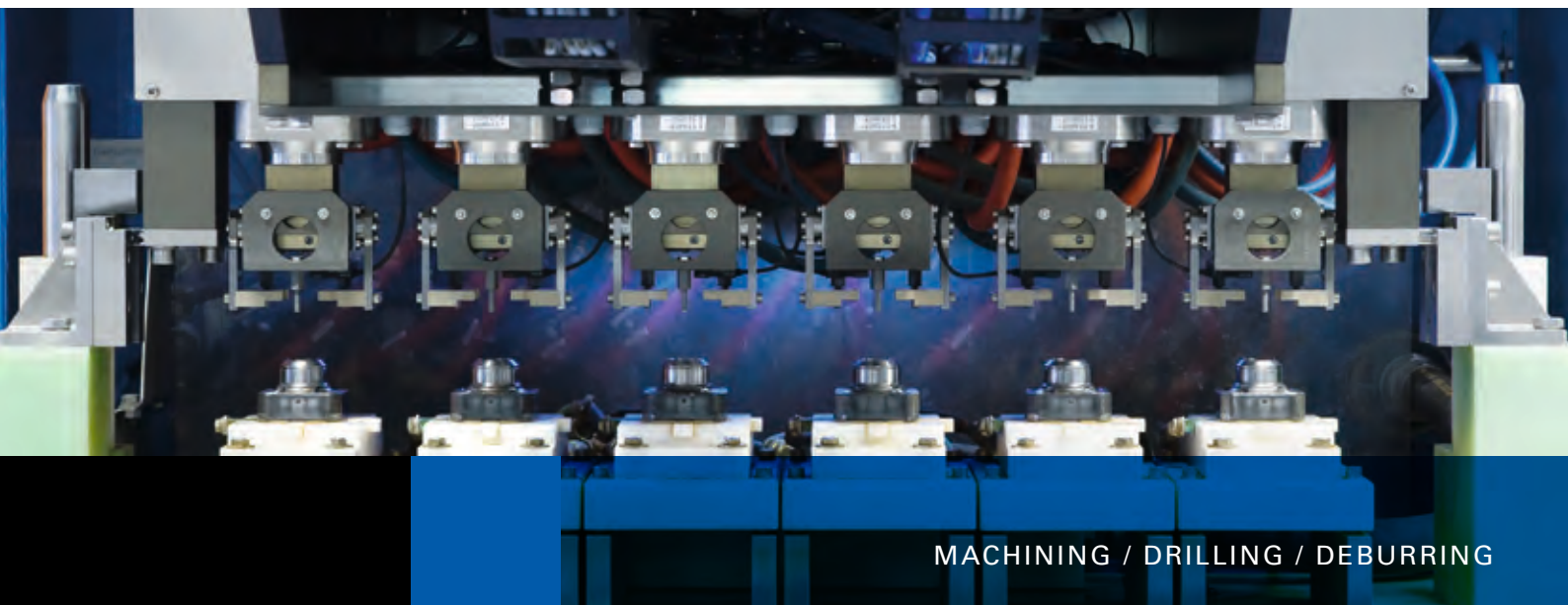


## PECM / ECM TECHNOLOGY



MACHINING / DRILLING / DEBURRING

think

VERTICAL



## EMAG ECM GmbH

Complete solutions, development and consulting.

One contact for all your questions about electro-chemical machining.

PECM / ECM





## ELECTRO-CHEMICAL MACHINING



- + Modular machine concept
- + Reliable supplier with high-level expertise in the development and manufacture of machine tools
- + More than 15 years of experience in ECM mechanical engineering
- + Supplier of (P)ECM turnkey solutions

