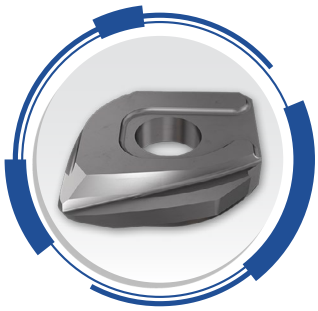
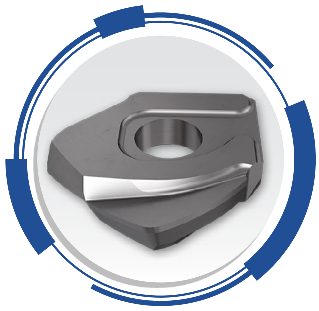
BARREL SHAPED ENDMILLS

Tool Selector Guide

Metric Catalog

MACHINING INTELLIGENTLY





SOLID CARBIDE ENDMILLS

MULTI-MASTER HEADS

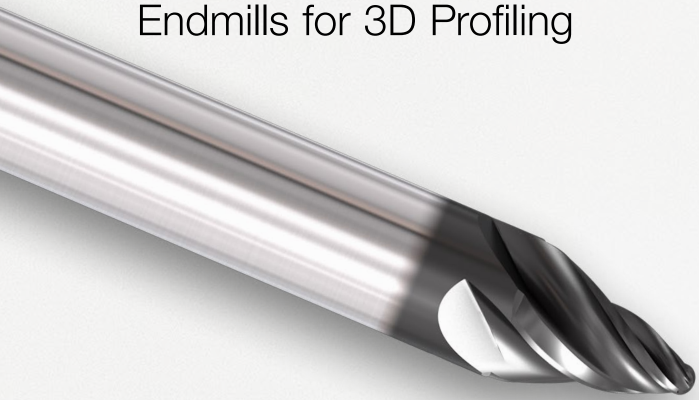
SINGLE INSERT CUTTERS

Member IMC Group

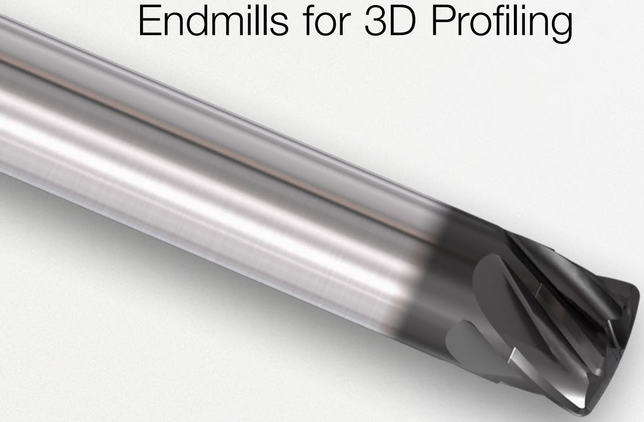
www.iscar.com

Barrel Shaped Endmills

Oval Shaped
Solid Carbide
Endmills for 3D Profiling



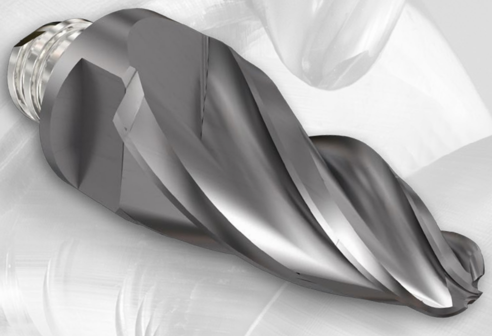
Taper Shaped
Solid Carbide
Endmills for 3D Profiling



Lens Shaped
Solid Carbide
Endmills for 3D Profiling

NEOBARREL
PROFILE MILLING

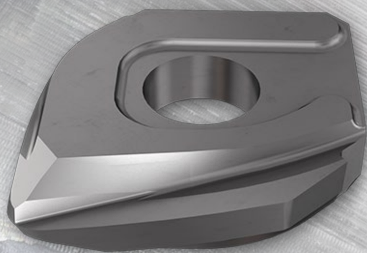
MULTI-MASTER Exchangeable Carbide Heads



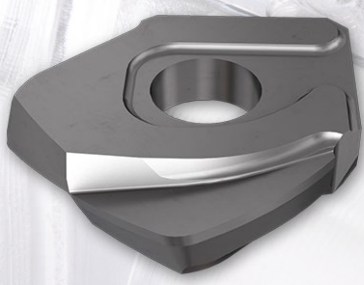
Oval Shaped
Solid Carbide Heads

Lens Shaped
Solid Carbide Heads

Single Insert Cutters



Taper Barrel Shaped
Inserts with 2 Cutting Edges



Combined Barrel and Lens Shaped
Inserts with 2 Cutting Edges

Expanding the Boundaries of Barrel Endmill Applications

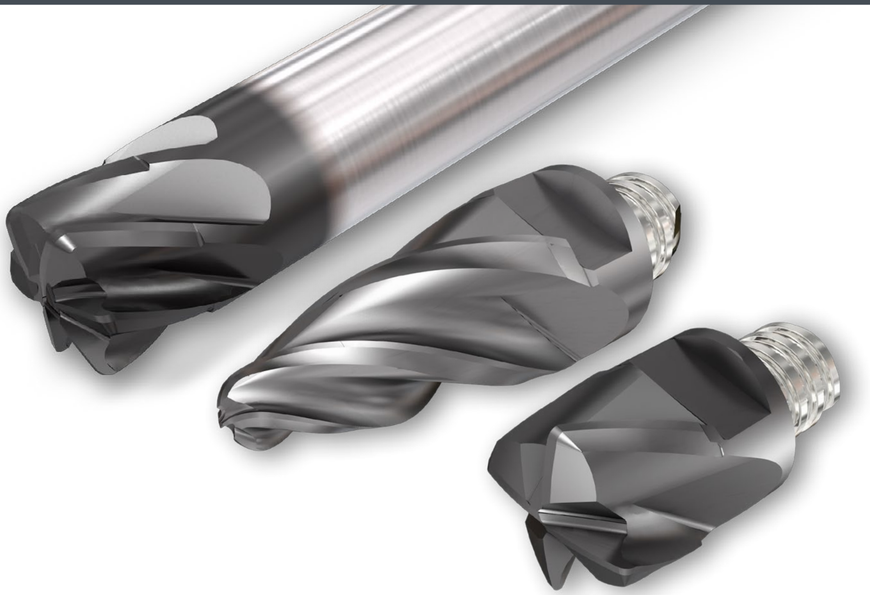
Endmills that feature a cutting edge being the segment of a large-diameter arc were introduced approximately 25 years ago.
As the cutting-edge shape of these endmills is reminiscent of a barrel profile, terms such as “barrel milling cutters”, “barrel endmills” became common when referring to these types of endmills. At first, the use of these barrel-shaped mills was limited to a few specific applications, such as machining 3D surfaces of complex dies and turbomachinery components.
However, advances in 5-axis machining and in CAM systems have significantly expanded the boundaries of barrel endmill applications.
Traditionally, ball-nose and toroidal cutters perform these machining operations.
The large-diameter arc of the endmills cutting edge provides substantial reduction of the cusp height generated between passes machined by a ball-nose or toroidal cutter.

Another advantage of this type of cutting edge versus ball-nose and toroidal cutters is a significant increase in the distance between passes (a stepover or a stepdown, depending on the direction of a cutter displacement after every pass), at least four times more without the degradation of the surface finish parameters. This implies that the number of passes and machining time can be substatially reduced. Increasing the distance between passes also improves tool life and therefore decreases tool cost per part.

The main consumers of “cutting barrels” are producers of aerospace, die and mold, medical, turbine and compressor components.
Cutting tool companies have strengthened their efforts to develop and manufacture more advanced barrel endmill designs to meet increased customer demands. Some of **ISCAR**’s latest product such as, barrel endmills, **MULTI-MASTER** and one insert cutter families show good examples of this trend.

