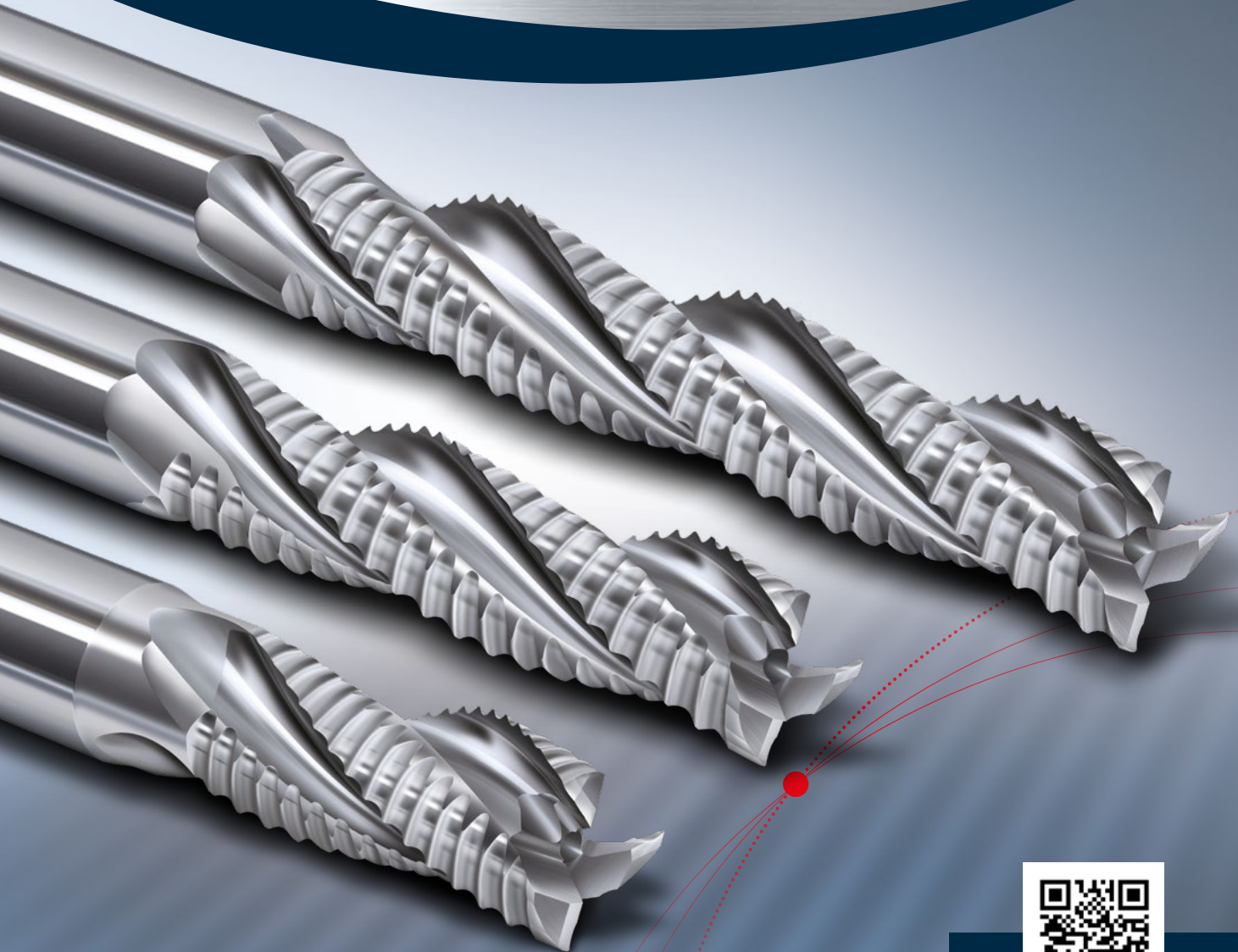


passion  
for precision

fraisa

## **AX-FPS – new performance horizons for high-performance milling of aluminum**

Productivity gains thanks to perfect coordination of the tool and machine environment



**FRAISA**  
**ToolExpert®**  
**AX-FPS**

# Maximum performance and minimal power consumption = extreme cost reduction!

With **AX-FPS**, FRAISA is presenting a **groundbreaking tool concept for aluminum machining**.

The new **AX-FPS** milling cutter opens up new performance horizons in the field of aluminum machining. The as good as perfect coordination between damping and cutting ability ensures **reduced power consumption and torque input** by the spindle and **guarantees a long service life** and **maximum process reliability**.

In combination with the new **ToolExpert AX-FPS**, the cutting parameters can be ideally matched to the spindle characteristics. This makes it possible to achieve not only productivity gains but also massive cost reductions as the tool can work at the ideal operating point of the spindle and machine environment.

**AX-FPS** is a **contoured roughing tool** with a 20° cutting angle and a helix angle of 30°. The specially designed flutes are **ground to a mirror finish** and **precisely designed damping surfaces are attached** at the curved and end cutting edges.

These geometric features form a **very easy-cut tool concept** and guarantee a **low-vibration** and **safe milling process** with previously **unattained material removal rates** per unit of time.

