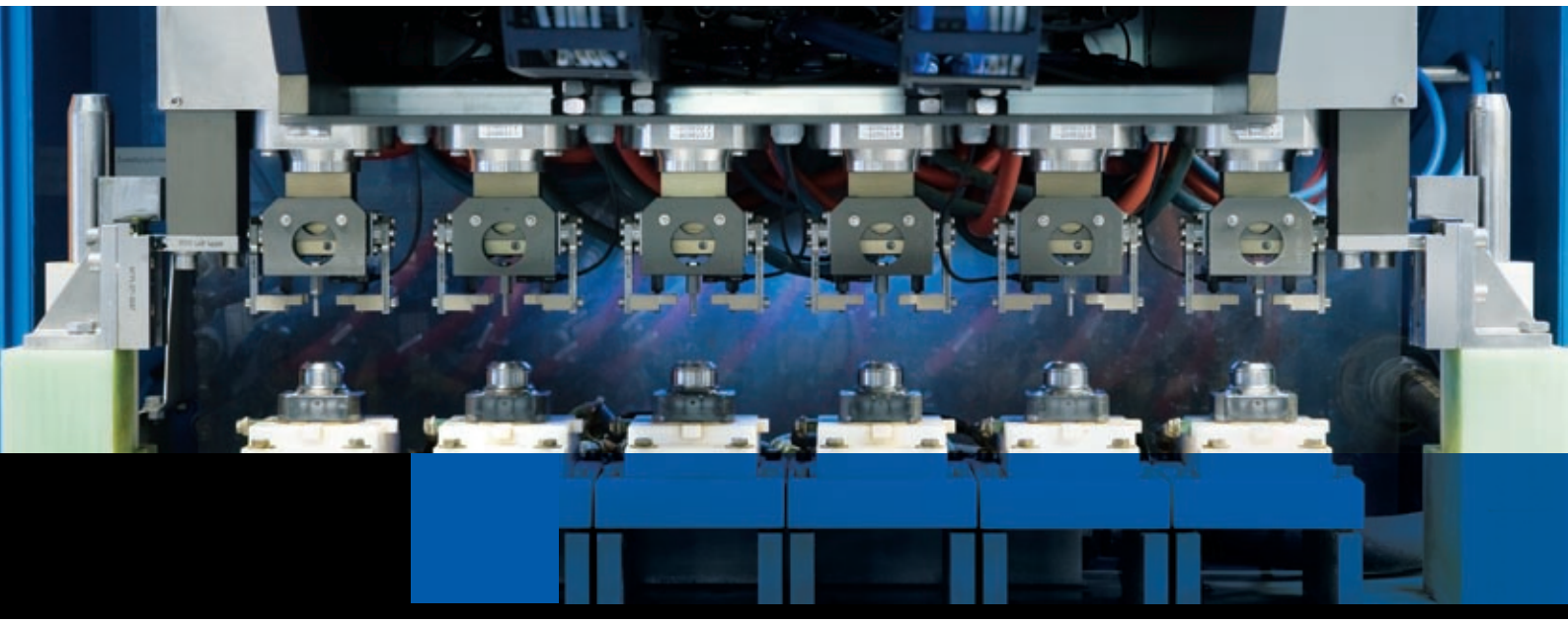
ECM / PECM Technology

Polishing, Deburring, 3D Contouring



EMAG

EMAG ECM GmbH
Complete solutions, design and development, contract manufacture, prototype manufacture, advisory service. Your contact for all questions on electro-chemical machining.

E C M
P E C M

ELECTRO-CHEMICAL MACHINING

The process.

The electro-chemical machining process is based on the principle of electrolysis. An electrode connected to a D.C. source acts as cathode (the tool). The work-piece represents the other electrode and is poled as anode. In a watery electrolyte solution cathode and workpiece exchange a charge that machines the workpiece – without touching – at the selected point, generating contours, annular grooves, flutes or cavities – all of the highest precision. The material being removed separates from the electrolyte solution as metal hydroxide. Machining is accomplished irrespective of the metal's microstructure and regardless of whether the material is soft or hard. The components are exposed to neither thermal nor mechanical stresses.

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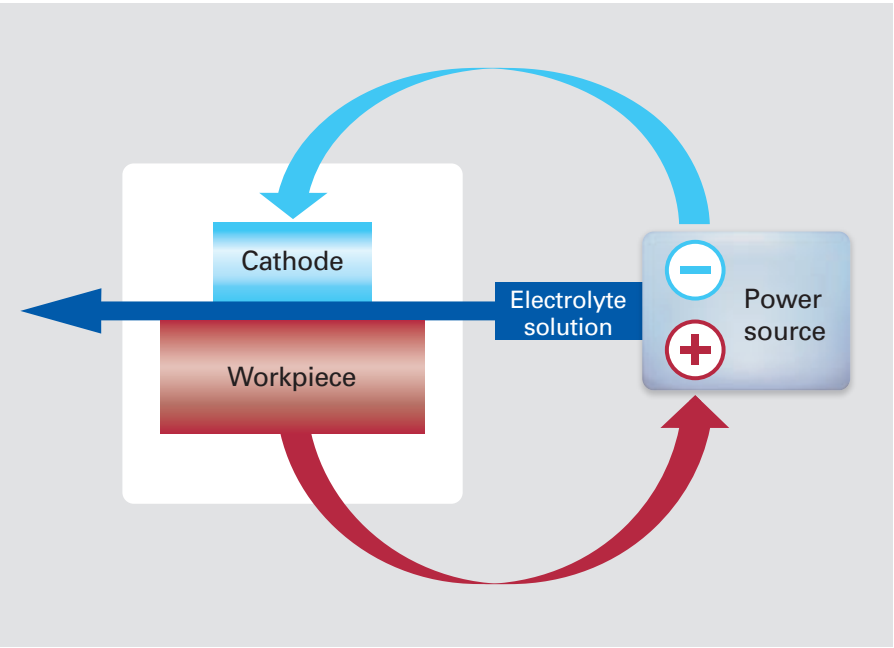


The different machining operations.

