passion
for precision

fraisa

AX high-performance milling cutters

New horizons for quality and process reliability

AX: Maximum performance and excellent component quality thanks to innovative technology

The **AX range of aluminum milling cutters** has undergone continuous development by **FRAISA** during the last years. In the field of roughing technology, the **AX-FPS** has set **new standards in terms of maximum performance and low power consumption**. The cutters are equipped with a speciallly ground roughing profile and an internal cooling channel. Ideal prerequisites for optimum chip removal.

FRAISA ToolExpert® AX-FPS ensures maximum productivity and safety in the respective application thanks to **perfect coordination of the tools and machine environment** – for **cutting depths of up to 5.2xd.**

The basis of these new performance horizons: a **supporting chamfer technology patented by FRAISA**. This involves forming a very highly polished (mirror-finish-ground), very finely coordinated chamfer at the curved and end cutting edges. This dampens any vibrations that occur and improves the milling properties in an impressive manner.

NEW TECHNOLOGY

This technology has now been developed even further for the new **AX high-performance finishing cutters**. The **supporting chamfer width changes variably from the end face to the side face** – when milling thin-walled components, this facilitates minimal deflection while still providing excellent damping.

This **innovative technology from FRAISA is patented and excites even experienced users.** For the first time, **very thin, tall or long aluminum component walls** can now be finished in one shot.

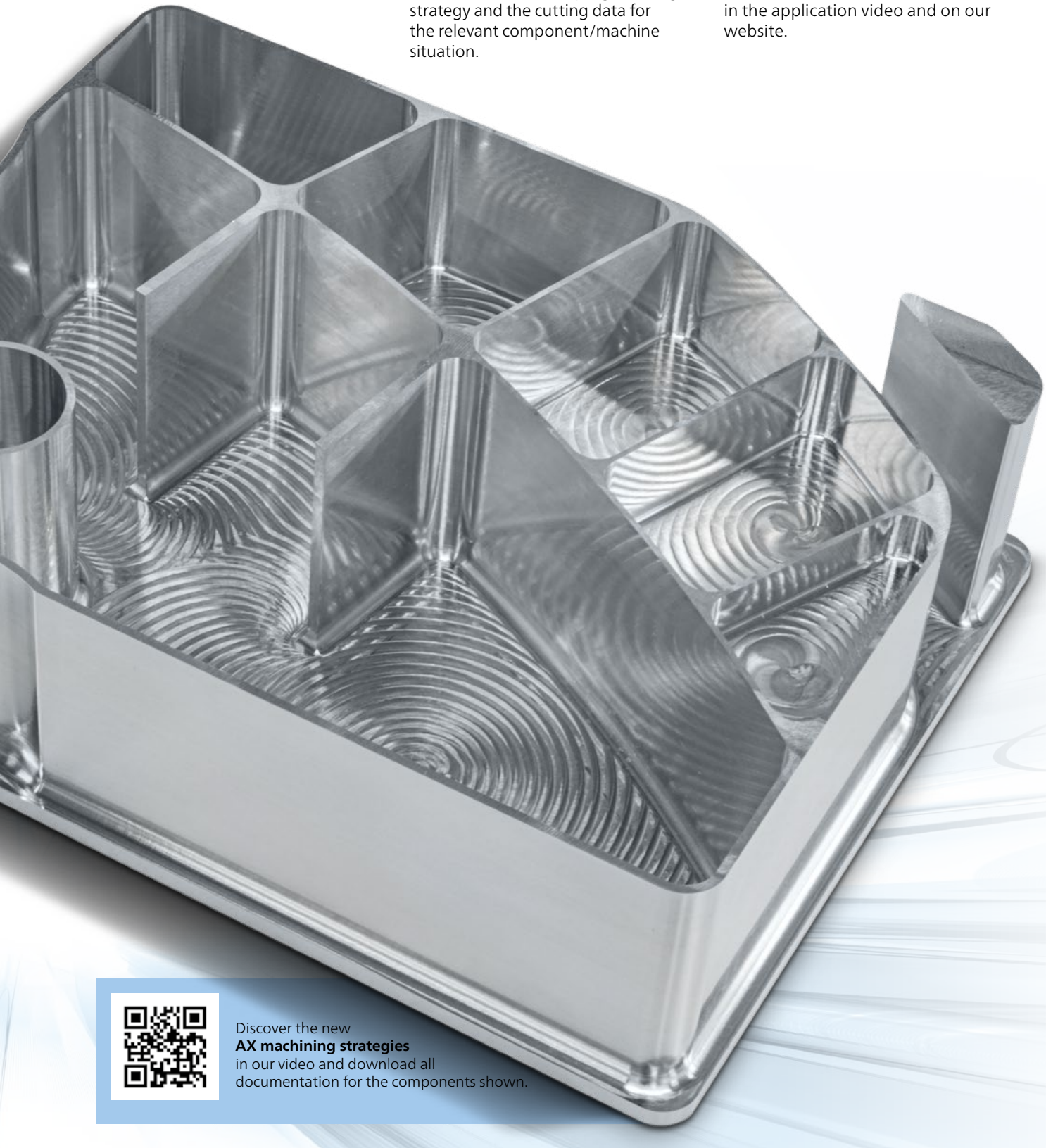
This significantly reduces **machining time** compared to conventional layer-by-layer finishing and raises **component quality** to an unprecedented level. Subsequent manual grinding operations to reduce the milled offsets can be completely eliminated and precise bores of the highest quality can be milled.

With deep and toleranced pockets with small transition radii, high accuracy is also achieved in machine components.

New machining strategy by combining roughing and finishing tools

Inspiring results can be achieved by **using long roughing and finishing tools in combination with** a **new machining strategy**. The key elements here are the programming strategy and the cutting data for the relevant component/machine situation.

The new **AX finishing cutters open up new horizons as regards quality and performance**. All information on the components depicted in this brochure can also be found in the application video and on our website.



Discover the new
AX machining strategies
in our video and download all
documentation for the components shown.

Roughing and finishing combined

Roughing with AX-FPS

With **AX-FPS technology**, **productivity and cost efficiency** take absolute top priority. Positive, easy-cut geometries and mirror-finish flutes ensure excellent chip formation and good chip removal that benefits from a central coolant supply. **This guarantees maximum performance.**

Notes on application technology:

- Degrease cylindrical shanks and chucking devices before assembling
- Always fully complete roughing of each plane both inside and outside

HPC roughing

- With normal or medium-long version with neck and with largest possible ap and ae, and normal fz
- Cutting data acc. to FRAISA ToolExpert® AX-FPS
- Speed n high, depending on dynamics and torque of the machine
- Final pass with ae = 0

HDC roughing

- With medium-long and 5.2xd versions
- Programming with constant cutting conditions and dynamic travel range
- No abrupt changes of direction
- Programming of the minimum curvature radius 1.05xd1 or 1.10xr
- Avoid vibration by varying the speed in FRAISA ToolExpert® AX-FPS – the volume remains constant
- For weak components: 2x contour milling with ae = 0.05xd1 and final pass with ae = 0
- Always machine each cut alternately on the inside and outside, working toward the final contour

AX high-performance finishing cutters with revolutionary supporting chamfer technology

Unique and patented by FRAISA:
The innovative supporting chamfer technology facilitates the **finishing of thin-walled, tall and long component walls** and **sturdy components with deep finishing depths and greater radial engagement.**

This unique tool concept is particularly impressive due to the fact that it offers extremely easy cutting with perfectly coordinated **variable supporting chamfers** and mirror-finish flutes and flanks for minimum adhesion.

