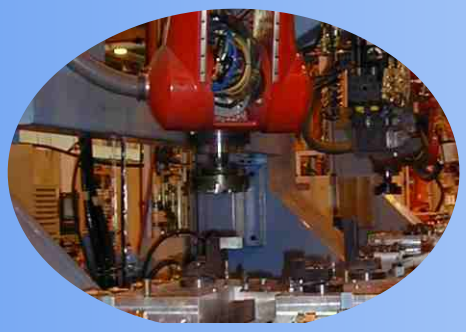
Over 30 years experience in High Speed Cutting

For over 30 years, IBAG has been a pioneer in the high-speed cutting process. IBAG offers a full line of motor spindles, suited for most appilcations. A selection of small sized spindles used for fine milling, drilling, and engraving are available. In addition, a wide assortment of large, powerful spindles are offered for heavy milling and for CNC machining centers. High speed cutting of mold and dies as well as automotive, transferline, aerospace, aircraft and small job shop applications are all possible with IBAG spindles. The benefits of high speed machining are well known today, and IBAG delivers a proven solution including the highest technlogy in spindle design. IBAG provides components or the complete system, including drives, lubrication and spindle cooling. High productivity options are also available to provide the best accuracy, reliability, and quality possible. With high speeds, high power, high torque, and the complete support of a world wide service organization you can trust IBAG to be your productivity partner. With over 30 years of experience and worldwide support in HSC-Technology, we are the experts ...

... IBAG of course

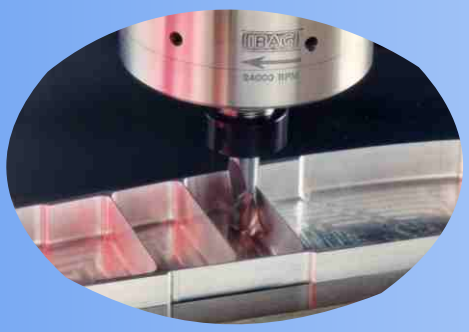
Comprehensive Knowledge in High Speed Cutting

IBAG HF motor spindles - successfull applications



Automotive Industrie

Machining of aluminum profiles

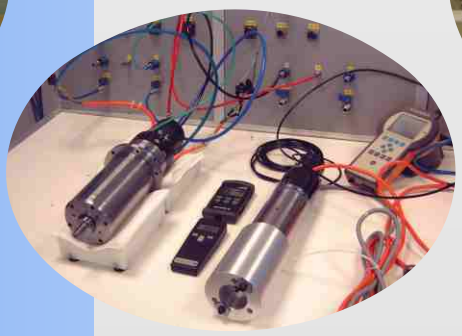


Aircraft Industrie

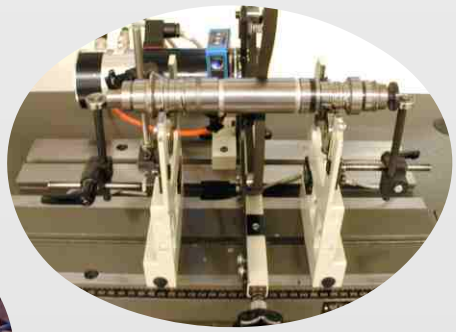
Tool and Die Making

Reliable Service and Support

Spindle repair and overhaul

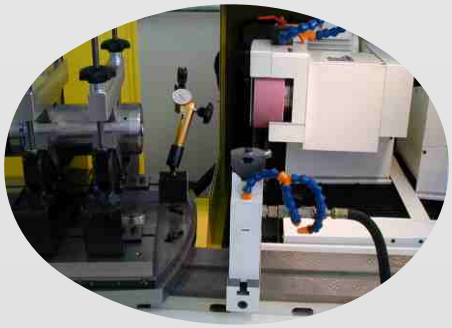


Superior Quality
(ISO 9000:2000)