ISCAR's program for barrel-shaped cutters comprises tools in the following design configuration:

- **Solid carbide endmills.**
- **Assembled endmills that mount MULTI-MASTER interchangeable carbide heads, and indexable endmills.**



These cutters differ in their capabilities and field of application.

The figures and tables provide general data that relate to the cutters.

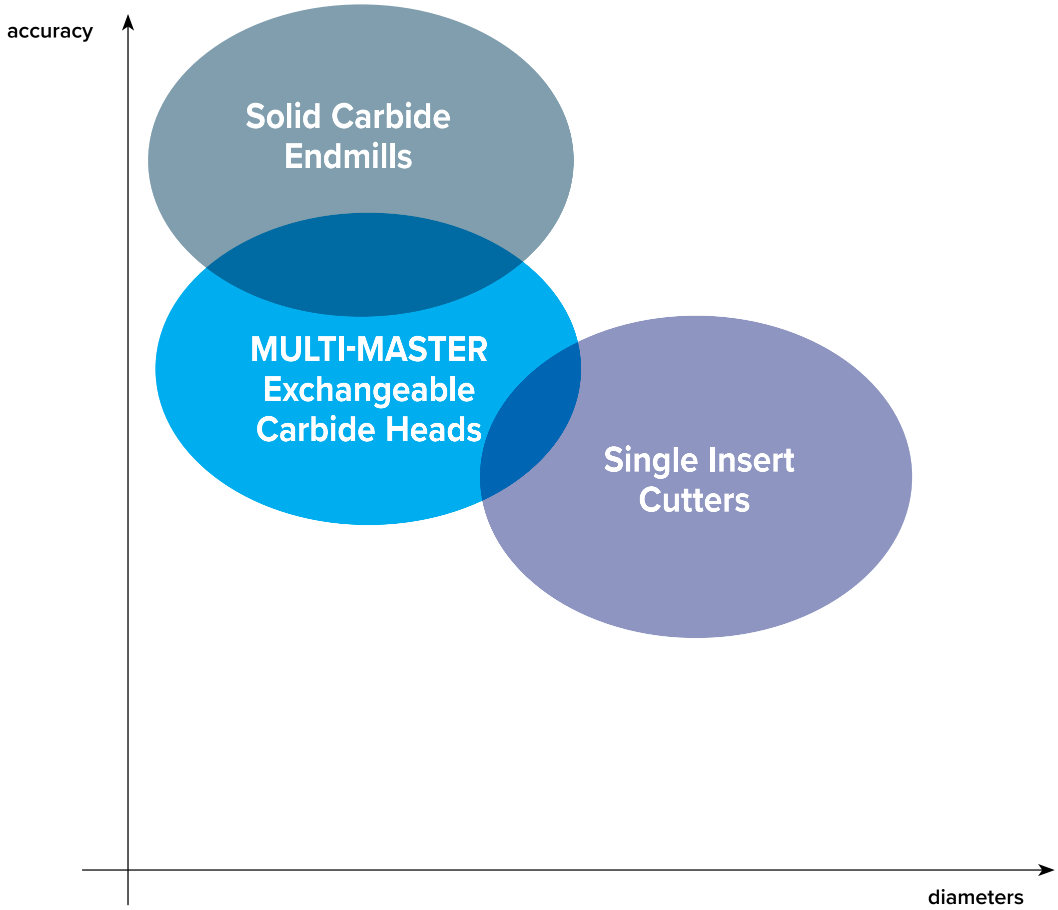


Table 1 - the Main Parameters of Barrel Shaped Cutters

Type	Parameters				
	Diameters Range (mm)	Geometry			Number of Teeth
		Barrel	Lens	Taper	
Solid Carbide Endmills	8-16	•	•	•	2-6
MULTI-MASTER Cutters	8-16	•	•		2-6
Single Insert Cutters	12-25	•	•	•	2

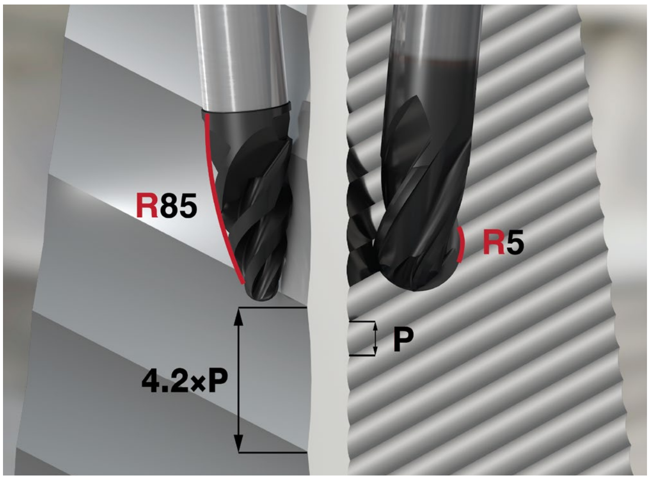
The Design Concept Advantages

Solid carbide design ensures the highest tool accuracy. **ISCAR** offers oval and lens shaped solid carbide endmills in diameter ranges of 8 - 16mm.
In addition, barrel endmills have been manufactured as interchangeable carbide heads with **MULTI-MASTER** threaded adaptations in the diameter ranges of 8 - 16mm.

MULTI-MASTER's distinctive "no setup time" phenomenon, which enables the replacement of a worn head without removing the tool from the machine spindle, is effective in barrel tool applications for semi-finish and finish milling operations.

The one insert cutter design enables cost-efficient increase of the cutter diameter range of up to 25mm. According to this concept barrel-shaped inserts are mounted on endmills.

MULTI-MASTER Interchangeable Carbide Heads



Comparative Example: Multiple-Pass Milling by 10-mm-in-Diameter Barrel Shaped (left) and Ball Nose (right) Endmills

Estimated Scallop when Milling with Barrel Shaped Cutters

Oval Shaped Solid Carbide Heads						
Diameter (mm)	Radius (mm)	Scallops Height (mm) 0.002	0.004	0.01	0.015	
8	80	1.13	1.6	2.53	3.1	Stepsize a_p (mm)
10	85	1.17	1.65	2.61	3.19	
12	75	1.1	1.55	2.45	3	
16	75	1.1	1.55	2.45	3	

Lens Shaped Solid Carbide Heads						
Diameter (mm)	Radius (mm)	Scallops Height (mm) 0.002	0.004	0.01	0.015	
8	16	0.51	0.72	1.13	1.39	Stepsize a_e (mm)
10	20	0.57	0.8	1.26	1.55	
12	24	0.62	0.88	1.39	1.7	
16	32	0.72	1.01	1.6	1.96	

Solid Carbide Endmills

Estimated Scallop when Milling with Barrel Shaped Cutters

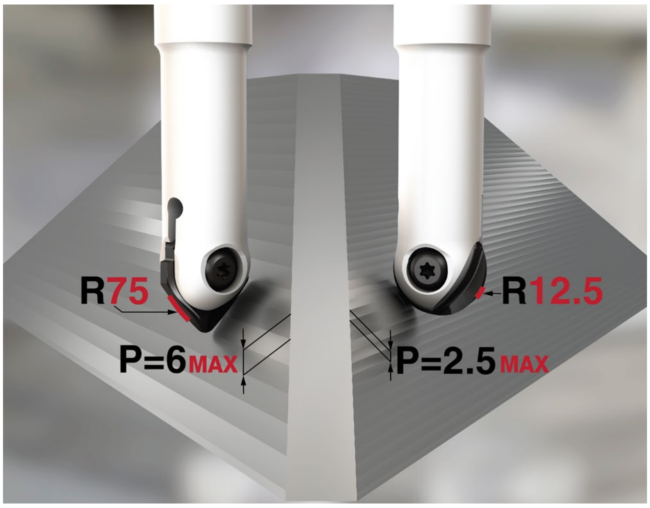
Tapered Shaped Endmills						
		Scallops Height (mm)				
Diameter (mm)	Radius (mm)	0.002	0.004	0.01	0.015	
8	250	2	2.83	4.47	5.48	Stepsize a_p (mm)
10	250	2	2.83	4.47	5.48	
12	250	2	2.83	4.47	5.48	