Notes on application technology:

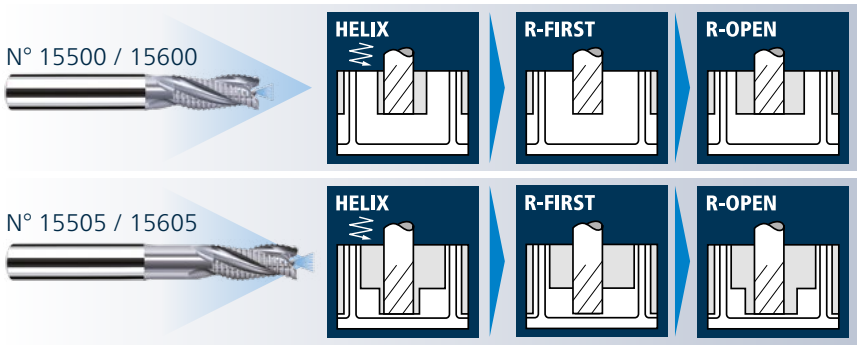
- Cutting data for **sturdy and weak components:** acc. to cutting data page in catalog and FRAISA ToolExpert® 2.0
- Less dynamic: reduction of speed n in line with the component complexity and machine environment
- The recommended feed rate fz and speed n can be reduced even further for very thin, tall or long component walls
- Machining begins with prefinishing of the inner and outer sides of the component wall, which is then followed by finishing

Technologies built into the AX finishing cutters

For detailed explanations of the tool technologies, please refer to the information section in the "High-performance Milling Tools" catalog.

1. HPC roughing of NL & ML neck with AX-FPS up to depth of approx. 4xd

- Penetration w. helical interpolation
- Roughing from the inside to the outside
- Roughing layer by layer
- Cutting data: FRAISA ToolExpert® AX-FPS
- Alternate both sides of the wall per layer
- Final pass with ae = 0
- Allowance per side of wall with ae = PF+F

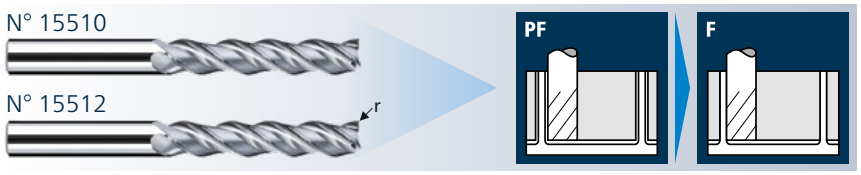


2. HDC roughing of ML & 5.2xd with AX-FPS up to depth of 5.2xd

- Penetration w. helical interpolation
- Cutting data: FRAISA ToolExpert® AX-FPS
- Weak: 2x contour milling with ae = 0.05xd1 and final track with blank cut ae = 0. Use speed n and feed rate vf from PF application for weak components from AX finishing cutter.
- Allowance per side of wall with ae = PF+F

3. Finishing of wall with AX finishing cutter up to depth of 5.2xd

- Prefinishing PF, both sides of wall
- Finishing F, both sides of wall
- Cutting data: FRAISA ToolExpert® 2.0 or cutting data page for weak components
- Adjust dynamics (vc) to component and machine environment



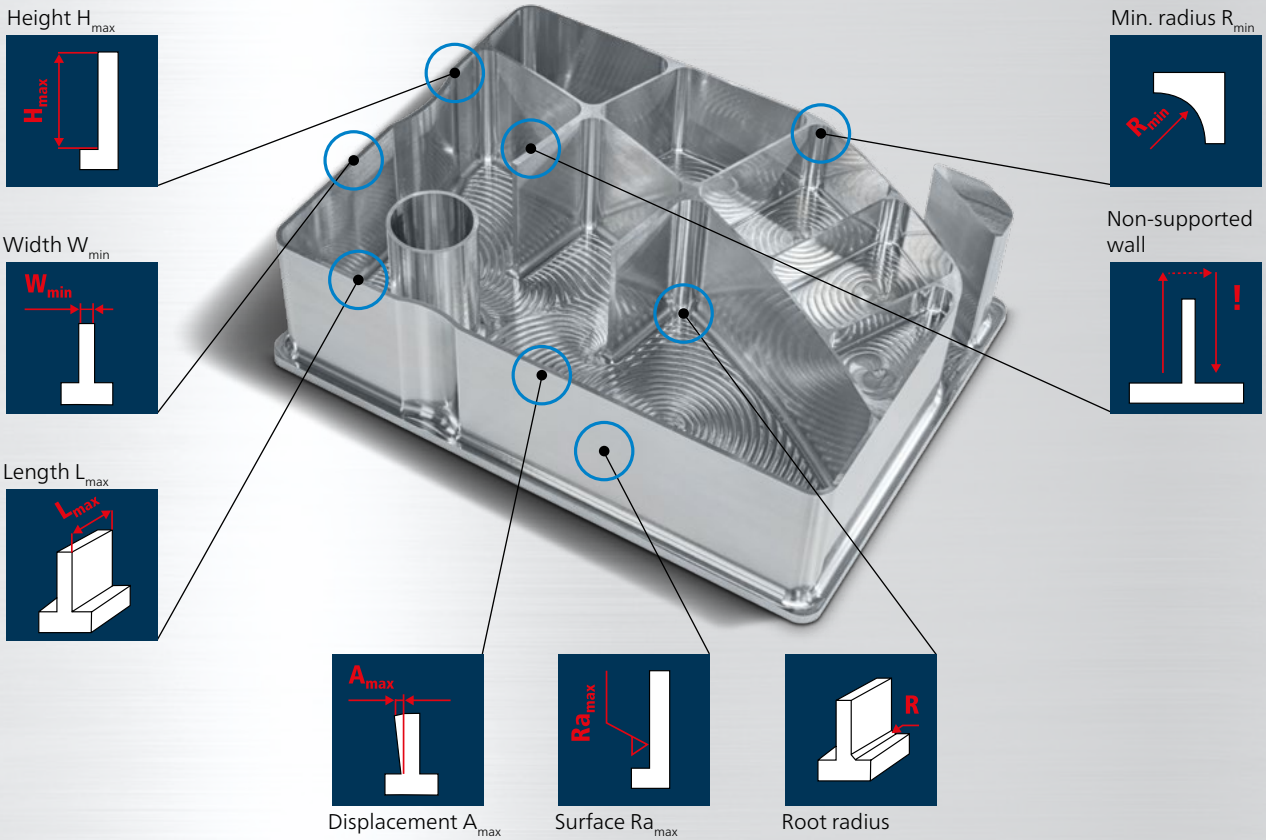
4. Milling of the base and root radius

- The base can also be milled prior to finishing (wall finishing)
- Milling of the base with AX-RV
- Root radius with AX-RV or AX finishing cutter with corner radius
- Root radius: Program a small clearance of approx. 0.02 mm from wall and base

Optimization of the cutting data and machining strategy

The tool, cutting data, and machining strategy are selected on the basis of the component. The following notes on the individual component properties and their effect on the machining process can be used to optimize the manufacturing time and improve the manufacturing quality.