**AX-FPS** tools are equipped with the FRAISA **high-performance penetration edge** and **central cooling channel bore**. The tools are **finely balanced** and have a **short shank** with smooth transitions.

All of these technologies **increase the reliability** and **productivity** of the **AX-FPS** tools to an unparalleled level of performance!

The **ToolExpert AX-FPS** specially developed for the **AX-FPS** tools enables you to determine the machine environment and to optimize the performance of the tools and the **system utilization** of the spindle and machine.

## The benefits

- **Maximum performance with minimal spindle load**  
Maximum productivity – low costs
- **High process reliability**  
Guaranteed chip removal thanks to mirror-finish grinding, a central cooling channel, and contoured cutting edge
- **Lower energy consumption per area of material milled**  
Extremely easy cutting
- **New ToolExpert AX-FPS**  
Cutting data that matches the machine spindle and machine environment
- **At least 2xd to 5.2xd length of cutting edge**  
High infeed rates, reliable chip removal, and low axial extraction force
- **Ideal life cycle**  
With FRAISA ToolCare® tool management, FRAISA ReTool® tool reconditioning, and FRAISA ReToolBlue tool recycling

## Key factors: Machine spindle and machine environment

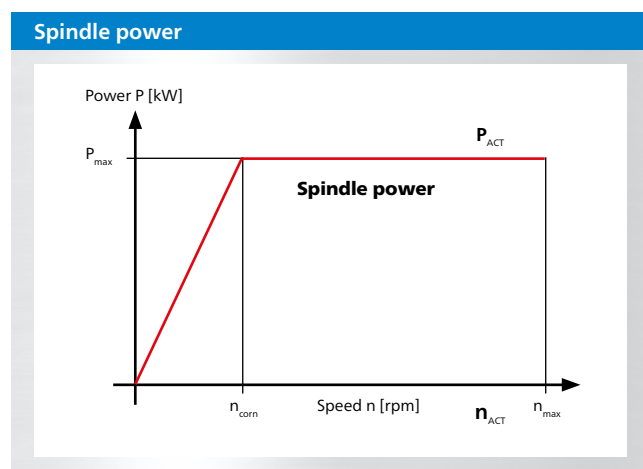
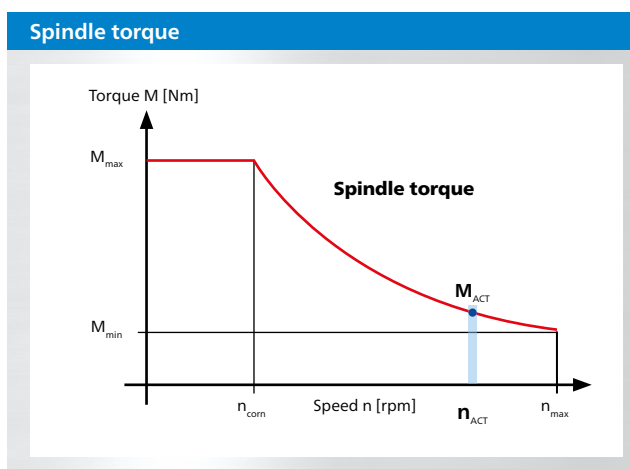
When milling aluminum, the machine tool is all too often the limiting factor. This is due to the

- reduced spindle torque at high speeds
- existing axial spindle preload and the spindle interface (example HSK-63)
- cooling lubrication and maximum coolant pressure
- tool throats and the stability of the chucking
- active spindle power
- reliable chip removal

### Characteristic curves of the spindle torque and spindle power

The torque of a machine spindle decreases significantly as the speed increases. As aluminum is machined in the very highest speed range ( $n_{ACT}$ ), the active torque in the operational area ( $M_{ACT}$ ) is usually crucial with respect to the spindle's performance.

One aspect that is often not taken into account but is very relevant is the bearing pretensioning of the spindle. This is why the axial tensile force must be kept as low as possible in order not to damage the spindle.



[ 3 ]

Since FRAISA has measured the power and torque requirements of the **AX-FPS** tools, the application data in **ToolExpert AX-FPS** can be optimally positioned on the spindle characteristic to obtain maximum performance without overloading the spindle motor.



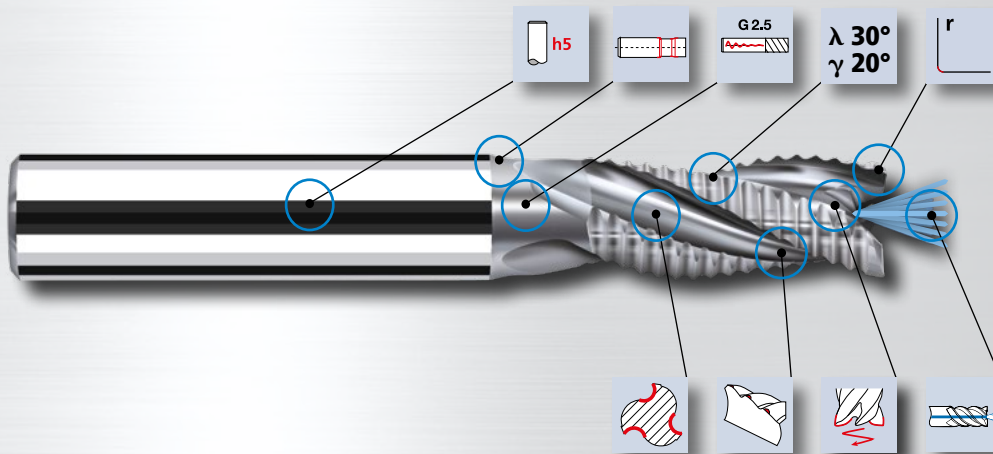
# The **technologies** of the **AX-FPS** tools