Oval Shaped Endmills						
		Scallops Height (mm)				
Diameter (mm)	Radius (mm)	0.002	0.004	0.01	0.015	
8	90	1.2	1.7	2.68	3.29	Stepsize a_p (mm)
10	85	1.17	1.65	2.61	3.19	
12	80	1.13	1.6	2.53	3.1	
16	1000	4.00	5.66	8.95	10.95	

Lens Shaped Endmills						
		Scallops Height (mm)				
Diameter (mm)	Radius (mm)	0.002	0.004	0.01	0.015	
8	16	0.51	0.72	1.13	1.39	Stepsize a_e (mm)
10	20	0.57	0.8	1.26	1.55	
12	25	0.63	0.89	1.41	1.73	

Barrel Shaped Endmills

Single Insert Cutters



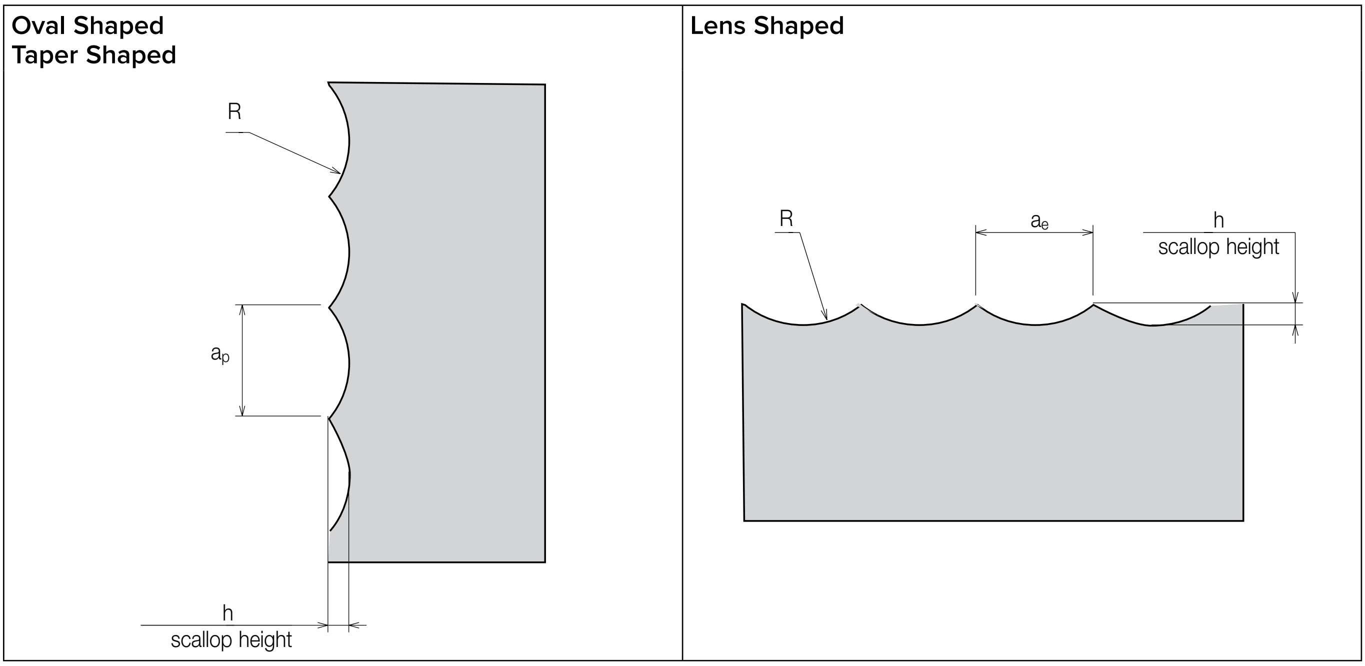
3D Profiling Aluminum Comparative Example: Multiple Pass
Milling by 10-mm-in-Diameter Barrel Shaped (left) and Ball Nose (right)

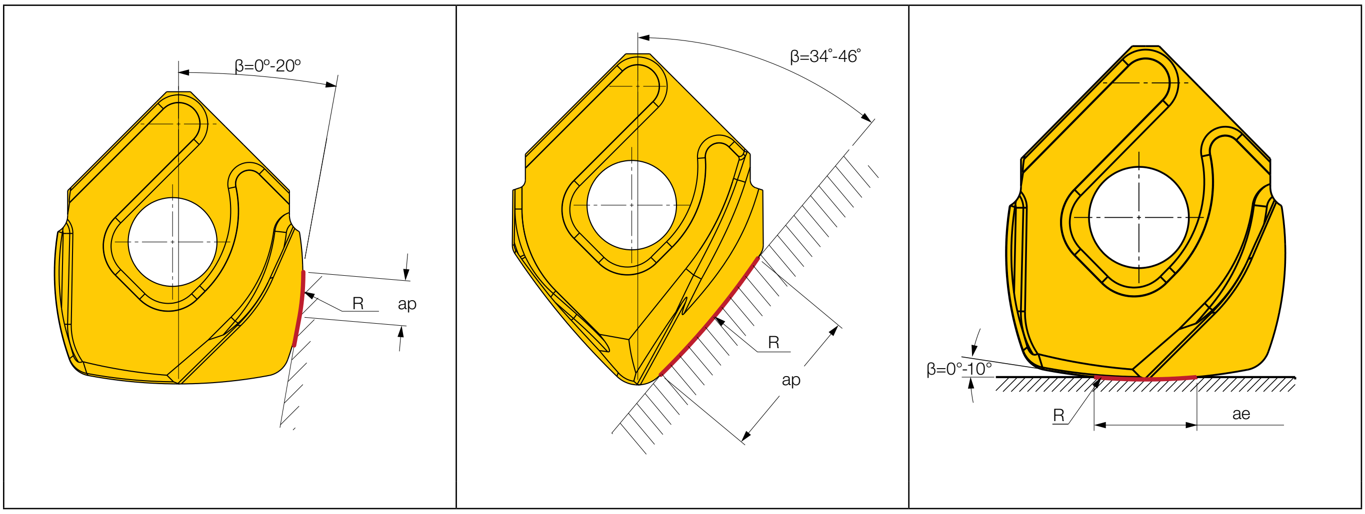
Endmills Estimated Scallop when Milling with Barrel Shaped Cutters

HCT Taper Barrel Determination of a_p Value							
Insert Designation	R (mm)	h- Scallop Height (mm)					
		0.002	0.004	0.006	0.01	0.016	
HCT D120-QF	30	0.7	0.98	1.2	1.55	1.96	Stepsize a_p (mm)
HCT D160-QF	45	0.85	1.2	1.47	1.9	2.4	
HCT D200-QF	60	0.98	1.39	1.7	2.19	2.77	
HCT D250-QF	75	1.09	1.55	1.9	2.45	3.1	

HLB Barrel Determination of a_p Value							
Insert Designation	R (mm)	h- Scallop Height (mm)					
		0.002	0.004	0.006	0.01	0.016	
HLB D120-QF	12	0.44	0.62	0.76	0.98	1.24	Stepsize a_p (mm)
HLB D160-QF	16	0.51	0.72	0.88	1.13	1.4	
HLB D200-QF	20	0.56	0.8	0.98	1.27	1.6	
HLB D250-QF	25	0.63	0.9	1.1	1.41	1.8	