Component properties



Min. radius R_{min} determines the maximum cutter diameter. Rule: R_{min}x0.90 ≥ r tool. In the case of critical radii or high cutting edge utilization, a 60% reduction of the feed rate should be programmed.

For the **non-supported wall**, synchronization should be achieved by milling the front side first, as long as the web is still sturdy. To prevent the webs from buckling, we recommend you traverse straight over the edge of each web.

The **height H_{max}, width W_{min}** and **length L_{max}** together determine how weak the component is at any given point. For extremely thin walls, the speed and feed rate of the PF and F cutting data recommendations should be reduced by a further 30%.

The **displacement A_{max}** is influenced by the machining strategy. In the case of very thin wall thicknesses, the prefinish and finish passes must be carried out. Reduced ae and fz values improve the displacement.

The inner and outer sides of the wall should always be machined one after the other with the same application in order to achieve the best homogenization result and uniform qualities.

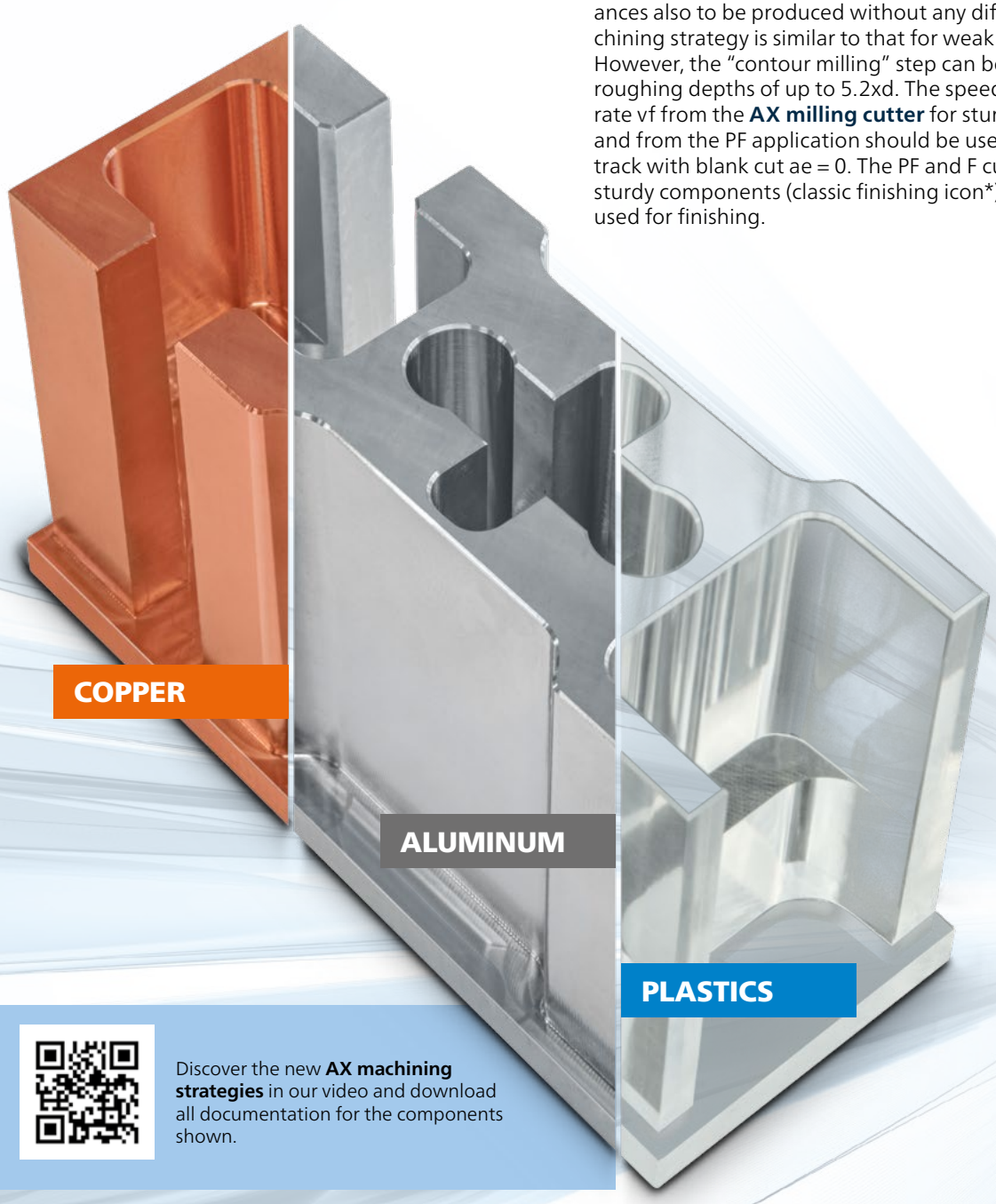
The parameters specified produce a **high surface quality R_a**. The **milling dynamics are the most important control parameter** when it comes to avoiding vibration. The speed should be reduced to achieve excellent finishing results. In addition, the milling cutter needs **time to build up a suitable cutting pressure and provide optimum chip formation.**

AX high-performance milling cutters for stabile components and newly added materials

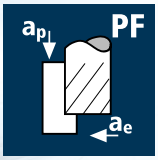
AX-FPS and **AX finishing cutters** are ideal for a range of different materials such as copper, plastics and non-ferrous metals. The relevant cutting data can be found in FRAISA ToolExpert® 2.0 as well as in this brochure.

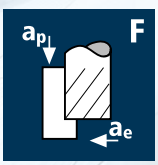
The advantage when machining sturdy component walls is the very low level of deflection of the **AX finishing cutter** combined with very smooth running. This enables **precise fits with tight tolerances** to be milled along the entire length of the cutting edge and a **very high surface quality** to be achieved.

High cutting edge utilization is also no problem for the **AX finishing cutter** – enabling bores with tight tolerances also to be produced without any difficulty. The machining strategy is similar to that for weak components. However, the "contour milling" step can be omitted when roughing depths of up to 5.2xd. The speed n and feed rate vf from the **AX milling cutter** for sturdy components and from the PF application should be used for the final track with blank cut ae = 0. The PF and F cutting data for sturdy components (classic finishing icon*) can also be used for finishing.



Discover the new **AX machining strategies** in our video and download all documentation for the components shown.





* Classic finishing icon.