## A groundbreaking X-Generation tool concept

The new **AX-FPS** technology is systematically designed for **productivity** and **cost effectiveness**. Very positive, easy-cut geometries paired with mirror-finish flutes ensure excellent chip formation and good chip removal, supported by a central coolant supply. Small, radially mounted surfaces on the tool circumference act as vibration dampers and result in a very smooth and reliable cut. Of course, the **AX-FPS** cutter also has a high-performance penetration edge that further enhances the tool's range of applications.

### Description of the AX-FPS technologies

#### Standard version

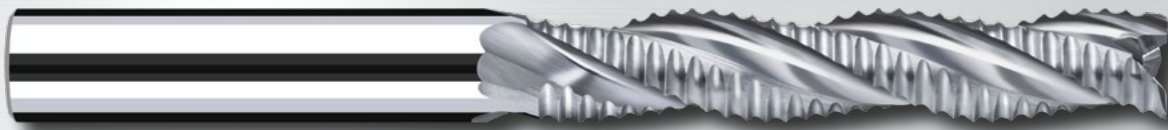


Version	$\lambda 30^\circ$ $\gamma 20^\circ$	r					G2.5		h5
Standard	■	■	■	■	■	■	■	■	■
Medium-long	■	■	■	■	■	■	■		■
Medium-long with neck	■	■	■	■	■	■	■	■	■
Extra-long	■	■	■	■	■	■	■		■

## Medium-long versions



## Extra-long version



### Milling tool with H5 shank

- High concentricity and accuracy of eccentricity
- Higher clamping force in nonpositive chucks (hot shrinking, hydraulic expansion chuck)
- **Important:** Degrease the tool and chucking device before assembly in order to increase the holding force and prevent tool slippage!



### Milling tool with special mirror-finish-ground flute geometry

- Mirror-finish-ground flute geometry with special flute exit at the end of the cutting edge
- Improved chip flow and reduction of the process temperature
- Increase in the cutting edge length  $l_2$  with the same overall length  $l_1$  despite the small helix angle



### Milling tool with parabolic support face

- Support of the tool in the radial and axial directions
- Reduced vibration levels and increased performance
- High effectiveness, especially in unstable conditions and with long throats



### Finely balanced tools (with HA shank)

- Finely balanced tools, at least G2.5 at  $n = 20,000$  rpm or  $U_{perm} < 1$  gmm
- Reduction or elimination of balancing for finely balanced chucking devices
- Improved surface quality thanks to smoother running and less vibration
- Longer service life for the machine spindle



### High-performance penetration edge specially designed for aluminum tools

- Easy-cutting, high-performance penetration edge for high penetration angles
- Better performance, longer tool life, and greater process reliability during penetration
- High functionality with cutting data from ToolExpert AX-FPS



### Tools with a central cooling channel

- The tool has a central, continuous hole
- Perfect chip removal, especially at inner contours and when penetrating
- Better cooling of the cutting edge and less chip adhesion



### Tools with a short shank and smooth transitions

- The transitions between the shank, neck, and cutting edge have smooth gradients and radii
- Improved tool rigidity and therefore less radial deflection
- Higher loads can be transmitted and be transformed into improved performance



### Small corner radius

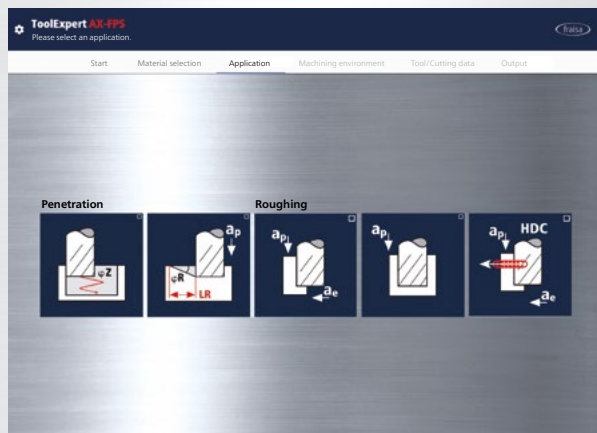
- The cylindrical tool has a small corner radius to strengthen the cutting edge
- Higher thermal and mechanical loads are possible and can be transformed into improved performance

