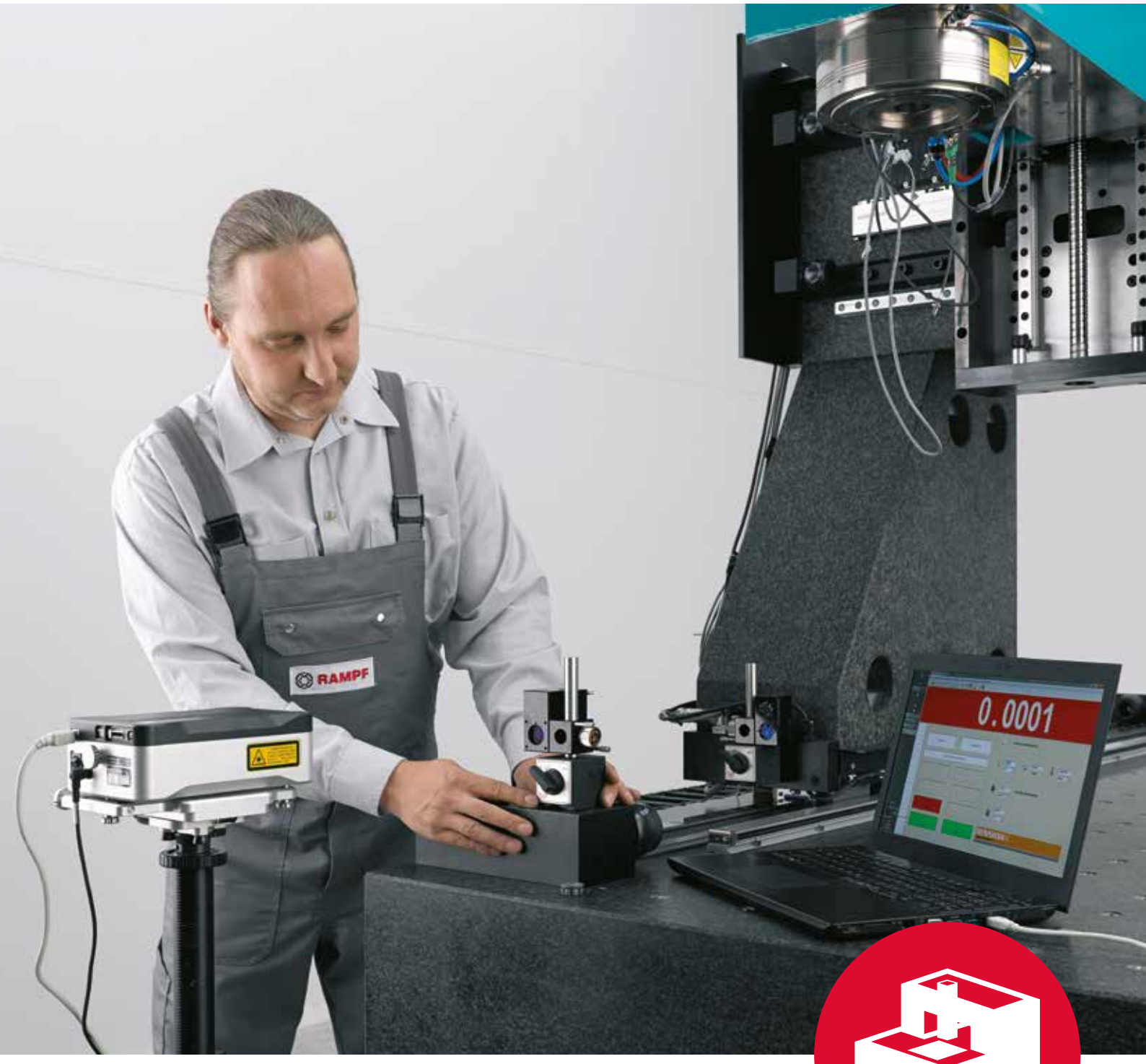
RAMPF
discover the future

EPUSTONE I **Machine beds made of natural hard stone**



Machine Systems

EN

Innovative solutions for highly dynamic production technology

RAMPF Group

The international RAMPF Group stands for **engineering and chemical solutions** and caters to the economic and ecological needs of industry.

