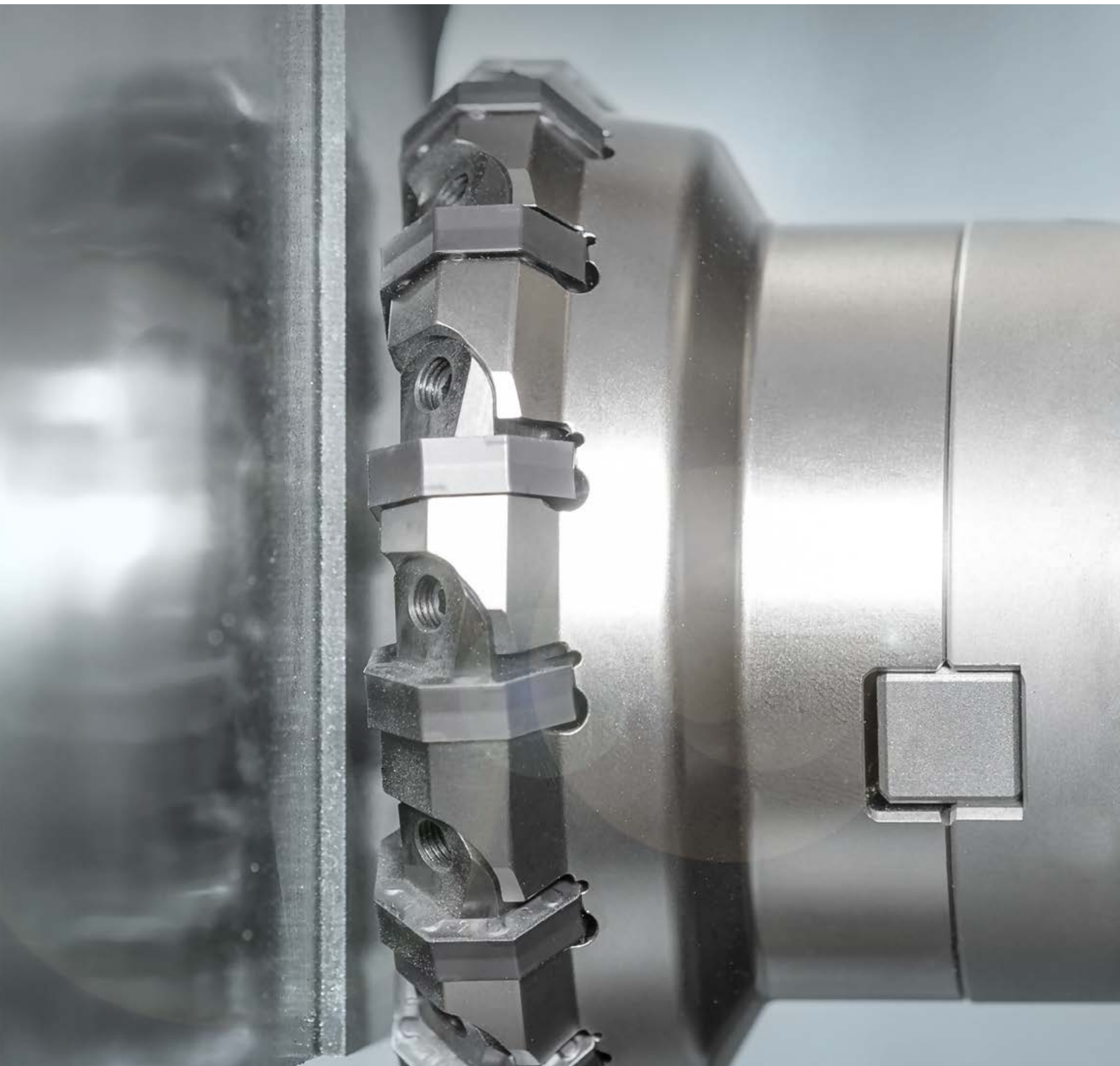