ECM – Electro-Chemical Machining

Stationary cathode

Operation	Technologies
Deburring	DC (Direct Current) or pulsed ECM
Polishing	Pulsed ECM
Recessing the surface	Pulsed ECM
Cavity	DC or pulsed ECM

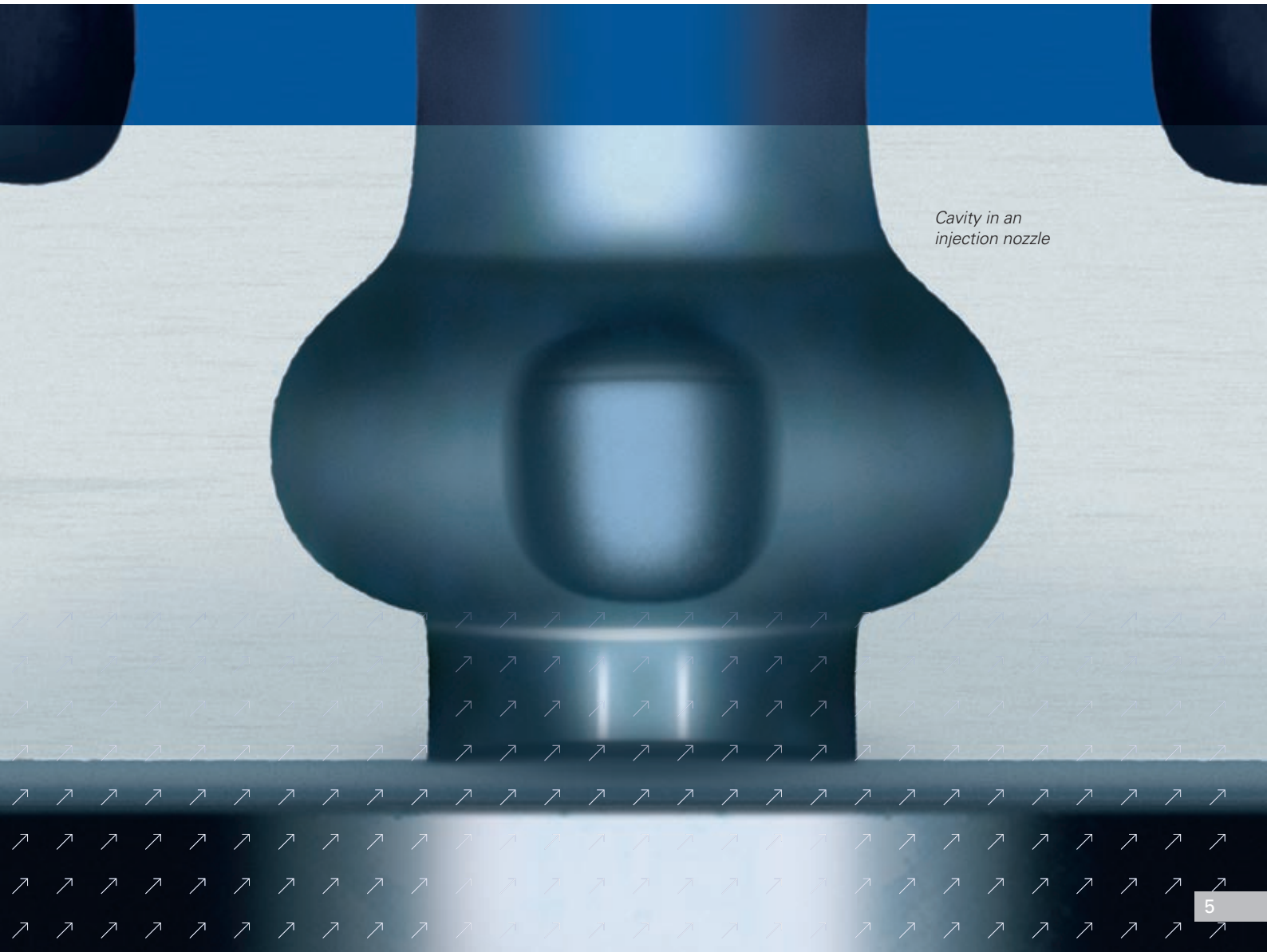
Cathode with infeed

Operation	Technologies
Drilling	DC or pulsed ECM
2.5D countersinking	DC or pulsed ECM

PECM – Precise Electro-Chemical Machining

Cathode with infeed and mechanical oscillation

Operation	Technologies
Precision profile	Pulsed ECM



Cavity in an injection nozzle

Electro-chemical machining – Great precision and highly cost-effective.

ECM – Electro-Chemical Machining is the generic term for a variety of electro-chemical processes. ECM is used to machine workpieces by electrolytically dissolving the metal. The process is used in aerospace engineering and the automotive, medical equipment, microsystem and power supply industries. Almost all kinds of metal can be electro-chemically machined, even high-alloyed nickel- or titanium-based ones, and so can hardened materials. As it is a contactless procedure with no heat input, the process is not subject to any of the disadvantages experienced with conventional machining methods, e.g. tool wear, mechanical stresses, micro-fissures caused by heat transfer, surface oxidation or the need for subsequent deburring operations. All electro-chemical machining processes are characterised by stress-free stock removal, gentle transitions and smooth surfaces without burr formation.