## The Process

**Electro-chemical machining is based on the principle of electrolysis.**

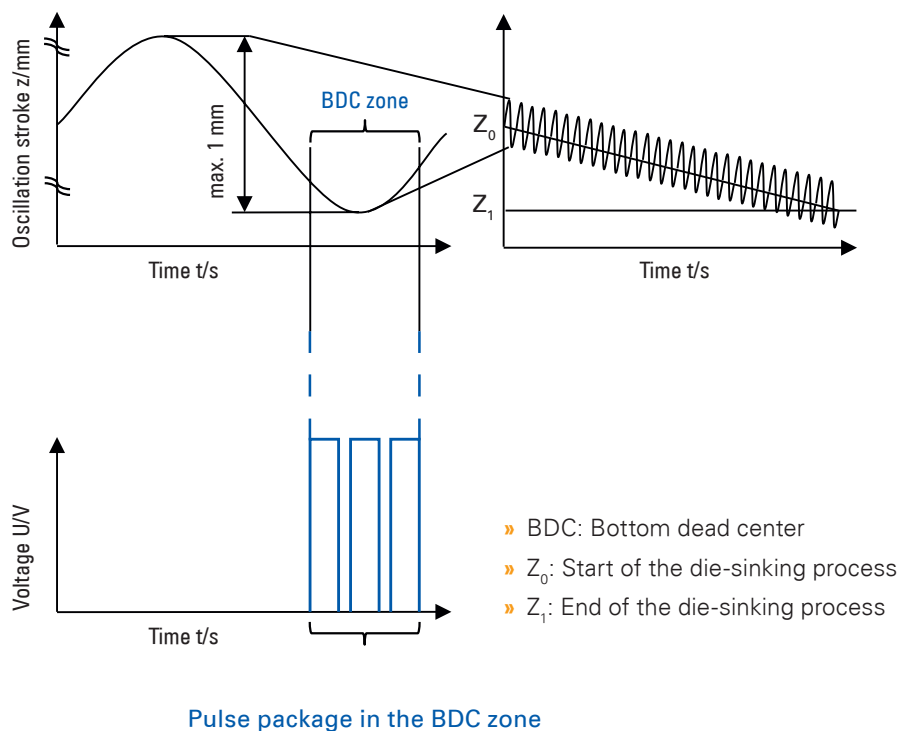
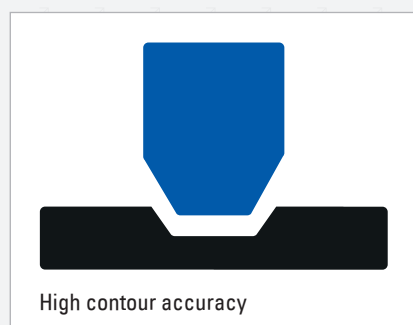
The tool, i.e. the cathode, is connected to a direct voltage source with the workpiece acting as the anode. A charge exchange takes place between the cathode and the anode in an aqueous electrolyte solution which targets specific areas of the workpiece. This can be used to create contours, ring ducts, grooves or bell hollows with no contact but very high precision. The removed material is precipitated from the electrolyte solution in the form of metal hydroxide. The machining can be carried out regardless of the structural condition of the metal and both soft and hard materials, including exotic metals, can be machined.

**The components are subjected to neither thermal nor mechanical stresses.**

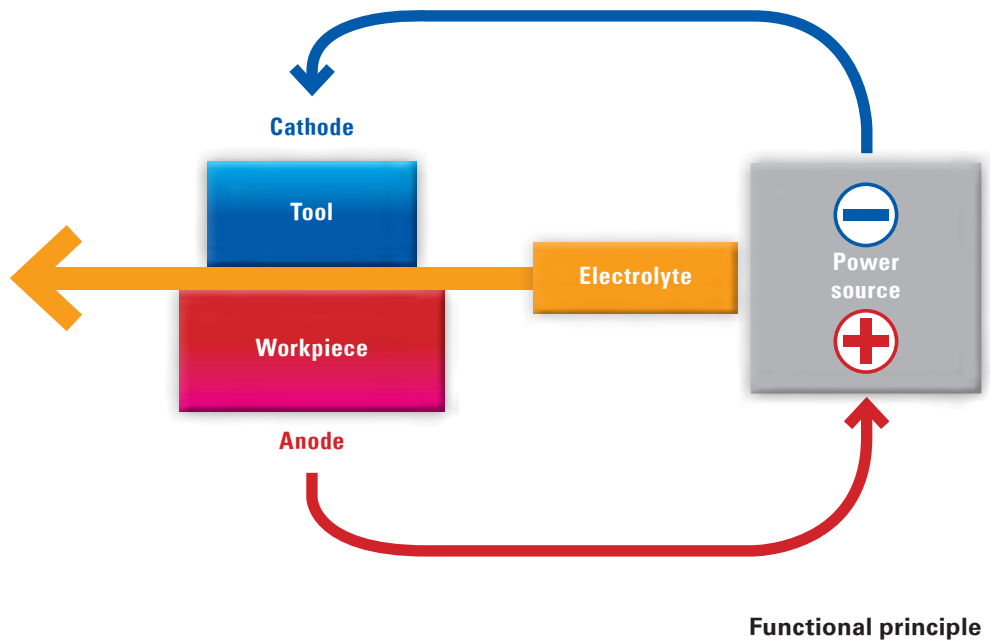
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### The PECM process