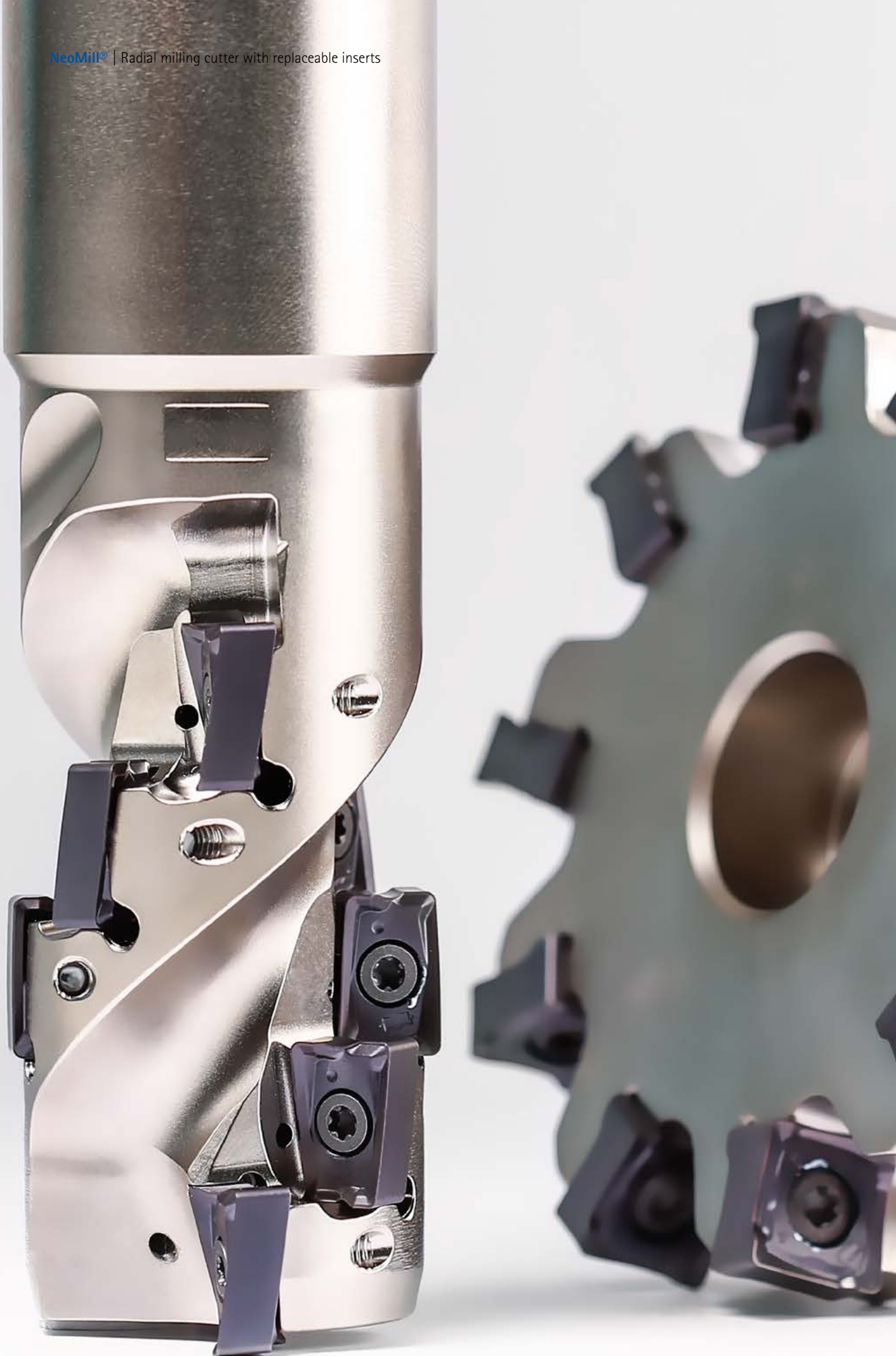