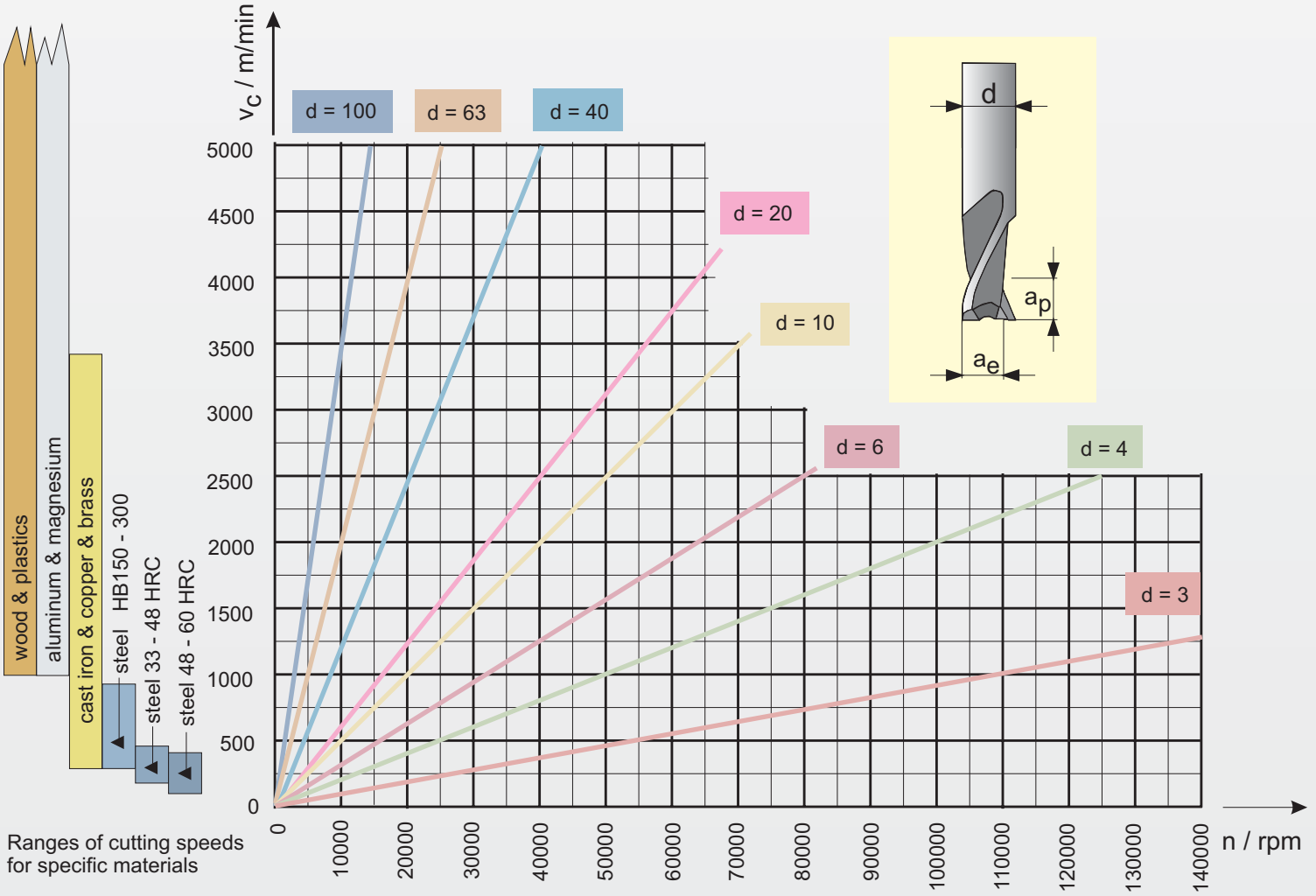
Fine balancing of spindle shafts

Seminars and Trainings



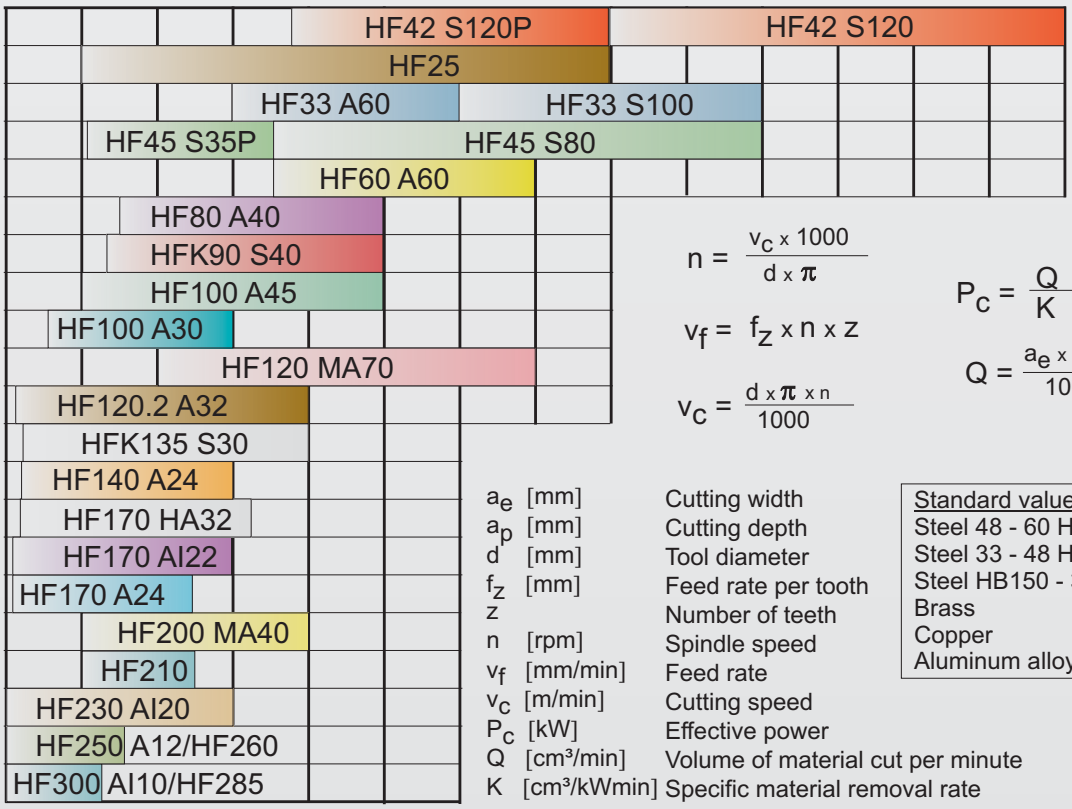
Grinding of spindle nose and tapper cones

Major Advantages of High Speed Cutting
Improved Quality and Reduced Production Time



Ranges of cutting speeds for specific materials

In order to use High Speed make sure you are using best quality, accurate and well balanced tool holders and face mills, minimum G2.5 and to the maximum speed of the used spindle rpm.



$$n = \frac{v_c \times 1000}{d \times \pi}$$

$$v_f = f_z \times n \times z$$

$$v_c = \frac{d \times \pi \times n}{1000}$$

$$P_c = \frac{Q}{K}$$

$$Q = \frac{a_e \times a_p \times v_f}{1000}$$

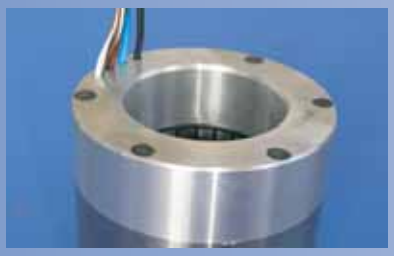
a_e	[mm]	Cutting width
a_p	[mm]	Cutting depth
d	[mm]	Tool diameter
f_z	[mm]	Feed rate per tooth
z		Number of teeth
n	[rpm]	Spindle speed
v_f	[mm/min]	Feed rate
v_c	[m/min]	Cutting speed
P_c	[kW]	Effective power
Q	[cm³/min]	Volume of material cut per minute
K	[cm³/kWmin]	Specific material removal rate

Standard values for K	
Steel 48 - 60 HRC	5
Steel 33 - 48 HRC	10
Steel HB150 - 300	20
Brass	30
Copper	40
Aluminum alloy	60

For more Information on HSC and Cutting Parameters ask for our Software P-Calc

IBAG Motor-Technology

IBAG uses latest and best motor technlogy. AC for high performance at mid and high speeds, DC for maximum torque, especially at very low RPM and almost no heat transferred from the rotor to the spindle shaft.