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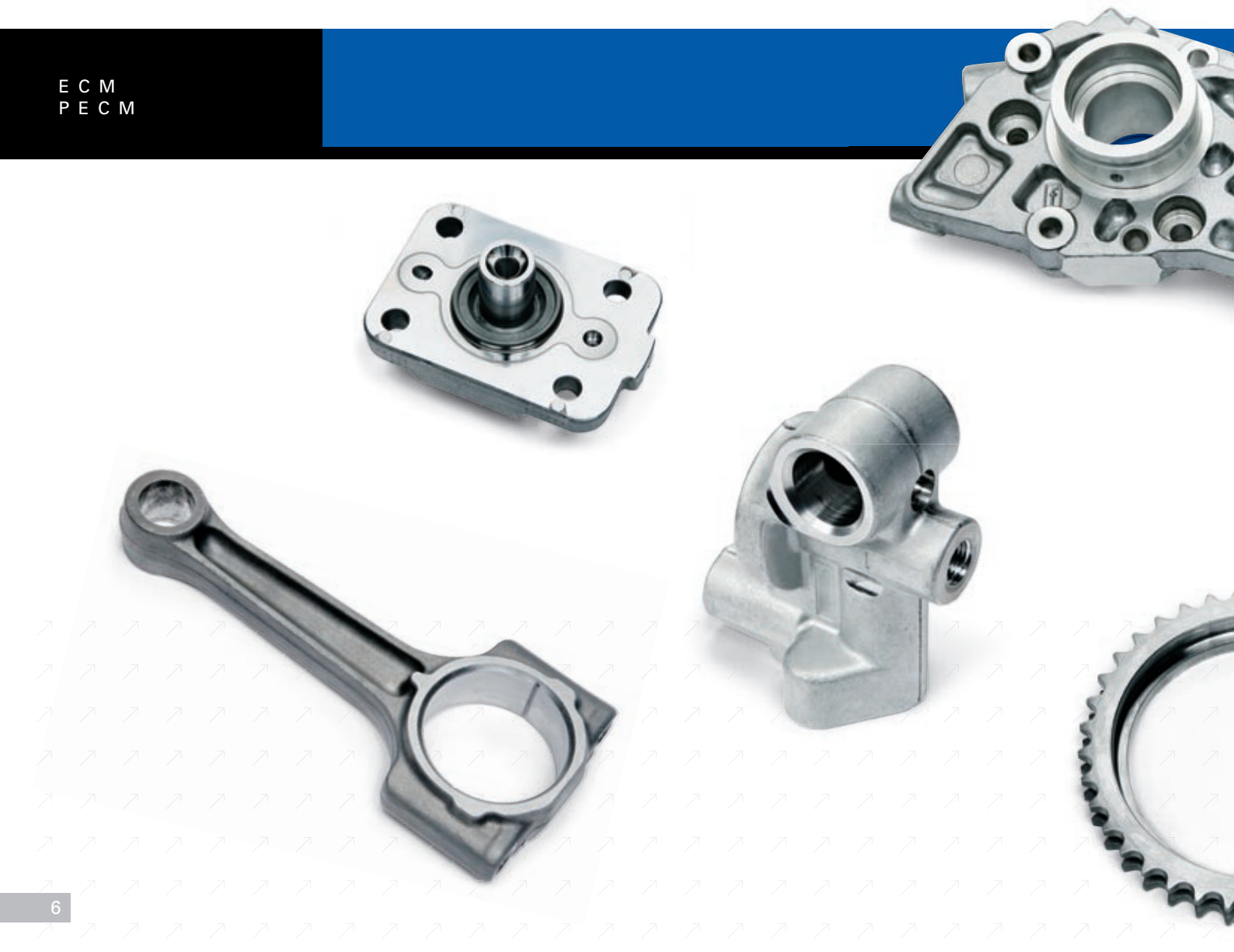


The advantages of electro-chemical machining

- Low-level tool wear (cathode), an ideal precondition for batch production
- Surface finishes of up to Ra 0.05
- Precise machining
- No negative thermal and mechanical effects, thus no changes in the material's microstructure
- The material properties are not affected
- Hardness, toughness and magnetic qualities of the material remain unchanged
- Possibility to machine diminutive and thin-walled contours
- A high degree of repeat accuracy in the machining of the surface structure
- Simple but highly efficient production process; no need for subsequent deburring or polishing
- Rough-machining, finish-machining and polishing in a single operation
- Possibility to machine superalloys
- Possibility to simultaneously machine macro and micro structures