Your technology partner for cost-effective machining

## NeoMill® MILLING PROGRAMME





# CONTENTS

## Introduction

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Programme overview	4
Machining examples	6
Selection guide	12
Cutting material overview	18
Product ID codes	24

## Face milling cutter

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NeoMill®-8-Face, OFMT07	28
NeoMill®-16-Face, ONKU07	30

## Shoulder milling cutter

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NeoMill®-2-Corner, AOKT12	34
NeoMill®-4-Corner, ANMU12	36
NeoMill®-4S-Corner, SDKT10	38
NeoMill®-8-Corner, SNMU12	40

## High-feed milling cutter

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NeoMill®-2-HiFeed90, LP_06	44
NeoMill®-2-HiFeed90, LP_10	46
NeoMill®-2-HiFeed90, LP_18	48
NeoMill®-4-HiFeed90, SD_06	54
NeoMill®-4-HiFeed90, SD_10	56
NeoMill®-4-HiFeed90, SD_14	58
NeoMill®-4-HiFeed90, SD_18	59

## Shell end face milling cutter

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NeoMill®-2-Shell, AOKT12	66
NeoMill®-4-Shell, ANMU12	68

## Accessories and spare parts

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Accessories and spare parts for milling cutter with indexable inserts	72
Allocating milling cutter clamping screws	74
General accessories	76

## Technical appendix

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Terminology and formulae	78
Technical information milling	80
Application notes	82
Handling instructions face milling cutter with radial indexable inserts	84
Pictograms and MAPAL machining groups	86





# NeoMill® Milling Programme

## Milling cutters with radial indexable inserts

MAPAL rounds off its portfolio of standard milling tools with a NeoMill milling programme with pressed, radial indexable inserts. Until now the focus was mainly on a milling programme with ground tangential indexable inserts. These are used in particular for special applications, very large stock removal, unstable conditions or disc milling cutters.

MAPAL has incorporated the comprehensive know-how gathered in these special applications into the new series of milling cutters with radial indexable inserts. The new powerful face, shoulder, slot and shell end face milling cutters are designed for roughing and for medium machining of cast iron, steel and stainless steel. They have optimally designed tool bodies with the ideal number of teeth for the respective application. Positive and nega-

tive indexable inserts made of four different PVD cutting materials, based on newly developed carbide substrates and coatings, are available for the milling cutters.

Depending on the requirement, the most economically efficient version is used. For example, between eight and 16 cutting edges per radial indexable insert can be selected for face milling and between two, four and eight cutting edges for shoulder milling. When used, the new tools are impressive thanks to their

quiet running and low noise level. In addition, very long tool lives are achieved due to the possibilities for exact adjustment to the respective material and the respective application.





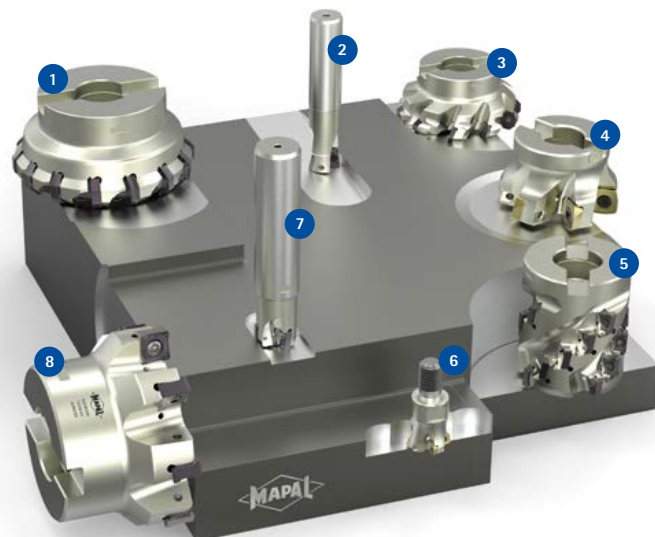
## AT A GLANCE

- Milling programme with compacted radial indexable inserts
- Face, shoulder, slot and shell end face milling cutters
- For roughing and medium machining of cast iron, steel and stainless steel
- Positive and negative indexable inserts made from four different PVD cutting materials

## ADVANTAGES

- Comprehensive complete range for cost-effective and efficient machining
- Very quiet running
- Low noise
- Maximum tool lives

- 1 Face milling cutter with close spacing and 16 cutting edges for maximum economic efficiency
- 2 Shoulder milling cutter with cylindrical shank and positive basic form – ideally suited for steep angle plunging
- 3 Face milling cutter with positive basic form – ideal for machining operations susceptible to vibration
- 4 High-feed milling cutter for high machining rates with good process reliability
- 5 Shell end face milling cutter for stable machining operations – ideal for shoulder milling with large cutting depths
- 6 Screw-in milling cutter in combination with the solid carbide extensions minimise vibrations at extreme projections
- 7 Shoulder milling cutter with cylindrical shank and up to four cutting edges
- 8 Shoulder milling cutter with eight cutting edges



# MILLING

## Machining examples



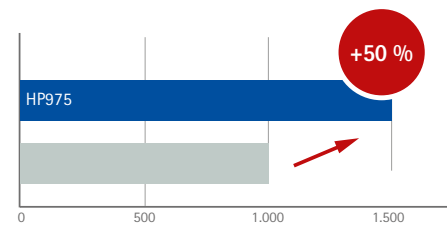
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### BRAKE CALIPER / BRAKE HOLDER