- » Precise electro-chemical machining
- » Pulsed direct voltage and an oscillating cathode

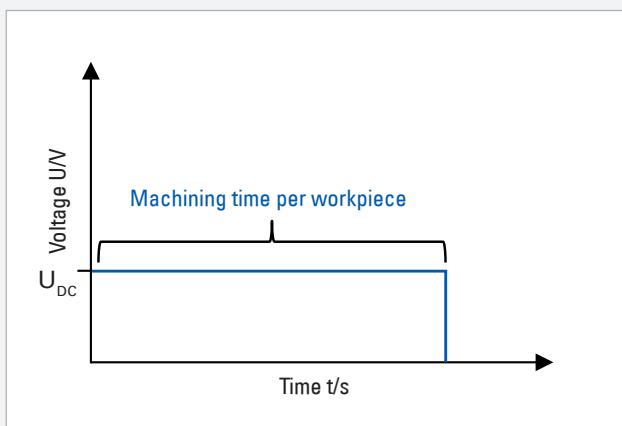






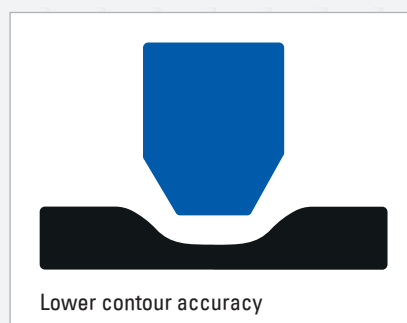
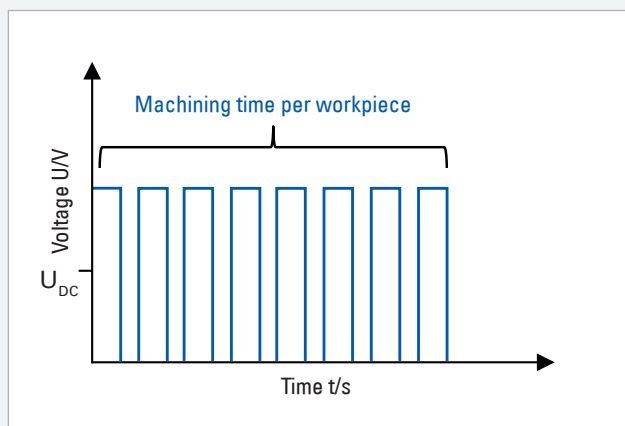
## The ECM process

- » Non-pulsed direct voltage



## The pulsed ECM process

- » Pulsed direct voltage



## Electro-Chemical Machining – Maximum Precision and Economy

**Electro-chemical Machining (ECM) is the generic term used to describe various process variants.**

The ECM process manufactures workpieces through the electrolytic dissolution of metal. The process is used in the aerospace, automotive, medical, micro-system and energy industries. Almost all metals, even exotic materials such as nickel-based and titanium alloys or tempered materials can be easily machined using this process.