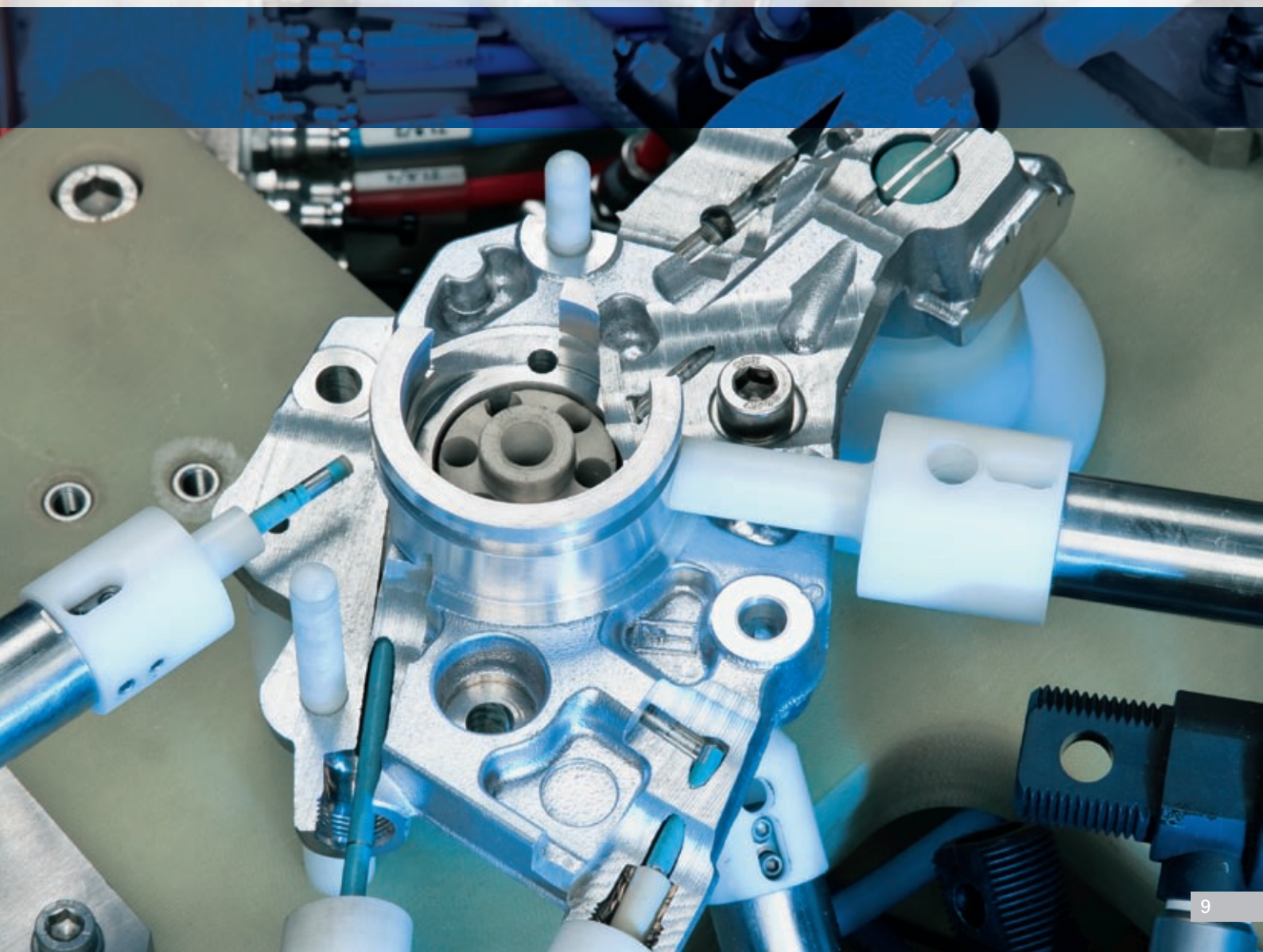
Basic Standard / Basic Integrated.

On the ECM Standard Machining System "Basic Standard / Basic Integrated" the operator loads and removes the workpieces from the ECM unit by hand. A two-handed control button operation activates the ECM process that carries out the repeatable deburring operation.

A stainless-steel and plastic construction with a manual workstation of ergonomic design forms a solid basis, equipped – in its standard version – with:

- Operator-friendly Siemens control S7-300 with graphic panel
- Current relay and voltage monitor
- pH-value control and conductance monitor
- Temperature control
- Machining area: 1,150 x 950 mm
- Two-handed control button operation

Optional equipment on request



Comfort Standard / Comfort Integrated.

The Comfort Standard / Comfort Integrated represents the optimal introduction to the automation of ECM processes.

- Modular machine concept
- Intelligent software and hardware interfaces
- Starting with manual / semi-automatic operation, the system is quickly upgraded to full automation

The CS / CI contains as standard:

- Siemens touch-screen panel
- Scalable generator technology
- Conductance monitor
- Temperature control
- pH-value control with acid metering
- Quill clamping surface: 1,150 x 950 mm
- Quill stroke with safety interlock
- Two-handed control button operation
- Automation interfaces included

The Comfort stand-alone machine forms the basis of a modular automation concept. It saves on capital outlay, as further investment is only required when an increase in production calls for the link-up of a number of processes (e.g. pre-cleansing, ECM station 1, ECM station 2, secondary treatment).

PECM Premium.

PECM system based on a modularly upgradeable machine tool concept.

- Sophisticated 2D and 3D micro structures
- Optional upgrades: auxiliary axes for clamping systems and machining sequences
- Scalable generator technology, up to 40,000 A
- Pulse frequencies of up to 100 kHz
- Temperature and pH-value control
- Conductance monitor
- Microfiltration
- Machine base in MINERALIT® or granite
- High degree of positioning accuracy
- Precision oscillator
- Graphic visualisation with ergonomic operator interface

PremiumTwo

E C M
P E C M

The PECM Premium shortens the process stream and provides viable solutions for difficult metalworking applications.

The excellent repeatability of the PECM process on the Premium series is a result of the intelligent machine concept and the patented process control.