Milling bolt-on surfaces

	■	■
Material	EN-GJS-500 (GGG50)	
Tool	Corner Mill (tangential)	Corner Mill NeoMill®-8-Corner
Insert	WSP	SNMU120508R-M05-HP975
Tool-Ø [mm]	50	
Tooth t	7	6
Cutting edges per insert	4+4	8
Coolant	dry	
$v_c$ [m/min]	188	
$f_z$ [mm]	0,27	0,31
$v_f$ [mm/min]	2.200	2.226
$a_p$ [mm]	4,2	
$a_e$ [mm]	30	
Number of cuts	2	

#### Machined parts



- Process reliability guaranteed by uniform cutting direction
- Tool life increased by 50 %
- CPP reduced by 46 %



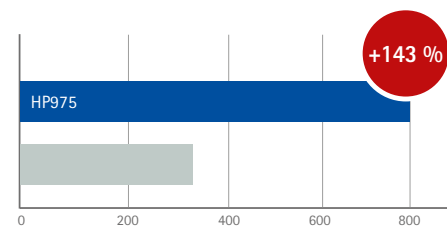
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### GEARBOX

Various face and corner milling operations

	■	■
Material	EN-GJL-250 (GG25)	
Tool	Corner Mill	Corner Mill NeoMill®-8-Corner
Insert	WSP	SNMU120512R-M05-HP975
Tool-Ø [mm]	63	
Tooth t	7	8
Cutting edges per insert	4	8
Coolant	dry	
$v_c$ [m/min]	336	238
$f_z$ [mm]	0,19	0,27
$v_f$ [mm/min]	2.295	2.600
$a_p$ [mm]	3	
$a_e$ [mm]	10 - 25	
Number of cuts	7	6

#### Machined parts



- Cycle time reduction of 13 %
- Tool life increased by 143 %
- CPP reduced by 65 %

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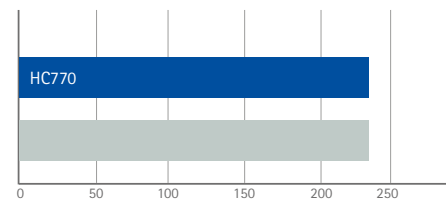
## HYDRAULIC PUMP

Pre-machining drive side



	■	■
Material	EN-GJL-300 (GG30)	
Tool	Corner Mill (tangential)	Corner Mill NeoMill®-8-Corner
Insert	Tangential	SNMU120508R-M05-HC770
Tool-Ø [mm]	63	
Tooth t	8	
Cutting edges per insert	4	8
Coolant	Air	
$v_c$ [m/min]	336	272
$f_z$ [mm]	0,18	0,64 / 0,31
$v_f$ [mm/min]	2.500	7.060 / 3.400
$a_p$ [mm]	12,45	7 / 5,45
$a_e$ [mm]	15 - 43	3,5 / 15 - 43
Number of cuts	1	2

### Machined parts



- Cycle time neutral despite 2 cuts
- Cutting division results in fewer cutting forces, which lead to lower form and position tolerances -> better component quality
- CPP was reduced by 64 %

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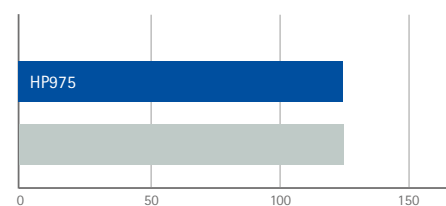
## COMPRESSOR

Face milling operations on the housing



	■	■
Material	EN-GJS-400 (GGG40)	
Tool	Corner Mill	Face Mill NeoMill®-16-Face
Insert	WSP	ONKU070508R-R05-HP975
Tool-Ø [mm]	100	
Tooth t	19	14
Cutting edges per insert	8	16
Coolant	dry	
$v_c$ [m/min]	225	234
$f_z$ [mm]	0,22	0,30
$v_f$ [mm/min]	3.000	
$a_p$ [mm]	2 / 2,4	
$a_e$ [mm]	6 / 95	
Number of cuts	2	

### Machined parts



- Optimization of the milling strategy
- Consistent cycle and tool life
- CPP was reduced by 55 %

