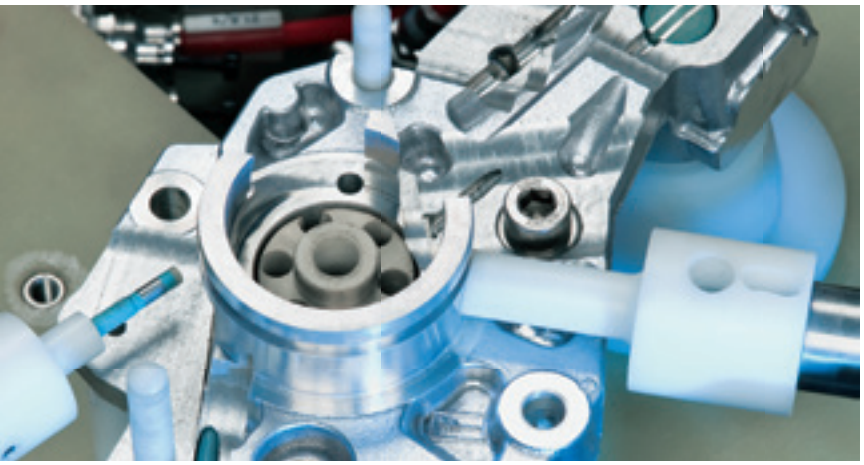
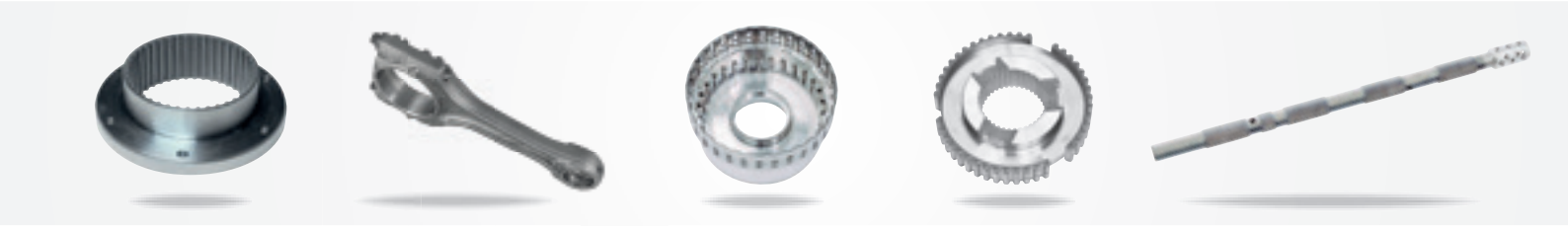
ELECTROCHEMICAL MACHINING (ECM)

