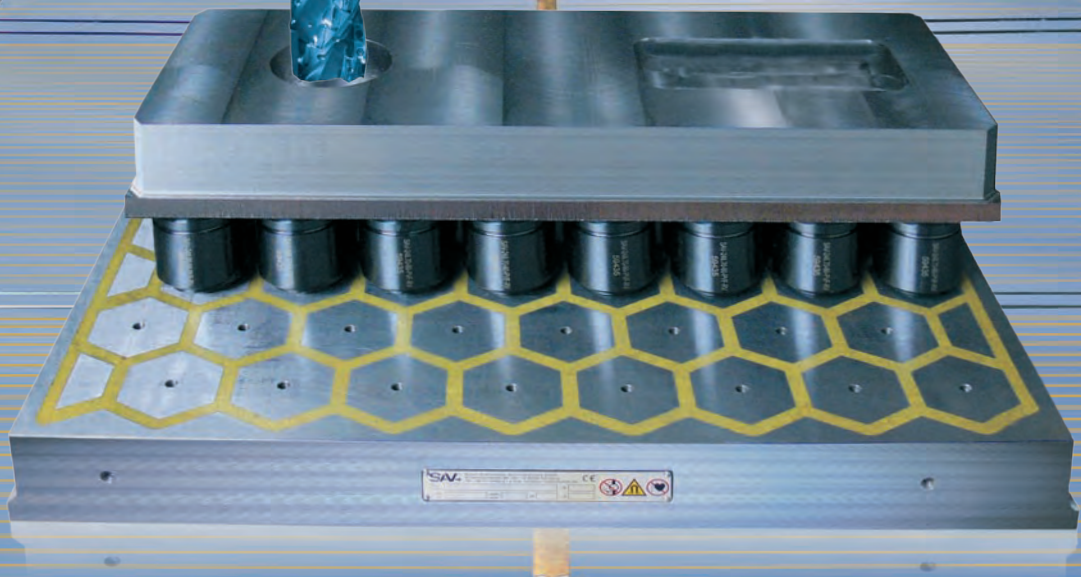




WORKHOLDING AND AUTOMATION



while we clamp you machine!

WORKHOLDING
FOR **MILLING OPERATIONS**

YEARS
25 OF COMPETENCE
IN **WORKHOLDING**

FROM PART TO PROCESS

MAGNETIC
HYDRAULIC
MECHANICAL
VACUUM

 INTELLIGENT
SOLUTIONS

FOR
HEAVY
CHIP REMOVAL

According ISO 9001/2000



SAV IS A CERTIFIED PRODUCER OF TOP QUALITY WORKHOLDING

Own production with:

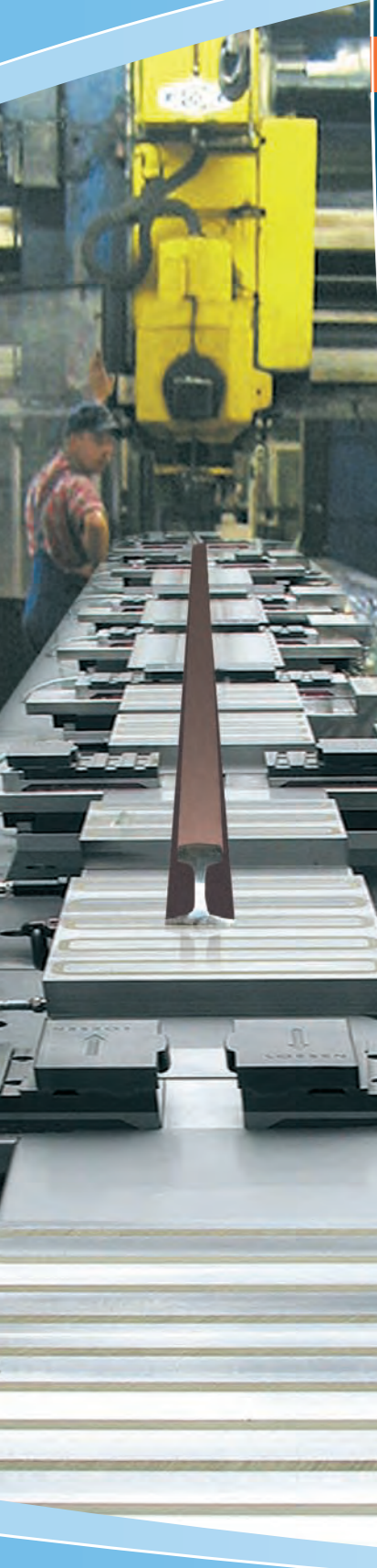
- ➔ 55 machine centers up to 5000x3000 mm machining surface
- ➔ 50 profile-/surface-/ coordinate-/outside- and inside circular grinding machines up to 4000 mm machining length
- ➔ 12 wire- and spark erosion machines
- ➔ 4 CNC-lathes and 1 facing-lathe with table diameter Ø 3000 mm
- ➔ 4 Coordinate measuring machines

SAV → GUARANTEES

- ➔ Quality, reliability and longevity
- ➔ Efficiency
- ➔ Precision solutions
- ➔ Problem solving competence
- ➔ From Workpiece to Process, Handling and Automation
- ➔ The right technology: magnetic, hydraulic, mechanical, vacuum
- ➔ Flexibility of design manufactured in SAV factory
- ➔ Innovation – new technologies
- ➔ Applications “made in Germany”
- ➔ Reduced clamping and set up times
- ➔ Magnetic active workpiece positioning
- ➔ 5-side machining
- ➔ Universal and flexible
- ➔ Wear Resistant
- ➔ Reliable in process and clamping
- ➔ High efficiency
- ➔ Extreme holding forces
- ➔ Optimal workpiece damping

The requirements of our customers determine our products and the company philosophy.

The development of magnetic chucks for milling have revolutionized the production technology:



SAV CLAMPING SYSTEMS FOR MILLING

magnetic – hydraulic – mechanical – vacuum

MAGNETIC

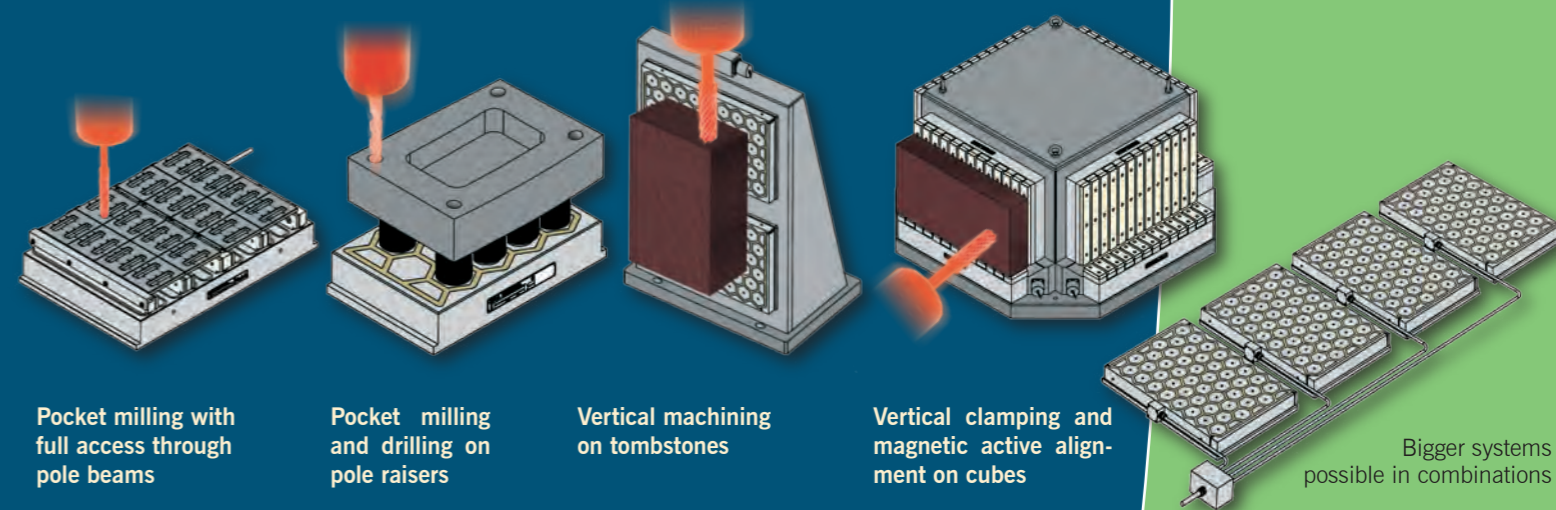
Electro-Permanent-Magnetic-Workholding

- fail safe, magnetizing through short impulses
- surface holding
- high damping
- pulldown of uneven parts
- 5-side machining possible
- stress-free clamping with flexible pole raisers
- high reliability and process safety
- also suitable for bigger air gaps
- high flexibility – price ratio
- suitable for very big parts
- full or partial coverage of the machine table
- modular design
- suitable for palletizing

Permanent-Magnetic-Workholding

- surface holding
- high damping
- pulldown of uneven parts
- suitable for palletizing
- high flexibility
- cost-efficient
- sizes up to 600x300 mm

CHOOSING THE CORRECT PRINCIPLE!