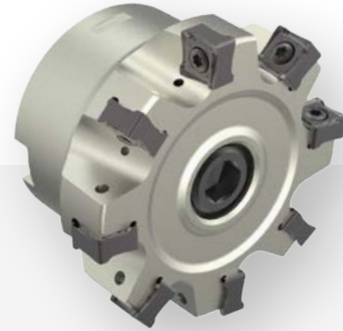
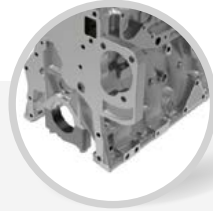
# MILLING

## Machining examples

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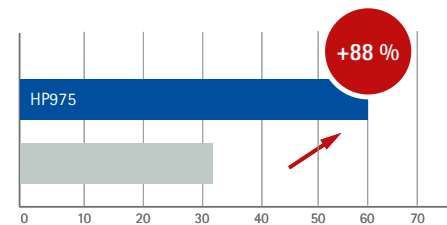
### ENGINE BLOCK

Milling of flat surfaces and shoulder machining



	■	■
Material	EN-GJL-250	
Tool	Corner Mill	Corner Mill NeoMill®-8-Corner
Insert	WSP	SNMU120508R-M05-HP975
Tool-Ø [mm]	80	
Tooth t	8	
Cutting edges per insert	4	8
Coolant	Trocken	
$v_c$ [m/min]	200	
$f_z$ [mm]	0,1	
$v_f$ [mm/min]	637	
$a_p$ [mm]	2 - 5	
$a_e$ [mm]	8 - 43	
Number of cuts	1	

#### Machined parts

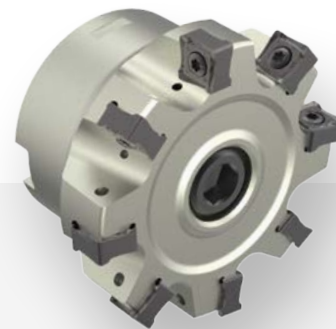


- Tool life increased by 88 %
- Very low burr formation – subsequent deburring is no longer necessary
- CPP reduced by 42 %

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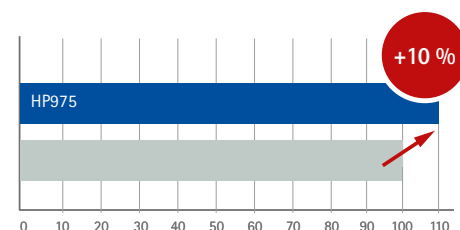
### PIVOT BEARING

Machining of the mounting surfaces



	■	■
Material	EN-GJS (ADI 900)	
Tool	Corner Mill	Corner Mill NeoMill®-8-Corner
Insert	WSP	SNMU120508R-M05-HP975
Tool-Ø [mm]	63	
Tooth t	6	8
Cutting edges per insert	4	8
Coolant	dry	
$v_c$ [m/min]	224 / 200	
$f_z$ [mm]	0,21 / 0,17	0,15 / 0,13
$v_f$ [mm/min]	1.400 / 1.200	
$a_p$ [mm]	1,5 - 3,5	
$a_e$ [mm]	20 - 60	
Number of cuts	2	

#### Machined parts



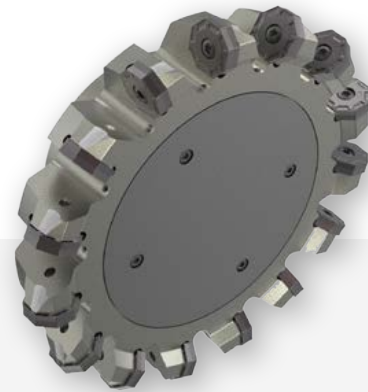
- Tool life increased by 10 %
- Less cutting forces lead to lower form and position tolerance
- CPP was reduced by 45 %



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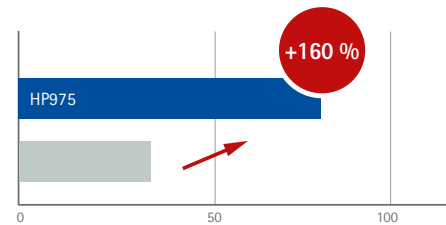
## VALVE BODY

Milling of the flat surfaces



	■	■
Material	GGG50	
Tool	Face Mill	Special Face Mill NeoMill®-16-Face
Insert	WSP	ONKU070508R-M05-HP975
Tool-Ø [mm]	200	
Tooth t	12	15
Cutting edges per insert	16	
Coolant	Emulsion	
$v_c$ [m/min]	300	180
$f_z$ [mm]	0,12	0,19
$v_f$ [mm/min]	660	804
$a_p$ [mm]	4	
$a_e$ [mm]	max. 90	
Number of cuts	1	