Our range of competencies includes:

> Production and recycling of **materials** for modeling, lightweight construction, bonding, and protection
> **Technical production systems** for precise, dynamic positioning and automation, as well as technologies for complex composite parts production
> **Comprehensive range of solutions and services**, particularly for innovative customer-specific requirements

This know-how helps our customers achieve profitable and sustainable growth.

Trusting relationships are of utmost importance to RAMPF. They are a vital part of the success story of the family-owned company, which now spans over 35 years.

RAMPF thinks globally and acts locally. The company has production facilities strategically located in Germany, in the United States, Canada, China, and Japan.

RAMPF Machine Systems

Based in Wangen (near Göppingen), Germany, the company is the market-leading development partner and system supplier of complete machine bed solutions and machine systems.

Its service portfolio includes system solutions, trunk machines, basic machinery, and multi-axis positioning and moving systems based on machine beds and machine bed components made from alternative materials such as mineral casting, hard stone, ultra-high performance concrete, aluminum foam, and fiber composites.

High-precision machine systems are created using innovative replication, grinding, and lapping processes in temperature-controlled production environments.

This makes RAMPF Machine Systems the full-service partner for developing and manufacturing future-oriented machinery and production technology for a wide range of industries.

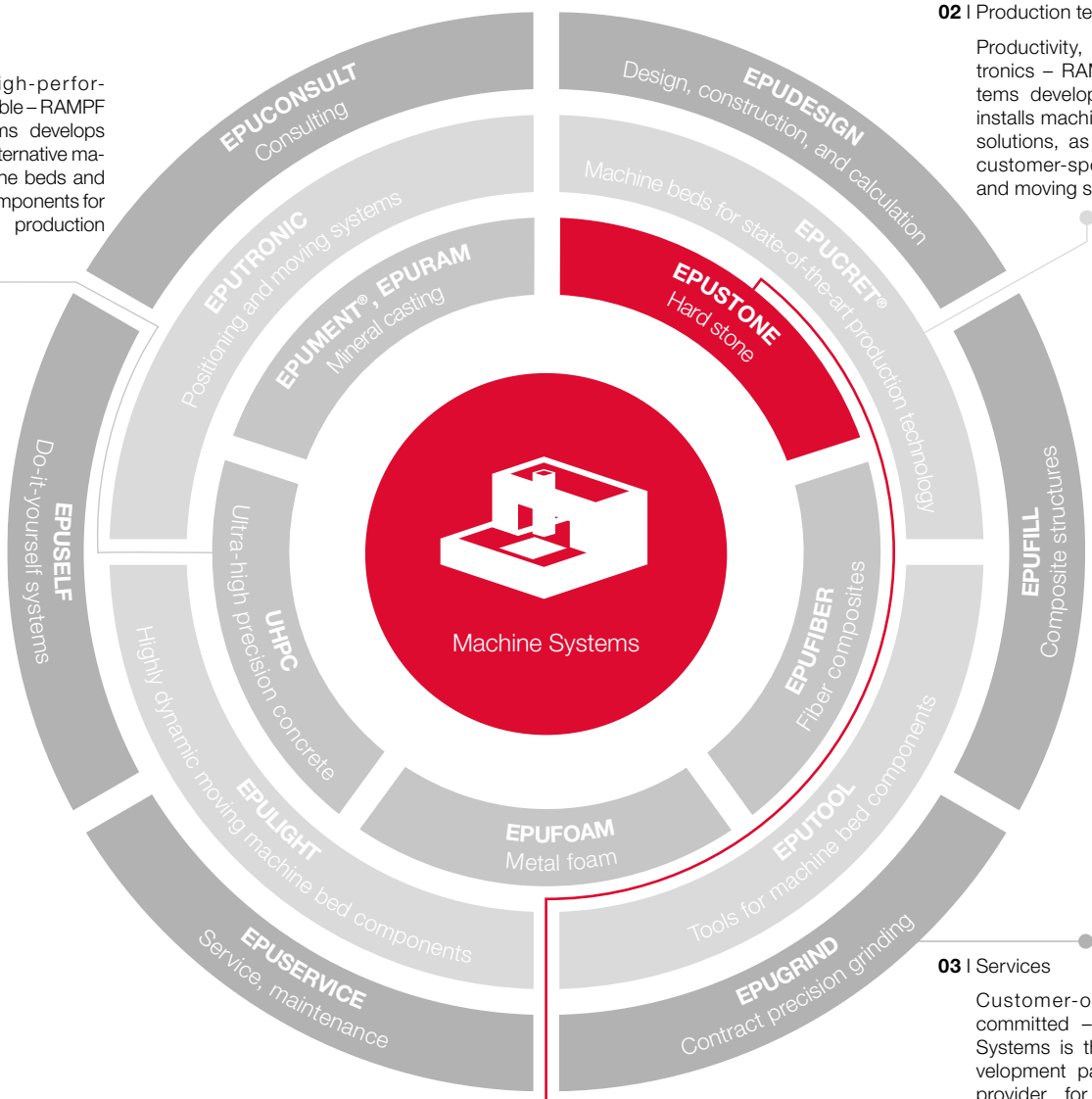
Range of products and services

01 I Materials

Innovative, high-performance, sustainable – RAMPF Machine Systems develops and produces alternative materials for machine beds and machine bed components for highly dynamic production technology