HLB Lens Determination of a_e Value							
Insert Designation	R (mm)	h- Scallop Height (mm)					
		0.002	0.004	0.006	0.01	0.016	
HLB D120-QF	24	0.62	0.88	1.08	1.39	1.75	Stepsize a_e (mm)
HLB D160-QF	32	0.72	1.01	1.24	1.6	2.02	
HLB D200-QF	40	0.8	1.13	1.39	1.79	2.26	
HLB D250-QF	50	0.89	1.26	1.55	2	2.53	





The scallop height can be calculated as a function of a_p/a_e and R by use of the equation in the table below

Insert/Application		H
HLB	milling by bottom edge	$0.5x(2xR-\sqrt{(2xR)^2-a_e^2})$
HLB	milling by peripheral edge	$0.5x(2xR-\sqrt{(2xR)^2-a_p^2})$
HCT	milling by taper edge	$0.5x(2xR-\sqrt{(2xR)^2-a_p^2})$

R-radius of appropriate (botton or peripheral) cutting edge

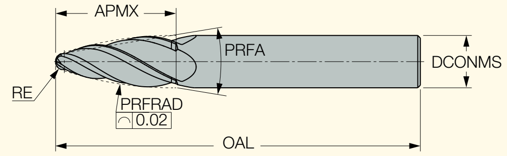
Recomended Range for Milling by use of Barrel Shaped Inserts

Insert	Angle β, Working Range
HLB - Barrel	0°-20°
HLB - Lens	0°-10°
HCT - Taper	34°-46°

NEOBARREL
PROFILE MILLING

EOB

Solid Carbide Oval Shaped (Barrel) Endmills for 3D Profiling



Designation	Dimensions								Tough ↔ Hard	
	DCONMS	RE	PRFRAD	APMX	PRFA	NOF[1]	OAL	Shank[2]	IC08	IC902
EOB-R1.5R85A17/5-8C06-57	6.00	1.50	85.00	17.00	10.82	8	57.00	C		
EOB-R1R90A24/7-4C08-63	8.00	1.00	90.00	24.50	14.88	4	63.00	C		●
EOB-R2R90A20/7-4C08-63	8.00	2.00	90.00	21.50	12.18	4	63.00	C		●
EOB-AL-R2R85A20/9-4C10-72	10.00	2.00	85.00	21.00	18.68	4	72.00	C	●	
EOB-R2R85A24/8-4C10-72	10.00	2.00	85.00	24.50	15.46	4	72.00	C		●
EOB-R3R85A21/6-4C10-72	10.00	3.00	85.00	21.30	12.62	4	72.00	C		●
EOB-R2R80A27/9-4C12-83	12.00	2.00	80.00	27.10	18.38	4	83.00	C		●
EOB-AL-R3R85A24/8-4C12-83	12.00	3.00	85.00	25.00	16.12	4	83.00	C	●	
EOB-R3R80A24/8-4C12-83	12.00	3.00	80.00	24.50	15.98	4	83.00	C		●
EOB-R4R80A21/6-8C12-83	12.00	4.00	80.00	21.50	13.10	8	83.00	C		●
EOB-R4R80A21/7-4C12-83	12.00	4.00	80.00	21.50	13.10	4	83.00	C		●
EOB-R4R1000A28/10-4C16-92	16.00	4.00	1000.00	27.00	20.00	4	92.00	C		●

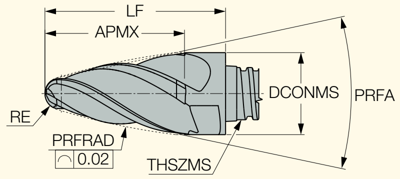
(1) Number of flutes
(2) C-Cylindrical

MULTI-MASTER
INDEXABLE SOLID CARBIDE LINE

NEOBARREL
PROFILE MILLING

MM EOB

Interchangeable Oval Shaped (Barrel) Solid Carbide Heads for 3D Profiling



Designation	PRFRAD	RE	APMX	PRFA	THSZMS	NOF(1)	DCONMS	LF	IC908
	Dimensions								
MM EOB08R1.5R80A13-4T05	80.00	1.50	14.20	24.00	T05	4	8.00	18.00	●
MM EOB08R1.5R80A13-6T05	80.00	1.50	14.10	24.00	T08	6	8.00	18.00	●
MM EOB10R2.0R85A16-4T06	85.00	2.00	16.50	24.00	T06	4	10.00	22.00	●
MM EOB10R2.0R85A16-6T06	85.00	2.00	16.50	24.00	T06	6	22.00	22.00	●
MM EOB12R2.0R75A21-4T08	75.00	2.00	21.30	24.00	T08	4	12.00	27.00	●
MM EOB12R2.0R75A21-6T08	75.00	2.00	21.30	24.00	T08	6	27.00	27.00	●
MM EOB16R3.0R75A26-4T10	75.00	3.00	27.00	24.00	T10	4	16.00	33.50	●
MM EOB16R3.0R75A26-6T10	75.00	3.00	27.00	24.00	T10	6	33.50	33.50	●

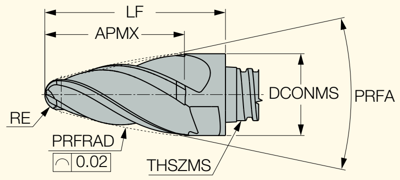
(1) Number of flutes

MULTI-MASTER
INDEXABLE SOLID CARBIDE LINE

NEOBARREL
PROFILE MILLING

MM EOBA

Interchangeable Oval Shaped (Barrel) Solid Carbide Heads for 3D Aluminum Profiling



Designation	PRFRAD	RE	APMX	PRFA	THSZMS	NOF(1)	DCONMS	LF	IC08
	Dimensions								
MM EOBA08R1.5R80A13-4T05	80.00	1.50	14.20	24.00	T05	4	8.00	18.00	●
MM EOBA10R2.0R85A16-4T06	85.00	2.00	16.50	24.00	T06	4	10.00	22.00	●
MM EOBA12R2.0R75A21-4T	75.00	2.00	21.30	24.00	T08	4	12.00	27.00	●
MM EOBA16R3.0R75A26-4T10	75.00	3.00	27.00	24.00	T10	4	16.00	33.50	●

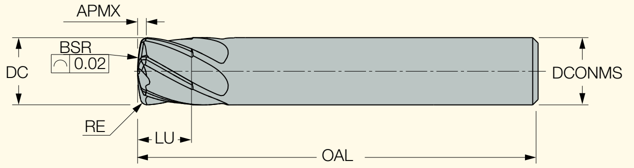
(1) Number of flutes

SOLIDMILL PREMIUM LINE

NEOBARREL PROFILE MILLING

ELB

Solid Carbide Lens Shaped (Barrel) Endmills for 3D Profiling



Designation	DC	BSR	RE	LU	APMX	DCONMS	NOF[1]	OAL	Shank[2]	IC902
	Dimensions									
ELB-R0.75R16A5-6C8-63	8.00	15.00	0.75	5.00	1.10	8.00	6	63.00	C	●
ELB-R1R20A7-6C10-72	10.00	20.00	1.00	7.00	1.43	10.00	6	72.00	C	●
ELB-R1R25A9-6C12-83	12.00	25.00	1.00	9.00	1.53	12.00	6	83.00	C	●

(1) Number of flutes

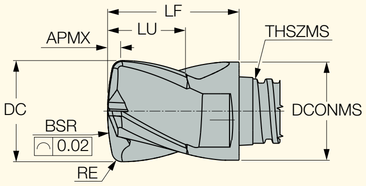
(2) C-Cylindrical

MULTI-MASTER INDEXABLE SOLID CARBIDE LINE

NEOBARREL PROFILE MILLING

MM ELB

Interchangeable Lens Shaped (Barrel) Solid Carbide Heads for 3D Profiling



Designation	DC	BSR	RE	LU	APMX	THSZMS	DCONMS	NOF[1]	LF	IC908
	Dimensions									
MM ELB08R16A05-4T05	8.00	16.00	0.50	5.50	0.90	T05	8.00	4	10.00	●
MM ELB10R20A07-4T06	10.00	20.00	1.00	7.50	1.42	T06	10.00	4	13.00	●
MM ELB12R24A09-4T08	12.00	24.00	1.00	9.00	1.55	T08	12.00	4	16.50	●
MM ELB16R32A12-4T10	16.00	32.00	1.00	12.00	1.80	T10	16.00	4	20.50	●

