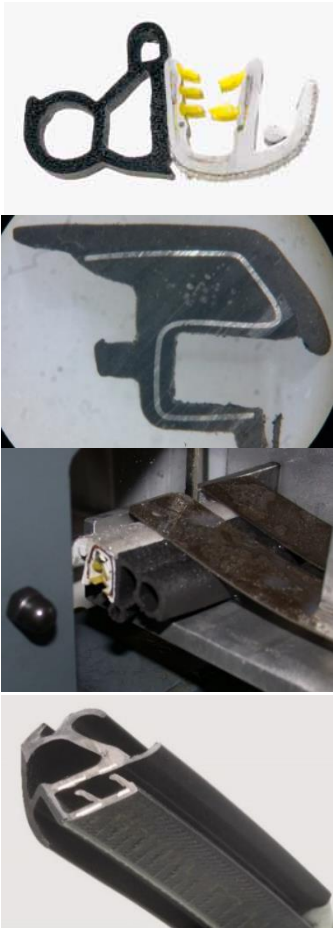
- › Cut electrical devices consisting of multiple different materials



Glass Bottle

- › Perfect cut and no sharp edges

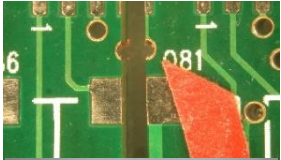
EXAKT DIAMOND BAND CUTTING RUBBER PROFILE



Quality control during production

- › Time efficient cutting technique
- › No edges and damages in different kind of rubber and metal materials
- › Cut precise and plane parallel surfaces for shape monitoring on a projector
- › Reliable and consistent process in the production area
- › No further finishing work (grinding) necessary
- › High sample output possible

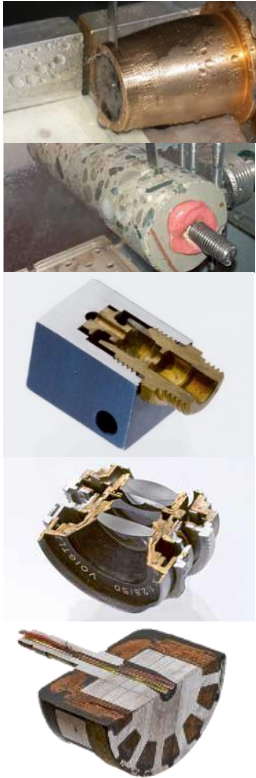
EXAKT DIAMOND BAND CUTTING COMPOSITE MATERIAL



Cut different material combination

- › Precise process for all kind of materials
- › Our technique cut & grinds with a diamond coated band, not with a dangerous and rough saw-tooth band
- › It is not necessary to further finish the sample with high effort
- › Sometime no embedding necessary

EXAKT DIAMOND BAND CUTTING CONSTRUCTION COMPONENTS



**Cut of hard material combination like steel, titanium, ceramic;
metallographic application**

- › Precise process for all kind of material
- › Minimal thermal and mechanical stress applied to the sample
- › CP-mode reduce the shear and cutting force
- › The material surface and the interface will be excellent
- › No smearing
- › It is not necessary to further polish the sample
- › Sometimes no embedding necessary

EXAKT DIAMOND BAND CUTTING GLAS/CARBON FIBER MATERIAL



Cutting and grinding for high-tech material

- › Cutting process without edges and artefacts
- › No thermal or mechanical stress for the sample
- › Analysing of cross sections is possible right after the cut
- › Thin section cutting technology with EXAKT equipment, including micron-precise grinding system
- › Measurement about glue layer is absolutely new principal

EXAKT DIAMOND BAND CUTTING GEOLOGY, STONES AND CRISTAL PRODUCTS



Cutting in research

- › Cutting process with CP-mode for an effective time and high throughput
- › Low hydraulic stress in the cutting area results in very fine surface without cracks and broken areas
- › The time for lapping and polishing will be reduced or even eliminated.

EXAKT DIAMOND BAND CUTTING ALUMINIUM CAST / PROFILE



The application for aluminium casts and profiles

- › Low stress in the cutting area and good cooling of the sample
- › Structure of the surface and tread packings from the material will be visible

EXAKT DIAMOND BAND CUTTING

BRITTLE, SENSITIVE AND DELICATE STRUCTURES



The applications for “non-cuttable” materials

- › Precise cutting process with fine coated diamond bands reduce the force and stress applied to the sample
- › Excellent roughness values in one pass
- › No sharp edges

EXAKT



Metalco Testing s.r.o

Havlíčková 361

252 63 Roztoky u Prahy

Tel.: +420 739 111 591

info@metalco.cz www.metalco.cz