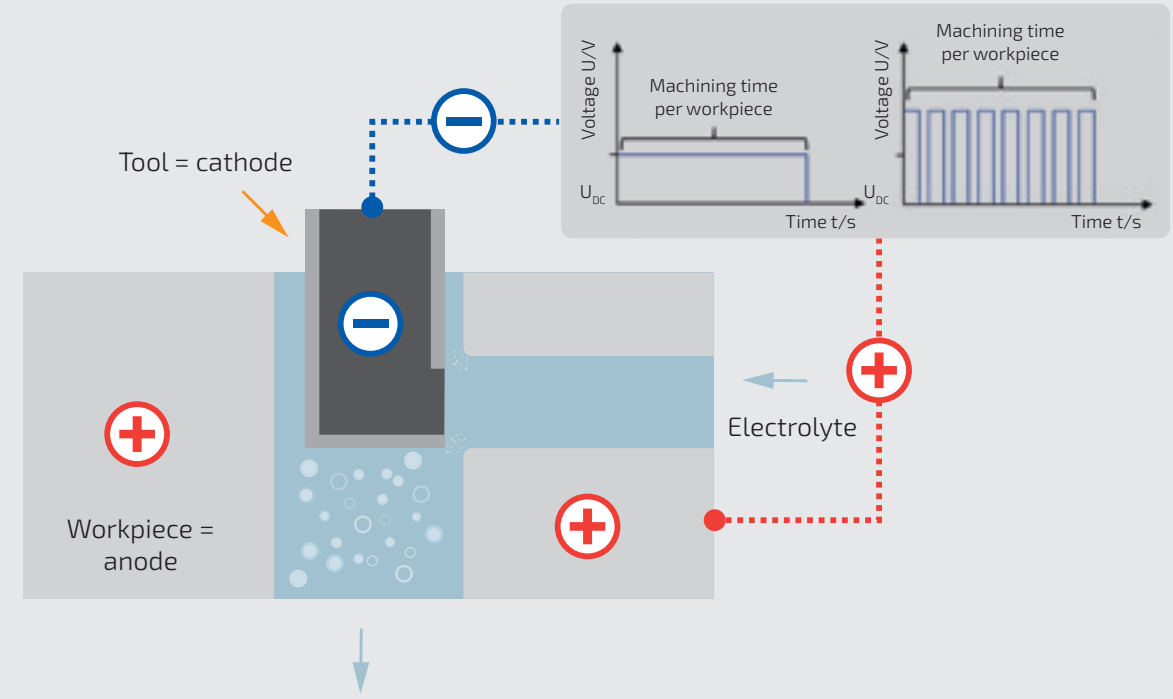




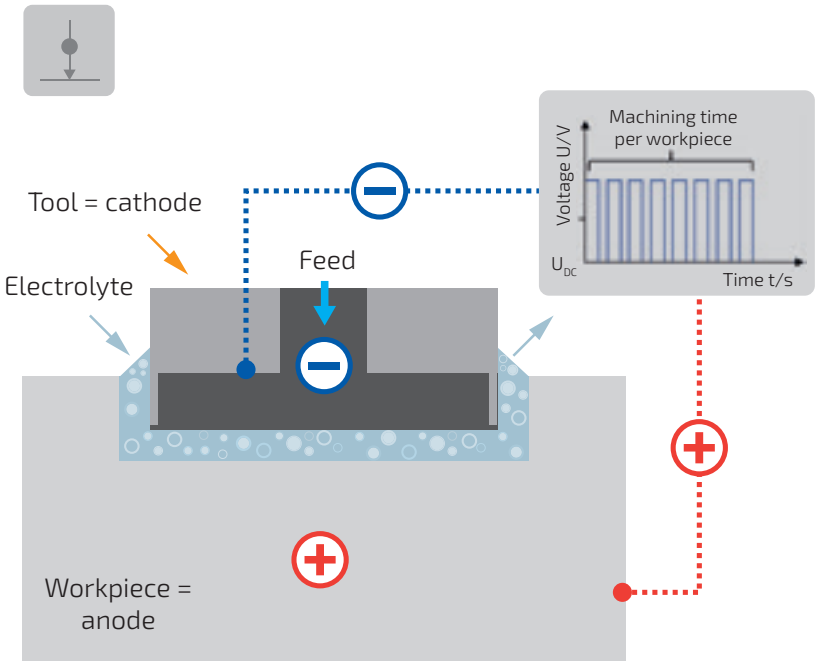
EMAG

ECM – The Process

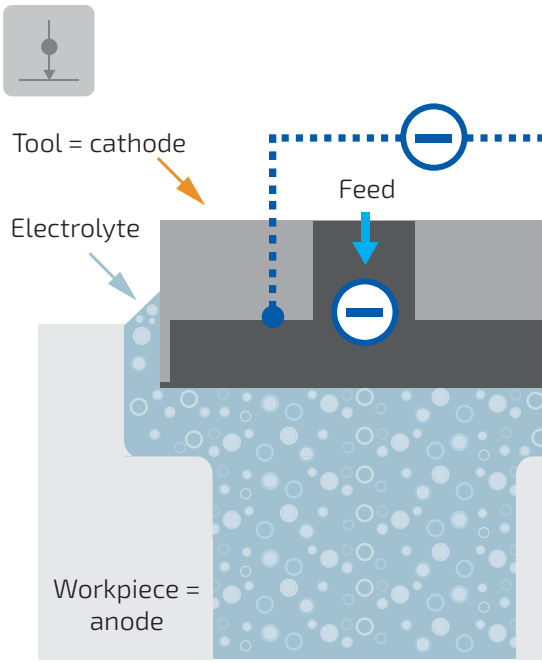
STATIONARY CATHODE



MOVING CATHODE



ELECTROCHEMICAL MACHINING (ECM)