Sealed and enclosed motor windings allow best heat transfer and protection against mechanical damages

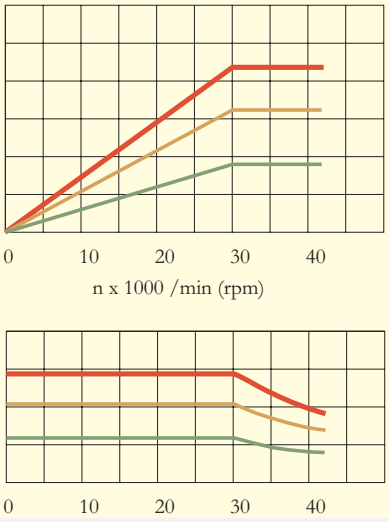
DC rotor with separate stator: major benefits are minimal losses, and vector control for orientation.

High Power - High Torque

Motors available in 220 or 380 Volt

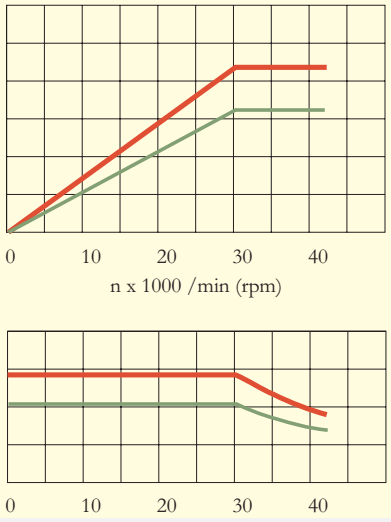
Benefit: Optimized spindle drive capacity

HF 120.2 AI36 - 220 V -- 55A - 32A



max. power with 380 Volt drive

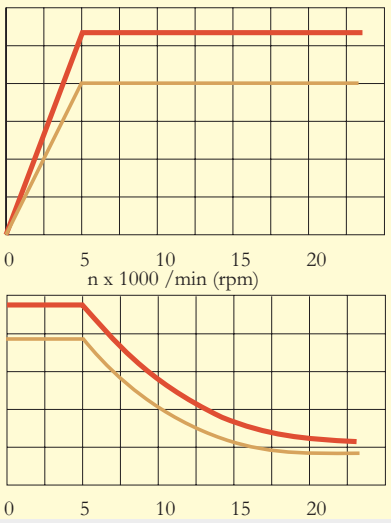
HF 120.2 AI36 - 380 V - 32A



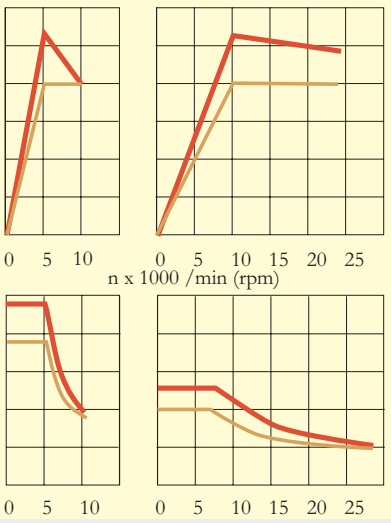
Motors available with Delta or Star/Delta Windings

Benefit: Cost saving solution with smaller drive, high power and torque at low and high speeds

HF 230.4 AI20 Δ-connected **380 V / 119 A**



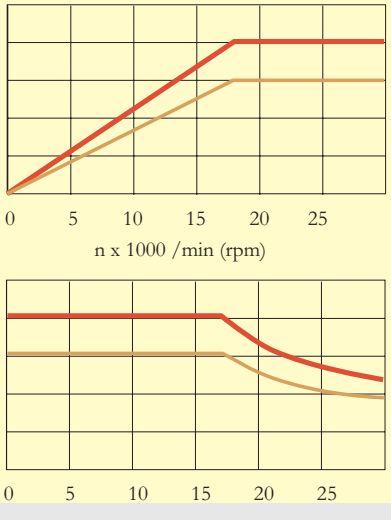
HF 230.3 AI20 Y - Δ - connected **380 V / 74 A**



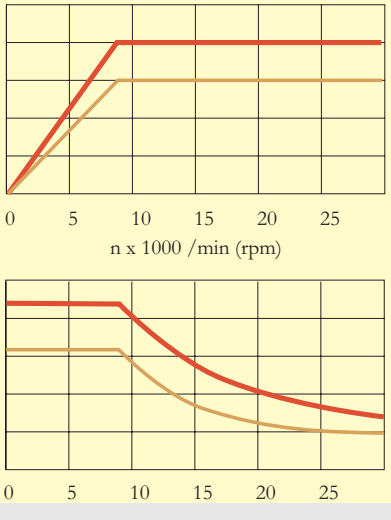
Motors available Non-synchronous (DC-Brushless) and Synchronous

Benefit: Motor Type selected for very high torque at low speeds or high power at high RPM

HF 170.5 AI22 - Non-synchronous Motor

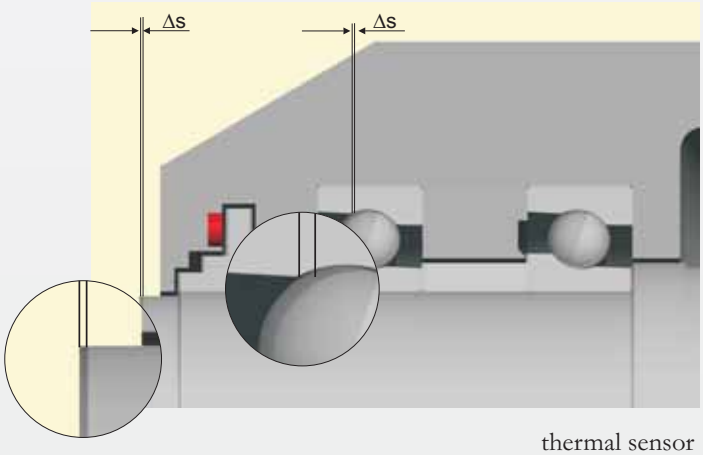


HF 170.5 AI22 - Synchronous Motor



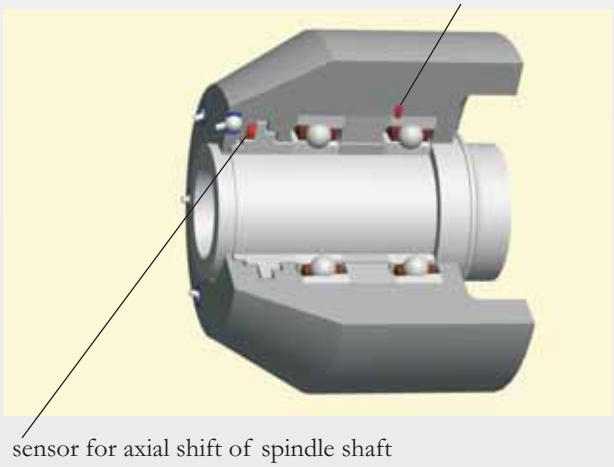
Spindle System Options for Monitoring Position, Temperature and Vibration