# Use ToolExpert AX-FPS to determine the best possible cutting data for your machine environment

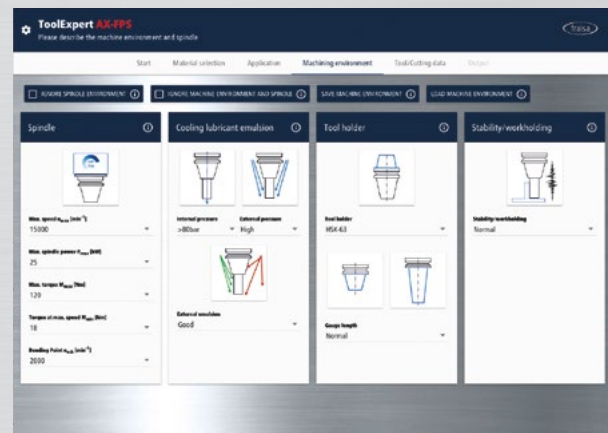
The new **ToolExpert AX-FPS** calculator is an innovative solution to determining **cutting data that match your machine environment**. High-performance roughing of wrought aluminum alloys is often not limited by the tool, but by the machine spindle being used and the actual machine environment.

Consequently, **ToolExpert AX-FPS** lets you describe your **machine environment clearly**, so that you can determine the cutting data that is most efficient and reliable for your application. This option is unique and new and shows that FRAISA is **continuing to “digitalize” its application know-how**. The **outcome is a customer benefit** in respect to cutting production costs and reducing machining times.

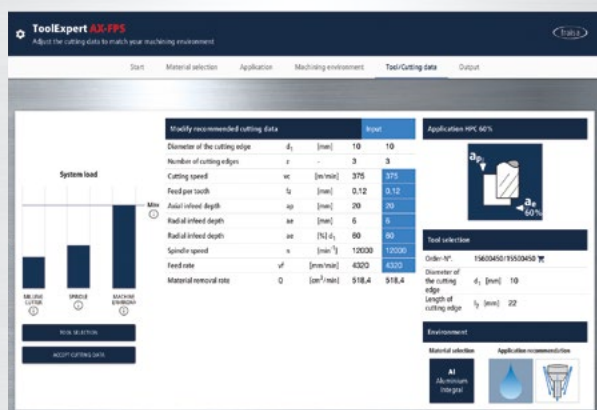
[ 6 ]



Select application



Specify machine environment



Optimize system utilization



**Working together to hone ToolExpert!**

**ToolExpert AX-FPS** includes a function that enables you to send us feedback regarding the cutting data recommended by FRAISA. In this way, we can work together to further perfect the knowledge we share and to enhance the benefits we gain from the cutting data recommendations.

FRAISA is looking forward to these discussions with its users!

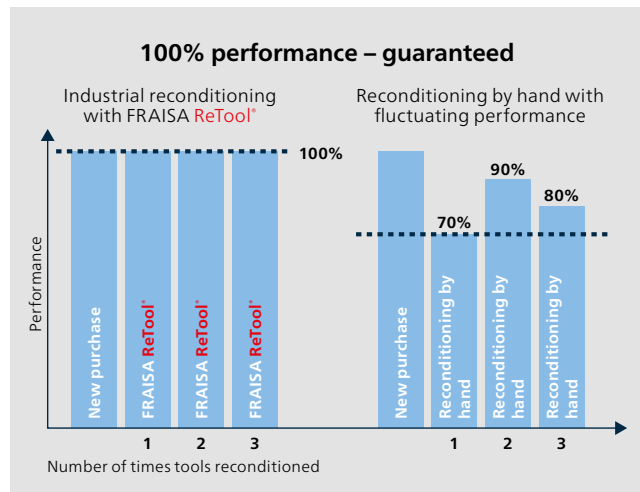
# FRAISA ReTool® – Industrial tool reconditioning with performance guarantee

FRAISA ReTool® offers an all-round service that restores your used tools to their original performance level and optimizes your processes. FRAISA and third-party tools are reconditioned using the very latest technology – and in a resource-friendly way. The outcome: mint-condition tools as productive as they were the first day they were used. And to make things even better, your level of investment is lower than if you were to buy new tools, you increase your productivity and you save costs.

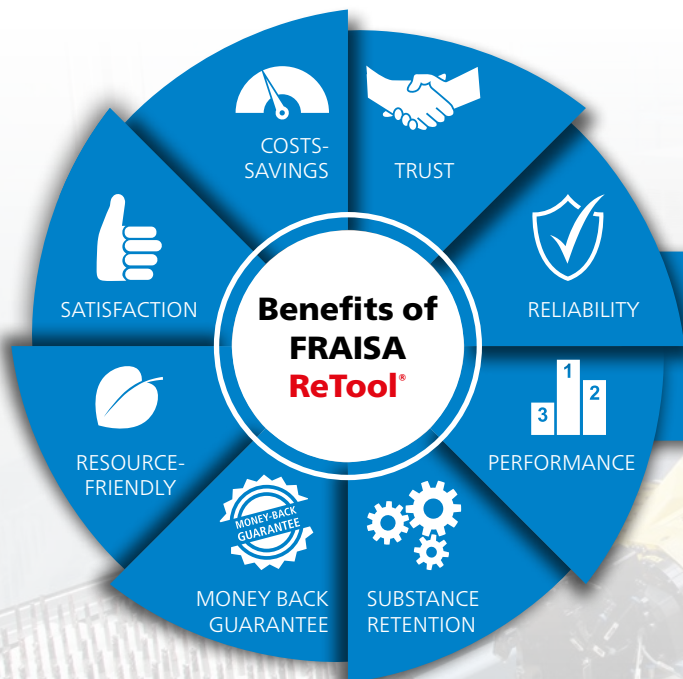
## FRAISA ReTool® – a performance guarantee founded on integrated development of the tools and the reconditioning process

We guarantee that following their reconditioning with FRAISA ReTool®, your used tools will be restored to the original performance level they had when new. Our ability to provide this performance guarantee is a priority of our team of experts right from very early on in product development.