02 I Production technology systems

Productivity, precision, mechatronics – RAMPF Machine Systems develops, produces, and installs machine beds as system solutions, as well as complete, customer-specific positioning and moving systems



03 I Services

Customer-oriented, skilled, committed – RAMPF Machine Systems is the end-to-end development partner and service provider for innovative production technology solutions – from machine base to basic machinery

» With its EPUSTONE brand, RAMPF Machine Systems offers a comprehensive range of services for processing natural hard stone (commonly known as granite) in short production runs for specialized mechanical engineering applications, prototypes, or pilot machines. The stone used is plutonic rock with a very dense and homogeneous microstructure. Special grinding, hand-lapping, screwing, and bonding processes are used to produce complex, high-precision machine beds. «

Industries

Measuring Technology

EPUSTONE for machine beds, stands, cross bars, and gantries in measuring, testing, and inspection technology

Laser Applications

EPUSTONE as the basis for innovative laser applications including cutting, removing, coating, joining, scoring, testing, and marking

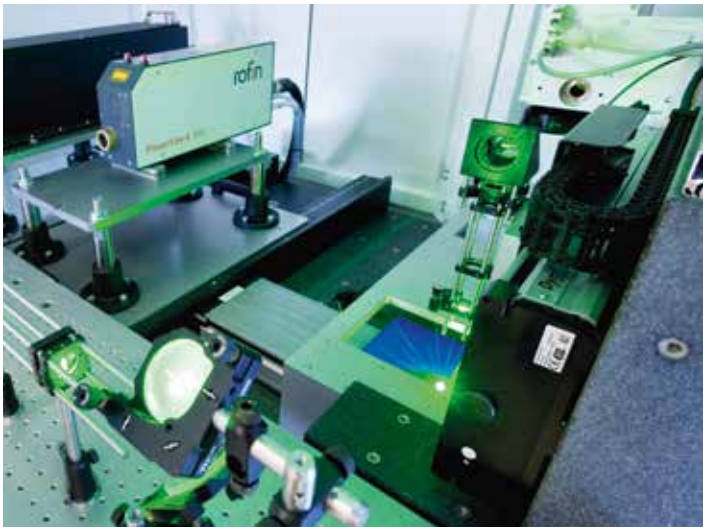
Microproduction

EPUSTONE for components and base frames in machines for producing microsystems, miniaturized products, and functional microstructures.

Your industry I Your application

High-profile customers worldwide benefit from the 30+ years of experience that RAMPF Machine Systems has in the design, engineering, production, and assembly of natural hard stone machine beds. We produce innovative and high-precision hard stone systems at our own manufacturing facility in Bessenbach to be used in a wide range of areas and branches of high-performance production technology.