The drawbacks of conventional metal-working, such as tool wear, mechanical stress, micro-cracking from heat input, oxidation coatings or subsequent deburring work do not occur with this non-contact machining process. ECM features material removal without any inherent stresses, soft transitions and smooth finishes.

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**Turbo charger**



- » Balancing
- » Machining
- » Deburring

**Gearbox**



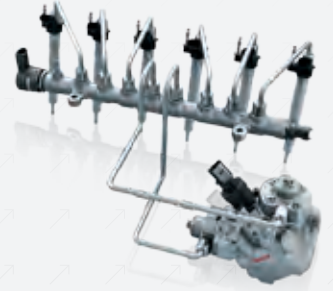
- » Machining
- » Drilling
- » Deburring

**Valve train**



- » Drilling
- » Machining
- » Deburring

**Injection system**



- » Machining
- » Deburring



# The Advantages of Electro-Chemical Machining

- 1** Minimal tool wear (cathode), an ideal precondition for batch production
- 2** Peak-to-valley heights of up to Rz 0.2 / Ra 0.05 (depending on material)
- 3** Illustration accuracy < 20 µm
- 4** No thermal and mechanical effects, therefore, no changes in the material properties
- 5** Very high repeat accuracy
- 6** Highly efficient manufacturing process, no secondary operations such as deburring or polishing required
- 7** Rough-machining, finish-machining and polishing in a single operation
- 8** Machining materials which are difficult to cut