AX high-performance milling cutters for aluminum with cutting edge lengths of up to 5.2xd

End milling tools for aluminium and copper
Finishing, cylindrical

5.2xd version

N° 15510

AX

X-Generation

Roughing
Finishing

d, 6 – 20

r

Al Aluminium Alloy

Cu Copper

Finishing, with corner radius

5.2xd version

N° 15512

AX

X-Generation

Roughing
Finishing

r 1.0, 2.5

r

Al Aluminium Alloy

Cu Copper

Profiled, cylindrical

Normal version

N° 15500 / 15600

AX-FPS

X-Generation

Roughing
Finishing

d, 6 – 25

r

Al Aluminium Alloy

Medium length version

N° 15506 / 15606

AX-FPS

X-Generation

Roughing
Finishing

d, 6 – 20

r

Al Aluminium Alloy

Medium length version with neck

N° 15505 / 15605

AX-FPS

X-Generation

Roughing
Finishing

d, 6 – 25

r

Al Aluminium Alloy

5.2xd version

N° 15507 / 15607

AX-FPS

X-Generation

Roughing
Finishing

d, 6 – 20

r

Al Aluminium Alloy

Profiled, with corner radius

Normal version

N° 15502

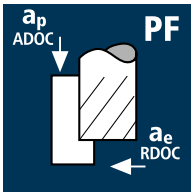
AX-FPS

X-Generation

Roughing
Finishing

r 1.0, 2.0, 2.5, 3.0

Al Aluminium Alloy

Application	Material	d_1 [mm]	z	v_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	n [min^{-1}]	v_f [mm/min]
	Wrought aluminium Construction aluminium	6.00	3	300	0.025	32.000	0.080	15915	1194
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		10.00	3	350	0.030	53.000	0.120	11140	1003
		12.00	3	350	0.030	63.000	0.120	9285	836
		16.00	3	400	0.035	84.000	0.150	7960	836
		20.00	3	400	0.035	105.000	0.150	6365	668
	Cast aluminium	6.00	3	270	0.025	32.000	0.080	14325	1074
		8.00	3	270	0.030	42.000	0.100	10745	967
		10.00	3	315	0.030	53.000	0.120	10025	902
		12.00	3	315	0.030	63.000	0.120	8355	752
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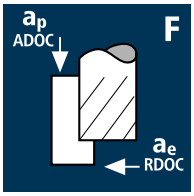	Wrought aluminium Construction aluminium	6.00	3	200	0.020	32.000	0.030	10610	637
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		12.00	3	250	0.025	63.000	0.050	6630	497
		16.00	3	300	0.030	84.000	0.050	5970	537
		20.00	3	300	0.030	105.000	0.050	4775	430
	Cast aluminium	6.00	3	180	0.020	32.000	0.030	9550	573
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		10.00	3	225	0.025	53.000	0.050	7160	537
		12.00	3	225	0.025	63.000	0.050	5970	448
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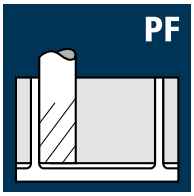	Wrought aluminium Construction aluminium	6.00	3	200	0.025	32.000	0.060	10610	796
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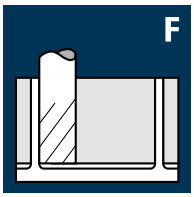	Wrought aluminium Construction aluminium	6.00	3	150	0.020	32.000	0.030	7960	478
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		12.00	3	120	0.025	63.000	0.040	3185	239
		16.00	3	150	0.030	84.000	0.050	2985	269
		20.00	3	150	0.030	105.000	0.050	2385	215

Cylindrical/Square end mills AX

Finishing, version 5.2xd

X-Generation

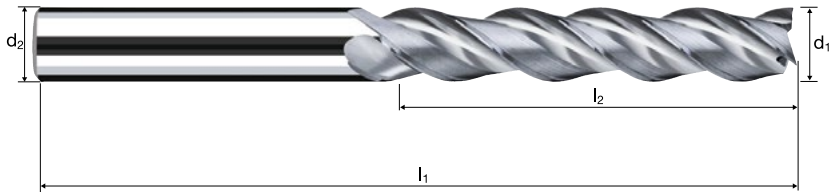
HM
MG10

λ 40°
γ 20°

r

G 2.5

Vario



Roughing

Finishing

ReTool®

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

Example: **Order-N°.** Coating **15510** Article-N°. ø-Code **300**

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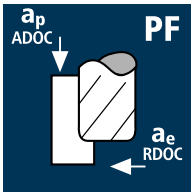
450	10.00	10.00	100	53.00	0.200	3	●	
501	12.00	12.00	117	63.00	0.200	3	●	
610	16.00	16.00	144	84.00	0.200	3	●	
682	20.00	20.00	169	105.00	0.200	3	●	

Application	Material	d_1 [mm]	z	v_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	n [min^{-1}]	v_f [mm/min]
	Wrought aluminium Construction aluminium	6.00	3	300	0.025	32.000	0.080	15915	1194
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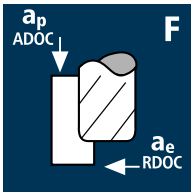	Wrought aluminium Construction aluminium	6.00	3	200	0.020	32.000	0.030	10610	637
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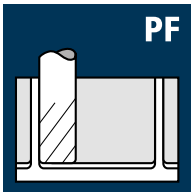	Wrought aluminium Construction aluminium	6.00	3	200	0.025	32.000	0.060	10610	796
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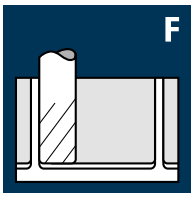	Wrought aluminium Construction aluminium	6.00	3	150	0.020	32.000	0.030	7960	478
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		20.00	3	150	0.030	105.000	0.050	2385	215

Corner radius end mills AX

Finishing, version 5.2xd

X-Generation

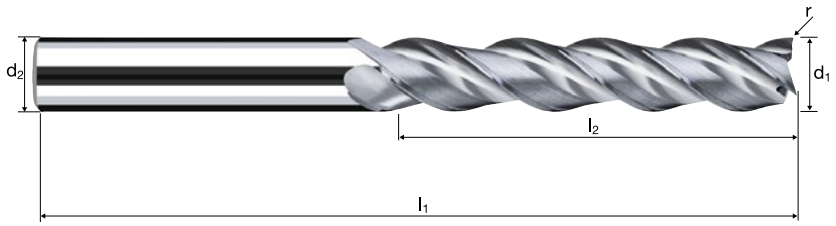
HM
MG10

λ 40°
γ 20°

r

G 2.5

Vario



Roughing

Finishing

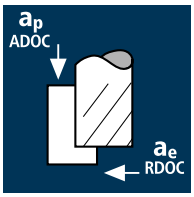
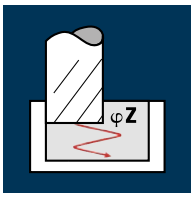
ReTool®

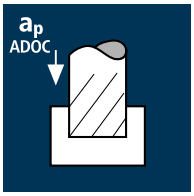
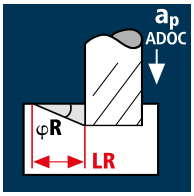
			Al Aluminium > 99%	Al Aluminium Alloy	Al Aluminium Cast		Cu Copper	Plastic Thermoplast	