- Machine tools
- Laser applications
- Solar module production
- Electronics production
- Microproduction
- Measuring, testing and inspection technology
- Measuring and testing standards
- Flat panel technology
- Battery production
- Medical technology
- Optical production
- Graphic machines
- Pick & place applications
- Dispensing technology



Properties

EPUSTONE | Specific material selection

for high-performance machine beds and machine bed components subjected to dynamic loads

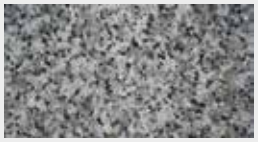
Industrially mined hard stone (commonly known as granite) has been used for several decades for measuring plates, straightness and angle standards, and machine bed components for measuring and high-precision production machinery. Hard stone is an isotropic, homogeneous material that follows Hooke's law and can be analyzed using linear-elastic FEM modeling. The high moduli of elasticity (up to a maximum of 90 kN/mm²) and the very low coefficient of linear thermal expansion (as low as $5 \cdot 10^{-6}$ K^{-1}) are of particular interest for machine beds in mechanical engineering applications.

On the basis of its superior properties, hard stone has proved a reliable and stable machine bed material for applications in the micrometer range involving short production runs, customizations, and prototypes.

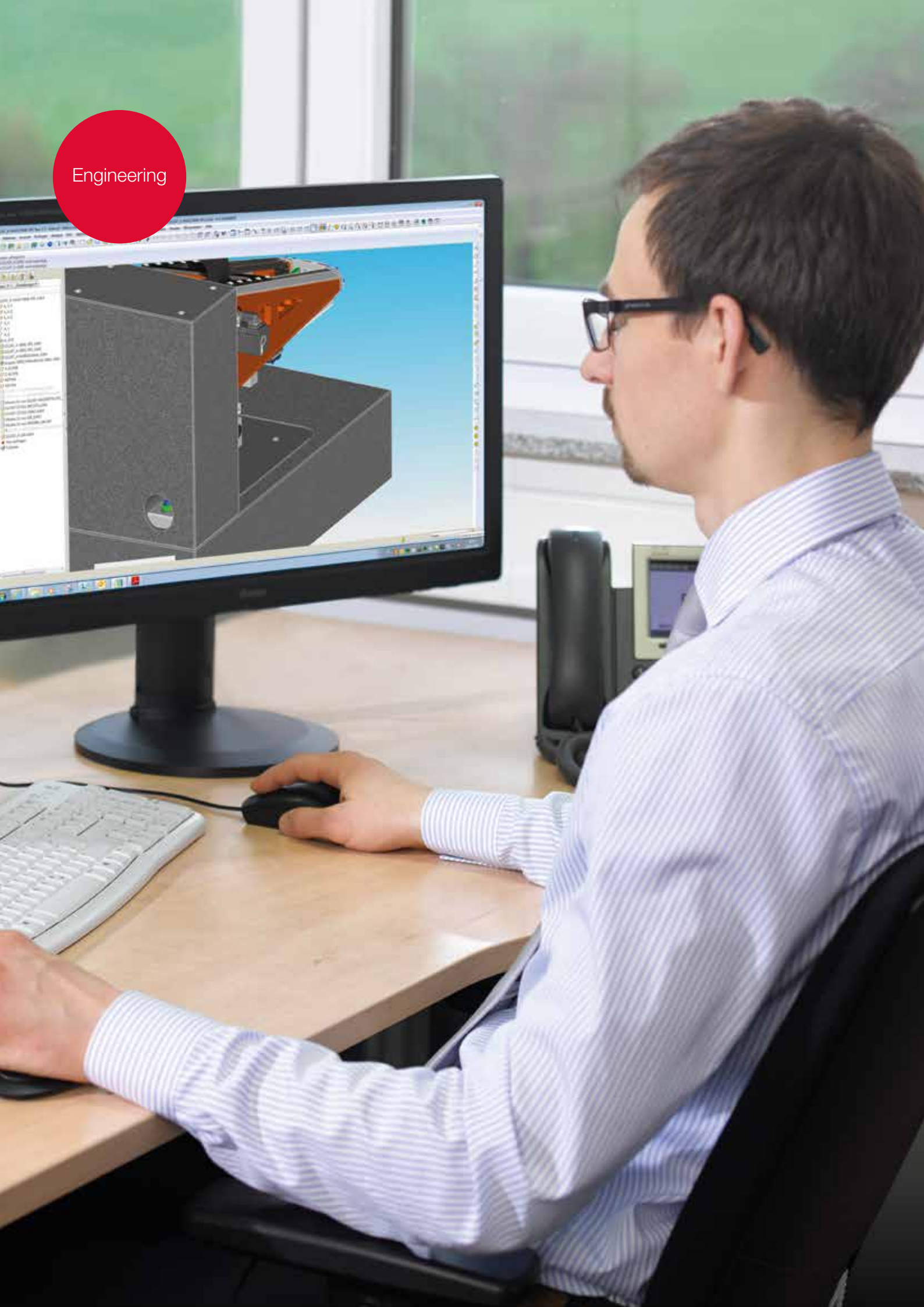
Your benefits

- Hard stone is a virtually tension-free material as a result of the slow cooling process during its creation and its mellenia long aging process.
- In addition, hard stone :
  - is non-magnetic
  - does not conduct electricity
  - does not rust
  - does not form burrs
- Hard stone is ideal for guide systems employing pneumatic or oil bearings due to its extreme hardness (HV: 850–900), good abrasion resistance (8 cm³/50 cm²), and homogeneous surface.

Technical values for various types of hard stone for machine bed components in mechanical engineering

	Impala	Black Galaxy	Ji Nan Black	Tarn
Origin	South Africa	India	China	France
				
Density kg/dm³	2.90	2.90	3.00	2.60
Compressive strength N/mm²	300	190	250	180
Flexural strength N/mm²	20	19	26	24
Modulus of elasticity kN/mm²	90	44	70	46
Thermal expansion 10^{-6} K^{-1}	6.5	6.0	5.0	6.0

Engineering



EPUSTONE I Engineering, design, modeling