Pocket milling with full access through pole beams

Pocket milling and drilling on pole raisers

Vertical machining on tombstones

Vertical clamping and magnetic active alignment on cubes

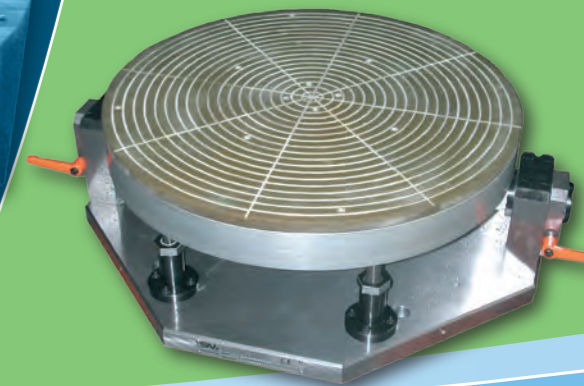
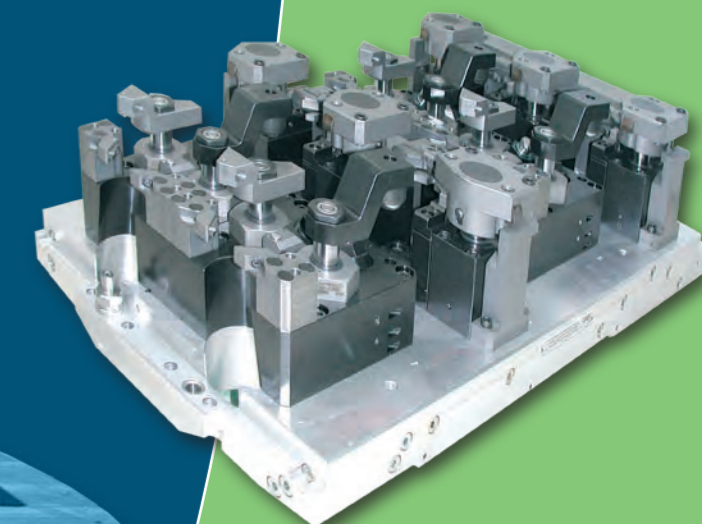
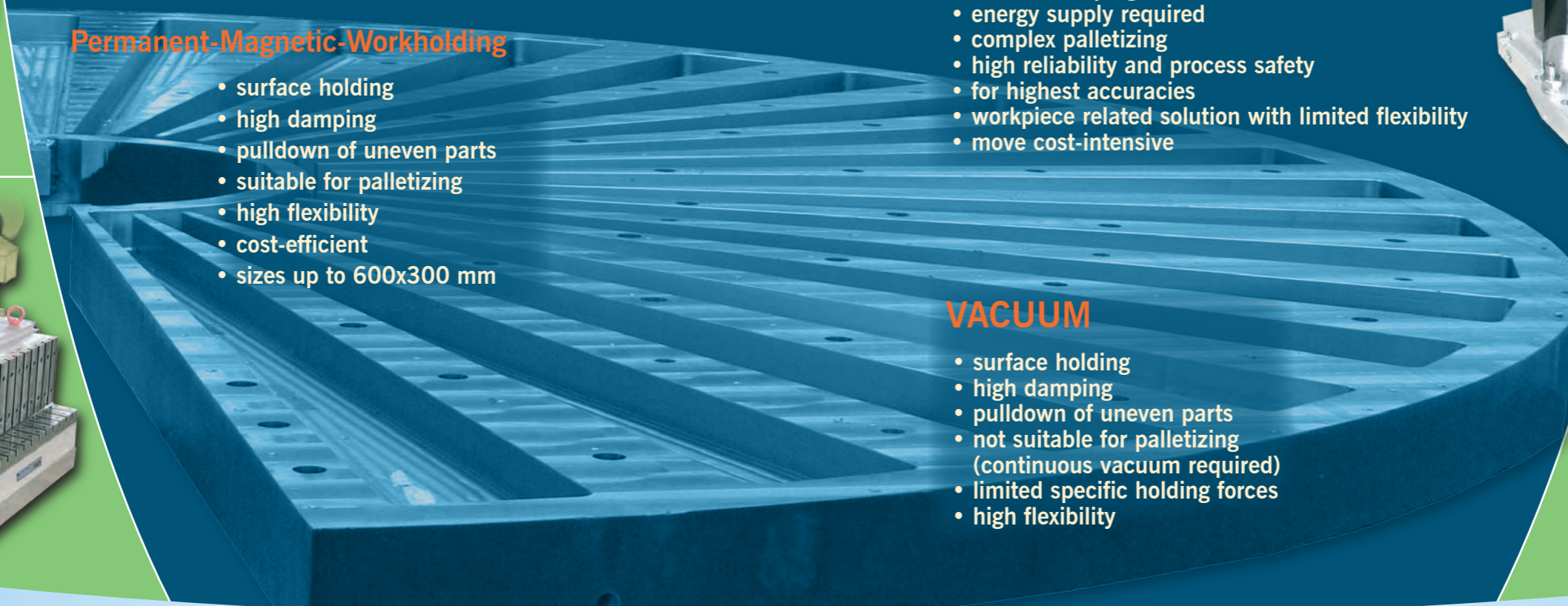
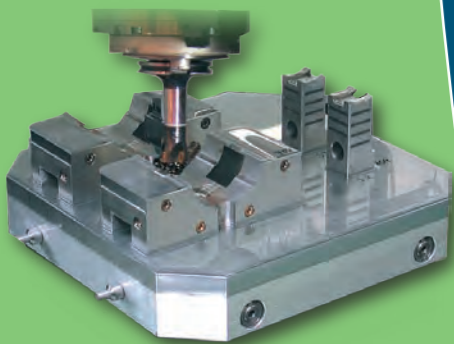
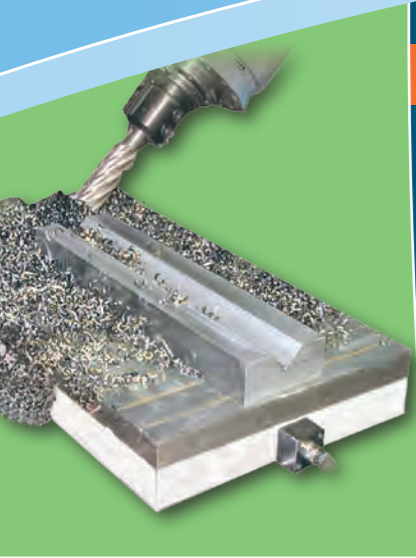
Bigger systems possible in combinations

MECHANIC / HYDRAULIC

- selective holding force initiation
- limited damping
- energy supply required
- complex palletizing
- high reliability and process safety
- for highest accuracies
- workpiece related solution with limited flexibility
- move cost-intensive

VACUUM

- surface holding
- high damping
- pulldown of uneven parts
- not suitable for palletizing (continuous vacuum required)
- limited specific holding forces
- high flexibility



MAGNETIC WORKHOLDING TECHNOLOGY – SELECTION CRITERIA

Application example	Applications	Selection criteria	Machining example	Products	Application example	Applications	Selection criteria	Machining example	Products
	Universal use	<ul style="list-style-type: none"> • Uniform pole division • Flexible work-piece dimensions and alignments 	Workpiece 500x500x50mm Material C 45 Feed 1100 mm/min Cutting depth 6 mm No. of teeth 3 Infeed 10 mm Stock removal volume 360 cm ³ /min	SAV 243.77-55 SAV 243.79 SAV 243.11 		Face and contour machining of thin work-pieces, welding edge preparation	<ul style="list-style-type: none"> • Low magnetic field at high holding forces to pull down thin parts 	Workpiece 200 x 80 x 15 mm Material St 52-3 Feed 1400 mm/min Cutting depth 15 mm No. of teeth 4 Stock removal volume 135 cm ³ /min	SAV 243.11 SAV 243.77-27.5
	Pocket and window milling	<ul style="list-style-type: none"> • Low magnetic field • High holding forces • Good chip removal 	Workpiece 400x400x80mm Material 16 MnCr5 Feed 800 mm/min Cutting depth 15 mm No. of teeth 6 Stock removal volume 530 cm ³ /min	SAV 243.77-55 SAV 243.77-27.5 		Palletising HSC machining	<ul style="list-style-type: none"> • Independent energy supply • Low magnetic field • Reliability • Precision 	Workpiece 150x150 mm Material 16 MnCr45, HRC 52 Feed 2500 mm/min Cutting depth 1 mm No. of teeth 4 Stock removal volume 50 cm ³ /min	SAV 220.79 SAV 220.31
	5-side machining	<ul style="list-style-type: none"> • High holding forces • 5-side access • Low stress clamping 	Workpiece 500x500x60mm Material 16 MnCr5 Feed 2000 mm/min Cutting depth 6 mm No. of teeth 6 Infeed 10 mm Stock removal volume 650 cm ³ /min	SAV 243.77-55 SAV 243.77-85 SAV 243.79 		Rail milling	<ul style="list-style-type: none"> • Extreme air gaps • High holding forces • Extreme robust and wear-resistant 	Workpiece UIC 60 Material Rails steel Cutting cross section 40 x 35 mm	SAV 243.77-Rail

SAV HEXAGONAL POLE TECHNOLOGY SAV 243.79 ELECTRO-PERMANENT MILLING CHUCKS

Development especially for universal use on milling machines

Double, enhanced magnetic system for extreme holding forces at low magnetic field height

Multi-dimensional field set-up for equal force distribution

Also for smaller workpieces from 100x100x15 mm

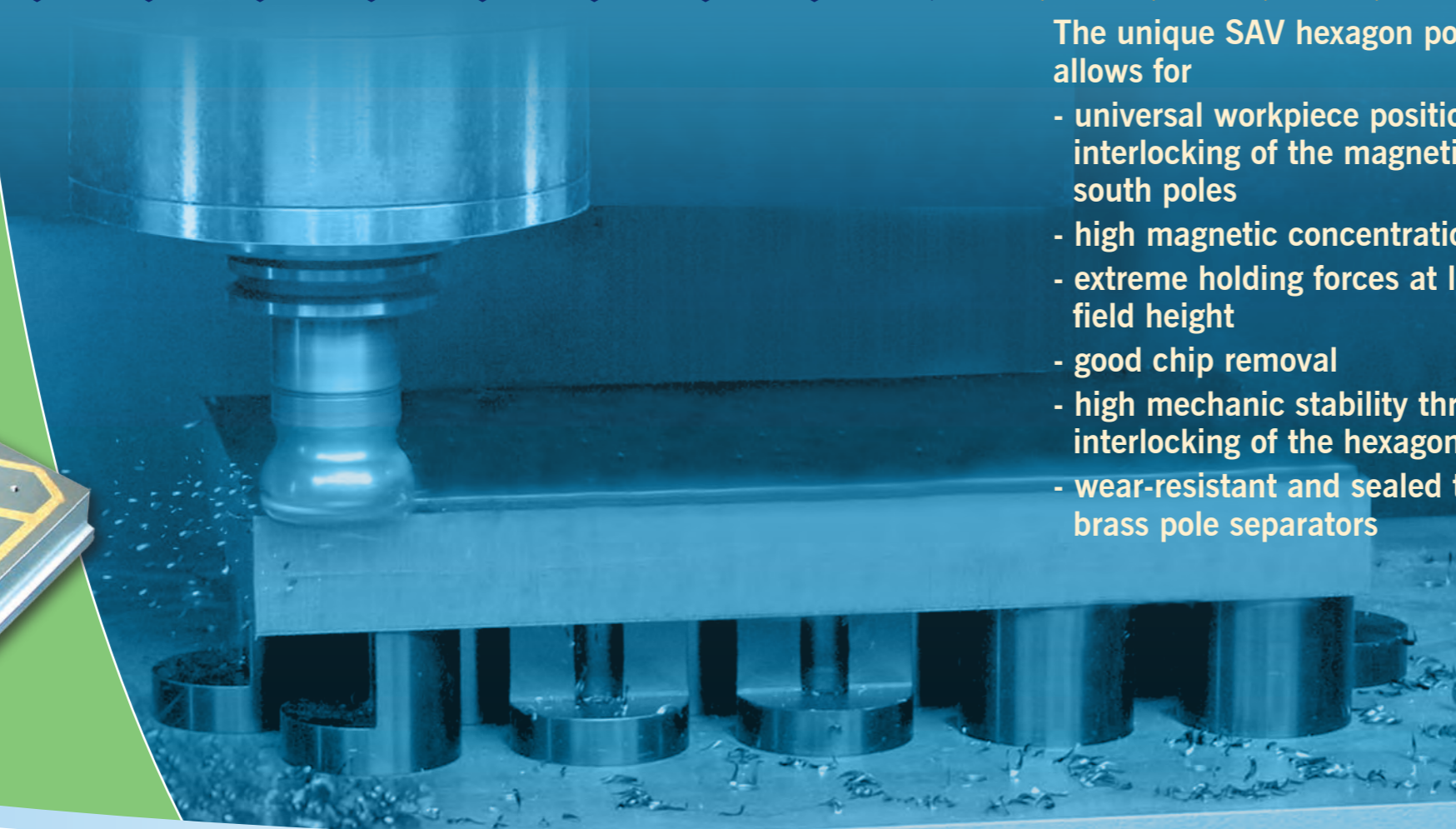
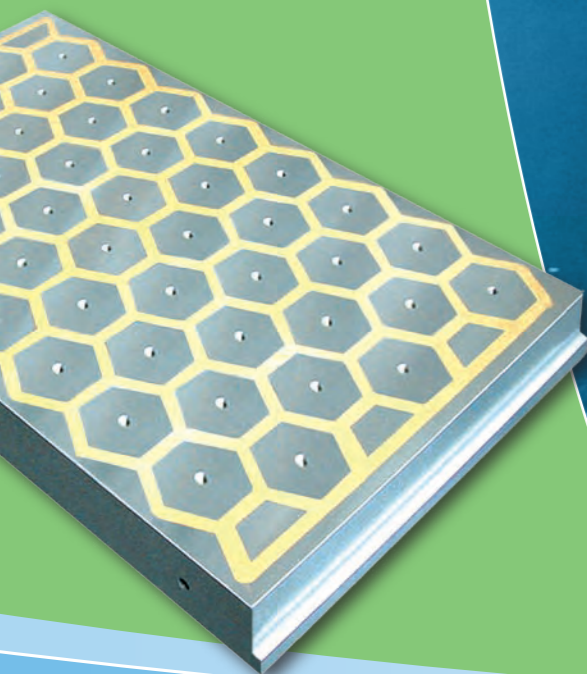
Maximum physical force development