axial shift Δs due to mechanical movement and thermal extension

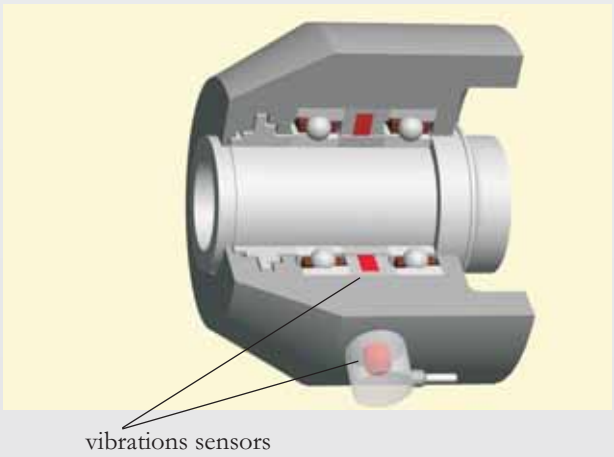


Integrated Sensors Increase Capability, Performance and Reliablity

Option M: Shaft Position Measurement
Measures axial shaft movement due to mechanical motion and thermal growth. Sensors mounted in the spindle nose accurately measure the spindle shaft position, and provide an analog signal available to the machine tool CNC for Z axis compensation.
Note: CNC software not included

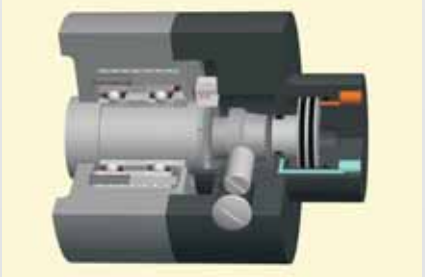


Option M + Thermal Sensors on the Bearing
Option M features plus thermal sensors (PT100 or PT1000) mounted internally provide front bearing temperature data for analysis and monitoring purposes.
Note: This sensor is also available without Option M, rear bearing thermal sensors are optional

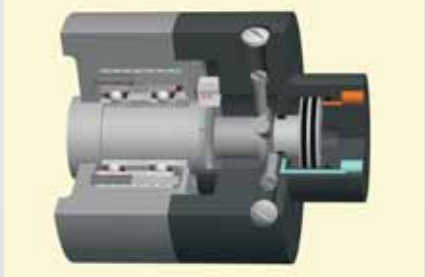


Vibration Monitoring (Chatter and Crash Monitor)
Integrated sensors measure vibration during spindle operation. High vibration levels can exist due to imbalanced tools, improper cutting conditions or crashes. The system can be set up to output three levels of vibration: OK (green), Warning (amber), Unacceptable (red). When interfaced with a CNC, proper control of the machine tool is possible, which includes increased spindle performance and extends spindle lifetime.
Note: Sensors are internally mounted on large spindles externally mounted on small spindle models

analog sensor



digital sensors

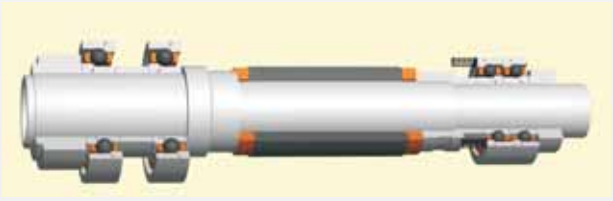


Tool Position (ATC) Sensors
All spindles utilizing automatic tool change include digital sensors that monitor the spindle draw bar and detect tool clamped, no tool and tool unclamped conditions. Digital sensors are adjustable and compatible with most CNC and PLC systems.
Note: single analog sensor with remote adjustment feature available on larger spindle models.

Rigidity, Accuracy and a long Lifetime
Great Speed Range up to high RPM

IBAG Spindles Are Built Using Various Bearing Configurations, Oil or Grease Lubrication. They Offer a Variable Bearing Pre-Load System Option

The tandem (TD) bearing configuration is standard for small and mid sized spindles and allows very high RPM.
The "O" configuration is possible for all spindle models. When using the "O" configuration, the maximum speed will be slightly reduced, but the spindle will have equal axial rigidity in both directions (pulling and pushing) and less dynamic shaft displacement (typically used for dedicated drilling applications).
The "O-TD" configuration is typically for large sized spindles and high torque spindles for heavy cutting and long tools.



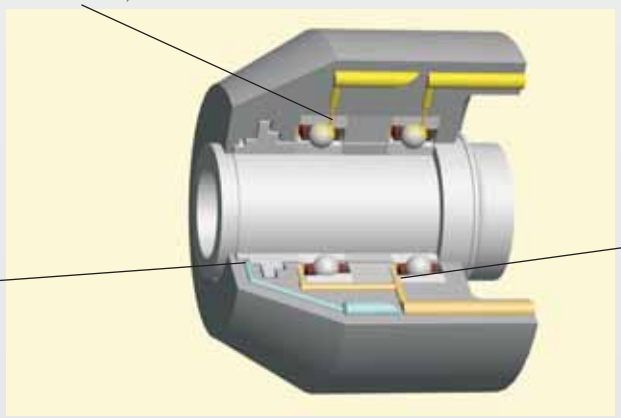
"TD"(Tandem)- configuration

"O"- configuration

"O-TD"- configuration

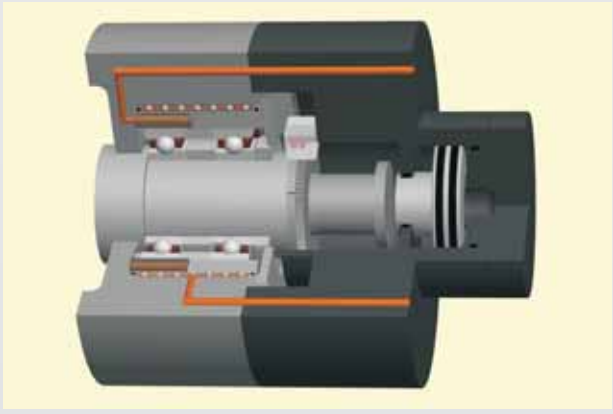
The IBAG Oil Air Lubrication System delivers the optimum amount of oil and air to the high speed hybrid ceramic bearings. A mechanical mixing block combines the oil and air in exact amounts.