for material-specific and cost-conscious design of hard stone machine beds

The initial shapes of hard stone machine bed components are cuboids or cubes. Each functional space and each weight reduction needs to be machined out. For economic reasons, thin-walled, ribbed, and complex designs that deviate from the cube shape are best avoided.

Due to the specific properties of hard stone, a number of factors are key to the quality and durability of products made using this material. These include engineering the design to accommodate compressive loading, taking into account the flow of forces, and selecting the optimum cross-sections.

Additional information

> **Image 1:** Machine elements can be mounted on hard stone machine bed assemblies using bonded-in thread bushings. Positional tolerances of ±0.1 mm are possible.

> **Image 2:** For complex machine beds, individual hard stone components are joined to be detachable or non-detachable. Detachable connections are created using special screw elements.

> **Image 3:** Usually, moving machine bed components are guided on machine beds made of hard stone using either profile rails or air/hydrostatic bearings (figure shows air bearing).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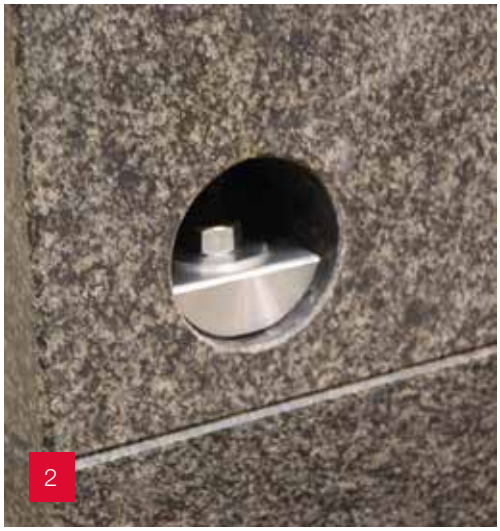
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Production

EPUSTONE I Production and precision

– machine beds and systems in climate-controlled production and assembly halls

After mining, the hard stone blocks are cut into prismatic structures, and continuous grooves and recesses and two-dimensional contours are carved. Boreholes and recesses for transportation and reducing weight, as welll as for fastening and connecting elements such as thread bushings, clamping pins, and T-slot rails are produced at state-of-the-art milling and drilling centers.

Special grinding and hand-lapping processes, screwing, and bonding are used to produce complex, high-precision machine beds, moving systems, and basic machinery.

Additional information

> **Image 1:** Grinding of a hard stone plate using cutting-edge flat and guideway grinding equipment – for workpieces up to a size of 7,000 × 2,650 × 2,000 mm (L × W × H) and a weight of 25,000 kg.

> **Image 2:** Hand-lapping of a hard stone gantry with high-precision requirements.