Full holding surfaces magnetically active

Flexible workpiece arrangement

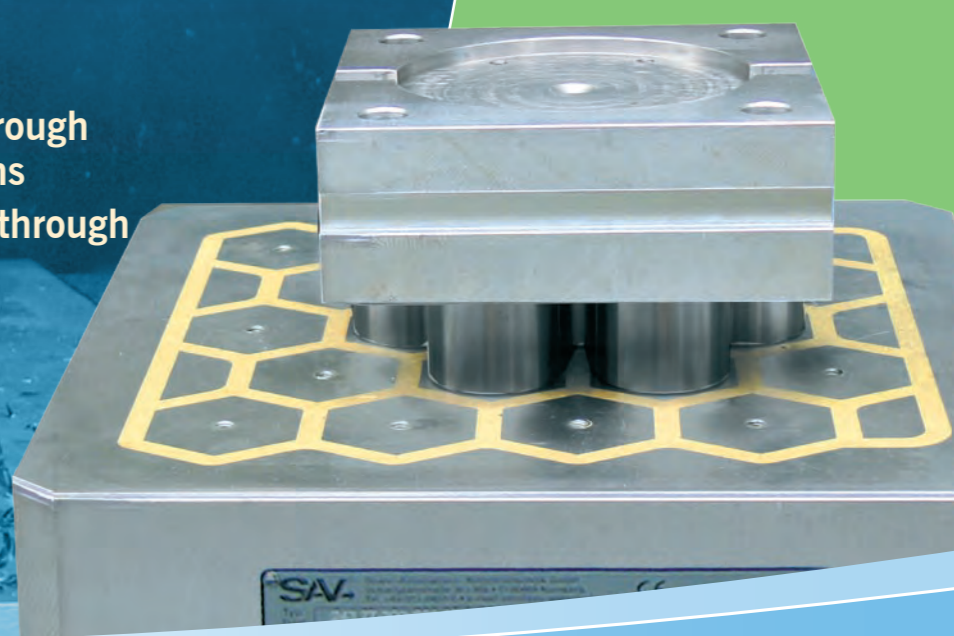
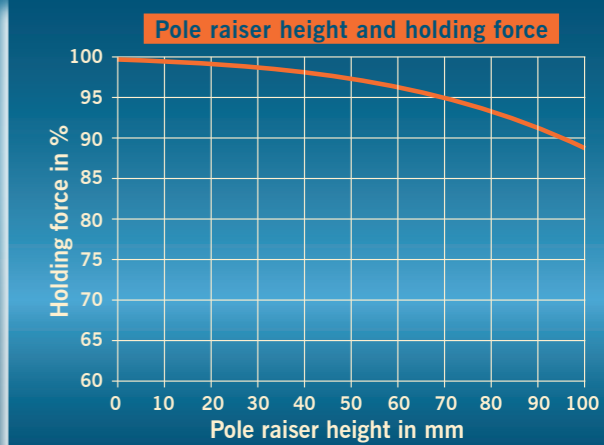
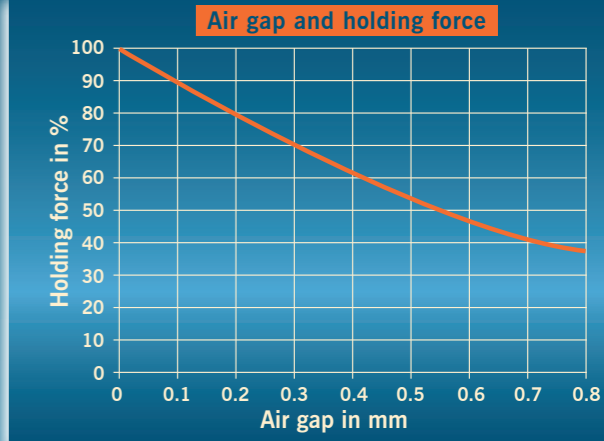
The hexagon:
A natural choice

**POWERFUL
EFFICIENT
UNIVERSAL**



The unique SAV hexagon pole configuration allows for

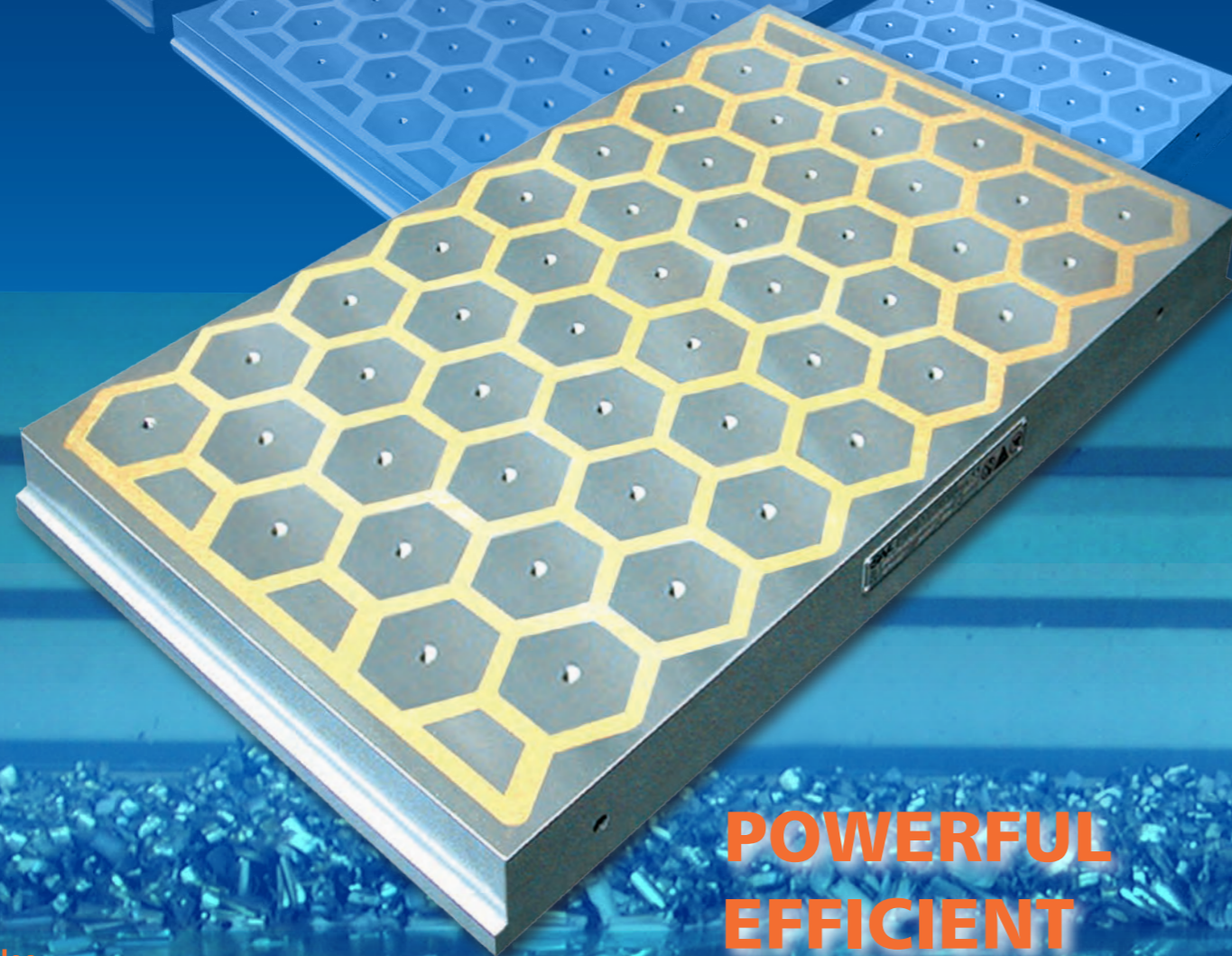
- universal workpiece positioning through interlocking of the magnetic north- and south poles
- high magnetic concentration effects
- extreme holding forces at low magnetic field height
- good chip removal
- high mechanic stability through interlocking of the hexagons
- wear-resistant and sealed through brass pole separators