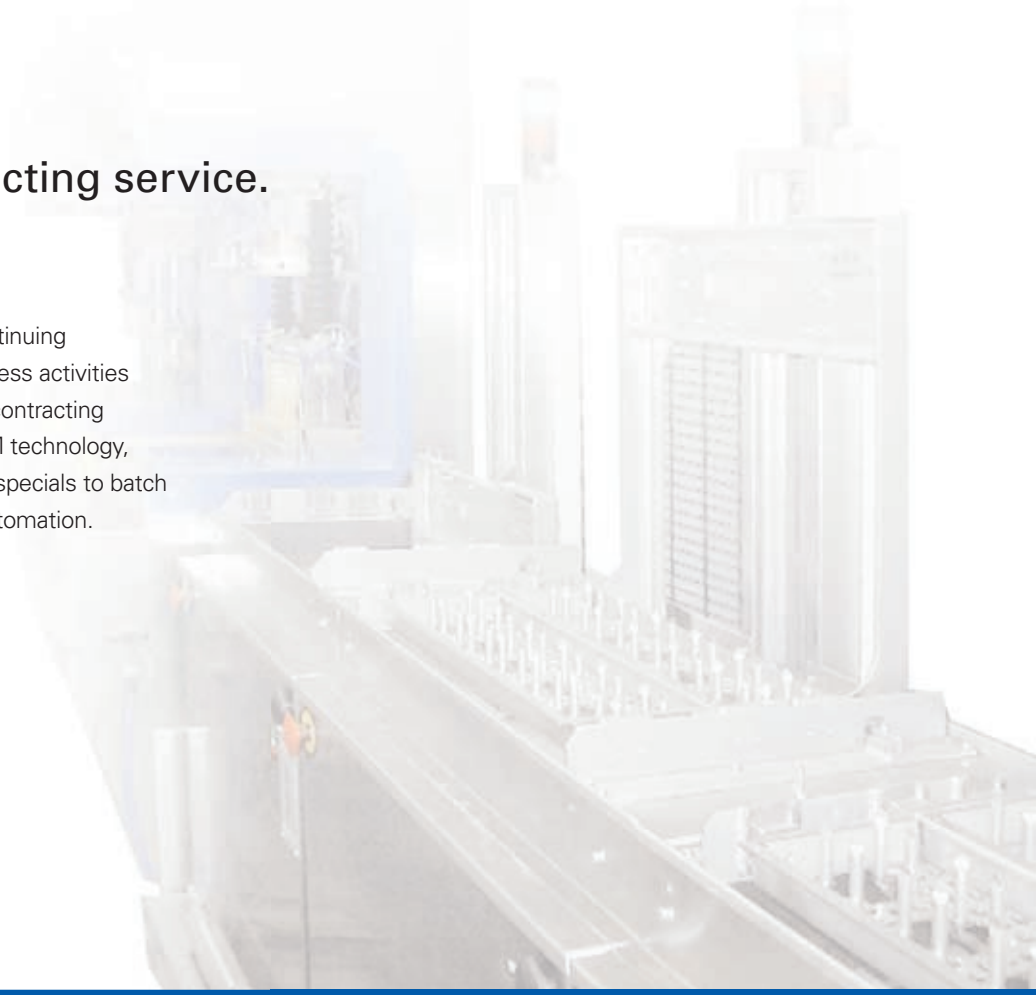
Highlights:

- Precision imaging in 2.5D
- Great repeatability of lowering speeds
- Surface finishes up to Ra 0.05

PremiumOne

ECM / PECM subcontracting service.

In the course of the continuing expansion of their business activities EMAG ECM offers subcontracting services in ECM / PECM technology, covering anything from specials to batch production, including automation.



PECM laboratory.

The PECM laboratory is equipped to optimise the process to suit individual customer requirements. Trials determine how a variety of component geometries can be machined at an advantageous cost-benefit ratio.

Range of services:

- Design and development of fixtures
- Material testing
- Development of and support in developing new products
- Process optimisation
- Process and cycle time analyses

Technical Data.

Capacity	BS	BI	CS	CI
Machining area	1,150 x 950	1,150 x 950	1,150 x 950	1,150 x 950
Vertical travel	–	–	300	300

Power rating / equipment specification

DC	30–60 V / 200–5,000 A	30–60 V / 200–5,000 A	30–60 V / 200–5,000 A	30–60 V / 200–5,000 A
Pulsed	max. 20,000 A	max. 20,000 A	max. 20,000 A	max. 20,000 A
Electrolyte	NaNO3 / NaCl	NaNO3 / NaCl	NaNO3 / NaCl	NaNO3 / NaCl
Operating pressure	10 bar	10 bar	10 bar	10 bar
Automation	possible	possible	possible	possible
NC drive	option	option	option	option
Retraction unit	–	–	option	option
Extraction system	–	–	option	option

Measurements

Length	–*	3,400	–*	3,400
Width	–*	2,000	–*	2,000
Height	2,700	2,700	2,700	2,700

Electrolyte supply

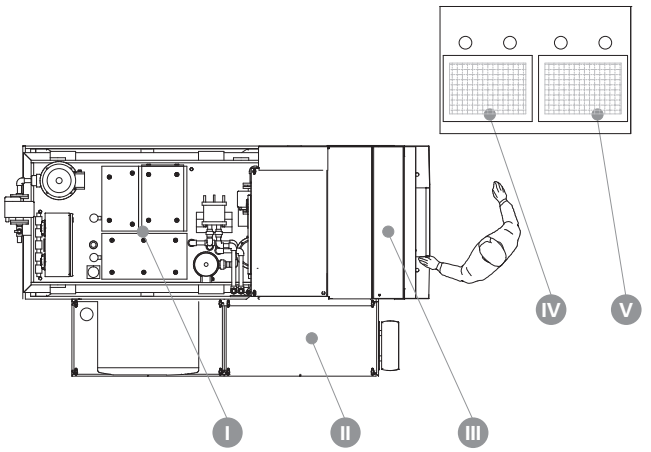
Tank	1,000–2,700	1,000	1,000–2,700	1,000
Temperature measurement	yes	yes	yes	yes
pH-value measurement	yes	yes	yes	yes
Conductance measurement	yes	yes	yes	yes
Acid replenishment	yes	yes	yes	yes
Cooling system	yes	yes	yes	yes
Filtration	Chamber filter-press / microfiltration / filter cartridge **			