> **Image 3:** Precision assembly of complete and complex machine systems of hard stone.

> **Image 4:** Documented precision – measurement in fully climate-controlled inspection facilities using calibrated equipment including laser interferometers, autocollimators, and electronic inclination balances


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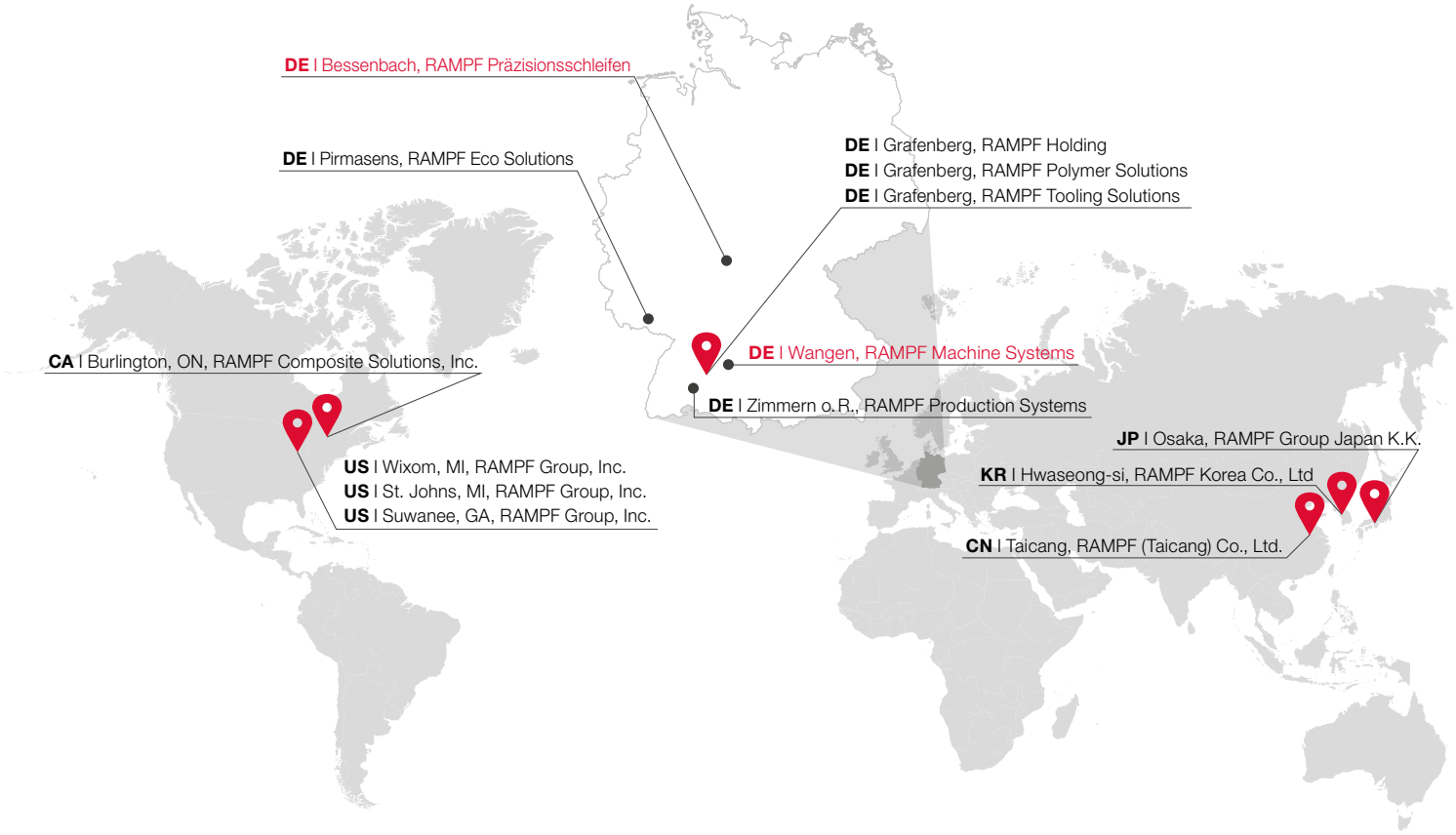
RAMPF Group | Locations



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