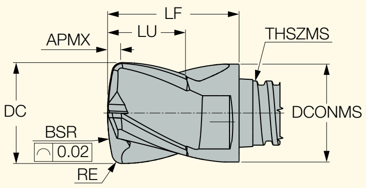
(1) Number of flutes

MULTI-MASTER INDEXABLE SOLID CARBIDE LINE

NEOBARREL PROFILE MILLING

MM ELBA

Interchangeable Lens Shaped (Barrel) Solid Carbide Heads for 3D Aluminum Profiling



Designation	DC	BSR	RE	LU	APMX	THSZMS	DCONMS	NOF[1]	LF	IC08
	Dimensions									
MM ELBA08R16A05-4T05 08	8.00	16.00	0.50	5.50	0.90	T05	8.00	4	10.00	●
MM ELBA10R20A07-4T06	10.00	20.00	1.00	7.50	1.42	T06	10.00	4	13.00	●
MM ELBA12R24A09-4T08 08	12.00	24.00	1.00	9.00	1.55	T08	12.00	4	16.50	●
MM ELBA16R32A12-4T10	16.00	32.00	1.00	12.00	1.80	T10	16.00	4	20.50	●

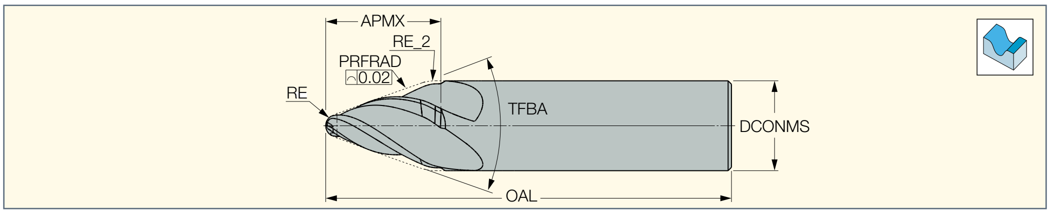
(1) Number of flutes

SOLIDMILL
PREMIUM LINE

NEOBARREL
PROFILE MILLING

ETB

Solid Carbide Taper Shaped (Barrel) Endmills for 3D Profiling



Designation	Dimensions									IC902
	PRFRAD	RE_2	RE	APMX	TFBA	DCONMS	NOF(1)	OAL	Shank(2)	
ETB-R1R250A10/20-4C08-63	250.00	4.00	1.00	10.00	40.00	8.00	4	63.00	C	●
ETB-R2R250A11/20-4C10-72	250.00	5.00	2.00	11.00	40.00	10.00	4	72.00	C	●
ETB-R3R250A12/20-4C12-83	250.00	6.00	3.00	12.00	40.00	12.00	4	83.00	C	●

(1) Number of flutes

(2) C-Cylindrical

Table 2 - Recommended Cutting Parameters to Start

ISO	Material		Condition	Tensile Strength (N/mm^2)	Hardness HB	Material No.	Cutting Parameter Range	
							v_c (m/min)	f_z (mm/t)
P	non-alloy steel and cast steel, free cutting steel	<0.25% C	annealed	420	125	1	210-300	0.005-0.01xD**
		≥0.25% C	annealed	650	190	2	200-250	0.005-0.01xD
		<0.55% C	quenched and tempered	850	250	3	160-240	0.004-0.009xD
		≥0.55% C	annealed	750	220	4	160-240	0.003-0.008xD
			quenched and tempered	1000	300	5	140-200	0.004-0.009xD
	low alloy and cast steel (less than 5% of alloying elements)		annealed	600	200	6	160-240	0.003-0.008xD
			quenched and tempered	930	275	7	120-200	0.003-0.008xD
				1000	300	8	130-200	0.003-0.008xD
				1200	350	9	140-200	0.003-0.008xD
	high alloyed steel, cast steel and tool steel		annealed	680	200	10	130-200	0.003-0.008xD
			quenched and tempered	1100	325	11	70-130	0.002-0.007xD
	stainless steel and cast steel		ferritic / martensitic	680	200	12	80-175	0.002-0.007xD
			martensitic	820	240	13	60-165	0.002-0.007xD
M	stainless steel and cast steel		austenitic, duplex	600	180	14	60-110	0.002-0.007xD
K	gray cast iron (GG)		ferritic / pearlitic		180	15	150-275	0.005-0.01xD
			pearlitic / martensitic		260	16	150-265	0.005-0.01xD
	nodular cast iron (GGG)		ferritic		160	17	150-200	0.005-0.01xD
			pearlitic		250	18	90-150	0.004-0.009xD
	malleable cast iron		ferritic		130	19	150-200	0.005-0.01xD
			pearlitic		230	20	90-150	0.004-0.009xD
S	high temperature alloys	Fe based	annealed		200	31	20-45	0.002-0.004xD
			hardened		280	32	20-35	0.002-0.004xD
		Ni or Co based	annealed		250	33	20-35	0.002-0.004xD
			hardened		350	34	20-35	0.002-0.004xD
			cast		320	35	60-90	0.002-0.004xD
	titanium alloys		pure	400	190	36	60-90	0.002-0.004xD
			alpha+beta alloys, hardened	1050	310	37	60-90	0.002-0.004xD
H	hardened steel		hardened		55 HRC	38	40-80	0.001-0.003xD
			hardened		60 HRC	39		
	chilled cast iron		cast		400	40	40-80	0.001-0.003xD
	cast iron		hardened		55 HRC	41	40-80	0.001-0.003xD

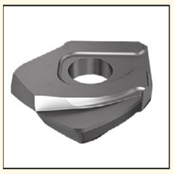
* Recommended amount of material engagement should not exceed 0.3 mm

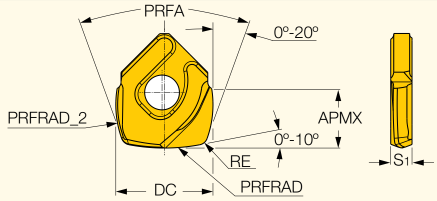
** D - nominal diameter of solid carbide endmill (MM head)

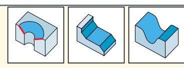
NEOBARREL
PROFILE MILLING

HLB-QF

Combined Barrel and Lens Shaped Inserts with 2 Cutting Edges







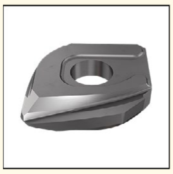
Designation	Dimensions							IC908
	DC	APMX	S1	RE	PRFRAD	PRFRAD_2	PRFA	
HLB D120-QF	12.00	5.00	2.60	1.20	24.00	12.00	20.00	•
HLB D160-QF	16.00	7.00	3.37	1.50	32.00	16.00	20.00	•
HLB D200-QF	20.00	9.00	4.65	2.00	40.00	20.00	20.00	•
HLB D250-QF	25.00	11.00	5.40	2.50	50.00	25.00	20.00	•

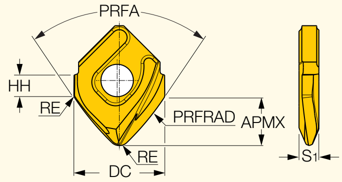
- For cutting speed recommendations, see Table 3