SAV HEXAGONAL POLE TECHNOLOGY

SAV 243.79

ELECTRO-PERMANENT MILLING MAGNETS



Dimensions in mm			Number of poles	Weight in kg	Control unit maximum imp. current in A
Length	Width	Height ϱ			
360	250	68	12	45	30
500	350	68	30	88	60
630	450	68	48	143	60
770	500	68	56	194	60 x 2

Execution:

- optimized high energy magnetic system
- low height
- electro-permanent magnetic system for absolute safety during power failure
- tapped holes M8 for optional pole raisers
- sealed to IP68
- wearing limit of pole plate 8 mm

Technical details:

Nominal holding force:

- on workpiece 150 N/cm²
- per pole pair 900 daN

Nominal voltage:

- 360 V DC magnet voltage
- 400 V AC mains supply

Due to magnetic workholding and free access to the sides, 5 side machining is possible when using pole raisers

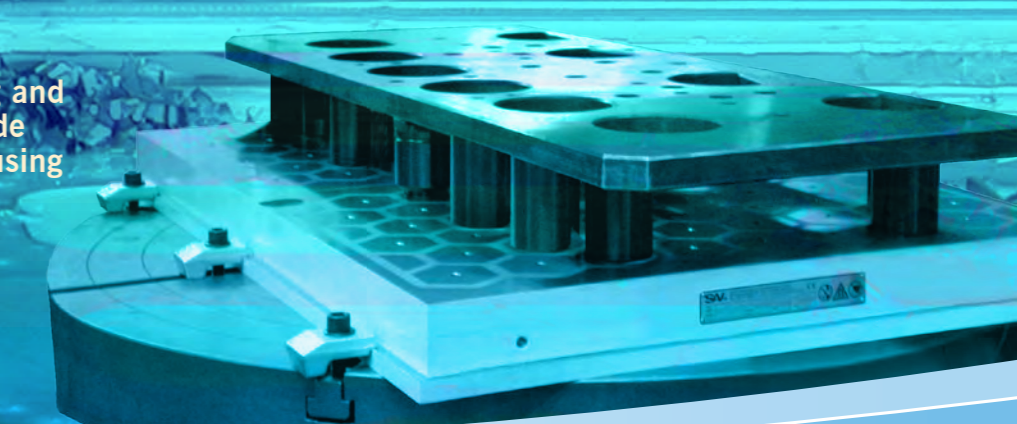
Use:

- for milling, especially for universal machining with high chip removal
- HSC milling (high speed cutting)
- also for bigger air gaps
- minimum workpiece thickness 15 mm
- minimum workpiece size 100x100 mm

**POWERFUL
EFFICIENT
UNIVERSAL**

Heavy duty industrial connector with quick lock.

Simple operation of plug connection



SAV PARALLEL POLE TECHNOLOGY

SAV 243.77

ELECTRO-PERMANENT MILLING MAGNETS

THE NEXT DEVELOPMENT IN CLASSIC MAGNETIC WORKHOLDING

Execution:

- The magnetic system with bigger penetration also bridges bigger air gaps
- Solid mono block design with optimum stiffness
- "real" pole distance N/S
- Pole separator closed with brass and wear resistant

Technical details:

- Optimized high energy magnetic system
- Electro-Permanent magnetic system for absolute safety during power failure
- Tapped holes M8 for optional pole raisers / pole beams
- Flexible use of pole raisers and pole beams for optimal workpiece access

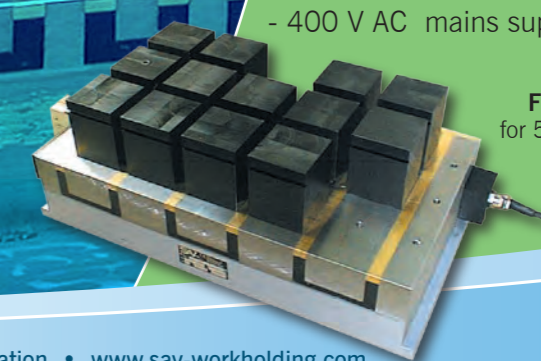
Nominal holding force:

- 195 N/cm² on inducible steel surfaces
- Holding force regulation through control unit and selector switch

Advised nominal voltage:

- 360 V DC magnet voltage
- 400 V AC mains supply

Flexible pole raisers for 5-side machining of uneven workpieces



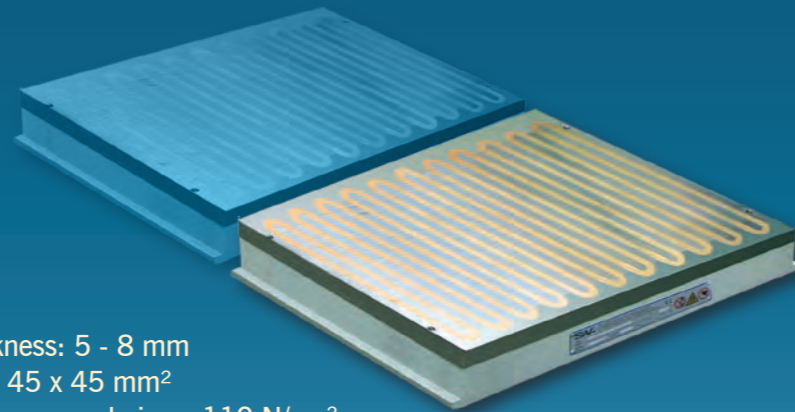
Dimensions in mm			Weight in kg	Control unit maximum imp. current in A
Length	Width	Height		
410	200	80	46.0	30
520	200	80	58.0	30
630	200	80	71.0	30
520	300	80	87.0	60
630	300	80	107.0	60
800	300	80	135.0	60
630	400	80	143.0	60 x 2
800	400	80	180.0	60 x 2

Dimensions in mm			Weight in kg	Control unit maximum imp. current in A
Length	Width	Height		
590	300	97	116.0	30
810	300	97	159.0	30
1030	300	97	202.0	30
1140	300	97	224.0	30
810	400	97	212.0	30
1030	400	97	270.0	60
1030	500	97	180.0	60

Dimensions in mm			Weight in kg	Control unit maximum imp. current in A
Length	Width	Height		
750	300	110	167.0	60
750	400	100	203.0	60
1090	400	100	294.0	60
1430	400	100	386.0	60
750	500	110	278.0	60
1090	500	110	405.0	60
1430	500	110	531.0	60

SAV 243.77 - 27.5

Small pole pitch: 27.5 mm



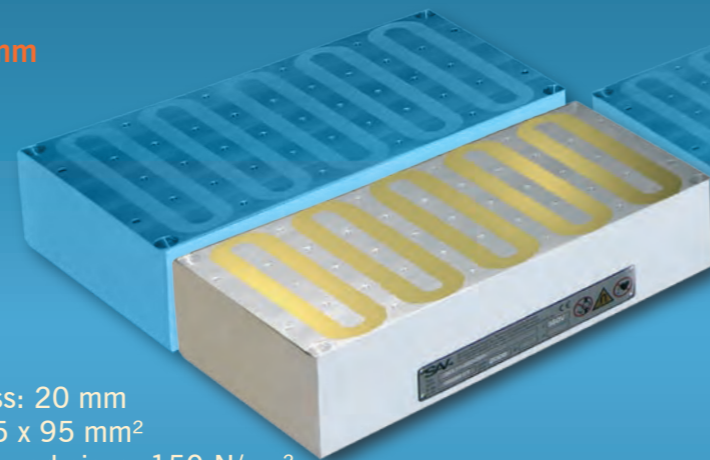
Milling of thin plates

Application:

- Min. workpiece thickness: 5 - 8 mm
- Min. workpiece size: 45 x 45 mm²
- Nominal holding force on workpiece: 110 N/cm²

SAV 243.77 - 55

Universal pole pitch: 55 mm



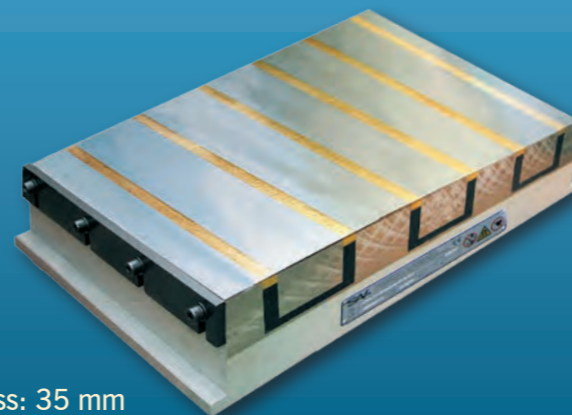
For flexible usage

Application:

- Min. workpiece thickness: 20 mm
- Min. workpiece size: 95 x 95 mm²
- Nom. holding force on workpiece: 150 N/cm²

SAV 243.77 - 85

Wide pole pitch: 85 mm



For heavy milling of big and thick workpieces. For big air gaps.

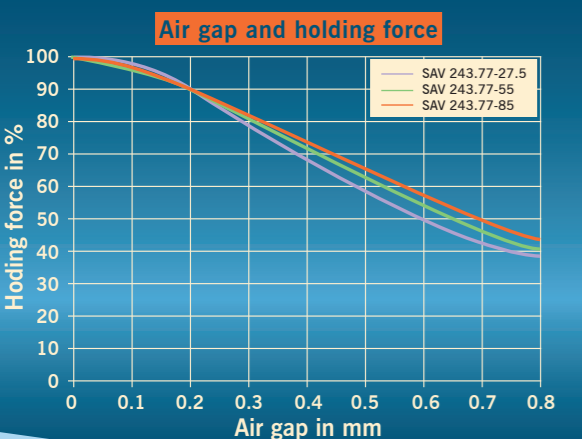
Application:

- Min. workpiece thickness: 35 mm
- Min. workpiece size: 150 x 150 mm²
- Nominal holding force on workpiece: 170 N/cm²

The right way to success!

Parallel pole configuration for machining on the limits

- Extreme forces through large steel poles
- Densely packed high grade magnetic materials
- Robust mono block construction
- Exceptional air gap behavior also for thin parts
- Flexible workpiece adjustment through top tooling
- 100% active surfaces



SAV RAIL CLAMPING TECHNOLOGY

MILLING OF RAILS

SAV 243.77-RAIL

Use:
For coarse chip removal of the sides, foot and bracket-pockets of railway rails.

The first step of the dual magnetic system allows the side-alignment. In the second step the main magnetic base is activated.