Example: **Order-N°.** Coating **15512** Article-N°. ø-Code **302**

Ø Code	d_1 e8	d_2 h6	l_1	l_2	r	z	15512	
302	6.00	6.00	73	32.00	1.000	3	●	I
391	8.00	8.00	84	42.00	1.000	3	●	I
450	10.00	10.00	100	53.00	1.000	3	●	I
501	12.00	12.00	117	63.00	1.000	3	●	I
608	16.00	16.00	144	84.00	1.000	3	●	I
457	10.00	10.00	100	53.00	2.500	3	●	I
506	12.00	12.00	117	63.00	2.500	3	●	I
612	16.00	16.00	144	84.00	2.500	3	●	I
684	20.00	20.00	169	105.00	2.500	3	●	I

I Availability and delivery dates on request

Application	Material	d_1 [mm]	z	v_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	n [min^{-1}]	v_f [mm/min]	Q [cm^3/min]	φZ [°]
	Wrought aluminium Construction aluminium	6.00	3	500	0.080	9.000	4.800	26525	6366	275.0	20.0°
		8.00	3	500	0.100	12.000	6.400	19895	5969	458.4	20.0°
		10.00	3	500	0.120	15.000	8.000	15915	5729	687.5	20.0°
		12.00	3	500	0.140	18.000	9.600	13265	5571	962.7	20.0°
		16.00	3	500	0.160	24.000	12.800	9945	4774	1466.4	20.0°
		20.00	3	500	0.180	30.000	16.000	7960	4298	2063.2	20.0°
		25.00	3	500	0.200	37.500	20.000	6365	3819	2864.3	20.0°
	Cast aluminium	6.00	3	450	0.080	9.000	4.800	23875	5730	247.5	20.0°
		8.00	3	450	0.100	12.000	6.400	17905	5372	412.5	20.0°
		10.00	3	450	0.120	15.000	8.000	14325	5157	618.8	20.0°
		12.00	3	450	0.140	18.000	9.600	11935	5013	866.2	20.0°
		16.00	3	450	0.160	24.000	12.800	8950	4296	1319.7	20.0°
		20.00	3	450	0.180	30.000	16.000	7160	3866	1855.9	20.0°
		25.00	3	450	0.200	37.500	20.000	5730	3438	2578.5	20.0°
	Unalloyed copper	6.00	3	400	0.072	9.000	4.800	21220	4584	198.0	12.0°
		8.00	3	400	0.090	12.000	6.400	15915	4297	330.0	12.0°
		10.00	3	400	0.108	15.000	8.000	12730	4125	494.9	12.0°
		12.00	3	400	0.126	18.000	9.600	10610	4011	693.0	12.0°
		16.00	3	400	0.144	24.000	12.800	7960	3439	1056.4	12.0°
		20.00	3	400	0.162	30.000	16.000	6365	3093	1484.8	12.0°
		25.00	3	400	0.180	37.500	20.000	5095	2751	2063.5	12.0°

Application	Material	d_1 [mm]	z	v_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	n [min^{-1}]	v_f [mm/min]	Q [cm^3/min]	φR [°]	LR [mm]
	Wrought aluminium Construction aluminium	6.00	3	450	0.072	9.000	6.000	23875	5157	278.5	25.0°	19.3
		8.00	3	450	0.090	12.000	8.000	17905	4834	464.1	25.0°	25.7
		10.00	3	450	0.108	15.000	10.000	14325	4641	696.2	25.0°	32.2
		12.00	3	450	0.126	18.000	12.000	11935	4511	974.5	25.0°	38.6
		16.00	3	450	0.144	24.000	16.000	8950	3866	1484.7	25.0°	51.5
		20.00	3	450	0.162	30.000	20.000	7160	3480	2087.9	25.0°	64.3
		25.00	3	450	0.180	37.500	25.000	5730	3094	2900.8	25.0°	80.4
	Cast aluminium	6.00	3	405	0.072	9.000	6.000	21485	4641	250.6	25.0°	19.3
		8.00	3	405	0.090	12.000	8.000	16115	4351	417.7	25.0°	25.7
		10.00	3	405	0.108	15.000	10.000	12890	4176	626.5	25.0°	32.2
		12.00	3	405	0.126	18.000	12.000	10745	4062	877.3	25.0°	38.6
		16.00	3	405	0.144	24.000	16.000	8055	3480	1336.2	25.0°	51.5
		20.00	3	405	0.162	30.000	20.000	6445	3132	1879.4	25.0°	64.3
		25.00	3	405	0.180	37.500	25.000	5155	2784	2609.7	25.0°	80.4
	Unalloyed copper	6.00	3	320	0.058	9.000	6.000	16975	2954	159.5	15.0°	33.6
		8.00	3	320	0.072	12.000	8.000	12730	2750	264.0	15.0°	44.8
		10.00	3	320	0.086	15.000	10.000	10185	2628	394.2	15.0°	56.0
		12.00	3	320	0.101	18.000	12.000	8490	2573	555.7	15.0°	67.2
		16.00	3	320	0.115	24.000	16.000	6365	2196	843.2	15.0°	89.6
		20.00	3	320	0.130	30.000	20.000	5095	1987	1192.3	15.0°	112.0
		25.00	3	320	0.140	37.500	25.000	4075	1712	1604.5	15.0°	140.0

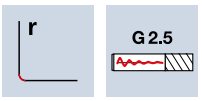
Use **ToolExpert® AX-FPS** to determine the best possible cutting data for your machining environment!

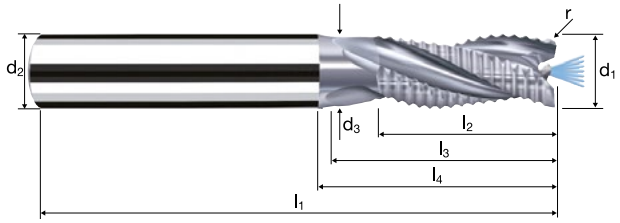
Cylindrical/Square end mills AX-FPS

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

X-Generation

HM MG10	λ 30° γ 20°





Roughing

Finishing

ReTool®

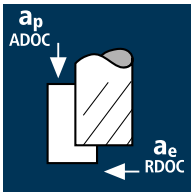
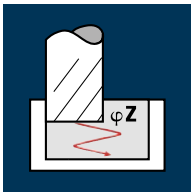
			Al Aluminium > 99%	Al Aluminium Alloy	Al Aluminium Cast		Cu Copper	Plastic Thermoplast	

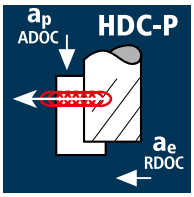
Example: **Order-N°.** Coating **15500** Article-N°. ø-Code **300**

Ø Code	d_1 e8	d_2 h5	d_3	l_1	l_2	l_3	l_4	r	z	15600	15500
300	6.00	6.00	5.50	57	13.00	18.15	20.00	0.100	3		●
391	8.00	8.00	7.40	63	18.00	23.63	26.00	0.150	3		●
450	10.00	10.00	9.20	72	22.00	27.99	31.00	0.200	3		●
501	12.00	12.00	11.00	83	26.00	33.29	37.00	0.200	3		●
610	16.00	16.00	15.00	95	32.00	41.73	46.00	0.200	3		●
682	20.00	20.00	19.00	104	40.00	48.23	53.00	0.200	3		●
770**	25.00	25.00	24.00	121	44.00	58.68	64.00	0.250	3		●
772*	25.00	25.00	24.00	121	50.00	64.68	70.00	0.250	3		●