* dependent on installation

** dependent on application

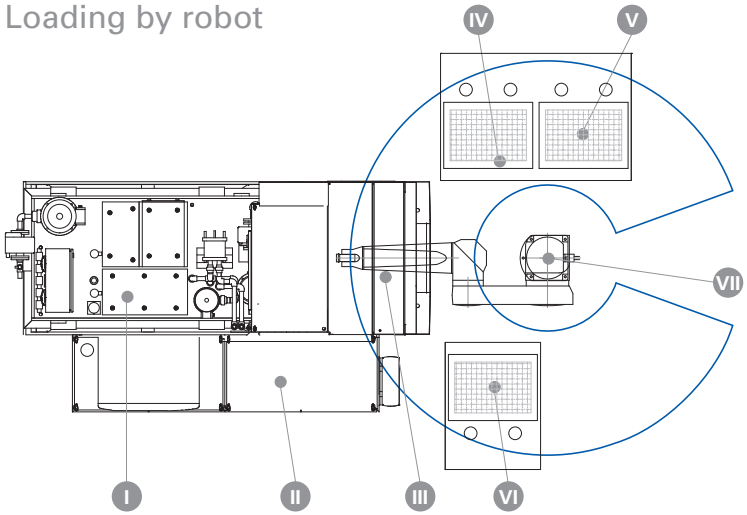
Measurements	Tank capacity	Side A	Side B
1	1,000 litre	2,100 mm	1,150 mm
2	1,600 litre	3,100 mm	1,150 mm
3	2,700 litre	3,500 mm	1,750 mm

Manual machining

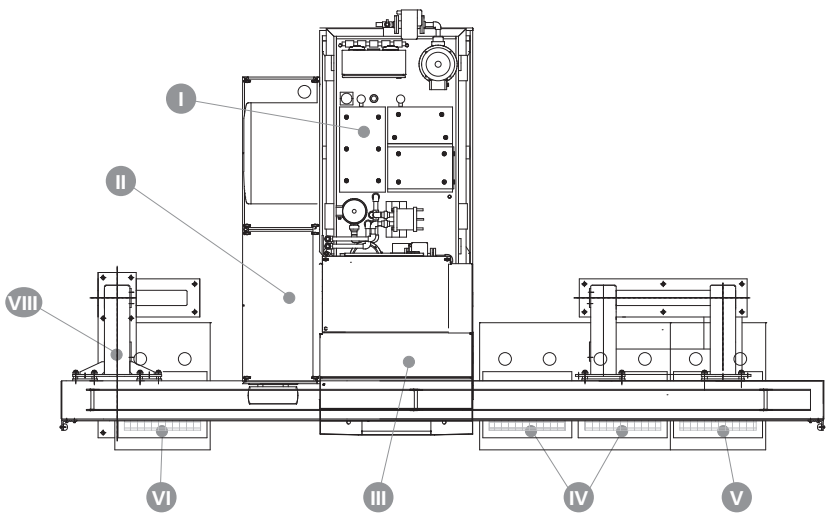


- I - ECM machine
- II - Electrical cabinet
- III - Machining area
- IV - Secondary cleaning
- V - Secondary preservation
- VI - Preliminary purification
- VII - Robot
- VIII - Linear handling system

Loading by robot



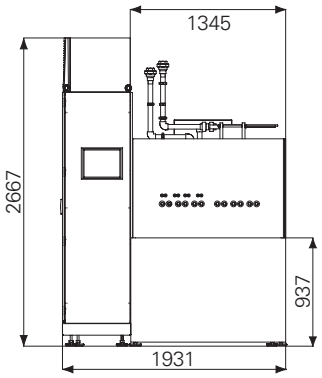
Loading with linear handling system

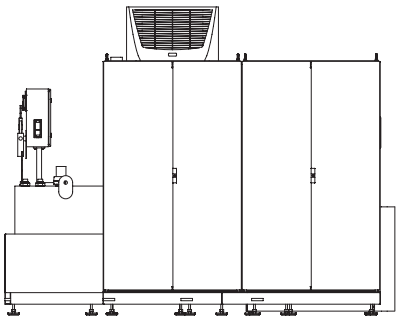


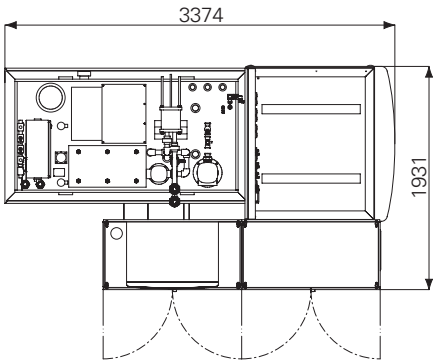
Technical Data.