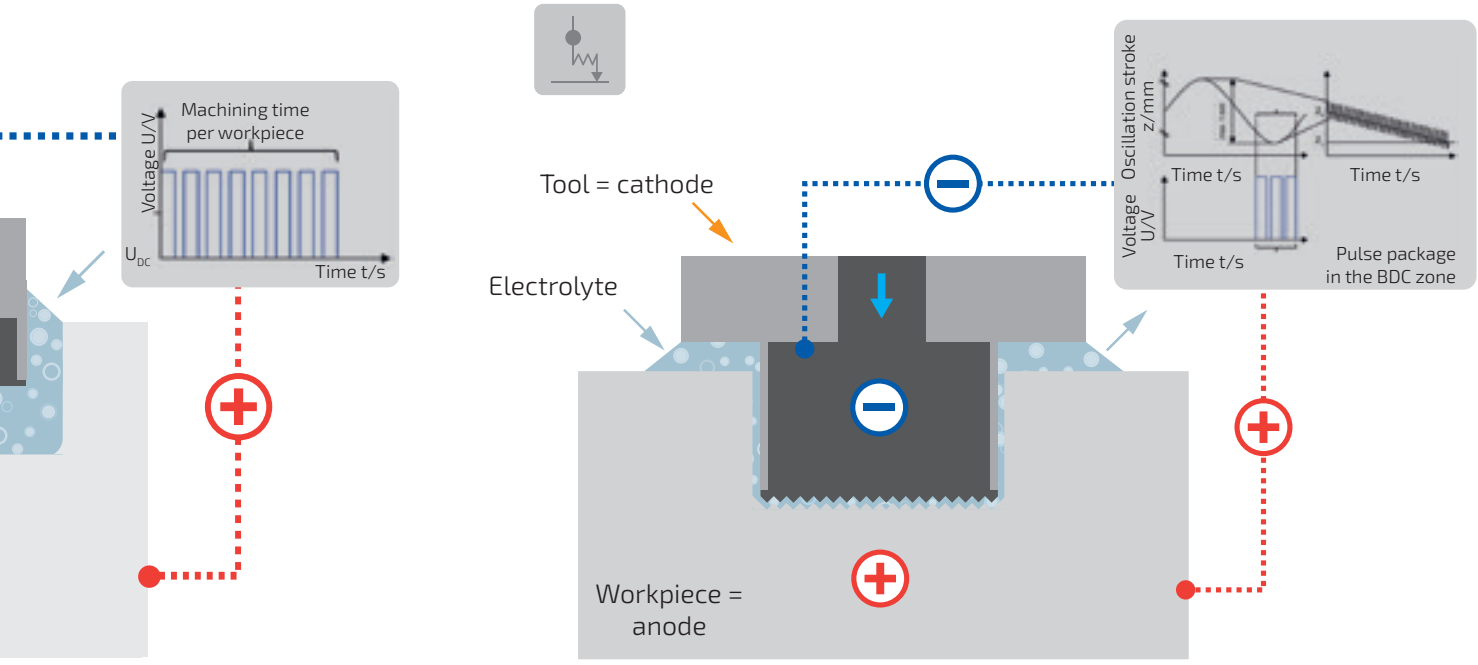
ELECTROCHEMICAL MACHINING IS BASED ON THE PRINCIPLE OF ELECTROLYSIS.

The tool is connected as the cathode to a DC voltage source with the workpiece acting as the anode. A charge exchange takes place between the cathode and 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. Both soft and hard material can be machined.

The components are not subjected to either thermal or mechanical stress.

PRECISION ELECTROCHEMICAL MACHINING (PECM)



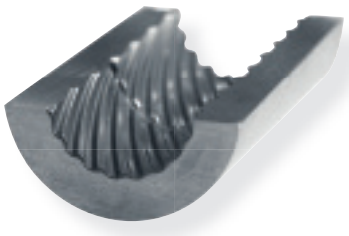
(P)ECM machine – PI

PI – PREMIUM INTEGRATED

The PI machine with its integral electrolyte management system is a compact entry-level machine to the (P)ECM precision machining process, The (P)ECM machining area, control cabinet with control system, and electrolyte management system are all mounted on one machine frame (single frame). This means that the PI has a small footprint, is compact, and can be transported with a forklift truck!

The PI is ideal for ...