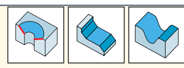
NEOBARREL
PROFILE MILLING

HCT-QF

Taper Barrel Shaped Inserts with 2 Cutting Edges







Designation	Dimensions							IC908
	DC	APMX	S1	RE	PRFRAD	PRFA	HH	
HCT D120-QF	12.00	6.65	2.60	1.20	30.00	80.00	2.8	•
HCT D160-QF	16.00	8.50	3.37	1.60	45.00	80.00	3.3	•
HCT D200-QF	20.00	10.50	4.65	2.00	60.00	80.00	5.5	•
HCT D250-QF	25.00	12.50	5.40	3.00	75.00	80.00	5.9	•

- For cutting speed recommendations, see Table 3

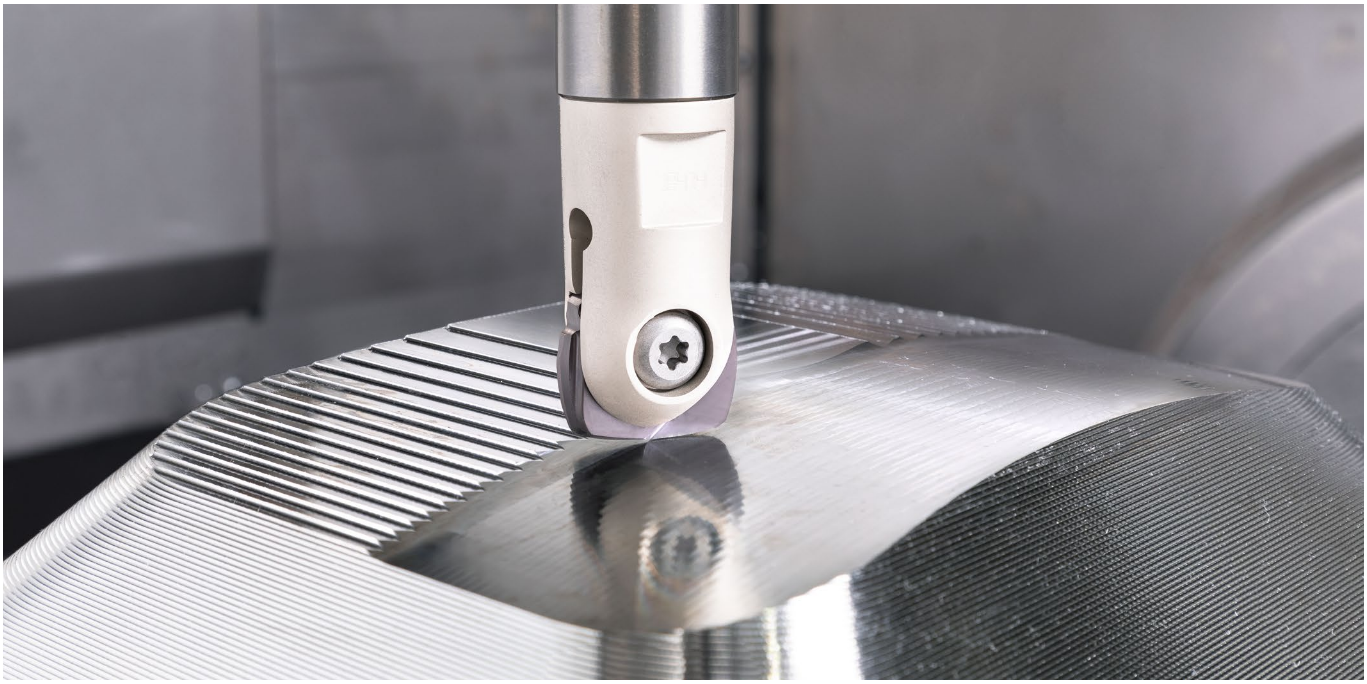


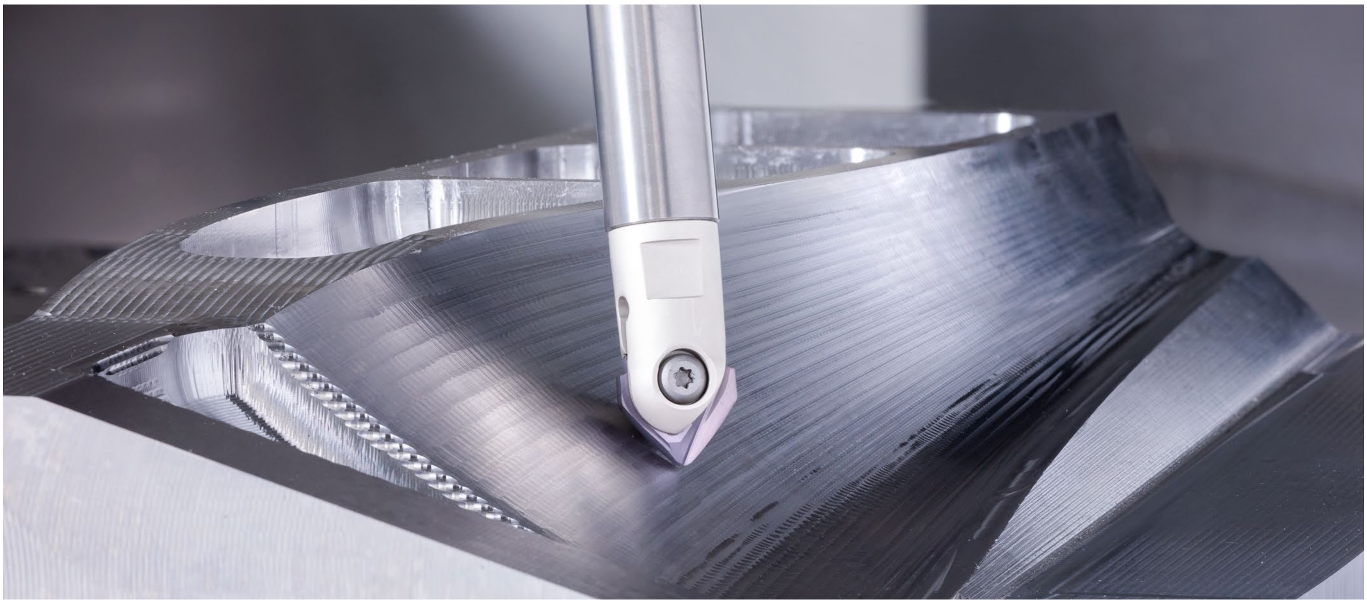
Table 3 - Average Cutting Data When Milling With Barrel Shaped Inserts

ISO	Material	Material Group No.	Hardness, HB	Typical Representstive		Carbide Grade	Cutting Speed v_{c0} (m/min)	Feed f_z (mm/t)			Deph of Cut (mm)			Coolant
				AISI/SAE/ ASTM	DIN W.-Nr.			HCT Taper	HLB Barrel	HLB Lens	a_e HCT Taper	a_e HLB Barrel	a_p HLB Lens	
P	non-alloy steel and cast steel, free cutting steel	1-5	130-180	1020	1.0402	IC908	500-600	0.1-0.2	0.12-0.25	0.15-0.3	0.1	0.1	0.1	Dry
P	low alloy and cast steel (less than 5% of alloying elements)	6-8	260-300	4340	1.6582	IC908	500-600	0.1-0.2	0.12-0.25	0.15-0.3	0.1	0.1	0.1	Dry
		9	35-42** HRC	3135	1.5710	IC908	400-500	0.1-0.2	0.12-0.25	0.15-0.3	0.1	0.1	0.1	Dry
P	high alloyed steel, cast steel and tool steel	10-11	200-220	H13	1.2344	IC908	500-600	0.1-0.2	0.12-0.25	0.15-0.3	0.1	0.1	0.1	Dry
P	stainless steel and cast steel	12-13	200	420	1.4021	IC908	500-600	0.1-0.2	0.12-0.25	0.15-0.3	0.1	0.1	0.1	Dry
M	stainless steel and cast steel	14	200	304L	1.4306	IC908	400-500	0.1-0.2	0.12-0.32	0.15-0.3	0.1	0.1	0.1	Wet
K	gray cast iron (GG)	15-16	250	Class 40	0.6025 (GG25)	IC908	600-700	0.15-0.3	0.2-0.35	0.25-0.4	0.125	0.125	0.125	Dry
K	nodular cast iron (GGG)	17-18	200	Class 65-45-12	0.7050 (GGG50)	IC908	500-600	0.15-0.3	0.2-0.35	0.25-0.4	0.125	0.125	0.125	
S	high temperature alloys and titanium	33-35	340	Inconel 718	2.4668	IC908	25-35	0.05-0.1	0.07-0.13	0.1-0.2	0.1	0.1	0.1	Wet
		36-37	35-40 HRC	AMS R56400	3.7165 (Ti6Al4V ELI)		40-60	0.06-0.1	0.07-0.13	0.1-0.2	0.1	0.1	0.1	
H	hardened steel	38	45-49 HRC	HARDOX 450 plate		IC908	200-300	0.05-0.1	0.1-0.15	0.15-0.2	0.075	0.075	0.075	Dry
			58-62 HRC	D2	1.2379		180-250	0.05-0.1	0.1-0.15	0.15-0.2	0.05	0.05	0.05	