Floor plan BI

Measurements in mm

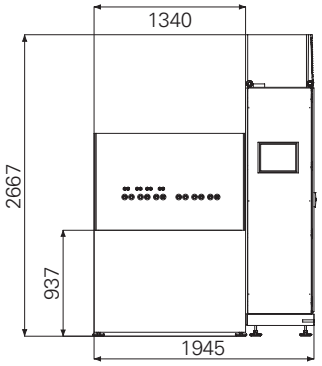


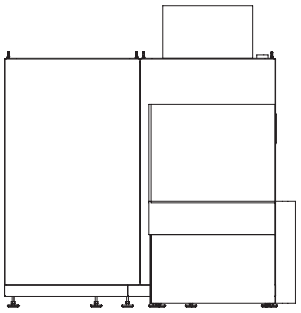


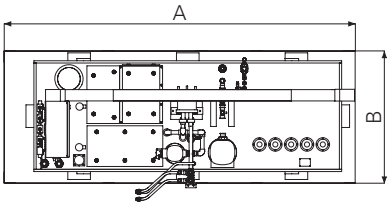


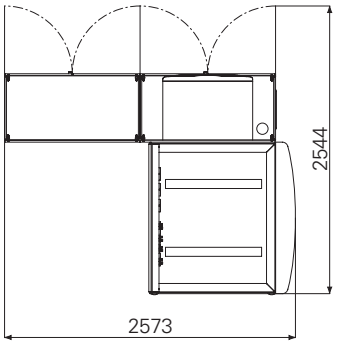
Floor plan BS

Measurements in mm





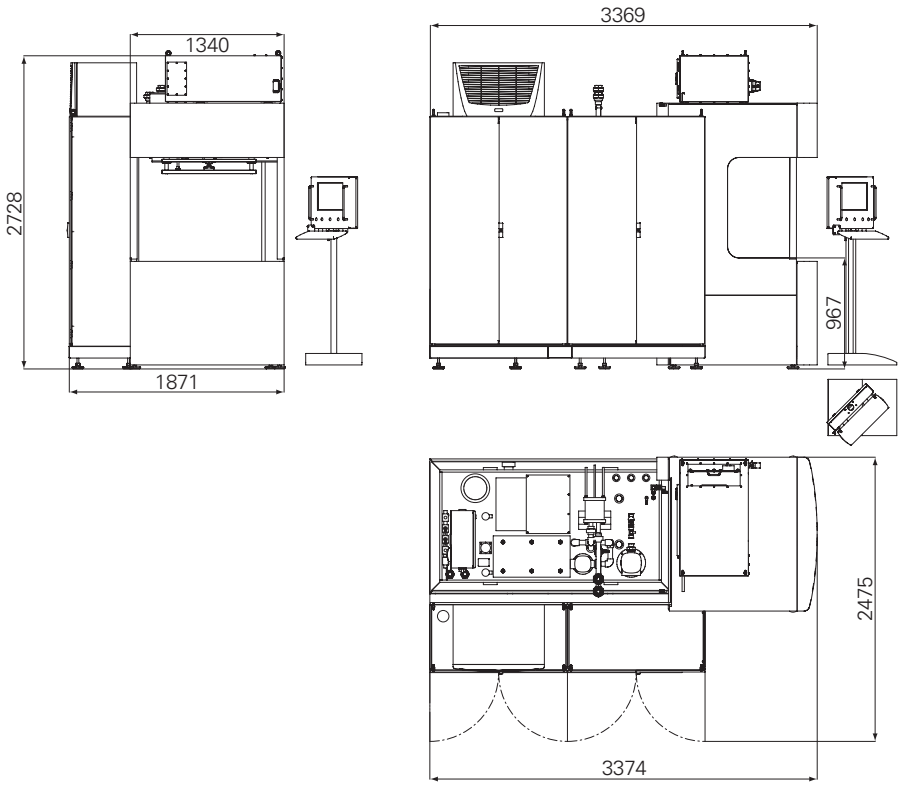




Subject to technical changes

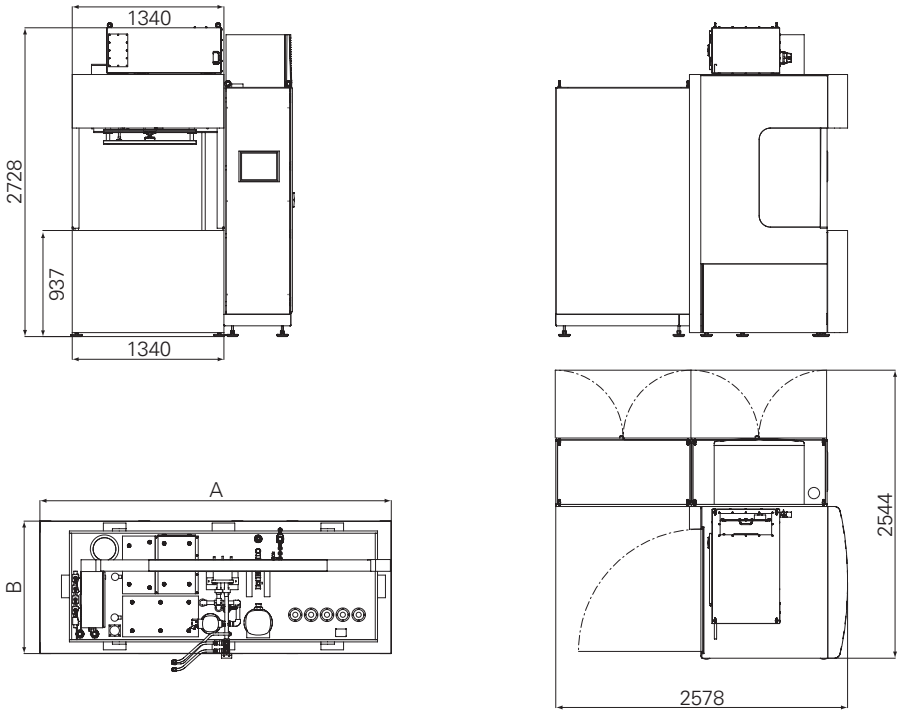
Floor plan CI

Measurements in mm



Floor plan CS

Measurements in mm



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At home in the world.