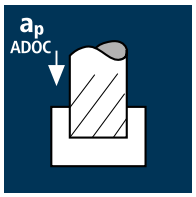
* Cylindrical shank HA, shank length = 50 mm

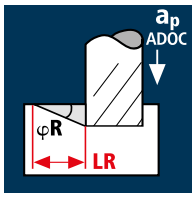
** Shank with side clamping according to DIN 6535 HB

Application	Material	d_1 [mm]	z	v_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	n [min^{-1}]	v_f [mm/min]	Q [cm^3/min]	φZ [°]
	Wrought aluminium Construction aluminium	6.00	3	450	0.064	9.000	3.600	23875	4584	148.5	15.0°
		8.00	3	450	0.080	12.000	4.800	17905	4297	247.5	15.0°
		10.00	3	450	0.096	15.000	6.000	14325	4126	371.3	15.0°
		12.00	3	450	0.112	18.000	7.200	11935	4010	519.7	15.0°
		16.00	3	450	0.128	24.000	9.600	8950	3437	791.8	15.0°
		20.00	3	450	0.144	30.000	12.000	7160	3093	1113.5	15.0°
	Cast aluminium	6.00	3	405	0.064	9.000	3.600	21485	4125	133.7	15.0°
		8.00	3	405	0.080	12.000	4.800	16115	3868	222.8	15.0°
		10.00	3	405	0.096	15.000	6.000	12890	3712	334.1	15.0°
		12.00	3	405	0.112	18.000	7.200	10745	3610	467.9	15.0°
		16.00	3	405	0.128	24.000	9.600	8055	3093	712.7	15.0°
		20.00	3	405	0.144	30.000	12.000	6445	2784	1002.3	15.0°
	Unalloyed copper	6.00	3	360	0.058	9.000	3.600	19100	3323	107.7	9.0°
		8.00	3	360	0.072	12.000	4.800	14325	3094	178.2	9.0°
		10.00	3	360	0.086	15.000	6.000	11460	2957	266.1	9.0°
		12.00	3	360	0.101	18.000	7.200	9550	2894	375.0	9.0°
		16.00	3	360	0.115	24.000	9.600	7160	2470	569.1	9.0°
		20.00	3	360	0.130	30.000	12.000	5730	2235	804.5	9.0°

Application	Material	d_1 [mm]	z	v_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	n [min^{-1}]	v_f [mm/min]	Q [cm^3/min]
	Wrought aluminium Construction aluminium	6.00	3	300	0.104	19.000	1.800	15915	4966	169.8
		8.00	3	350	0.134	28.000	2.400	13925	5598	376.2
		10.00	3	400	0.181	34.000	3.000	12730	6912	705.1
		12.00	3	400	0.259	40.000	3.600	10610	8244	1187.1
		16.00	3	500	0.300	48.000	4.800	9945	8951	2062.2
		20.00	3	500	0.340	56.000	6.000	7960	8119	2728.1
	Cast aluminium	6.00	3	270	0.104	19.000	1.800	14325	4469	152.9
		8.00	3	315	0.134	28.000	2.400	12535	5039	338.6
		10.00	3	360	0.181	34.000	3.000	11460	6223	634.7
		12.00	3	360	0.259	40.000	3.600	9550	7420	1068.5
		16.00	3	450	0.300	48.000	4.800	8950	8055	1855.9
		20.00	3	450	0.340	56.000	6.000	7160	7303	2453.9
	Unalloyed copper	6.00	3	240	0.083	19.000	1.800	12730	3170	108.4
		8.00	3	280	0.107	28.000	2.400	11140	3576	240.3
		10.00	3	320	0.145	34.000	3.000	10185	4431	451.9
		12.00	3	320	0.207	40.000	3.600	8490	5272	759.2
		16.00	3	400	0.239	48.000	4.800	7960	5707	1315.0
		20.00	3	400	0.273	56.000	6.000	6365	5213	1751.5

Use **ToolExpert® AX-FPS** to determine the best possible cutting data for your machining environment!





Cylindrical/Square end mills AX-FPS

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

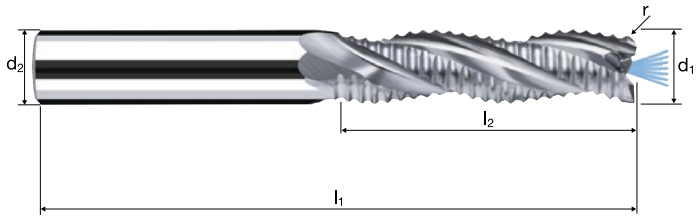
X-Generation

HM
MG10

λ 30°
γ 20°

r

G 2.5



Roughing

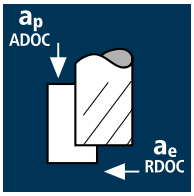
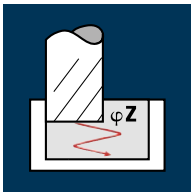
Finishing

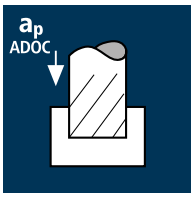
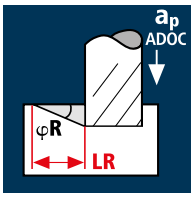
ReTool®

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

Example: **Order-N°.** Coating **15506** Article-N°. **300** ø-Code

							15606	
							15506	
Ø Code	d_1 e8	d_2 h5	l_1	l_2	r	z		
300	6.00	6.00	63	19.00	0.100	3	●	
391	8.00	8.00	72	28.00	0.150	3	●	
450	10.00	10.00	84	34.00	0.200	3	●	
501	12.00	12.00	97	40.00	0.200	3	●	
610	16.00	16.00	108	48.00	0.200	3	●	
682	20.00	20.00	122	56.00	0.200	3	●	

Application	Material	d_1 [mm]	z	v_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	n [min^{-1}]	v_f [mm/min]	Q [cm^3/min]	φZ [°]
	Wrought aluminium Construction aluminium	6.00	3	450	0.064	9.000	3.600	23875	4584	148.5	15.0°
		8.00	3	450	0.080	12.000	4.800	17905	4297	247.5	15.0°
		10.00	3	450	0.096	15.000	6.000	14325	4126	371.3	15.0°
		12.00	3	450	0.112	18.000	7.200	11935	4010	519.7	15.0°
		16.00	3	450	0.128	24.000	9.600	8950	3437	791.8	15.0°
		20.00	3	450	0.144	30.000	12.000	7160	3093	1113.5	15.0°
		25.00	3	450	0.160	37.500	15.000	5730	2750	1547.1	15.0°
	Cast aluminium	6.00	3	405	0.064	9.000	3.600	21485	4125	133.7	15.0°
		8.00	3	405	0.080	12.000	4.800	16115	3868	222.8	15.0°
		10.00	3	405	0.096	15.000	6.000	12890	3712	334.1	15.0°
		12.00	3	405	0.112	18.000	7.200	10745	3610	467.9	15.0°
		16.00	3	405	0.128	24.000	9.600	8055	3093	712.7	15.0°
		20.00	3	405	0.144	30.000	12.000	6445	2784	1002.3	15.0°
		25.00	3	405	0.160	37.500	15.000	5155	2474	1391.9	15.0°
	Unalloyed copper	6.00	3	360	0.058	9.000	3.600	19100	3323	107.7	9.0°
		8.00	3	360	0.072	12.000	4.800	14325	3094	178.2	9.0°
		10.00	3	360	0.086	15.000	6.000	11460	2957	266.1	9.0°
		12.00	3	360	0.101	18.000	7.200	9550	2894	375.0	9.0°
		16.00	3	360	0.115	24.000	9.600	7160	2470	569.1	9.0°
		20.00	3	360	0.130	30.000	12.000	5730	2235	804.5	9.0°
		25.00	3	360	0.140	37.500	15.000	4585	1926	1083.2	9.0°