- » ECM deburring
- » (P)ECM internal profiling (rifling)
- » (P)ECM machining
- » (P)ECM sinking



EMAG ECM – PI

+ Scalable generator technology up to 2,500 A
+ DC, pulse, and PECM technology
+ Flexibly configurable pulse technology
+ Individual cathodes can be selected/deselected
+ Single cathode monitoring
+ Process control using by time, distance, or ldt
+ Small footprint
+ Modular design
  - Machining area: sinking module, oscillation module, rifling module, deburring module
  - Electrolyte management system (EMS)
  - Microfiltration
  - Cr6+ reduction
+ Touch panel and S7-1500 controller from Siemens
+ Conductivity monitoring
+ Temperature control
+ pH value control with metering
+ Transportable by a forklift truck

Options:

» Fast short-circuit shutdown
» Automatic cathode cleaning
» Oscillation at up to 100 Hz and stroke from 0 to 0.6 mm
» C-axis for interpolated multiple sinking movement
» IoT Ready
» Automation interface
» Single nest pressure control
» Single nest flow monitoring
» Automatic machining area door

TECHNICAL DATA

Generator capacity	A (DC)	400 – 2,500
Generator capacity	A (pulse)	400 – 8,000

EMAG PI – Modular design

BASIC MODULE

Modules in the machining area are equipped with a basic module made of Mineralit, can be selected according to the ECM application.

1. DEBURRING MODULE

The machining area is prepared for an ECM deburring tool.

2. SINKING MODULE

The machining area with a Z-axis to carry out accurate sinking applications.

3. OSCILLATION MODULE

The machining area with a Z-axis and superimposed oscillation to carry out high-precision PECM applications.

4. RIFLING MODULE

The machining area with a Z-axis and a C-axis to produce internal profiles.

EMS & machining area

Microfiltration (for higher electrolyte quality)

Cr6+ reduction (depending on material)

Chamber filter press

OPTIONS FOR THE BASIC MODULE

(P)ECM machine – PS

PS – PREMIUM STANDARD

The PS machine with a deburring, sinking , or oscillation module is the flexible machine platform for the (P)ECM process:

» Modular machine concept

» Manual or semi-automatic starter systems

» Suitable for automation using robots or gantry loaders

» Smart software and hardware interfaces

The PS single machine provides the basis for a modular system. This reduces investment costs because customers only have to invest in linking several processes (e.g., pre-washing, (P)ECM station 1, (P)ECM station 2, final treatment, and automation) once production increases.

The PS is ideal for ...

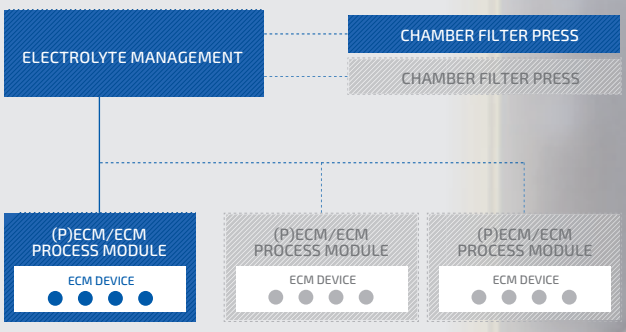
» ECM deburring

» (P)ECM internal profiling

» (P)ECM machining

» (P)ECM sinking

on a wide range of components.



BASIC MODULE

Modules in the machining area are equipped with a basic module made of Mineralit, can be selected according to the ECM application.

1. DEBURRING MODULE

The machining area is prepared for an ECM deburring tool.

2. SINKING MODULE

The machining area with a Z-axis to carry out accurate sinking applications.

EMAG ECM – PS

+ Machining area: sinking module, oscillation module or deburring module
+ Scalable generator technology up to 2,500 A
+ DC, pulse, and PECM technology
+ Flexibly configurable pulse technology
+ Individual cathodes can be selected/deselected
+ Single cathode monitoring
+ Process control using by time, distance, or ldt
+ In the form of a sinking module: 400 mm Z stroke
+ In the form of an oscillation module: 200 mm Z stroke
+ Touch panel and S7-1500 controller from Siemens
+ Conductivity monitoring
+ Temperature control
+ pH value control with metering

Options:

» Fast short-circuit shutdown
» Automatic cathode cleaning
» Oscillation at up to 100 Hz and stroke from 0 to 0.6 mm
» C-axis for interpolated multiple sinking movement
» IoT Ready
» Automation interface
» Can be combined with all electrolyte management systems from 20 to 600 l/min
» Automatic machining area door

3. OSCILLATION MODULE

The machining area with a Z-axis and superimposed oscillation to carry out high-precision PECM applications.