EMAG
Gruppen-Vertriebs- und Service GmbH

Salach
Austrasse 24
73084 Salach
Germany
Phone: +49 7162 17-0
Fax: +49 7162 17-820
E-mail: info@salach.emag.com

Frankfurt
Orber Strasse 8
60386 Frankfurt/Main
Germany
Phone: +49 69 40802-0
Fax: +49 69 40802-412
E-mail: info@frankfurt.emag.com

Köln
Robert-Perthel-Strasse 79
50739 Köln
Germany
Phone: +49 7162 17-0
Fax: +49 7162 17-820
E-mail: info@koeln.emag.com

Leipzig
Pittlerstrasse 26
04159 Leipzig
Germany
Phone: +49 341 4666-0
Fax: +49 341 4666-014
E-mail: info@leipzig.emag.com

München
Zamdorferstrasse 100
81677 München
Germany
Phone: +49 89 99886-250
Fax: +49 89 99886-160
E-mail: info@muenchen.emag.com

Österreich
Glaneckerweg 1
5400 Hallein
Austria
Phone: +43 6245 76023-0
Fax: +43 6245 76023-20
E-mail: info@austria.emag.com

WORLDWIDE

NODIER EMAG INDUSTRIE S.A.
38, rue André Lebourblanc - B.P. 26
78592 Noisy le Roi Cedex
France
Phone: +33 130 8047-70
Fax: +33 130 8047-69
E-mail: info@nodier.emag.com

EMAG MAQUINAS HERRAMIENTA S.L.
Pasaje Arrahona, No.18
Centro Industrial Santiga
08210 Barberá del Vallés (Barcelona)
Spain
Phone: +34 93 7195080
Fax: +34 93 7297107
E-mail: info@emh.emag.com

ZETA EMAG Srl
Viale Longarone 41/A
20080 Zibido S.Giacomo (MI)
Italy
Phone: +39 02 905942-1
Fax: +39 02 905942-22
E-mail: zetaemag@emag.com

EMAG (UK) Ltd.
Chestnut House,
Kingswood Business Park
Holyhead Road
Albrighton
Wolverhampton WV7 3AU
Great Britain
Phone: +44 1902 37609-0
Fax: +44 1902 37609-1
E-mail: info@uk.emag.com

KP-EMAG
ul. Butlerova 17
117342 Moscow
Russia
Phone: +07 495 3302574
Fax: +07 495 3302574
E-mail: info@kp.emag.com

EMAG L.L.C. USA
38800 Grand River Avenue
Farmington Hills, MI 48335,
USA
Phone: +1 248 477-7440
Fax: +1 248 477-7784
E-mail: info@usa.emag.com

EMAG MEXICO
Colina de la Umbria 10
53140 Boulevares
Naucalpan Edo. de Mèxico
Mexico
Phone: +52 55 5374266-5
Fax: +52 55 5374266-4
E-mail: info@mexico.emag.com

EMAG DO BRASIL Ltda.
Rua Schilling, 413
Vila Leopoldina
05302-001 São Paulo
SP, Brazil
Phone: +55 11 38370145
Fax: +55 11 38370145
E-mail: info@brasil.emag.com

Dänemark
Horsvangen 31
7120 Vejle Ø
Denmark
Phone: +45 75 854854
Fax: +45 75 816276
E-mail: info@daenemark.emag.com

Schweden
Glasgatan 19B
73130 Köping
Sweden
Phone: +46 221 40305
E-mail: info@sweden.emag.com

Polen
Spółka Z Ograniczoną
Odpowiedzialnością
Oddzial w Polsce
Miodowa 14
00-246 Warsaw
Poland
Phone: +48 22 5310500
Fax: +48 71 3137359

Belarus
ul. Timirjazeva, 65 B, Pom. 78 (K.1101)
220035 G. Minsk
Belarus
Phone: +375 296 205100
Fax: +375 17 2547730
E-mail: info@emag.by

EMAG Machine Tools (Taicang) Co., Ltd.
Building 3, Cang Neng
Europe & American Technology Park
No. 8 Lou Jiang Rd. (N.)
215400 Taicang
P.R. China
Phone: +86 512 5357-4098
Fax: +86 512 5357-5399
E-mail: emag@emag-china.com

EMAG INDIA Private Limited
#12, 12th Main Street, 17th Cross
Malleswaram
Bangalore - 560 055,
India
Phone: +91 80 23447498
Fax: +91 80 23447498
E-mail: info@india.emag.com

EMAG KOREA Ltd.
Rm204, Biz center,
SKn Technopark, 190-1,
Sangdaewon-dong,
Joongwon-gu, Seongnam City,
Gyeonggi-do, 462-721,
South Korea
Phone: +82 31 77644-15
Fax: +82 31 77644-19
E-mail: info@korea.emag.com

TAKAMAZ EMAG Ltd.
1-8 Asahigaoka Hakusan-City
Ishikawa Japan, 924-0004
Japan
Phone: +81 76 274-1409
Fax: +81 76 274-8530
E-mail: info@takamaz.emag.com

EMAG SOUTH AFRICA
P.O. Box 2900
Kempton Park 1620
Rep. South Africa
Phone: +27 11 39350-70
Fax: +27 11 39350-64
E-mail: info@southafrica.emag.com

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