Application	Material	d_1 [mm]	z	v_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	n [min^{-1}]	v_f [mm/min]	Q [cm^3/min]	φR [°]	LR [mm]
	Wrought aluminium Construction aluminium	6.00	3	315	0.051	9.000	6.000	16710	2557	138.1	15.0°	33.6
		8.00	3	315	0.064	12.000	8.000	12535	2407	231.0	15.0°	44.8
		10.00	3	315	0.077	15.000	10.000	10025	2316	347.4	15.0°	56.0
		12.00	3	315	0.090	18.000	12.000	8355	2256	487.3	15.0°	67.2
		16.00	3	315	0.102	24.000	16.000	6265	1917	736.2	15.0°	89.6
		20.00	3	315	0.115	30.000	20.000	5015	1730	1038.1	15.0°	112.0
		25.00	3	315	0.130	37.500	25.000	4010	1564	1466.2	15.0°	140.0
	Cast aluminium	6.00	3	285	0.051	9.000	6.000	15120	2322	125.4	15.0°	33.6
		8.00	3	285	0.064	12.000	8.000	11340	2177	209.0	15.0°	44.8
		10.00	3	285	0.077	15.000	10.000	9070	2090	313.5	15.0°	56.0
		12.00	3	285	0.090	18.000	12.000	7560	2032	438.9	15.0°	67.2
		16.00	3	285	0.102	24.000	16.000	5670	1742	668.9	15.0°	89.6
		20.00	3	285	0.115	30.000	20.000	4535	1567	940.4	15.0°	112.0
		25.00	3	285	0.128	37.500	25.000	3630	1394	1306.8	15.0°	140.0
	Unalloyed copper	6.00	3	216	0.040	9.000	6.000	11460	1375	74.3	9.0°	56.8
		8.00	3	216	0.050	12.000	8.000	8595	1289	123.8	9.0°	75.8
		10.00	3	216	0.060	15.000	10.000	6875	1238	185.6	9.0°	94.7
		12.00	3	216	0.071	18.000	12.000	5730	1221	263.6	9.0°	113.6
		16.00	3	216	0.081	24.000	16.000	4295	1044	400.8	9.0°	151.5
		20.00	3	216	0.091	30.000	20.000	3440	939	563.5	9.0°	189.4
		25.00	3	216	0.100	37.500	25.000	2750	825	773.4	9.0°	236.8

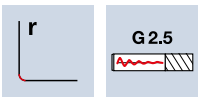
Use **ToolExpert® AX-FPS** to determine the best possible cutting data for your machining environment!

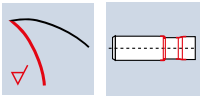
Cylindrical/Square end mills AX-FPS

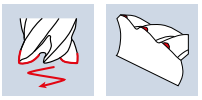
Profiled, medium version, neck
High-performance penetration edge, central cooling channel

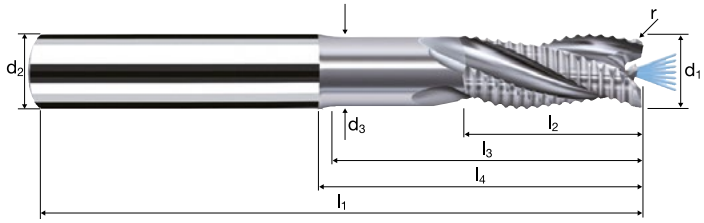
X-Generation

HM MG10	λ 30° γ 20°









Roughing

Finishing

ReTool®

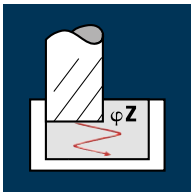
			Al Aluminium > 99%	Al Aluminium Alloy	Al Aluminium Cast		Cu Copper	Plastic Thermoplast	

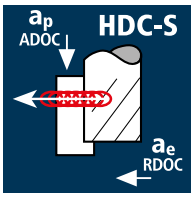
Example: **Order-N°.** Coating **15505** Article-N°. **300** ø-Code

											15605	
											15505	
Ø Code	d_1 e8	d_2 h5	d_3	l_1	l_2	l_3	l_4	r	z			
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

Application	Material	d_1 [mm]	z	v_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	n [min^{-1}]	v_f [mm/min]	φZ [°]
	Wrought aluminium Construction aluminium	6.00	3	300	0.065	32.000	5.400	15915	3103	5.0°
		8.00	3	300	0.080	42.000	7.200	11935	2864	5.0°
		10.00	3	350	0.095	53.000	9.000	11140	3175	5.0°
		12.00	3	350	0.110	63.000	10.800	9285	3064	5.0°
		16.00	3	400	0.130	84.000	14.400	7960	3104	5.0°
		20.00	3	400	0.145	105.000	18.000	6365	2769	5.0°
	Cast aluminium	6.00	3	270	0.065	32.000	5.400	14325	2793	5.0°
		8.00	3	270	0.080	42.000	7.200	10745	2579	5.0°
		10.00	3	315	0.095	53.000	9.000	10025	2857	5.0°
		12.00	3	315	0.110	63.000	10.800	8355	2757	5.0°
		16.00	3	360	0.130	84.000	14.400	7160	2792	5.0°
		20.00	3	360	0.145	105.000	18.000	5730	2493	5.0°
	Unalloyed copper	6.00	3	240	0.059	32.000	5.400	12730	2253	3.5°
		8.00	3	240	0.072	42.000	7.200	9550	2063	3.5°
		10.00	3	280	0.086	53.000	9.000	8915	2300	3.5°
		12.00	3	280	0.099	63.000	10.800	7425	2205	3.5°
		16.00	3	320	0.117	84.000	14.400	6365	2234	3.5°
		20.00	3	320	0.131	105.000	18.000	5095	2002	3.5°