Some [illegible]dels are equi[illegible]AI Injection Lube System. It feeds a minimum amount of oil through 3 small bores located on the outer bearing race. This brings the oil directly to the contact line between the race and the ceramic balls, optimising the bearing lubrication and reducing the heat generation. See picture to the right. The air seal protects the spindle against external contamination.



AI: Oil-Air-Injection-Lubrication for best performance

A variable hydraulic pre-load option is available on selected spindle models. This feature allows the bearing pre-load to be controlled by an external hydraulic source. For large cutters and low speed operation, a high pre-load should be utilized to maximize stiffness and rigidity. For high operation speeds and small cutters, a low pre-load is used. Varying the pre-load to match the desired spindle speed will result in maximum spindle performance, high quality surface finish and extended bearing life.
Note: Not available on small spindle models.

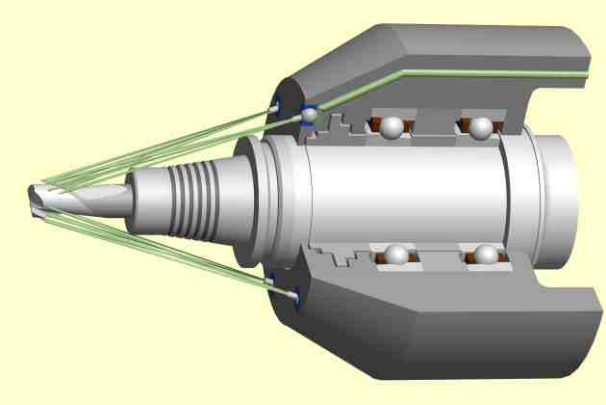


Controlable, hydaulic variable preload system according to spindle speeds. Benefits: additional damping for better bearing and cutter lifetime

Cutter and Work Piece Cooling Options

Coolant spray nozzles on the spindle and Coolant through the center (TSC)

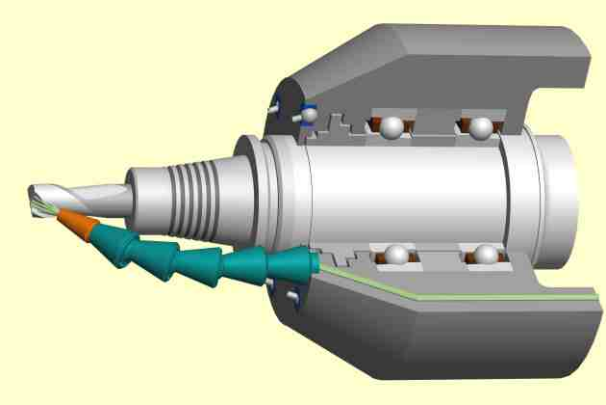
<u>Keep cool and Last Long!</u>
Use three different coolants or two different coolant supplies with different pressures and air for best cutter cooling and performance



Option TCW1 - coolant jet through adjustable nozzles

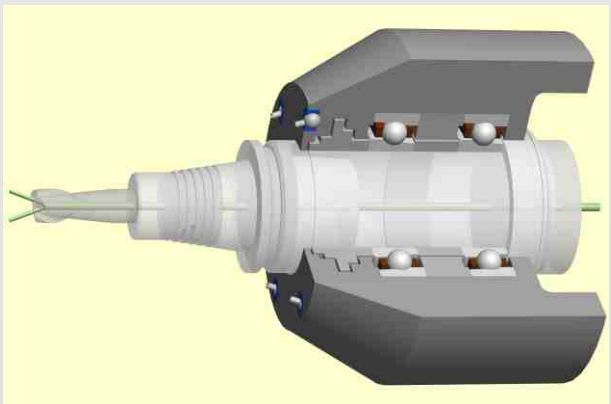
Coolant Supply TCW1
The TCW1 feature includes 4 to 6 adjustable coolant nozzles on the spindle nose. The cooling media is fed through the spindle housing connected at a fitting located on the rear of the spindle. It can be used for liquid cooling media to wash chips away from the work piece while cutting, or compressed air to blow chips off after machining is finished.

Auxiliary Coolant Supply TCW2
TCW2 is an additional single coolant nozzle located on the spindle nose. It is typically used to provide an additional coolant supply or special lubricant (air, oil, grease) for selected operations including rigid tapping. TCW2 is available on most mid sized and large spindles.

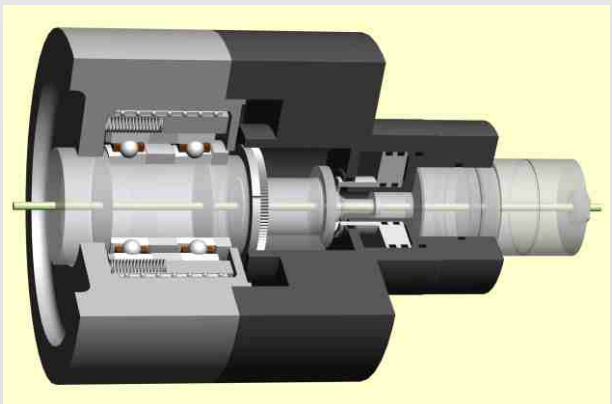


Option TCW2 - coolant jet through flexible nozzles

Through the Shaft Coolant (TSC): Option W
TSC is the most effective way to cool the cutter, work piece and flush the chips out of the cutting area. Typically used for deep hole drilling, slot milling and the machining of pockets, TSC is available for use with high pressure (80 bar / 1200 PSI), and up to a maximum speed of 30'000 RPM. As the coolant is fed through the cutter center, chips are flushed away, preventing re-cutting of chips. This produces better surface finish and extends cutter edge life. Pictures below illustrate the coolant coupling attached to the rear of the spindle, and the outlet of the coolant at the front end of the spindle through the drill or cutter.