Nominal holding force:
195 N/cm² on full inducible steel surface

Execution:

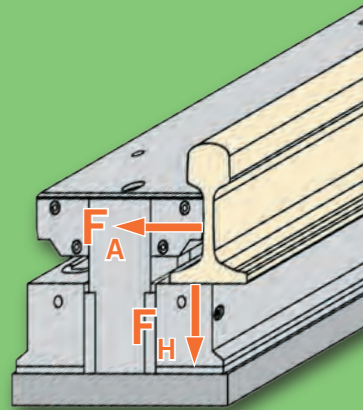
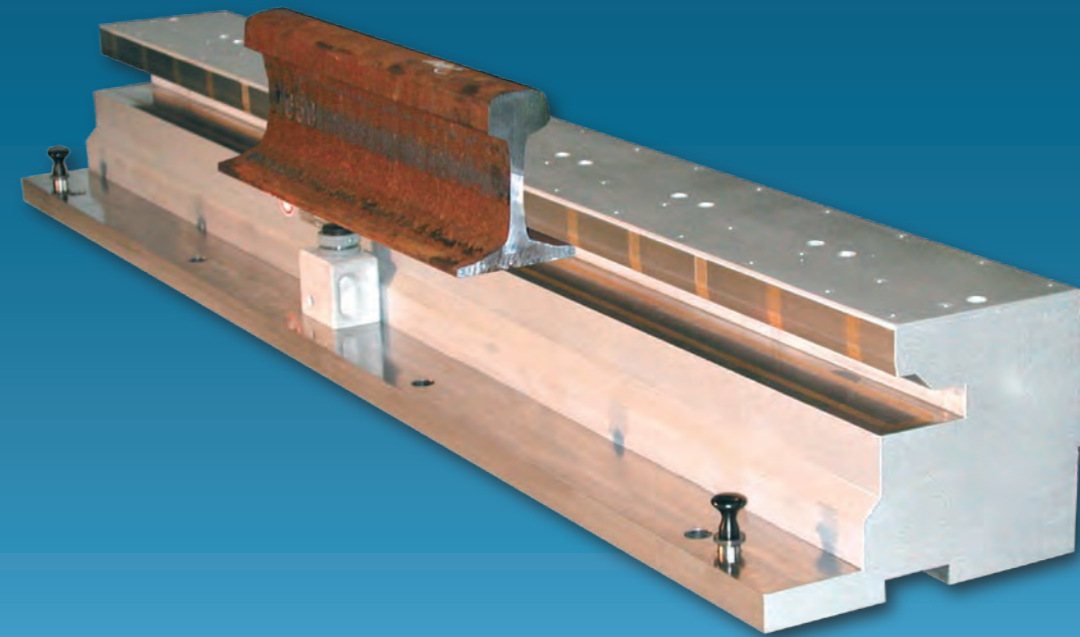
- Double high energy magnetic system
- Holding forces in physically maximum range
- Due to deep magnetic field, bigger air gaps up to 10 mm can be bridged
- Solid mono block design
- Pole separator with brass; high wearing resistance



ELECTRO-PERMANENT MAGNETIC

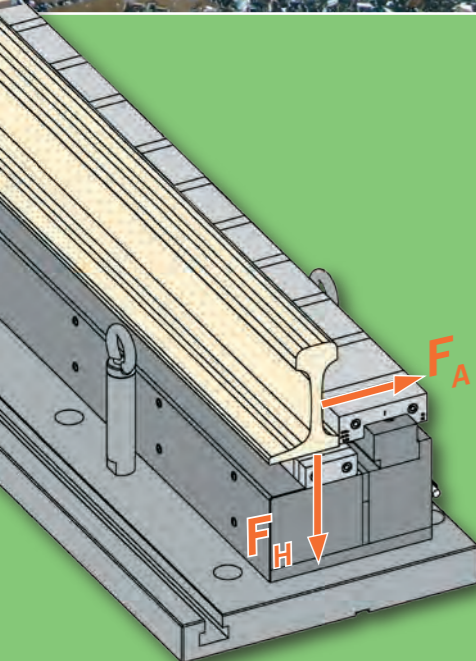
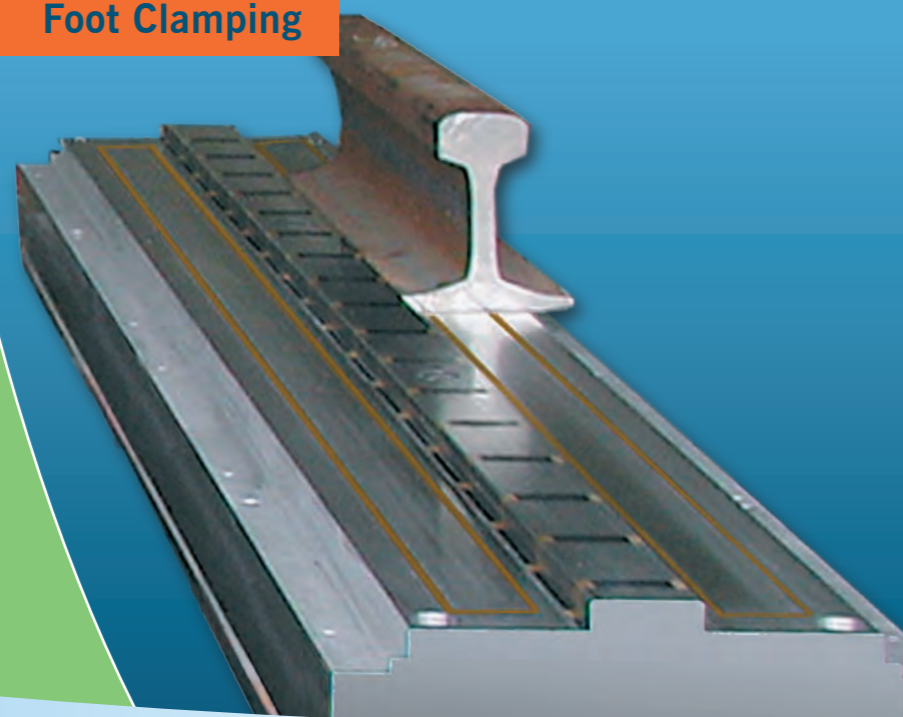
Web Clamping

WORKHOLDING SYSTEMS

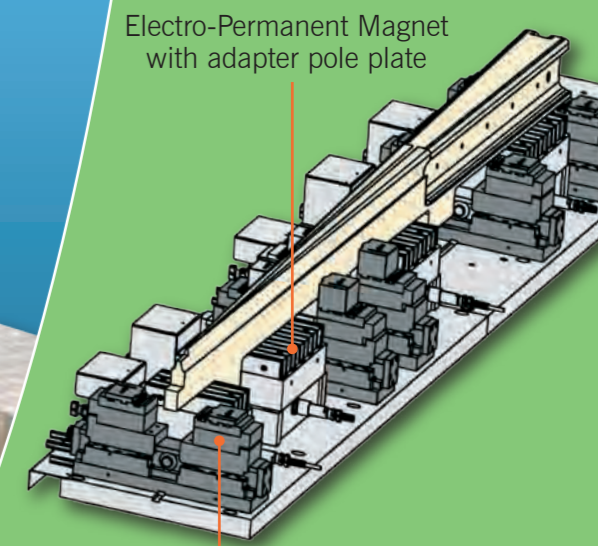


- F_A for transverse alignment of rail
- F_H generated in second step through base magnet

Foot Clamping



COMBINATION HYDRAULIC AND MAGNETIC



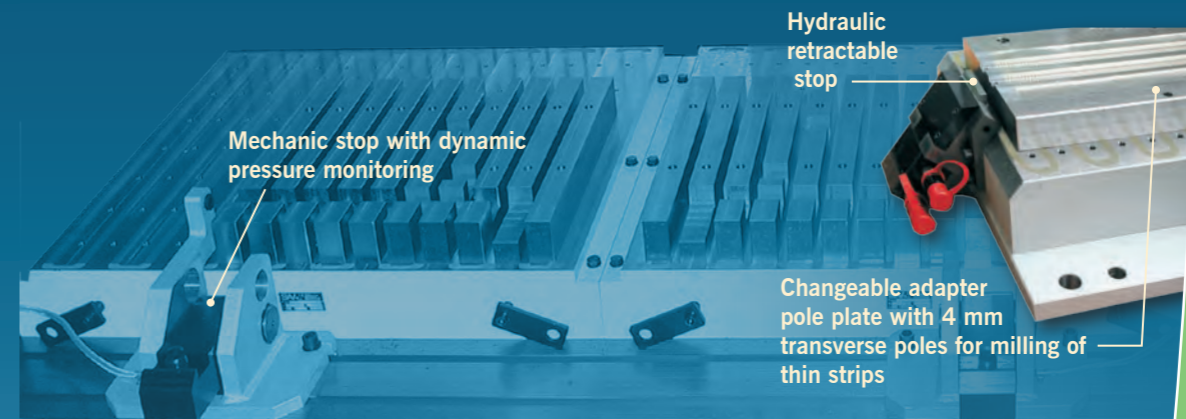
Hydro-vice centric / floating, adaptable

SAV POLE RAISER TECHNOLOGY

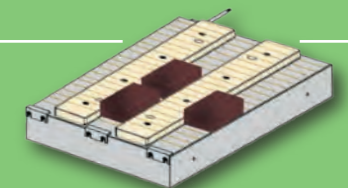
SAV 248.70

SAV POLE PLATE TECHNOLOGY / TOP-TOOLING

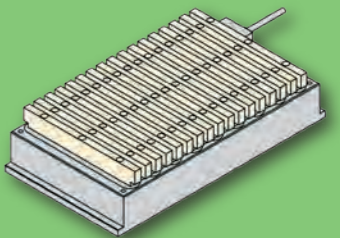
Mechanic or hydraulic stops



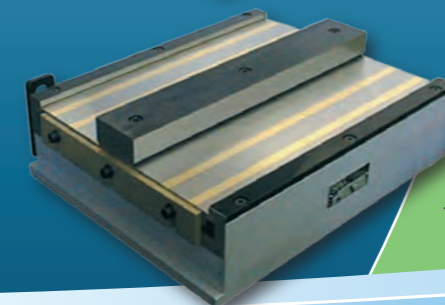
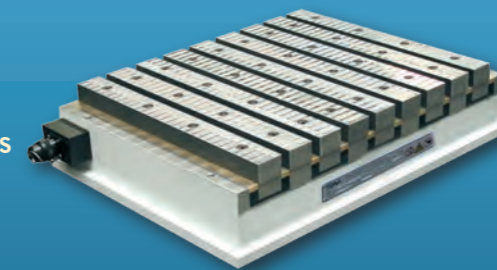
- retractable for 5-side machining
- suitable for automation
- with position monitoring
- for mechanic workpiece positioning



- free access for drilling of through holes possible
- wear-resistant
- simple cleaning of chips in automated systems
- no magnetic short-circuit through chips
- workpiece positioning and heavy machining through mechanic/magnetic stops