That's why the development of the reconditioning process is an integral part of the development phase, alongside the actual product tests and calculating the cutting data. Strict rules apply: the FRAISA ReTool® process is approved only if we are able to fulfil our performance guarantee 100%.



[ 7 ]



## FRAISA ReToolBlue – recycle rather than throw away

With our FRAISA ReToolBlue service, we recycle the valuable carbide from tools that can no longer be reconditioned.

FRAISA ReTool® makes economic sense for you, too: After reconditioning them, we return your tools to you in mint condition. We restore them to their original performance level at a price that's more cost-effective for you than purchasing new ones or reconditioning them by hand.

Over 30 years' experience in tool reconditioning:

Our competence center in Germany is Europe's largest service center for carbide milling tools.



Video on our service product: FRAISA ReTool®

# Use ToolExpert **AX-FPS**

## Highly productive and reliable system utilization

### How does ToolExpert AX-FPS work and what influencing factors are considered?

The functions built into ToolExpert were developed from more than a thousand recorded measuring points. Highly productive and reliable system utilization comes about when the degree of capacity utilization of the milling cutter, the machine spindle, and the machine environment is as close as possible to maximum utilization.

#### Utilization of the milling cutter:

The optimum is the maximum possible chip removal rate of the cutter at the speed selected. The blue bar represents the chip removal rate with the set or recommended cutting data.

#### Utilization of the spindle:

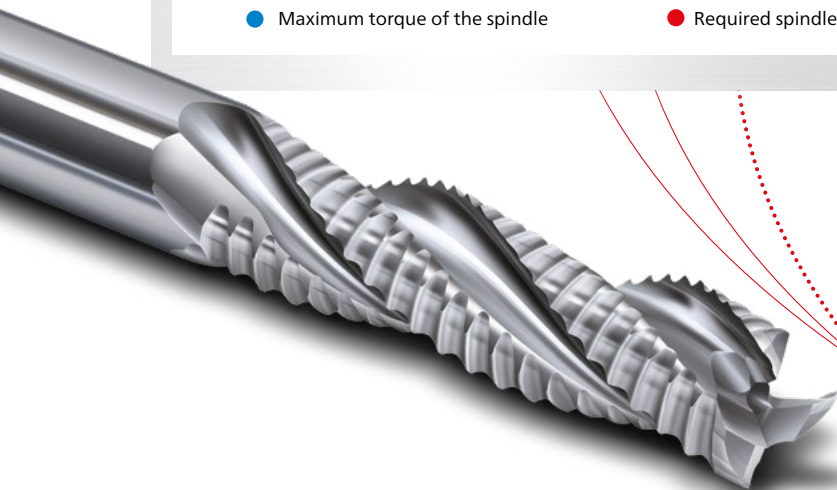
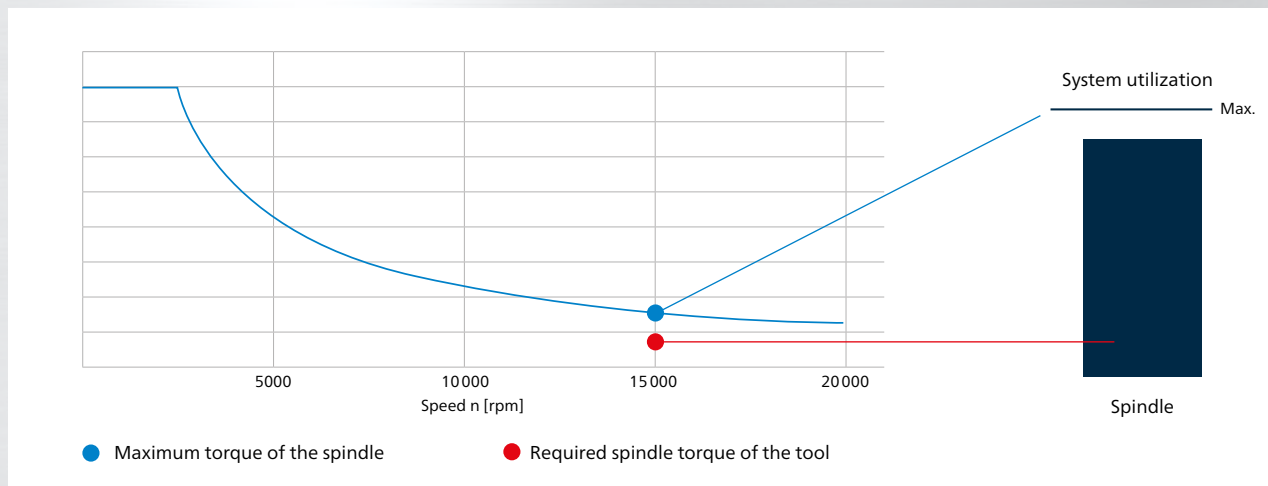
The maximum is the active spindle power and the spindle torque at the corresponding speed. The blue bar shows the power and torque required by the tool in relation to the active spindle power and spindle torque.