Option W - coolant through the center



Rear end of spindle with tool release and coolant coupling

Highest Quality Tooling and Drawbar Systems

Drawbar Systems Used

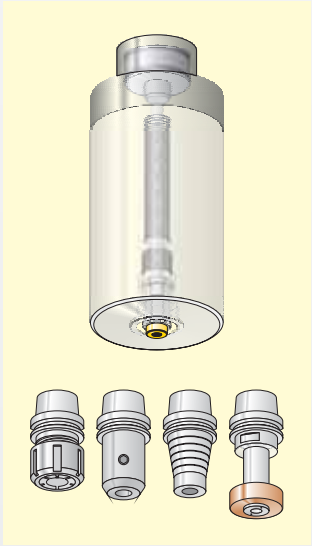
HSK, SK and BT (Ott Jakob),
Capto (Sandvik),
SKI (IBAG - Patented)

Utilizing the Latest Developments

Built-in Drawbar for DIN 69893 - HSK-E

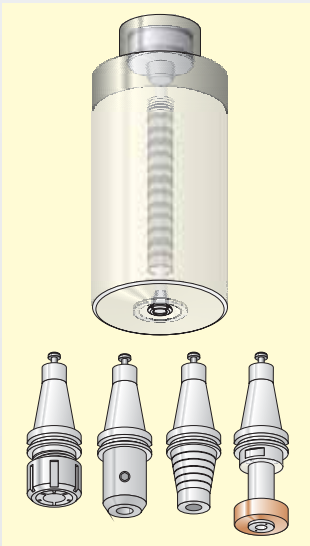
for Automatic Tool Change
Tool Holder Balanced G2.5
to maximum Spindle Speed

Tool holders available:
Collet Holder (precision)
Weldon Type Holder
Shrink Fit Type Holder
Special Holder for Grinding

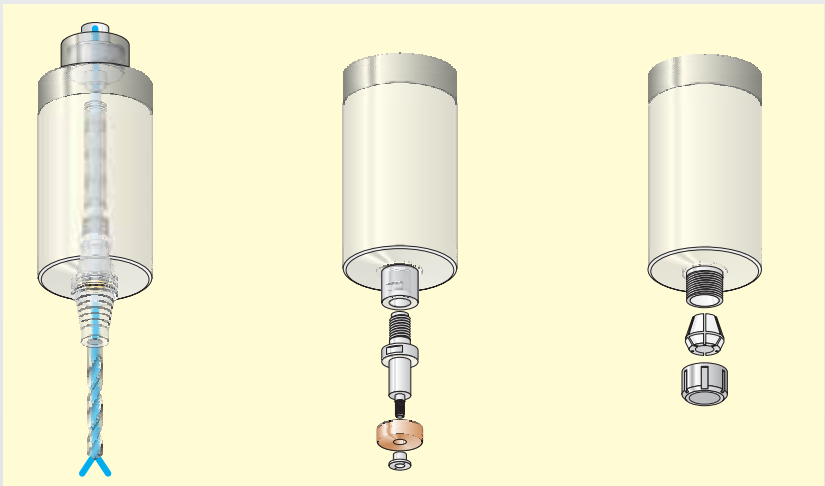


Built-in Drawbar for JIS B 6340-1992 - BT or BBT, and IBAG SKI Type

BT and BBT Type common in Asia and USA
IBAG SKI Type or SK used in Europe and mostly for small sized tool holder such as SK / SKI 16, 20, 25, and 30
Large sized are common in HSK, Capto or BBT



Various Tool Interfaces Available:



A-Type Spindle with built-in drawbar for all the above mentioned tool holders (Option W only with HSK and BT)

D-Type spindle with Grinding arbors

S-Type spindle with Collet clamping

High Quality at Much Lower Price!

HF45

HF80

HF100

HF120

IBAG Motor Spindles "Silver Edition" Offer Exceptional Value and Performance

Selected Small and Mid Size Spindle Models Offered in "Silver Edition"

These spindles are built with the same IBAG Quality & Accuracy but with very limited options.

The "Silver Edition" spindles are typically built in large quantities. This reduces the manufacturing costs, and reduces the spindle cost for you. "Silver Edition" spindles must be ordered in reasonable quantities with identical specifications. By providing a standard product, in high quantities, IBAG can provide the most cost effective solution for your manufacturing needs.

Notes

A-Type Spindles are available with CAT, SK, SKI or BT (BBT) Tooling Interface.

Standard Tool Release System is Hydraulic (some models available with pneumatic)

Permanent Grease Bearing Lubrication Standard.

Quick Connection for all Hoses on the Spindle and Motor Cable with Connector.

Precision Hybrid Ceramic Bearings Used for Long Spindle Life.

Type	rpm	kW	Nm	Collet mm
HF45	55'000	0.4	0.07	7
HF80	40'000	3.2	0.8	8
HF100	30'000	7.8	2.1	10
HF120	30'000	16.9	5.4	12
HF150	24'000	28.6	11.5	16
HF210	20'000	30	80	20

IBAG Small Sized Motor Spindles

These spindles are used in fine-drilling, milling, engraving, and other operations.
Small sized spindles HF25, HF33 and HF45 are commonly used on Swiss Type Turning Machines. These types are also used on engraving machines and special purpose machines for small parts manufacturing.

The Types HF45 and HF60 spindles can also be used for "Nano Technology" machines, very high rpm (80'000 rpm), and super precision applications. Also available with automatic tool changer (ATC) as an option.