**Blisk**



- » Nickel-based alloys
- » Titanium-based alloys

**Single blade**



- » Nickel-based alloys
- » Titanium-based alloys
- » γ-titanium aluminides

**Diffuser**



- » Nickel-based alloys

**Disk**



- » Nickel-based alloys

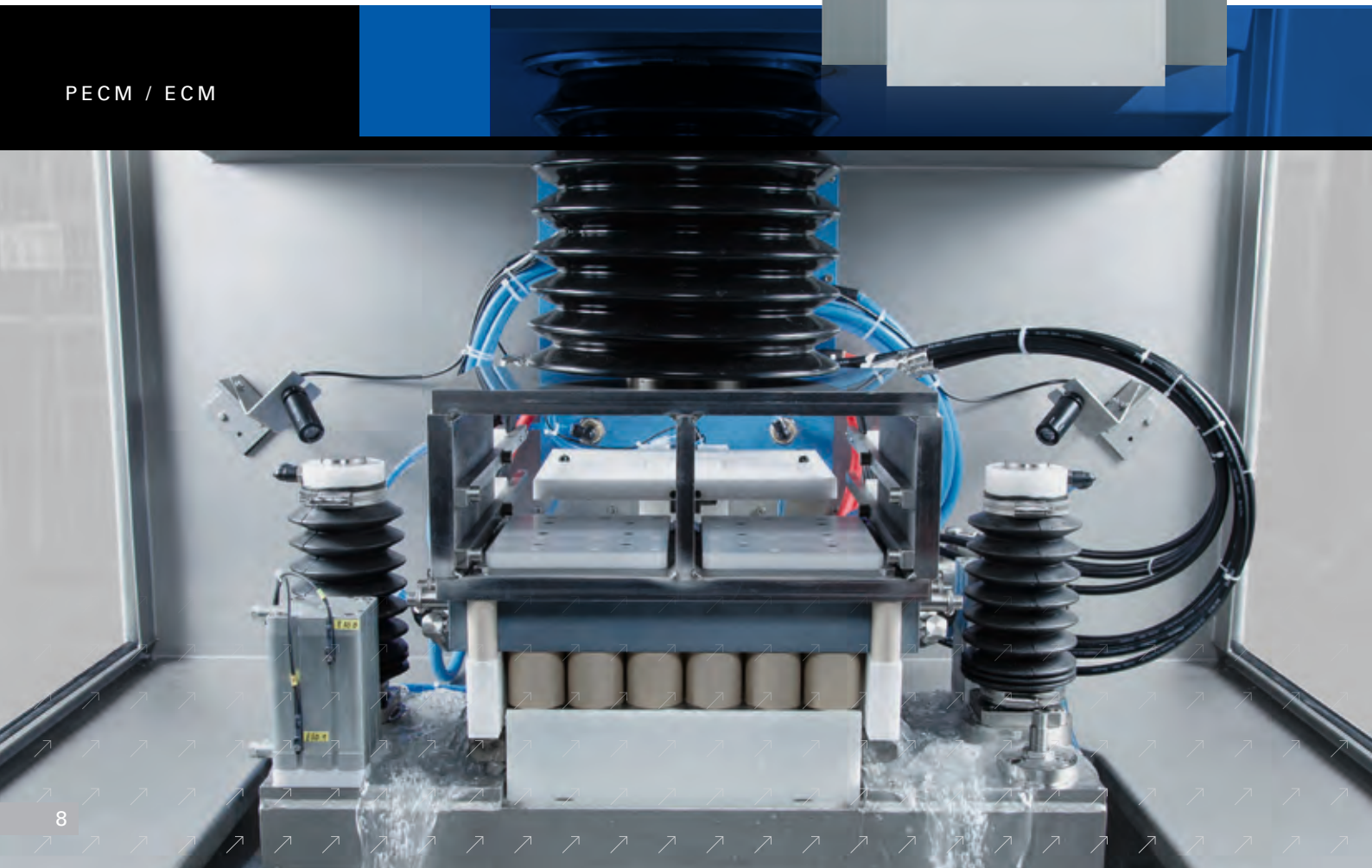
## PECM PTS System

**The economical solution for machining demanding 2-D and 3-D geometries.**

- » Machine base made of MINERALIT® polymer concrete
- » Clamping surface: 800 x 550 x 515 mm (W x D x H)
- » Machining area size 1,070 x 700 mm (W x D)
- » Space requirement 2,100 x 3,200 x 2,900 mm (W x D x H)
- » Oscillator with zero backlash
- » Z-axis with max. 25 kN axial load
- » Hydraulic zero point clamping system
- » SIEMENS SINUMERIK 840D sl machine control unit
- » Scalable generator technology with up to 12,000 A pulsed power
- » Pulse duration from 50 µs to DC (direct current)
- » Electrolyte management system tailored to the machining task
- » Optional: XY table
- » Optional: C-axis in the form of rotary table



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# PECM PT System

**In addition to the PTS series, EMAG offers the PT series with the following advantages:**

- » Machine base made of MINERALIT® polymer concrete
- » Clamping surface: 800 x 450 x 660 mm (W x D x H)
- » Machining area size 1,250 x 800 mm (W x D)
- » Space requirement 1,500 x 2,200 x 3,500 mm (W x D x H)
- » Oscillator with zero backlash
- » Z-axis with max. 50 kN axial load
- » Hydraulic zero point clamping system
- » SIEMENS SINUMERIK 840D sl machine control unit
- » Scalable generator technology with up to 20,000 A pulsed power
- » Pulse duration from 50 µs to DC (direct current)
- » Electrolyte management system tailored to the machining task



## PT 4000-3

**Based on the PT system, the PT 4000-3 is fitted with an additional XY table.**

- » X-, Y- and Z-axes
- » Clamping surface: 700 x 600 x 800 mm (W x D x H)
- » Machining area size 1,900 x 2,000 mm (W x D)
- » Optional: C-axis in the form of rotary table

## PECM PO 100 SF System

**The economical solution for the complex machining of turbine blades.**

- » Machine base made of MINERALIT® polymer concrete
- » Clamping surface: 370 x 450 x 360 mm (W x D x H)
- » Machining area size 750 x 600 mm (W x D)
- » Space requirement 2,800 x 2,300 x 2,600 mm (W x D x H)
- » Oscillators with zero backlash
- » X1- and X2-axes each with max. 25 kN axial force
- » Y-axis
- » Hydraulic zero point clamping system
- » SIEMENS SINUMERIK 840D sl machine control unit
- » Scalable generator technology with up to 24,000 A pulsed power
- » Pulse duration from 50 µs to DC (direct current)
- » Electrolyte management system tailored to the machining task