TECHNICAL DATA

Generator capacity	A (DC)	400 – 2,500
Generator capacity	A (pulse)	2,000 – 8,000

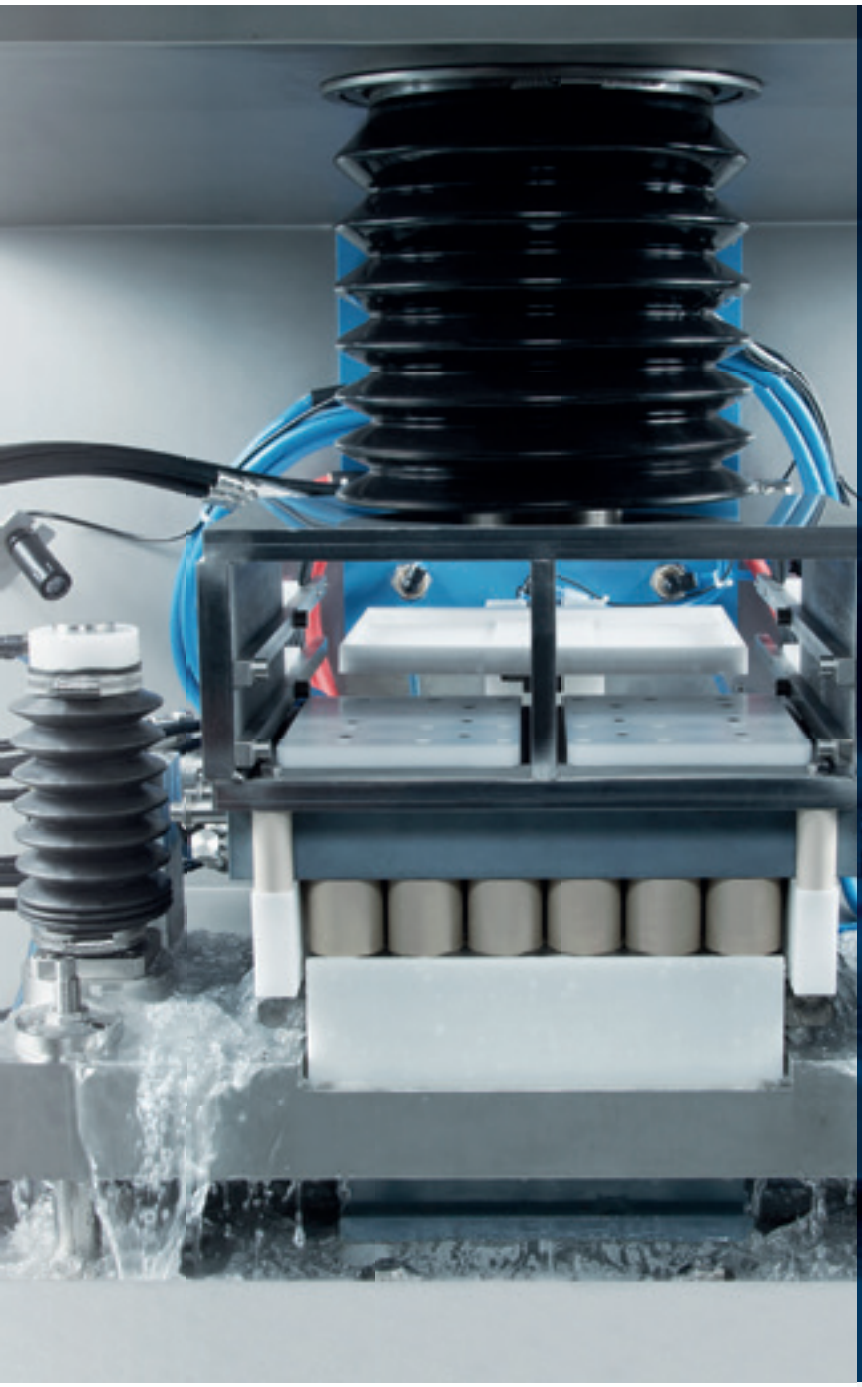
Subject to changes. The layout may change to suit technical requirements. All systems are built to current CE standards.