Type	Watt	Ncm	Collet mm
HF25	250	3	6
HF33	135	2.1	6
HF45	680	6.8	8
HF60	2000	32	10

HF25 in Swiss Type Turning Machine

Complete system HF25 with converter, air regulator, and oil air lubrication

Focus on Micro Production and "Nano Technology" Machines

HF25

HF33

HF45

HF60

High Speed and High Quality for Universal Use

IBAG Mid Sized Motor Spindles for Drilling, Milling, and High Speed Cutting


HF80

HF Motor Spindles HF80, HF100, HF120, and HF140

These spindles are used for production manufacturing, electrodes, and for mold and die machining. Materials cut include hardened steel, aluminum, brass, copper, graphite, and various plastics. All mid sized spindles are available with built-in drawbar for automatic tool change (ATC) and various tooling systems (See page 8 for details).


HF100

Type	rpm	kW	Nm	Clamping
HF80	50'000	3.2	0.8	SKI20
HF100	50'000	7.8	2.1	HSK32
HF120	42'000	16.9	5.4	HSK40
HF140	36'000	28.6	11.5	HSK50


HF120


Milling graphite electrodes with HF80


HF140


5 axis milling turbine propeller with HF120

The Ultimate Spindle

for Your Machining Center

Increase Power, Productivity, Efficiency, and Profits

IBAG's Large Sized Motor Spindles

These spindles are built for use in mid to large sized horizontal and vertical machining centers, large bridge type mills and multi-spindle CNC machines.

Type	rpm	kW	Nm	Clamping
HF170	30'000	26	38	HSK63
HF210	24'000	30	80	HSK63
HF230	24'000	35	118	HSK63
HF250	15'000	40	222	HSK100
HF260	12'000	45	350	HSK100
HF285	12'000	50	350	HSK100
HF300	10'000	80	380	HSK100

Each large spindle is available with various motor specifications, using both AC and DC technology. (See page 4 for details.)

Powerful spindles are typically used for large parts manufacturing, heavy mold and die cutting, and automotive parts production.They are ideal for aircraft applications with high material removal rates in aluminum, High Speed Cutting of titanium, carbon fiber composites and plastics. Many of these spindles are used in automotive transfer lines in production at companies like Peugeot, Renault and BMW.

These powerful and high torque spindles are used for roughing, semi finishing and super finishing work. IBAG supplies one spindle type for all your needs.

5 axis machining with HF 230

Mold & Die work with HF 170

Horizontal MC with HF 230

Horizontal MC with HF 250

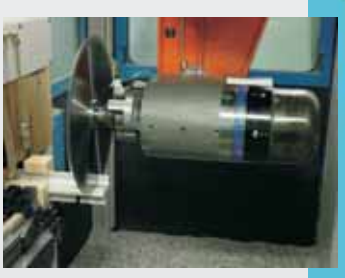
Developed for Special Customer Applications and Specifications

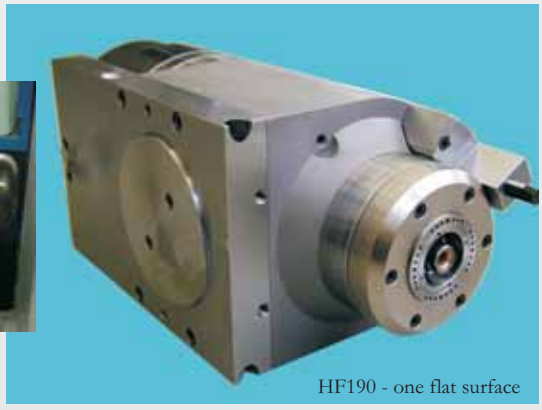
Custom Made IBAG Motor Spindles with High Speed and Superior Quality

HF90 - double end shaft

HF120 - special flange

HF160 - special flange





HF190 - one flat surface

You name it - we do it for you!

Many Sizes and Types of Spindles Can Be Made to Meet a Specific Application or Specification

From very small, to mid sized, and up to very large spindles can be custom made exactly to your needs. Do you need super high speed or extreme accuracy? Or, more power with high torque at a specific speed?

Spindles are available with custom mounting flanges. One design, used on a robotic application, features a double ended shaft with collets on both sides to cut quickly without a tool change.

Type	rpm	kW	Nm	Clamping
HF90	30'000	4.2	1.4	8 mm
HF160	36'000	28.6	11.5	HSK40
HF190	38'000	16.9	5.4	HSK40

Spindle designs are possible with a square housing, or with one flat surface to adapt on the machine tool for easy 5-axis use. This design is used by the Handtmann Company.

Custom spindles can be supplied with special tooling systems and built-in drawbars for automatic tool change (ATC).

IBAG's "PLUG & GO" spindles HFK Type with 4 Models

The HFK95 is the Economy Model It needs NO WATER COOLING. Features include permanent grease lubricated bearings, positive air over pressure and labyrinth air seal protection. Cooling is provided by passing compressed air over the heat sink ribs on the outside of the spindle housing.

The HFK 90.1 features a water cooled housing, and offers higher power and torque than the air cooled model. It is available as standard with grease lubricated bearings, and uses a 220 V AC motor.

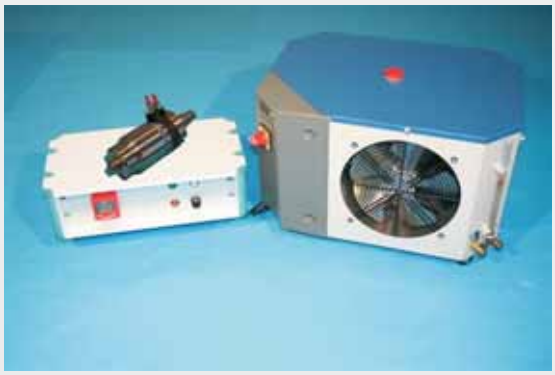
The HFK 90 features a water cooled housing and is available with grease or oil air lubrication for the hybrid ceramic bearings. A 380 V AC motor provides more power and higher torque. We deliver as single components, or as a complete system including mobile Supply-Unit 20.

The HFK 135 is the most powerful model, utilizing water cooling and a 380 V AC motor. Grease or oil air lubrication for the hybrid ceramic bearings available. We deliver as single components, or as a complete system including Supply-Unit 35. Optional S62 quick change system is available for easier tool change and tool length presetting.