### Machined parts

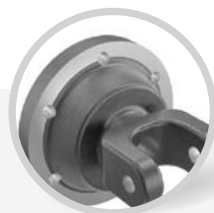


- Cycle time reduced by 22 %
- Tool life increased by 116 %
- CPP reduced by 47 %

P

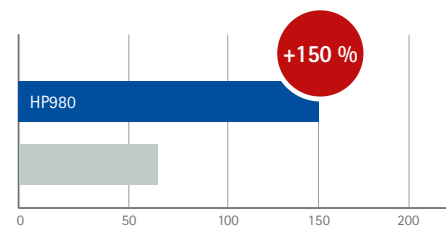
## UNIVERSAL JOINT

Face milling of the flange surfaces



	■	■
Material	42CrMo	
Tool	Face Mill	Face Mill NeoMill®-8-Face
Insert	WSP	OFMT070405R-M03-HP980
Tool-Ø [mm]	125	
Tooth t	8	10
Cutting edges per insert	8	
Coolant	dry	
$v_c$ [m/min]	206	
$f_z$ [mm]	0,25	0,28
$v_f$ [mm/min]	1.000	1.400
$a_p$ [mm]	3	
$a_e$ [mm]	76	
Number of cuts	4	

### Machined parts



- Productivity increased due to higher feed rate
- Tool life increased by 416 % with reduced burr formation at the same time
- CPP reduced by 70 %

# MILLING

## Machining examples



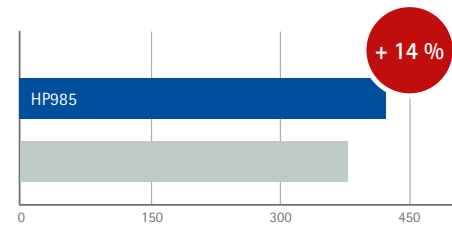
P

### CRANK SHAFT

Corner milling on end faces

	■	■
Material	1538 My Steel	
Tool	Face Mill	Corner Mill NeoMill®-8-Corner
Insert	WSP	SNMU120508R-M03-HP985
Tool-Ø [mm]	80	
Tooth t	12	10
Cutting edges per insert	8	
Coolant	dry	
$v_c$ [m/min]	138	
$f_z$ [mm]	0,13	0,16
$v_f$ [mm/min]	824	851
$a_p$ [mm]	2,5 - 4	
$a_e$ [mm]	30 - 55	
Number of cuts	2	

#### Machined parts



- Process-safe end of service life
- Less burr formation due to change of milling strategy
- Overall performance increased, feed rate and tool life increased, costs reduced at the same time
- CPP reduced by 11 %



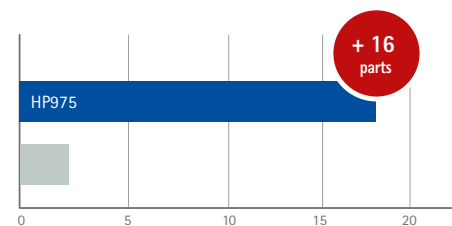
P

### STEEL ALLOY PART

Face milling of the bolt-on/flange surfaces

	■	■
Material	42CrMo HRC42-46	
Tool	Face Mill	Face Mill NeoMill®-16-Face
Insert	WSP	ONKU070508R-M05-HP975
Tool-Ø [mm]	125	
Tooth t	7	10
Cutting edges per insert	2	16
Coolant	dry	
$v_c$ [m/min]	314	275
$f_z$ [mm]	0,036	0,05
$v_f$ [mm/min]	200	300
$a_p$ [mm]	0,3	
$a_e$ [mm]	50 - 95	
Number of cuts	1	

#### Machined parts



- Tool life increased by 800 %
- Economy improved due to 16 cutting edge insert
- CPP reduced by 80 %