Application	Material	d_1 [mm]	z	v_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	n [min^{-1}]	v_f [mm/min]	Q [cm^3/min]
	Wrought aluminium Construction aluminium	6.00	3	300	0.106	32.000	0.600	15915	5061	97.2
		8.00	3	350	0.153	42.000	0.800	13925	6392	214.8
		10.00	3	401	0.175	53.000	1.000	12765	6702	355.2
		12.00	3	401	0.211	63.000	1.200	10635	6732	508.9
		16.00	3	500	0.215	84.000	1.600	9945	6415	862.1
		20.00	3	500	0.241	105.000	2.000	7960	5755	1208.6
	Cast aluminium	6.00	3	270	0.106	32.000	0.600	14325	4555	87.5
		8.00	3	315	0.153	42.000	0.800	12535	5754	193.3
		10.00	3	360	0.175	53.000	1.000	11460	6017	318.9
		12.00	3	360	0.211	63.000	1.200	9550	6045	457.0
		16.00	3	450	0.215	84.000	1.600	8950	5773	775.9
		20.00	3	450	0.241	105.000	2.000	7160	5177	1087.1
	Unalloyed copper	6.00	3	240	0.085	32.000	0.600	12730	3246	62.3
		8.00	3	279	0.123	42.000	0.800	11100	4096	137.6
		10.00	3	320	0.138	53.000	1.000	10185	4217	223.5
		12.00	3	320	0.168	63.000	1.200	8490	4279	323.5
		16.00	3	399	0.170	84.000	1.600	7940	4049	544.2
		20.00	3	399	0.192	105.000	2.000	6350	3658	768.1

Use **ToolExpert® AX-FPS** to determine the best possible cutting data for your machining environment!

Cylindrical/Square end mills AX-FPS

Profiled, version 5.2xd
High-performance penetration edge, central cooling channel

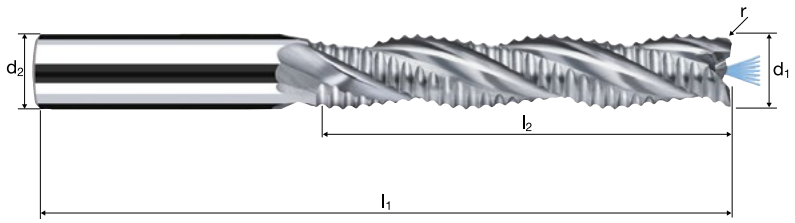
X-Generation

HM
MG10

λ 30°
γ 20°

r

G 2.5



Roughing

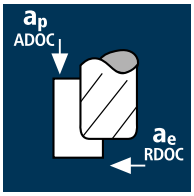
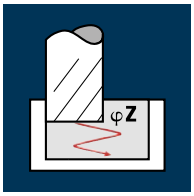
Finishing

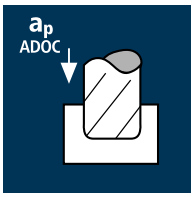
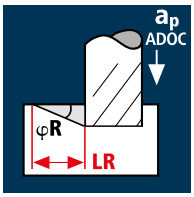
ReTool®

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

Example: **Order-N°.** Coating **15507** Article-N°. **300** ø-Code

Ø Code	d_1 e8	d_2 h5	l_1	l_2	r	z	15607	15507
300	6.00	6.00	73	32.00	0.100	3	●	
391	8.00	8.00	84	42.00	0.150	3	●	
450	10.00	10.00	100	53.00	0.200	3	●	
501	12.00	12.00	117	63.00	0.200	3	●	
610	16.00	16.00	144	84.00	0.200	3	●	
682	20.00	20.00	169	105.00	0.200	3	●	

Application	Material	d_1 [mm]	z	v_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	n [min⁻¹]	v_f [mm/min]	Q [cm³/min]	φZ [°]
	Wrought aluminium Construction aluminium	12.00	3	500	0.140	18.000	9.600	13265	5571	962.7	12.0°
		16.00	3	500	0.160	24.000	12.800	9945	4774	1466.4	13.0°
		20.00	3	500	0.180	30.000	16.000	7960	4298	2063.2	15.0°
	Cast aluminium	12.00	3	450	0.140	18.000	9.600	11935	5013	866.2	12.0°
		16.00	3	450	0.160	24.000	12.800	8950	4296	1319.7	13.0°
		20.00	3	450	0.180	30.000	16.000	7160	3866	1855.9	15.0°
	Unalloyed copper	12.00	3	400	0.126	18.000	9.600	10610	4011	693.0	7.0°
		16.00	3	400	0.144	24.000	12.800	7960	3439	1056.4	8.0°
		20.00	3	400	0.162	30.000	16.000	6365	3093	1484.8	9.0°

Application	Material	d_1 [mm]	z	v_c [m/min]	f_z [mm]	a_p [mm]	a_e [mm]	n [min⁻¹]	v_f [mm/min]	Q [cm³/min]	φR [°]	LR [mm]
	Wrought aluminium Construction aluminium	12.00	3	450	0.126	18.000	12.000	11935	4511	974.5	15.0°	67.2
		16.00	3	450	0.144	24.000	16.000	8950	3866	1484.7	16.0°	83.7
		20.00	3	450	0.162	30.000	20.000	7160	3480	2087.9	19.0°	87.1
	Cast aluminium	12.00	3	405	0.126	18.000	12.000	10745	4062	877.3	15.0°	67.2
		16.00	3	405	0.144	24.000	16.000	8055	3480	1336.2	16.0°	83.7
		20.00	3	405	0.162	30.000	20.000	6445	3132	1879.4	19.0°	87.1
	Unalloyed copper	12.00	3	320	0.101	18.000	12.000	8490	2573	555.7	9.0°	113.6
		16.00	3	320	0.115	24.000	16.000	6365	2196	843.2	9.5°	143.4
		20.00	3	320	0.130	30.000	20.000	5095	1987	1192.3	11.5°	147.5

Use **ToolExpert® AX-FPS** to determine the best possible cutting data for your machining environment!

Corner radius end mills AX-FPS

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

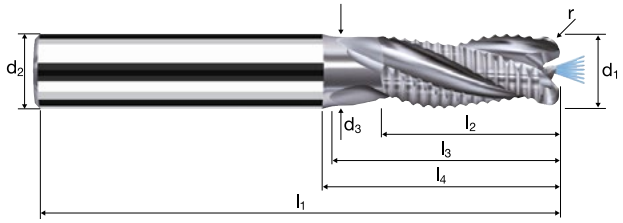
X-Generation

HM
MG10

λ 30°
γ 20°

h5

G 2.5



Roughing

Finishing

ReTool®

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

Example: **Order-N°.** Coating: — Article-N°.: **15502** ø-Code: **501**

Ø Code	d_1 e8	d_2 h5	d_3	l_1	l_2	l_3	l_4	r 0/+0.03	z	15502	
501	12.00	12.00	11.00	83	26.00	33.29	37.00	1.000	3	●	
608	16.00	16.00	15.00	95	32.00	41.73	46.00	1.000	3	●	
611	16.00	16.00	15.00	95	32.00	41.73	46.00	2.000	3	●	
506	12.00	12.00	11.00	83	26.00	33.29	37.00	2.500	3	●	
612	16.00	16.00	15.00	95	32.00	41.73	46.00	2.500	3	●	
684	20.00	20.00	19.00	104	40.00	48.23	53.00	2.500	3	●	
613	16.00	16.00	15.00	95	32.00	41.73	46.00	3.000	3	●	

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