Easy to Mount on Any Machine Tool Costeffective and Profitable for You

HFK 95:
40'000 rpm, 1 kW, 0.20 Nm, clamping capacity 6 mm

HFK 90.1 for USA & Asia with 220 V AC motor:
42'000 rpm, 1.9 kW, 0.4 Nm, clamping capacity 10 mm, picture shows complete system with HFK 90.1, converter and chiller



HFK 90 with 380 V AC motor:
42'000 rpm with grease lubrication, 60'000 rpm with oil air lubrication, 2.7 kW, 0.45 Nm, clamping capacity 10 mm, available as turn-key finished system with Supply-Unit 20

HFK 135 with 380 V AC motor:
26'000 rpm with grease lubrication, 40'000 rpm with oil air lubrication, 10 kW, 5.6 Nm, clamping capacity 16 mm

HFK 135 turnkey finished system with Supply-Unit 35

Engineered, Tested and Optimized - Components and Accessories

Guarantee for Continuous Performance and Maximum Uptime

Frequency converter for mid sized and large spindles to be build in, into electric cabinet

Complete system HF 33 with air supply, lubrication and converter

Frequency converter for small sized spindles HF 25, HF33, HF45 or HFK 90.1 and HFK95

Transformer or chokes for a perfect use of all the delivered components and IBAG spindles

Cooling Unit with compressor, coolant pump and surveillance for mid sized spindles

Pressure intensifier (hydraulic / pneumatic) to push the drawbar for a tool release

Air Supply Unit with filter and regulator for best air management to the spindles

Supply Unit 45 for multi spindle systems, mid sized or large spindles (Turnkey-finished)

IBAG delivers the optimized components for each spindle, tested and proven before delivery. All spindle drives supplied by IBAG are delivered fully programmed with proven parameter sets resulting in trouble free operation with a minimum of losses and little heat generated. Parameter sets and software support for approved drives not suppplied by IBAG are available for a fee. Using the IBAG-Oil-Air-lubrication system guarantees the proper installation and long lifetime of the hybrid ceramic bearings. Recommended noise filters and approved chokes should be installed to minimize electrical rotor losses and result in minimum heat generation. Verify that the voltage required by the IBAG components is available in your factory. Many components, including transformers that may be required, are available from IBAG by request to satisfy any and all needs. Technical support, including wiring diagrams and operating instructions are available to support the installation. If you prefer to have a turn-key finished system, please request the IBAG Supply-Units. The IBAG Supply-Units include all necessary components to support the spindle system, completly built-in and ready for operation. See more details on Supply-Units on page 14.

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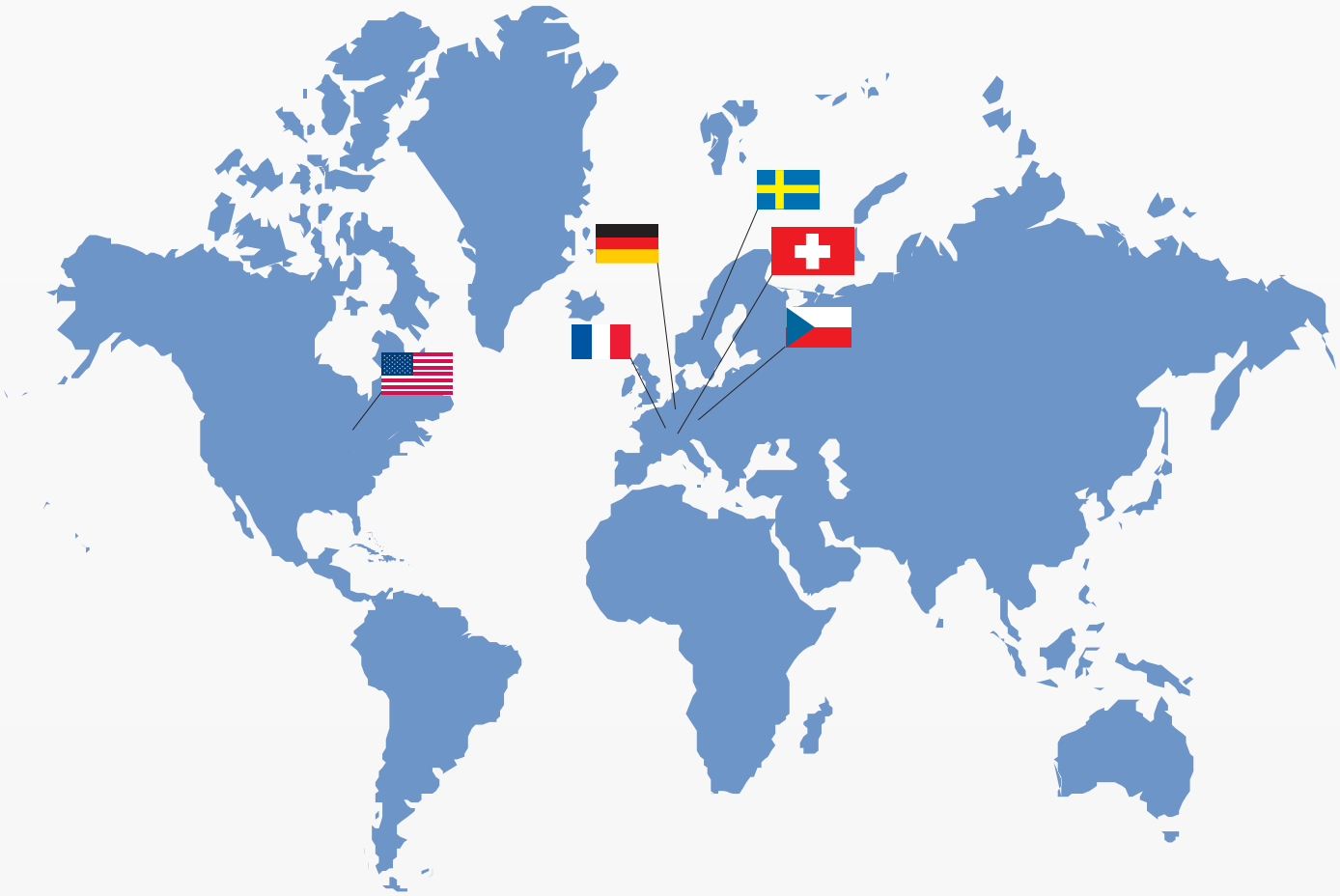

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