- 5-side machining possible
- free access for drilling of through-holes
- design with magnetic active stop
- wear-resistant
- simple and cost-effective
- simple cleaning
- short set-up times



Pole beams

Electro-permanent magnetic chuck with wearing pole beams

Electro-permanent magnetic chuck with magnetic active stops for small parts

Use:

- 5-side machining possible
- Free access for drilling of through-holes
- Reduction of air gaps
- Deformation-free clamping of uneven plates from 15-20 mm thickness with flexible pole raisers
- Execution as mechanic stop for positioning and increase of machining force possible

Pole raiser – rectangular



Fixed pole raiser

Flexible

Type	Execution	Dimensions in mm			Weight in kg
		Length	Width	Height	
248-70-48-PVS 3	Fixed	48	40	53.5	0.8
248-70-70-PVS 4	Flexible	70	70	86.5	3.3
248-70-48-PVF 3	Fixed	48	40	51-56	0.8
248-70-70-PVF 4	Flexible	70	70	84-89	3.5

Adapter pole plates

Electro-Permanent Magnetic Chuck with special profiled adapter pole plate



- free access for drilling of through holes possible
- wear-resistant
- simple cleaning of chips in automated systems
- no magnetic short-circuit through chips
- workpiece positioning and heavy machining through mechanic/magnetic stops

Pole raiser – round



Full pole raiser

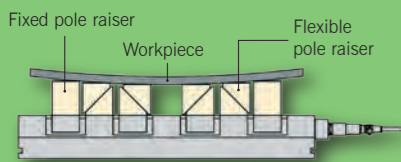
Half pole raiser

Flexible pole raiser

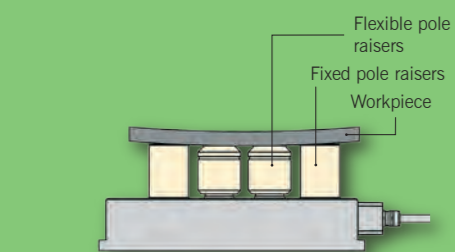
Type	Execution	Dimensions in mm		Weight in kg
		Diameter	Height	
248-70-55-PVS-RV	Fixed, full	55	75	1.8
248-70-55-PVS-RH	Fixed, half	55	75	1.4
248-70-60-PVF-RV	Flexible, full	60	70-80	1.5

Fixed pole raisers, which can be machined to fit the workpiece profile, attract the workpiece to the magnetic fixture and allow for high cutting rates

Flexible pole raisers adapt to the workpiece surface so that a fixation can be achieved with minimum deformation (for instance for rough parts with bigger tolerances).



Pole raisers for face milling



SAV CONTROL TECHNOLOGY

SAV 876.12

ELECTRONIC POLARITY REVERSING CONTROL UNIT

Advantages:

- Short circuit proof
- Fully electronic
- Extended diagnostics
- Monitoring of short circuit to ground
- Very compact design
- Pre-programmed settings
- Individual programmability
- Automatic mains-frequency recognition
- Functional design and operation guidance

Features:

- small and compact
- easy to integrate in any machine
- operator-friendly through LCD clear text display and foil keys
- reliable and safe

Use:

For electro-permanent magnetic clamping systems. Also suitable for retrofitting. Activation through hand remote unit or PLC signals.

Function:

Electronic polarity reversing control units are used as impulse-control for electro-permanent magnetic chucks

For your safety, the unit permanently monitors the current source, its own power components and all connection cables including magnet coil.

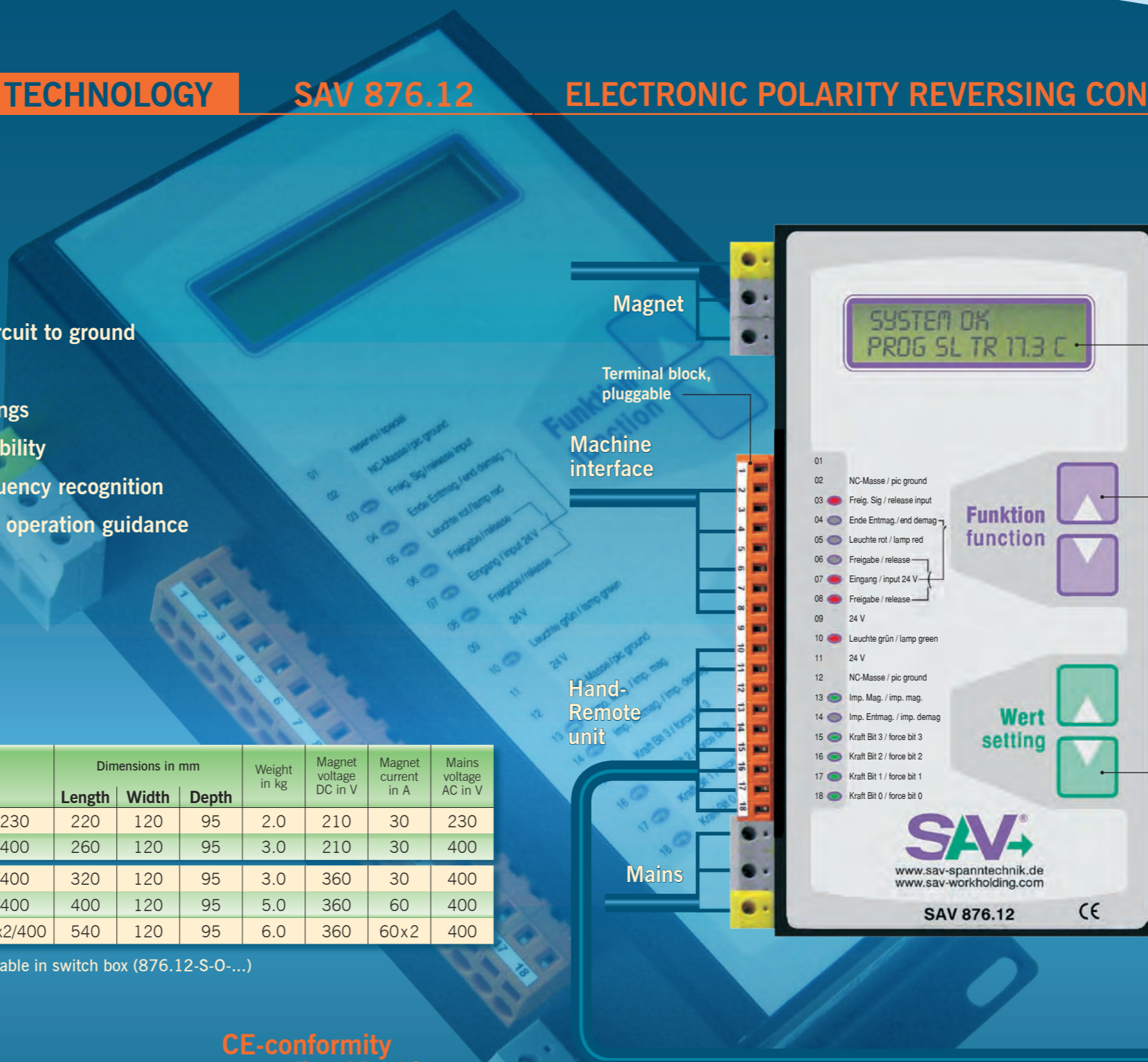
Machine release through safety contact

Holding force regulation through coded switch.

Ordering no.	Dimensions in mm			Weight in kg	Magnet voltage DC in V	Magnet current in A	Mains voltage AC in V
	Length	Width	Depth				
876.12-E-0-210/30/230	220	120	95	2.0	210	30	230
876.12-E-0-210/30/400	260	120	95	3.0	210	30	400
876.12-E-0-360/30/400	320	120	95	3.0	360	30	400
876.12-E-0-360/60/400	400	120	95	5.0	360	60	400
876.12-E-0-360/60x2/400	540	120	95	6.0	360	60x2	400

On request also available in switch box (876.12-S-0-...)

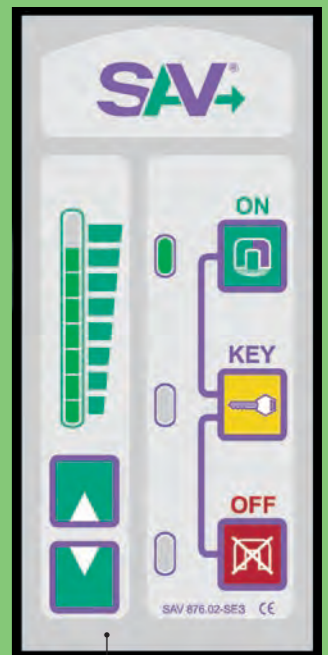
CE-conformity according Machine, Low-Voltage and EMC Directives.



Text display in German / English for operation status and fault messages

Simple menu-guide through foil keys

Remote control unit SAV 876.02-SE3



Panel suitable for integration in machine console

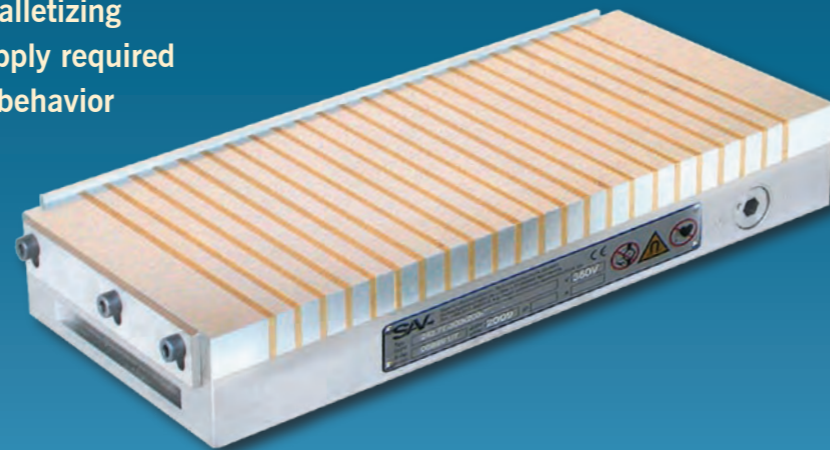
SAV PERMANENT MAGNETIC WORKHOLDING TECHNOLOGY

SAV Permanent Magnetic Chuck

SAV 243.11

Advantages:

- suitable for milling of small parts
- simple ON – OFF mechanism
- suitable for palletizing
- no energy supply required
- good air gap behavior
- cost-efficient



With solid transverse pole pitch $P = 15$ mm, with Neodymium magnets, enhanced system.