PECM / ECM

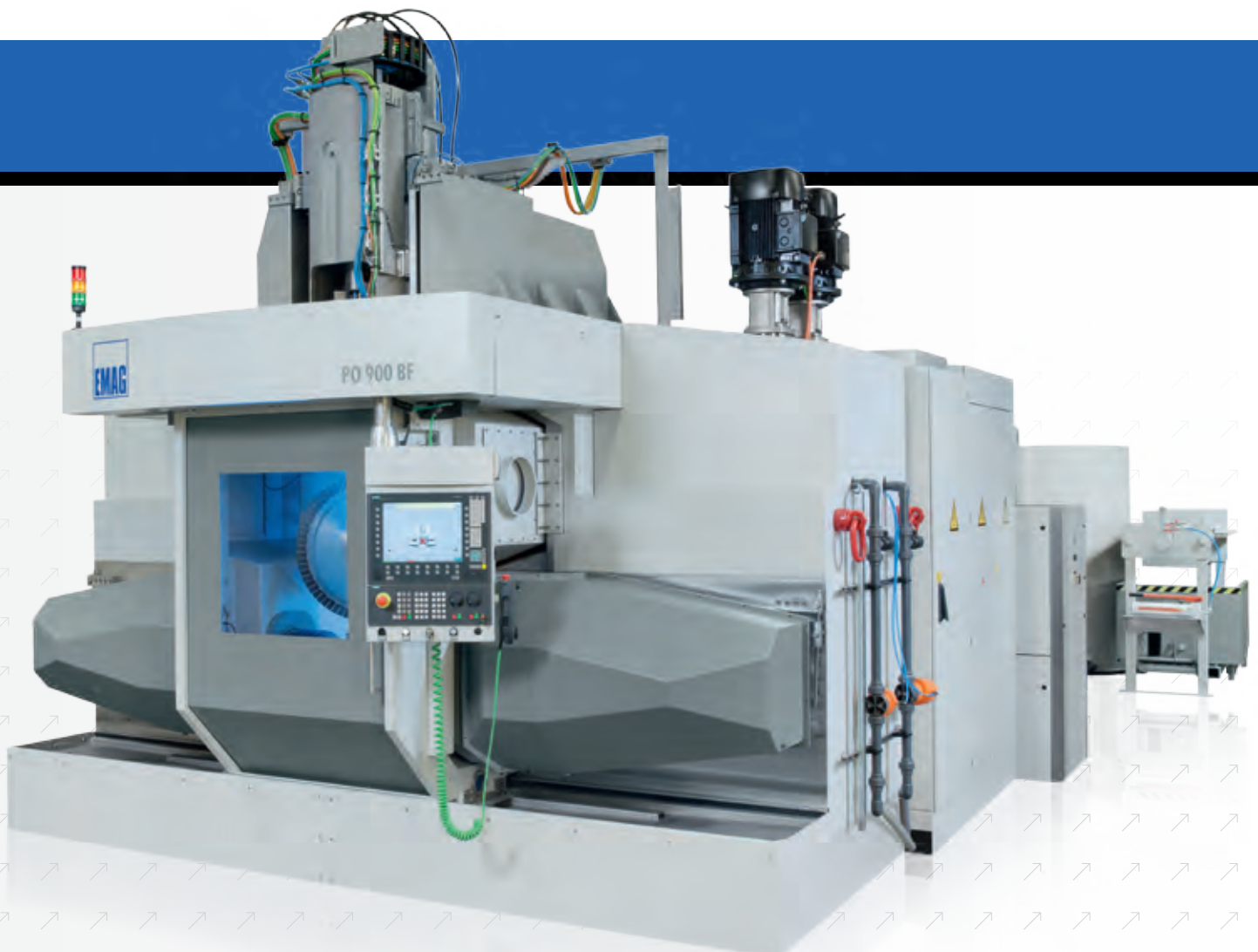
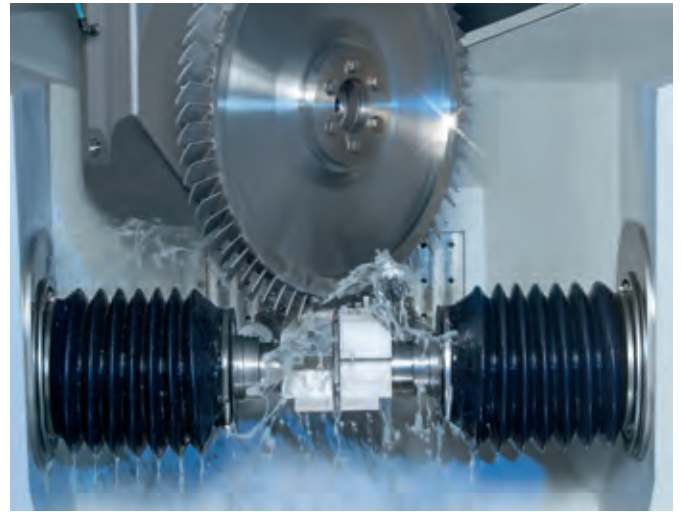