PECM machine – PTS

The EMAG PTS has a base made of MINERALIT®, a polymer concrete which is 8 times more resistant to vibration than gray cast iron. The machine and the tools suffer from less vibration as a result of this outstanding feature.

PECM technology is ideal for the precision machining of materials which are difficult to cut. Tasks involving high accuracy and surface requirements can be carried out using a completely new approach.

Subject to changes. The layout may change to suit technical requirements.
All systems are built to current CE standards.

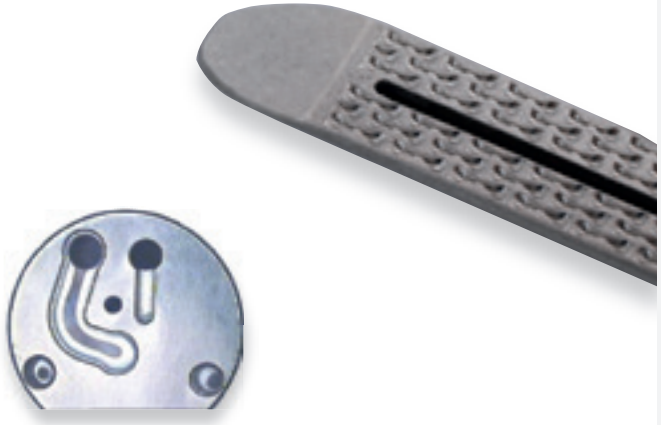


EMAG ECM – PTS:

+ Scalable generator technology up to 12,000 A
+ DC, pulse, and PECM technology
+ Flexibly configurable pulse technology
+ Fast short-circuit shutdown
+ Process control using time, distance, and ldt
+ Machine base made of Mineralit®
+ Footprint: 2,100 x 3,200 x 2,900 mm (W x D x H)
+ Oscillator with play-free precision drive
+ Z-axis with 200 mm stroke and max. 25 kN axial load
+ Hydraulic zero point clamping system
+ Siemens Sinumerik 840D sl controller

Options:

» Individual cathodes can be selected/deselected
» Single cathode monitoring
» Single nest pressure control
» Single nest flow monitoring
» Automatic machining area door
» Cathode cleaning
» XY worktable
» C-axis
» Scalable electrolyte management systems
» IoT Ready
» Automation interface
» Oscillation at up to 100 Hz and stroke from 0.05 to 0.6 mm
» Z-axis with 350 mm stroke and max. 25 kN axial load
» Enclosed machining area with lifting door



TECHNICAL DATA

Machining area	mm inch	1,070 x 700 x 515 42 x 27.5 x 20
Clamping table	mm inch	800 x 550 31.5 x 21.5
Generator capacity	A (DC)	2,500 – 5,000
Generator capacity	A (pulse)	6,000 – 12,000

PECM machine – PO 100 SF

PO 100 SF – SINGLE FOIL

The economical solution for the synchronous machining of both sides of turbine blades.

The PO 100 SF has a base made of MINERALIT®, a polymer concrete which is 8 times more resistant to vibration than gray cast iron. The machine and the tools suffer from less vibration as a result of this outstanding feature.

The machining process takes place using two opposite axes. This means that individual turbine blades with 3D shapes and high accuracy/surface requirements can be produced using a completely new approach.

Subject to changes. The layout may change to suit technical requirements.
All systems are built to current CE standards.

EMAG ECM – PO 100 SF

+ Scalable generator technology up to 24,000 A
+ DC, pulse, and PECM technology
+ Single cathode monitoring
+ Fast short-circuit shutdown
+ Process control using time, distance, and ldt
+ Machine base made of Mineralit®
+ Footprint: 2,800 x 2,300 x 2,600 mm (W x D x H)
+ Oscillator with play-free precision drive
+ X1-/X2-axis with 200 mm stroke and max. 25 kN axial load
+ Interpolating Y-axis with 100 mm stroke
+ Hydraulic zero point clamping system
+ Siemens Sinumerik 840D sl controller

Options:

» Parallel machining of blades
» Cathode cleaning
» Scalable electrolyte management systems
» IoT Ready
» Automation interface
» Single nest pressure control
» Single nest flow monitoring
» Oscillation at up to 100 Hz and stroke from 0.05 to 0.6 mm

TECHNICAL DATA

Machining area	mm inch	750 x 600 x 360 30 x 24 x 14
Clamping table	mm inch	370 x 450 15 x 18
Generator capacity	A (DC)	2 x 2,500 – 5,000
Generator capacity	A (pulse)	2 x 6,000 – 12,000

PECM machine – PO 900 BF

PO 900 BF – BLISK FOIL

The alternative to the traditional machining of blisks and IBRs.