#### Utilization of the machine environment:

The output variable represents the cutting data recommended by FRAISA to ensure process reliability. These were derived from the entries made with respect to the machine environment. The blue bar shows the difference when the operator adjusts the cutting data.

[ 8 ]

Torque diagram of the spindle





## System utilization of the milling cutter, spindle, and machine environment

The goal is to utilize the system as efficiently as possible in order to achieve maximum productivity. **ToolExpert AX-FPS** reveals when too large a diameter has been selected, while utilization of the spindle can be optimally adjusted by

setting reduced cutting data, the performance potential of the cutter is far from being fully utilized. Smaller diameters are therefore recommended for less powerful machines or spindle interfaces.

### Maximum system utilization

AX-FPS (z3, normal version with short neck) N  
N° 15600 / 15500 d1 6-25



	d <sub>1</sub> [mm]	d <sub>2</sub> [mm]	l <sub>2</sub> [mm]	l <sub>3</sub> [mm]	z	Shank [mm]
<input type="checkbox"/>	6	6	13	20	3	15600300 15500300
<input type="checkbox"/>	8	8	18	26	3	15600391 15500391
<input checked="" type="checkbox"/>	10	10	22	31	3	15600450 15500450
<input type="checkbox"/>	12	12	26	37	3	15600501 15500501
<input type="checkbox"/>	16	16	32	46	3	15600610 15500610
<input type="checkbox"/>	20	20	40	53	3	15600682 15500682

\* Cylindrical shank HA, shank length = 50 mm

AX-FPS (z3, normal version with short neck) N  
N° 15502 d1 12-25



AX-FPS (z3, medium length version with neck) M  
N° 15605 / 15505 d1 6-25



**System load**



MILLING CUTTER SPINDLE MACHINE ENVIRONI

MODIFY CUTTING DATA

**Recommended cutting data FRAISA**




Diameter of the cutting edge	d <sub>1</sub>	[mm]	10
Number of cutting edges	z	-	3
Cutting speed	vc	[m/min]	375
Feed per tooth	fz	[mm]	0,12
Axial infeed depth	ap	[mm]	20
Radial infeed depth	ae	[mm]	6
Radial infeed depth	ae	[%] d <sub>1</sub>	60
Spindle speed	n	[min <sup>-1</sup> ]	12000
Feed rate	vf	[mm/min]	4320
Material removal rate	Q	[cm <sup>3</sup> /min]	518,4





# High-performance milling of aluminum with **AX-FPS**

## FRAISA's **AX-FPS** range up to cutting edge lengths **5.2xd**

End milling tools for aluminium and copper  
Profiled, cylindrical

Normal version								
N° 15500 / 15600		<b>AX-FPS</b>	<b>X-Generation X</b>	Roughing Finishing	d <sub>1</sub> 6 – 25 r	Al Aluminium Alloy		
N° 8563 / 8663		<b>new!</b>	<b>Performance P</b>	Roughing Finishing	d <sub>1</sub> 6 – 20 r	Al Aluminium Alloy	Cu Copper	
N° 0392			<b>HSS</b>	Roughing Finishing	d <sub>1</sub> 6 – 20 45°	Al Aluminium Alloy	Cu Copper	

Medium length version								
N° 15506 / 15606		<b>AX-FPS</b>	<b>X-Generation X</b>	Roughing Finishing	d <sub>1</sub> 6 – 20 r	Al Aluminium Alloy		

Medium length version with neck								
N° 15505 / 15605		<b>AX-FPS</b>	<b>X-Generation X</b>	Roughing Finishing	d <sub>1</sub> 6 – 25 r	Al Aluminium Alloy		
N° 8573 / 8673		<b>new!</b>	<b>Performance P</b>	Roughing Finishing	d <sub>1</sub> 6 – 20 r	Al Aluminium Alloy	Cu Copper	

5.2xd version								
N° 15507 / 15607		<b>AX-FPS</b>	<b>X-Generation X</b>	Roughing Finishing	d <sub>1</sub> 6 – 20 r	Al Aluminium Alloy		

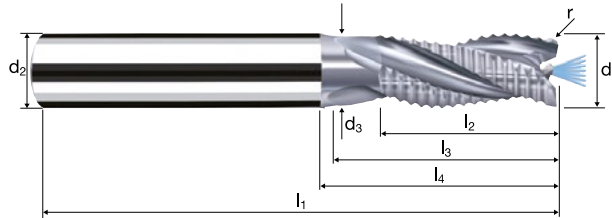
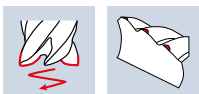
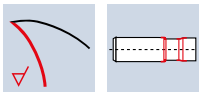
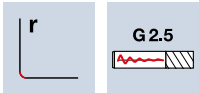
Normal version								
N° 15502		<b>AX-FPS</b>	<b>X-Generation X</b>	Roughing Finishing	r 1.0, 2.0, 2.5, 3.0	Al Aluminium Alloy		