# PECM PO 900 BF System

**The uncompromising alternative to traditional machining of blade-integrated disks (blisks).**

- » Machine base made of MINERALIT® polymer concrete
- » Component diameter of up to 900 mm
- » Workpiece weight of up to 300 kg
- » Space requirement 4,400 x 6,600 x 4,500 mm (W x D x H)
- » Oscillators with zero backlash
- » X1- and X2-axes each with max. 50 kN axial force
- » Compound slide with adapter for blisk with Z-, Y-, B- and C-axes
- » Hydraulic zero point clamping system
- » SIEMENS SINUMERIK 840D sl machine control unit
- » Scalable generator technology with up to 30,000 A pulsed power
- » Pulse duration from 50 µs to DC (direct current)
- » Electrolyte management system tailored to the machining task



## ECM CS / CI System

**The Comfort Standard and Comfort Integrated models are the perfect entry systems for automating the ECM process.**

- » Modular machine concept
- » Intelligent software and hardware interfaces
- » Manual or semi-automatic version starter systems
- » Fast upgrade to full automation

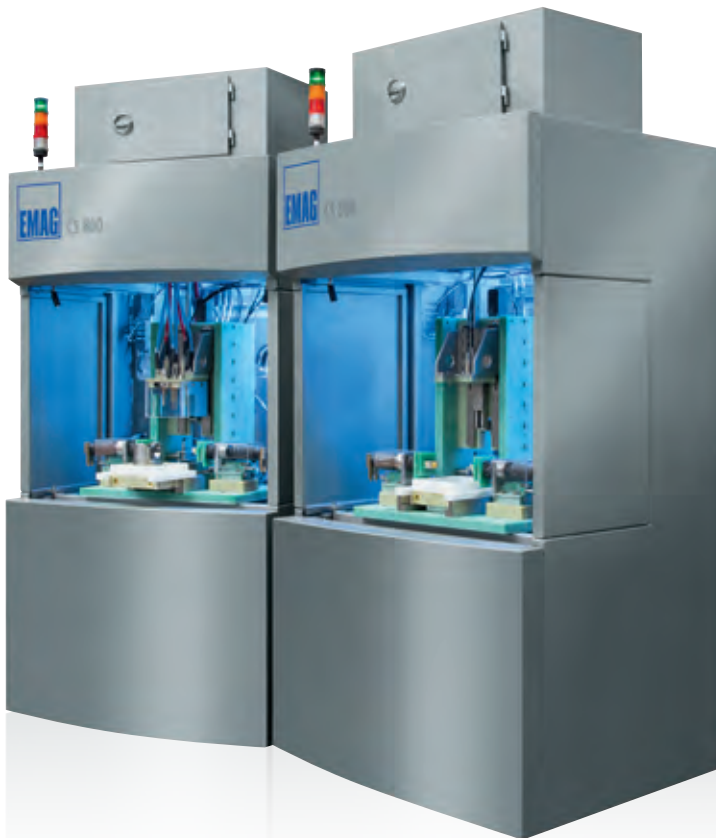


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## CS / CI BASIC EQUIPMENT:



- 1 Siemens touch-screen panel
- 2 Scalable generator technology
- 3 Conductance monitor
- 4 Temperature control
- 5 pH value control with acid metering system
- 6 Machining area 1,150 x 950 mm
- 7 Quill stroke with safety interlock
- 8 Two-handed control button operation
- 9 Fast short-circuit shut-down



- + Electrolyte  $\text{NaNO}_3$  or  $\text{NaCl}$
- + Flow rates of up to 600 l/min
- + Electrolyte pressures of up to 20 bar
- + Temperature control
- + Flow rate and pressure monitor
- + pH value control by means of metered acid / alkaline addition
- + Particle size  $< 0.5 \mu\text{m}$
- + Visualization and setting of all electrolyte parameters on a SIEMENS touchscreen panel

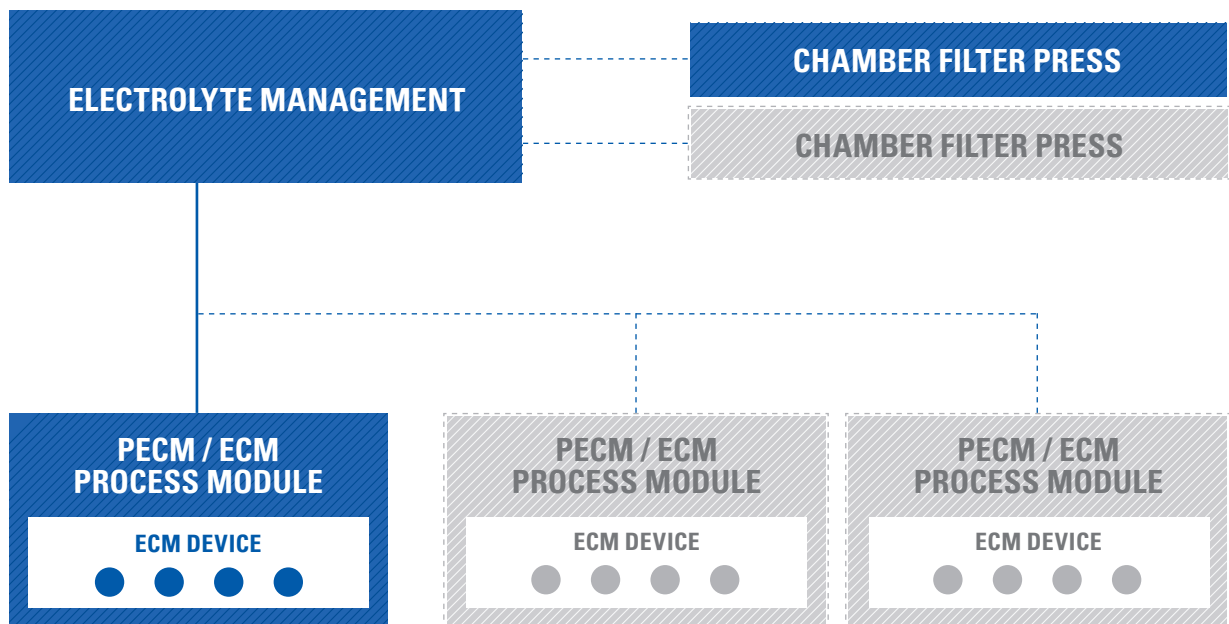
# FLEXIBLE

## Electrolyte Management System (EMS)

For filtration, systems with chamber filter presses or with microfiltration are available. The filtrate quality and volume can thus be tailored precisely to your requirements. Standard systems from 40 to 600 l/min filtration capacity are available with a high reproducibility of the machining result assured by monitoring conductivity, temperature, pressure, flow rate and pH value. The sludge can be discharged either manually or automatically, depending on cutting volume, and can be designed to operate without interrupting production on request.

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Microfiltration



Chamber filter press



Standard filtration



At home all over the world.

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