The PO 900 BF has a base made of MINERALIT®, a polymer concrete which is 8 times more resistant to vibration than gray cast iron. The machine and the tools suffer from less vibration as a result of this outstanding feature.

The machining takes place using multiple axes. This means that complete blisks with 3D shapes and high accuracy/surface requirements can be produced using a completely new approach.

Subject to changes. The layout may change to suit technical requirements.
All systems are built to current CE standards.

EMAG ECM – PO 900 BF

+ Scalable generator technology up to 12,000 A
+ DC, pulse, and PECM technology
+ Flexible step technology and type management
+ Fast short-circuit shutdown
+ Process control using time, distance, and ldt
+ Machine base made of Mineralit®
+ Footprint: 4,400 x 6,600 x 4,500 mm (W x D x H)
+ Oscillation at up to 50 Hz and stroke from 0.05 to 0.9 mm
+ Oscillator with play-free precision drive
+ X1-/X2-axis with 250 mm stroke and max. 50 kN axial load
+ Compound slide for holding workpieces with Y-/Z-axis, C-axis, and B-axis
+ X-, Y-, Z-, and interpolating C-axes
+ Zero point clamping system for cathodes and workpiece
+ Siemens Sinumerik 840D sl controller

Options:

» Cathode cleaning
» Scalable electrolyte management systems
» IoT Ready
» Automatic machining area door

TECHNICAL DATA

Component diameter up to	mm inch	900 35.5
Workpiece weight up to	kg	300
Generator capacity	A (DC)	2 x 2,500 – 5,000
Generator capacity	A (pulse)	2 x 6,000 – 12,000

EMS Electrolyte Management System

Both systems with chamber filter presses and with microfiltration are available for filtration purposes. The filtrate quality and volume can thus be tailored precisely to requirements. Systems from 40 to 900 l/min filtration capacity are available as standard.

High reproducibility of the machining result is 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. The economical solution for PECM process development and for the PECM machining of challenging 2D and 3D geometries.

EMS 150

Subject to changes. The layout may change to suit technical requirements.
All systems are built to current CE standards.

EMAG ECM – EMS:

+ Electrolyte $NaNO_3$ or NaCl
+ Flow rates of up to 600 l/min
+ Electrolyte pressure of up to 20 bar
+ Temperature control
+ Flow rate or pressure control
+ pH value control by means of metered acid/alkaline addition
+ Conductivity monitoring
+ Particle size: < 0.5 µm
+ Visualization and setting of all electrolyte parameters on a SIEMENS touch panel

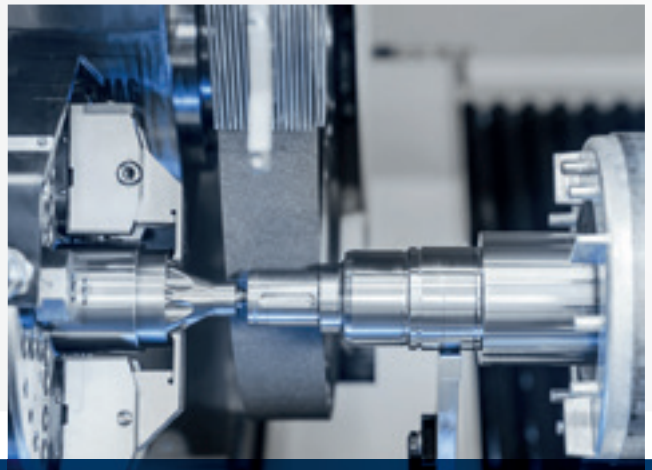
EMS 35

TECHNOLOGY. CONNECTED.

Turning Chucked Components

Turning Shafts

Gear Grinding



Cylindrical Grinding

Out-of-round Gr

Milling

Gear Hobbing

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ECM/PECM

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