# Cylindrical/Square end mills AX-FPS



Profiled, normal version, short neck  
 High-performance penetration edge, central cooling channel

**HM**  
**MG10**     $\lambda$  **30°**  
                   $\gamma$  **20°**



**Roughing**      **Finishing**

■■■■■      □□□□□

- Al Aluminium >99%
- Al Aluminium Alloy
- Al Aluminium Cast
- Cu Copper
- Plastic Thermoplast

Example: Order-N°.		Coating		Article-N°.	ø-Code					15600		
				<b>15500</b>	<b>300</b>			 			<b>15500</b>	
Ø Code	d <sub>1</sub> e8	d <sub>2</sub> h5	d <sub>3</sub>	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>4</sub>	r	z			
<b>300</b>	6.00	6.00	5.50	57	13.00	18.15	20.00	0.100	3	●		
<b>391</b>	8.00	8.00	7.40	63	18.00	23.63	26.00	0.150	3	●		
<b>450</b>	10.00	10.00	9.20	72	22.00	27.99	31.00	0.200	3	●		
<b>501</b>	12.00	12.00	11.00	83	26.00	33.29	37.00	0.200	3	●		
<b>610</b>	16.00	16.00	15.00	95	32.00	41.73	46.00	0.200	3	●		
<b>682</b>	20.00	20.00	19.00	104	40.00	48.23	53.00	0.200	3	●		
<b>770**</b>	25.00	25.00	24.00	121	44.00	58.68	64.00	0.250	3	●		
<b>772*</b>	25.00	25.00	24.00	121	50.00	64.68	70.00	0.250	3	●		
* Cylindrical shank HA, shank length = 50 mm												
** Shank with side clamping according to DIN 6535 HB												

# Cylindrical/Square end mills AX-FPS

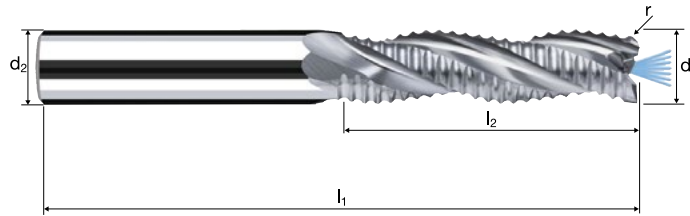
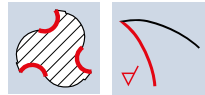
Profiled, medium version

High-performance penetration edge, central cooling channel



**HM**  $\lambda$  **30°**  
**MG10**  $\gamma$  **20°**

**r**  
**G 2.5**



**Roughing** **Finishing**

Al Aluminium > 99%   Al Aluminium Alloy   Al Aluminium Cast   Cu Copper   Plastic Thermoplast

Ø Code	d <sub>1</sub> e8	d <sub>2</sub> h5	l <sub>1</sub>	l <sub>2</sub>	r	z	Example: Order-N°.	
							Coating	Article-N°.
<b>300</b>	6.00	6.00	63	19.00	0.100	3	<b>15606</b>	<b>300</b>
<b>391</b>	8.00	8.00	72	28.00	0.150	3	<b>15506</b>	<b>300</b>
<b>450</b>	10.00	10.00	84	34.00	0.200	3	<b>15506</b>	<b>300</b>
<b>501</b>	12.00	12.00	97	40.00	0.200	3	<b>15506</b>	<b>300</b>
<b>610</b>	16.00	16.00	108	48.00	0.200	3	<b>15506</b>	<b>300</b>
<b>682</b>	20.00	20.00	122	56.00	0.200	3	<b>15506</b>	<b>300</b>

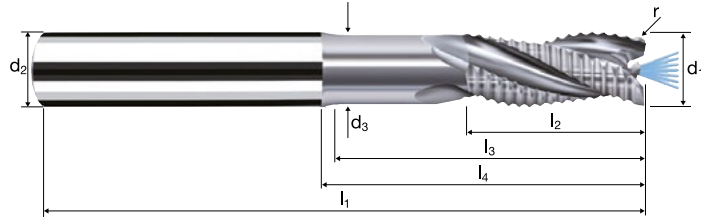
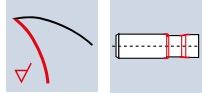
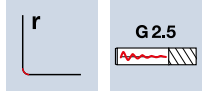
[ 12 ]

# Cylindrical/Square end mills AX-FPS

Profiled, medium version, neck  
High-performance penetration edge, central cooling channel



**HM**  
**MG10**     $\lambda$  **30°**  
                   $\gamma$  **20°**



**Roughing**      **Finishing**

■ ■ ■ ■ ■      □ □ □ □ □

			Al Aluminium > 99%	Al Aluminium Alloy	Al Aluminium Cast		Cu Copper	Plastic Thermoplast	
--	--	--	--------------------------	--------------------------	-------------------------	--	--------------	------------------------	--