* ISCAR material group in accordance with VDI 3323 standard

** Quenched and tempered

For machining under unstable conditions, the recommended cutting data should be reduced by 20-30%



Cutting speed v_c depends on the tool overhang H.
The cutting speed can be calculated as follows:

$v_c = v_{c0} \times k_H$

Where:

v_{c0} - cutting speed as recommended in table 3
k_H - overhang factor in table 4

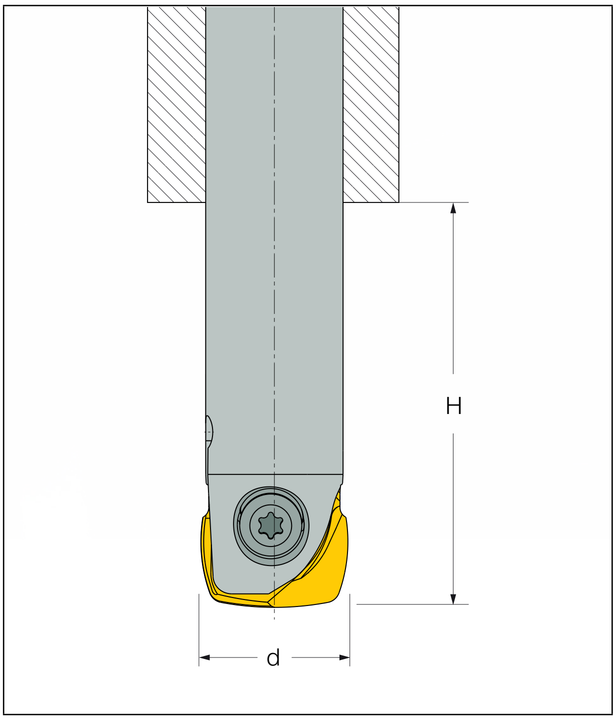


Table 4 - Overhang Factor K_H

H/d*	Low Then 3	Over 3 Up to 5	Over 5 Up to 6	Over 6 Up to 7	Over 7
k_H	1	0.8	0.7	0.6	0.5

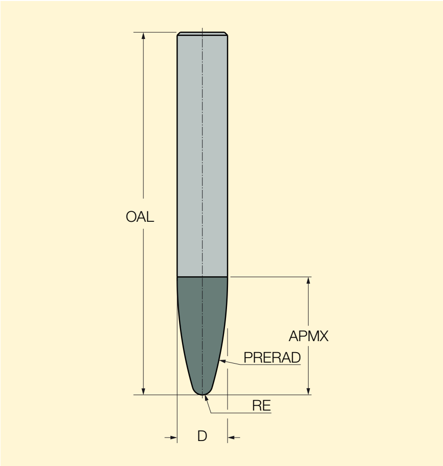
d* - nominal tool diameter

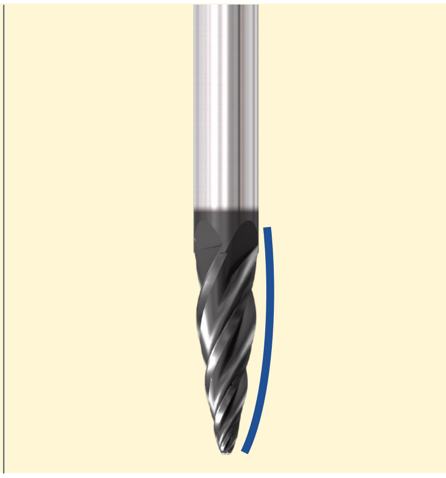
Barrel Shaped Endmills

Parameters for CNC Programing of Profile Cutters by Use of a CAM System

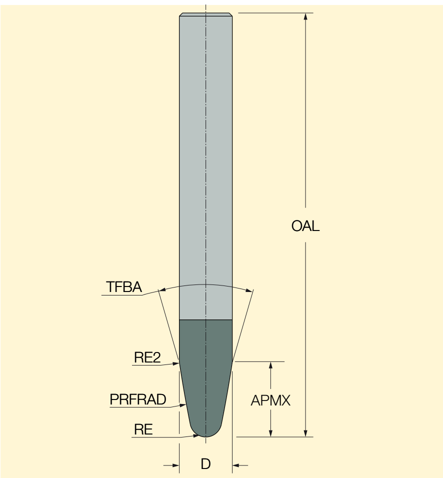
Select a barrel tool configuration and define its dimensions as shown below:

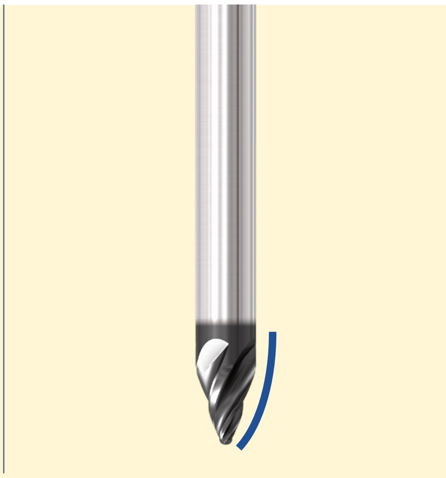
- **Oval (Barrel) Shaped**



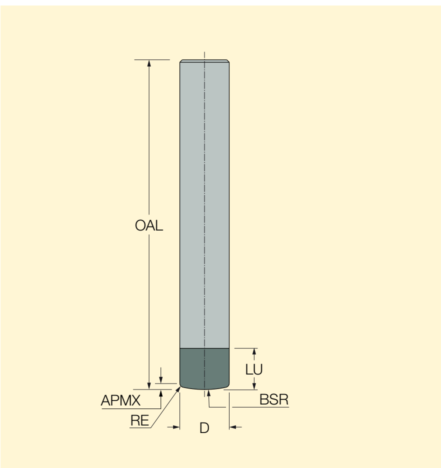


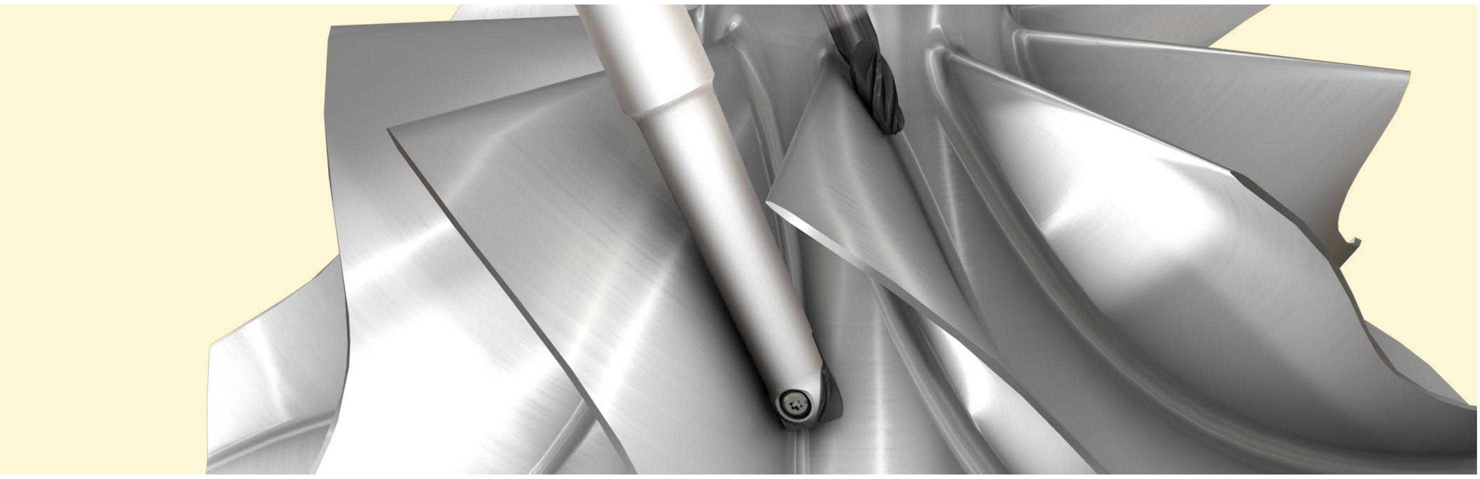
- **Taper Shaped**

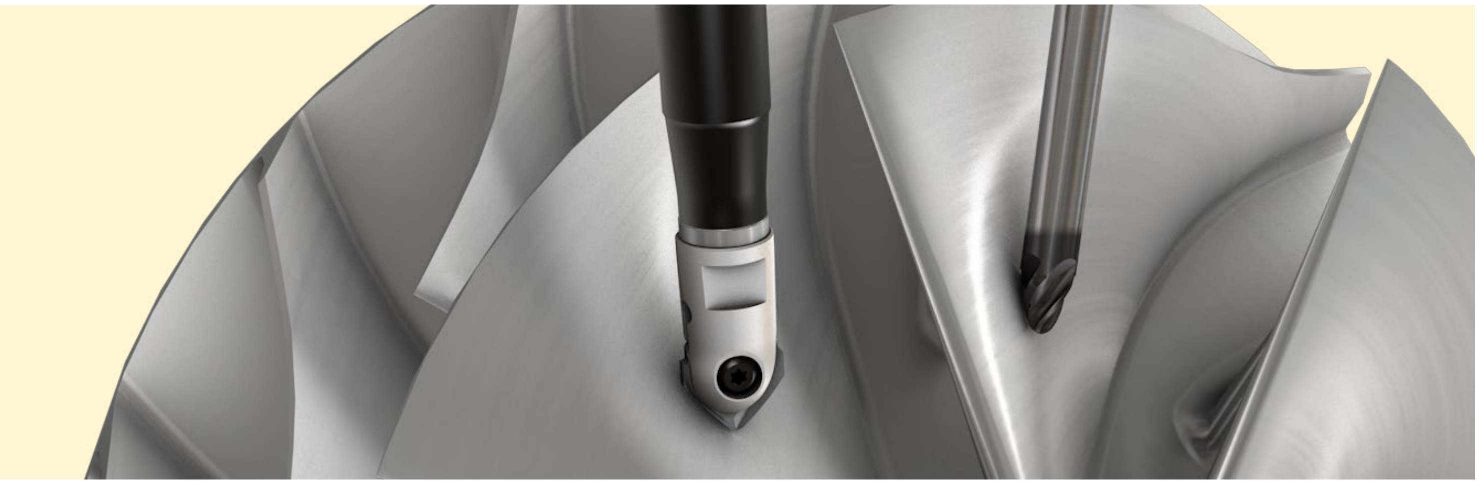


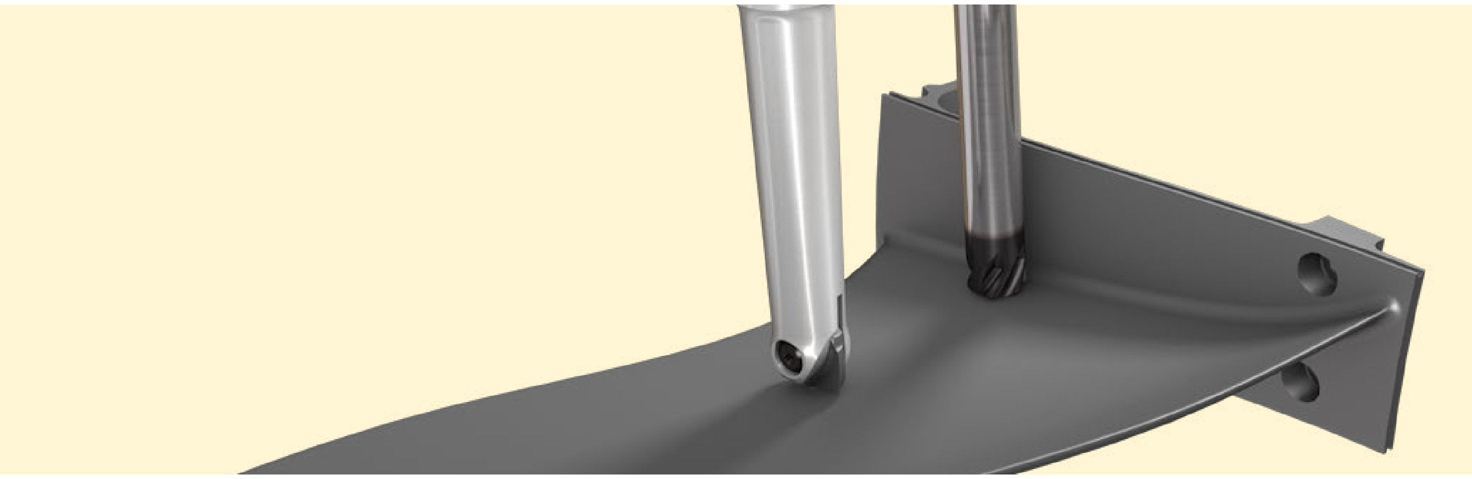


- **Lens Shaped**







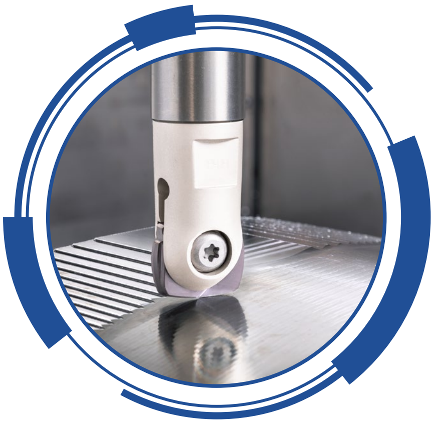


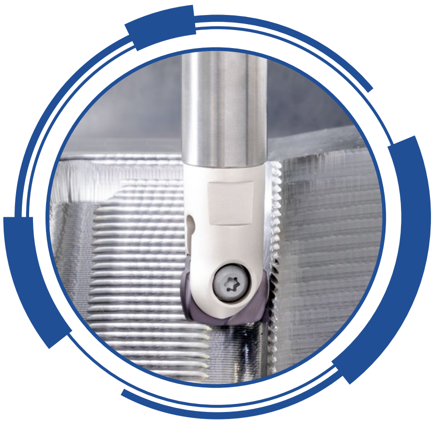
BARREL SHAPED ENDMILLS

Tool Selector Guide

Metric Catalog





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