Dimensions in mm			Magnetic active range in mm	Weight in kg
Length	Width	Height $^{+0.5}_{-2}$		
250	150	56	199	17.0
300	150	56	244	20.0
350	150	56	289	24.0
400	200	56	349	35.0
500	200	56	439	44.0
600	200	56	544	52.0
600	300	56	544	67.0

SAV MILLING MAGNETS

Neodymium Magnetic Chuck

SAV 243.10

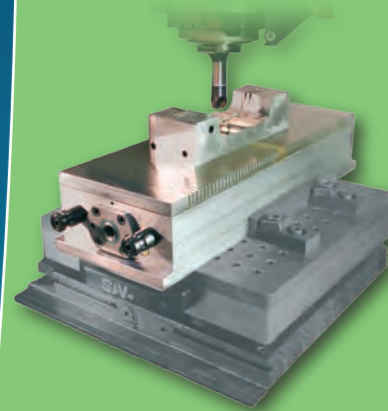
Advantages:

- Very small, real pole pitch
- For very small and high alloyed workpieces



With $P=6$ mm transverse pole pitch. Neodymium magnets, extreme high holding force

Dimensions in mm			Magnetic active range in mm	Weight in kg
Length	Width	Height $^{+0.5}_{-2}$		
400	150	82	2 x 171	35.0



Use:

For workpieces that are particularly difficult to clamp as well as small or thin parts. Also suitable for hard milling.

Design:

- Extreme high holding force through special developed design
- Stable full steel body
- ON-OFF control on both end faces
- 6 mm real transverse pole pitch

Technical details:

- Nominal holding force on inducible steel surfaces: 180 N/cm²
- Magnetic field height: approx. 4 mm
- Pole plate wearing limit: 3 mm



Use:

Suitable for heavy chip removal, such as rough milling.

Clamping of small workpieces possible due to concentrated magnetic field.

The low magnetic field prevents magnetization of the tool.

Design:

- ON-OFF control by means of hand lever
- In the OFF position a weak opposing field eases the removal of the workpiece
- The magnets are equipped with longitudinal and transverse stop rails
- Laminations from 3 mm brass / 12 mm steel

Technical details:

- Nominal holding force on workpiece: 150 N/cm²
- Magnetic field height: approx. 12 mm
- Pole plate wearing limit: 5 mm

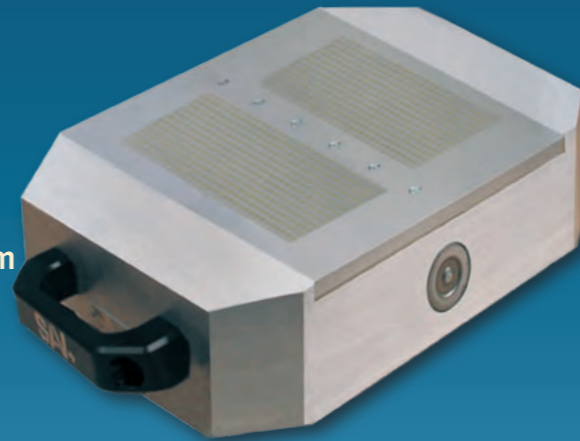
SAV MAGNETIC PALLETS

SAV 220.31

Permanent parallel pole

Advantages:

- Workpiece clamping outside the machine, during machining operation
- For small parts and parts that are difficult to clamp
- Adaption to zero-reference-system according requirements
- High precision design



Dimensions in mm			Active surfaces in mm	No. of switches	Weight in kg
Length	Width	Height*			
240	240	60	2x 126 x 80	1	18.0
280	280	66	2x 166 x 80	2	21.5
320 ⁻¹ _{-1.3}	320 ⁻¹ _{-1.3}	65	2x 200 x 80	1 / 2	25.0 / 36.0

* without reference system

Material:

Aluminum housing with pole plate of mild and stainless steel (St 37 / V4A)

Technical details:

- parallelism: 0.01 mm
- pole plate wearing limit: 2 mm
- nominal holding force on workpiece: 140 N/cm²
- stainless execution possible
- threaded holes for parallel and angled side stops possible
- low magnetic field

Additional clamping holes and surface on request

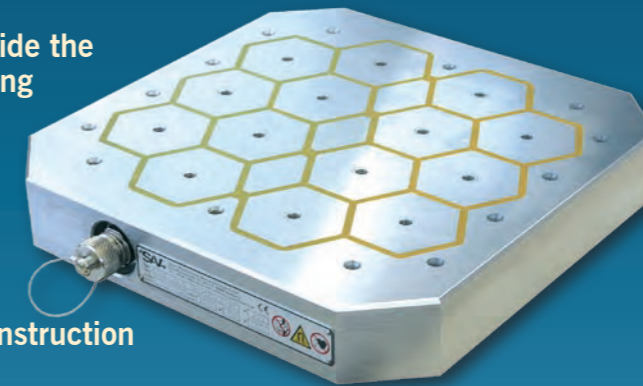
SAV MAGNETIC PALLETS

SAV 220.79

Electro-Permanent Hexagonal Pole

Advantages:

- workpiece clamping outside the machine, during machining operation
- universal use
- adaption to reference systems according requirements
- robust, high precision construction
- low height
- limited weight



Dimensions in mm			No. of poles	Weight in kg	Control unit max. imp. current in A
Length	Width	Height*			
160	100	64	2	6.4	30
240	240	50	6	23	30
240	240	56	6	20	30
320 ⁻¹ _{-1.3}	320 ⁻¹ _{-1.3}	50	10	41	30
400	400	52	20	66	60
500	500	52	24	102	60 x 2

* without reference system

Accessories pole raisers see page 18

Use:

- for milling, especially for universal machining with high chip removal
- HSC milling
- also for bigger air gaps
- minimum workpiece thickness 15 mm
- minimum workpiece size 100x100 mm



Design:

- optimized high energy magnetic system
- low height
- bridges bigger air gaps
- electro-permanent magnetic system for absolute fail safe operation during power failure
- tapped holes M8 for optional pole raisers

Technical details:

- nom. holding force per pole pair: 800 daN
- nom. holding force on workpiece: 140 N/cm²
- Parallelism: 0.01 mm
- Pole surface wearing limit: 6 mm

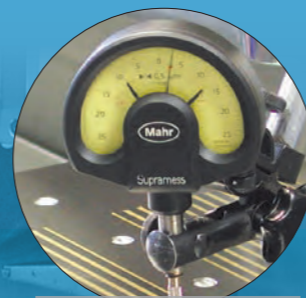
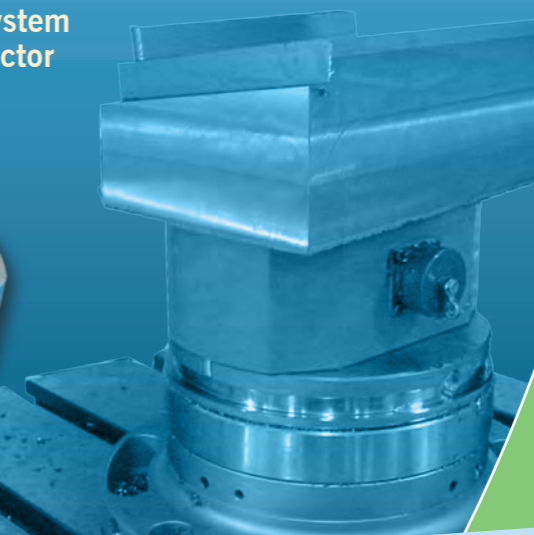
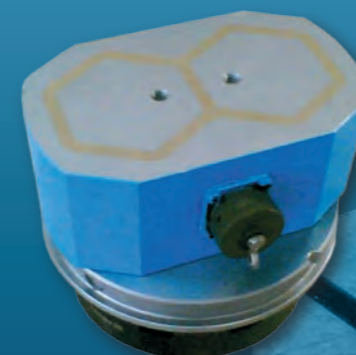
Advised nominal voltages:

- 210 V DC Magnet voltage
- 230 V AC Mains voltage

2-pole execution

- for 5-axis HSC machining
- with zero-reference system and heavy duty connector

SAV 243.79 - 160 x 100



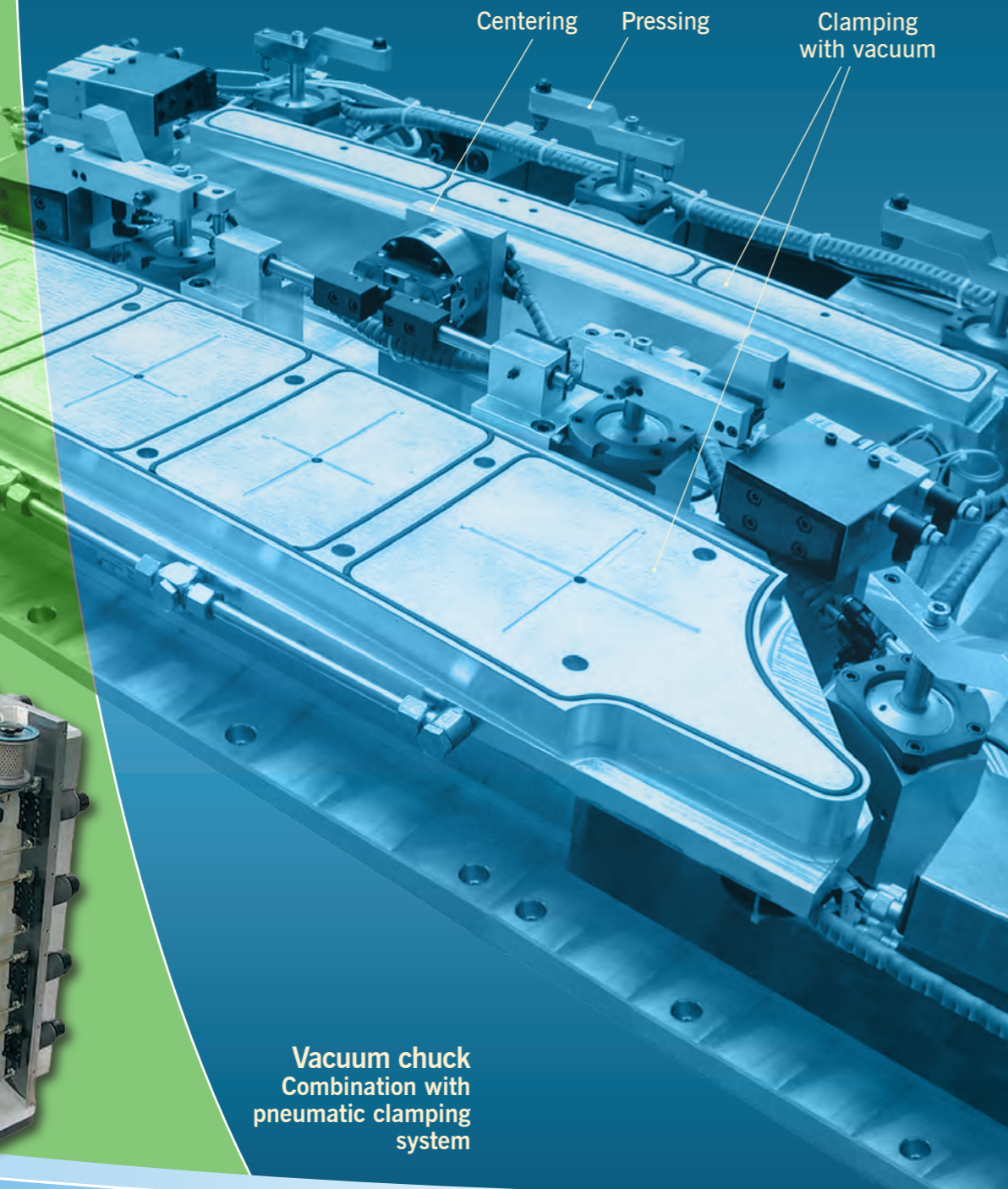
Stability: ± 0.001 mm

SAV VACUUM TECHNOLOGY

SPECIAL SOLUTIONS

Advantages:

- Use for clamping of non-magnetic light metal alloys and fiber-reinforced composites for milling applications
- Suitable for clamping of deformation and vibration sensitive parts



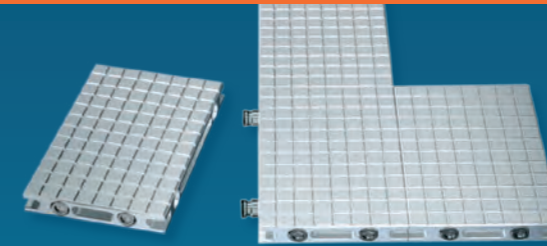
Vacuum chuck
Combination with
pneumatic clamping
system

MODULAR VACUUM CHUCKS

Modular Vacuum Grid Chuck

SAV 249.03

For heavy
machining



Length	Dimensions in mm			Grid pitch	Weight in kg
	Width	Height			
300	200	32.5	12.5	12.5	5
300	400	32.5	12.5	12.5	10
600	400	32.5	12.5	12.5	20
300	200	32.5	25.0	25.0	5
300	400	32.5	25.0	25.0	10
600	400	32.5	25.0	25.0	20

Use:

- For plain shaped workpieces with rough surfaces for heavy chip removal
- High holding forces, universal use
- Secure clamping of un-machined workpiece surfaces due to high friction coefficient of clamping surface
- Sealing cord evens out small irregularities between workpiece and chuck surface

Modular Vacuum Sinter Metal Chucks

SAV 249.04

For practically all materials



Length	Dimensions in mm			Weight for Sinter in kg
	Width	Height		
300	200	32.5	7.1	
300	400	32.5	14.2	
600	400	32.5	28.4	

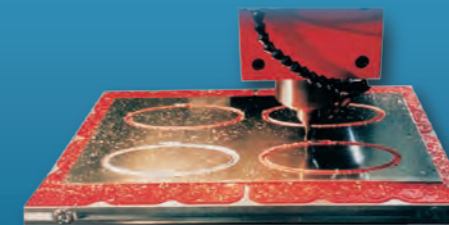
Use:

- Preferred for following materials:
- Thin (e.g. papers, foils, PCB's, metal tapes)
 - Fine (e.g. Optics)
 - Soft (e.g. Rubber) or for measuring and testing processes in micro / nano range
 - Precision chipping
 - Silicon wafer production

Modular Vacuum Mat Chuck

SAV 249.05

With clamping mats



Length	Dimensions in mm			Design	Weight in kg
	Width	Height			
300	200	30	Single	5.0	
300	400	30	Double	10.0	
600	400	30	Quadruple	20.0	

Use:

For finish machining of workpieces, especially for through-milling and drilling without loss of vacuum

Vacuum mat thickness tolerance:
± 0.04 mm
Concave up to: 0.1 mm

Vacuum-Hydraulic
Clamping System
Energy supply through
the machine table



SAV SPECIAL SOLUTIONS

Individual requirements demand individual solutions!

In the area of workpiece positioning, the combination with magnetic clamping systems opens complete new ranges of application.

Multi-clamping system

- Combination magnetic, hydraulic, mechanic and vacuum
- For universal geometries and materials

Integrated automatic hydro-coupling

Grid-Vacuum clamping surface

Hydro-vice in special execution

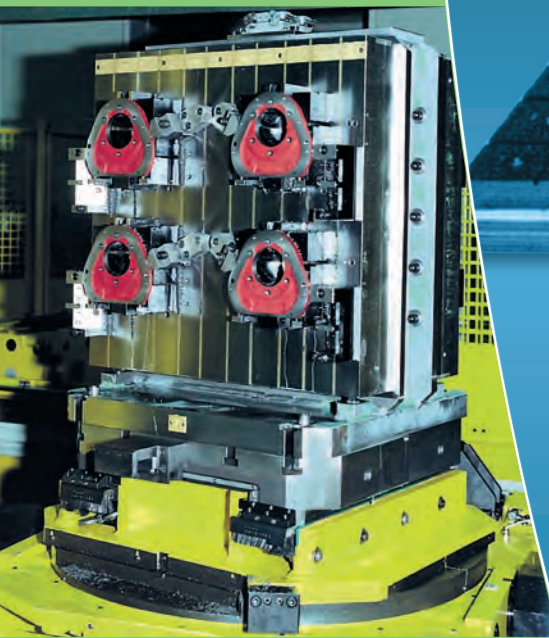
High energy magnet in special execution

Fitting holes for grid-clamping system

Efficient production of large batches is only possible with optimized jigs and fixtures.

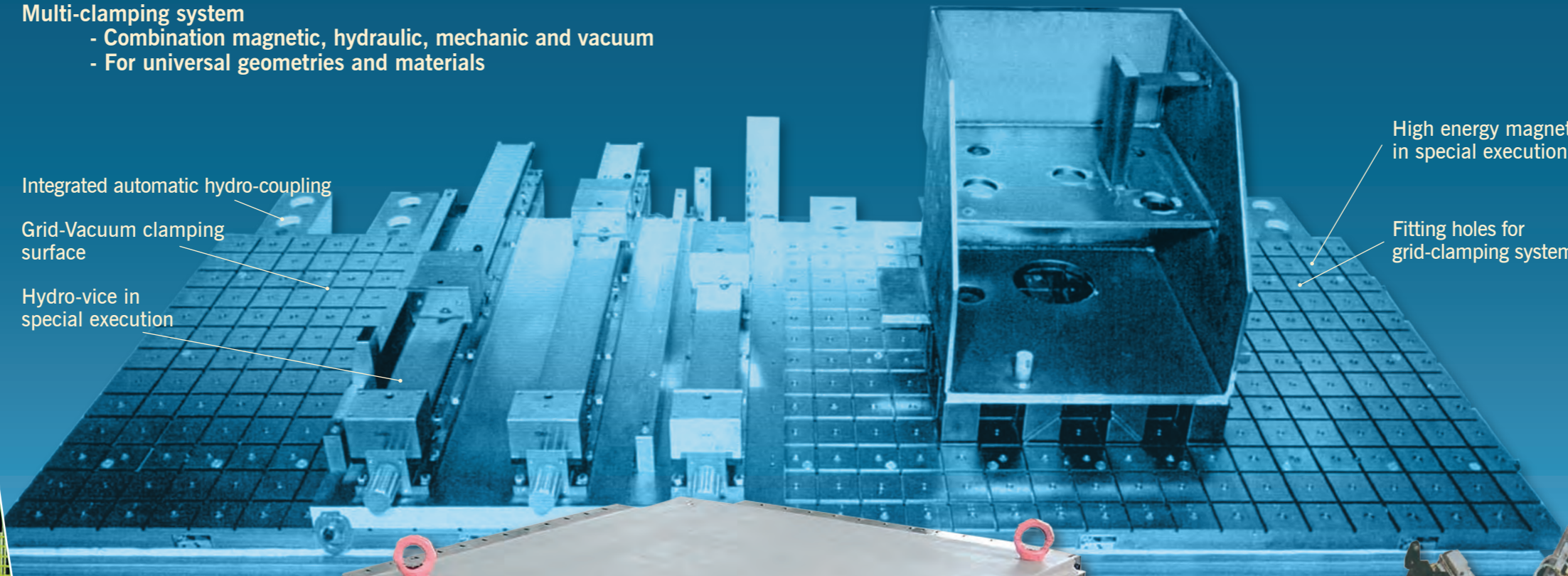
Here the emphasis is on:

- Precision
- Process reliability
- Availability
- Service



Electro-permanent magnetic fixture

For drilling and milling of cast iron parts on chained machine centers



Special magnetic fixture

- For hard-milling of dies
- Clamping cube with 8 magnets
- Dimension 1400x1400 mm



Special Clamping Fixture for sports car hardtop of magnesium die casting

For drilling and milling. Complete fixture hydraulically handled on base frame.

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WORKHOLDING

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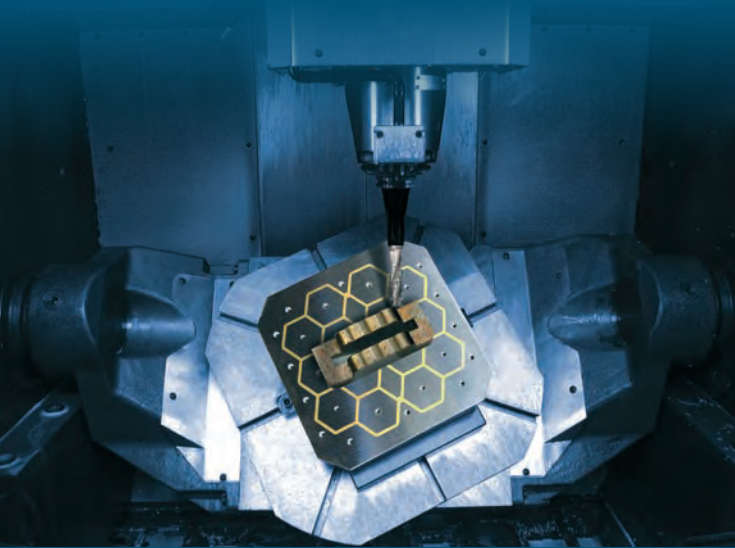
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WORKHOLDING AND AUTOMATION



DESIGN

DEVELOPMENT

PRODUCTION

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SERVICE

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