Ø Code	d <sub>1</sub> e8	d <sub>2</sub> h5	d <sub>3</sub>	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>4</sub>	r	z	Ordering	
										Coating	Article-N°
Example: Order-N°.										15605	
										15505	
300	6.00	6.00	5.50	63	13.00	24.15	26.00	0.100	3	●	
391	8.00	8.00	7.40	72	18.00	32.63	35.00	0.150	3	●	
450	10.00	10.00	9.20	84	22.00	39.99	43.00	0.200	3	●	
501	12.00	12.00	11.00	97	26.00	47.29	51.00	0.200	3	●	
610	16.00	16.00	15.00	108	32.00	54.73	59.00	0.200	3	●	
682	20.00	20.00	19.00	122	40.00	66.23	71.00	0.200	3	●	
770**	25.00	25.00	24.00	144	50.00	81.68	87.00	0.250	3	●	
772*	25.00	25.00	24.00	144	50.00	86.68	92.00	0.250	3	●	
* Cylindrical shank HA, shank length = 50 mm											
** Shank with side clamping according to DIN 6535 HB											

# Cylindrical/Square end mills AX-FPS

Profiled, version 5.2xd

High-performance penetration edge, central cooling channel

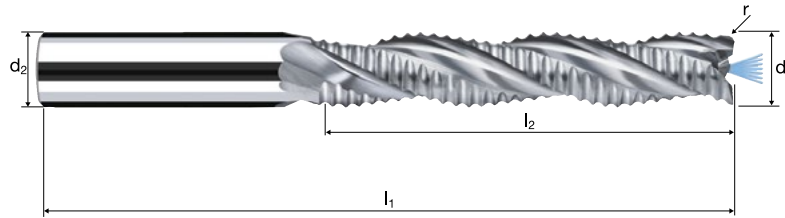
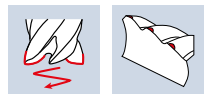
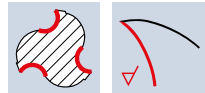


**HM**  
**MG10**

$\lambda$  **30°**  
 $\gamma$  **20°**

**r**

**G 2.5**



**Roughing**      **Finishing**

■ ■ ■ ■ ■      ■ ■ ■ ■ ■

Al Aluminium > 99%    **Al Aluminium Alloy**    Al Aluminium Cast    Cu Copper    Plastic Thermoplast

Ø Code	d <sub>1</sub> e8	d <sub>2</sub> h5	l <sub>1</sub>	l <sub>2</sub>	r	z	Example: Order-N°.	
							Coating	Article-N°.
							15607	
							15507	
<b>300</b>	6.00	6.00	73	32.00	0.100	3	●	
<b>391</b>	8.00	8.00	84	42.00	0.150	3	●	
<b>450</b>	10.00	10.00	100	53.00	0.200	3	●	
<b>501</b>	12.00	12.00	117	63.00	0.200	3	●	
<b>610</b>	16.00	16.00	144	84.00	0.200	3	●	
<b>682</b>	20.00	20.00	169	105.00	0.200	3	●	

[ 14 ]

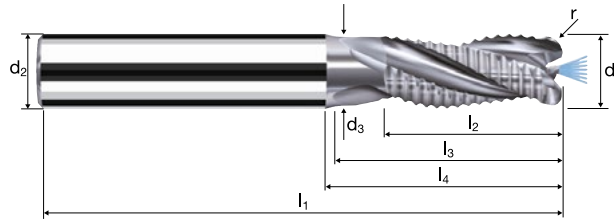
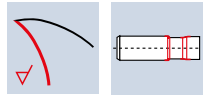
# Corner radius end mills AX-FPS



Profiled, normal version, neck  
High-performance penetration edge, central cooling channel

**HM**  $\lambda$  **30°**  
**MG10**  $\gamma$  **20°**

**h5** **G 2.5**



**Roughing** **Finishing**

			<b>Al</b> Aluminium > 99%	<b>Al</b> Aluminium Alloy	<b>Al</b> Aluminium Cast		<b>Cu</b> Copper	<b>Plastic</b> Thermoplast	
--	--	--	---------------------------------	---------------------------------	--------------------------------	--	---------------------	-------------------------------	--

Example: <b>Order-N°.</b>										Coating		Article-N°.		ø-Code		15502	
										15502		501					
$\emptyset$ Code	d <sub>1</sub> e8	d <sub>2</sub> h5	d <sub>3</sub>	l <sub>1</sub>	l <sub>2</sub>	l <sub>3</sub>	l <sub>4</sub>	r 0/+0.03	z								
<b>501</b>	12.00	12.00	11.00	83	26.00	33.29	37.00	1.000	3	●							
<b>608</b>	16.00	16.00	15.00	95	32.00	41.73	46.00	1.000	3	●							
<b>611</b>	16.00	16.00	15.00	95	32.00	41.73	46.00	2.000	3	●							
<b>506</b>	12.00	12.00	11.00	83	26.00	33.29	37.00	2.500	3	●							
<b>612</b>	16.00	16.00	15.00	95	32.00	41.73	46.00	2.500	3	●							
<b>684</b>	20.00	20.00	19.00	104	40.00	48.23	53.00	2.500	3	●							
<b>613</b>	16.00	16.00	15.00	95	32.00	41.73	46.00	3.000	3	●							



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