M

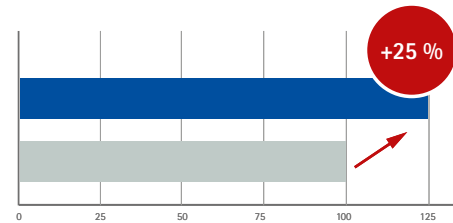
## TURBOCHARGER

Face milling operations on turbine housing



	■	■
Material	Cast steel GX40NiCrSiNb38-19 (1.4849)	
Tool	Face Mill	Face milling cutter NeoMill®-16-Face
Insert	WSP	ONKU070508R-R03-HP985
Tool-Ø [mm]	100	
Tooth t	11	14
Cutting edges per insert	12	16
Coolant	Emulsion	
$v_c$ [m/min]	110	
$f_z$ [mm]	0,28	
$v_f$ [mm/min]	1.078	1.372
$a_p$ [mm]	2	
$a_e$ [mm]	70	
Number of cuts	1	

### Machined parts

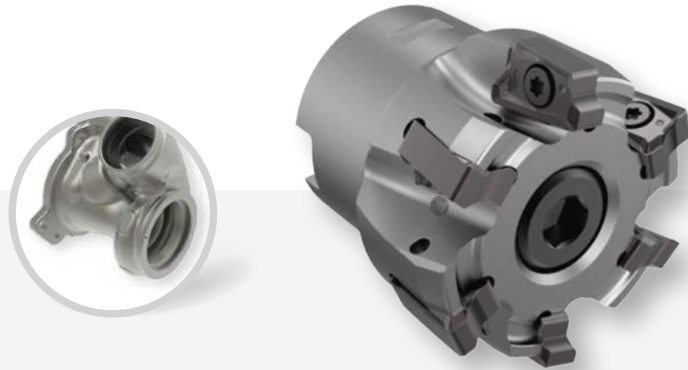


- Cycle time reduced by 27 %
- Tool life increased by 25 %
- CPP reduced by 13 %

M

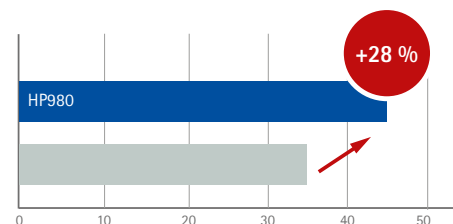
## TURBOCHARGER

Corner milling on turbine housing



	■	■
Material	Low Nickel Cast steel (similar to 1.4837)	
Tool	Corner Mill	Corner Mill NeoMill®-4-Corner
Insert	WSP	ANMU120508R-M05-HP980
Tool-Ø [mm]	40	
Tooth t	6	
Cutting edges per insert	2	4
Coolant	MMS	
$v_c$ [m/min]	145	
$f_z$ [mm]	0,12	
$v_f$ [mm/min]	852	
$a_p$ [mm]	2x 1,5 / 1 x 0,2	1 x 3,0 / 1 x 0,2
$a_e$ [mm]	3 - 27	
Number of cuts	3	2

### Machined parts


















- Cycle time reduced by 30 %
- Tool life increased by 28 %
- CPP reduced by 53 %

# SELECTING A MILLING CUTTER

## Step-by-step guide to selecting the right milling cutter

Looking for a milling cutter with indexable inserts for shoulder milling stainless steel with a diameter of 125 mm in unfavourable machining conditions? This selection guide explains how to choose the right milling cutter step by step.

1	<b>Type of milling cutter</b>	Select the type of milling cutter you need.	➤		Face milling cutter		Shoulder milling cutter
2	<b>Material suitability</b>	Select your workpiece according to the MAPAL machining groups (MMG).	➤		Steel		Stainless steel
3	<b>Manufacturing processes</b>	Select your manufacturing process.	➤		Roughing		Medium machining
4	<b>Process conditions</b>	Assess your process conditions.	➤		<b>Good:</b> – Stable conditions – Low cutting width		
5	<b>Application</b>	Select your preferred application.	➤		Face milling		Shoulder milling
					Ramps		Helix milling
6	<b>Technical design / Geometric features</b>	Check that the geometric features meet your requirements.	➤		Max. cutting depth		Diameter range
7	<b>Tool body</b>	Select the milling cutter you need. If there are several possible selections, select the milling cutter that is marked as 1st choice (★) for material suitability.	➤		If designs with different spacing are available, please note the information on the relevant product pages.		
8	<b>Indexable insert / Milling cartridge</b>	Select the indexable insert or milling cartridge you need. For the selection of the correct cutting material, pay attention to the cutting material overview on page 18.	➤		Select the indexable insert or milling cartridge you need.		
+	<b>Cutting material and chip guiding stage</b>	Select the cutting material and chip guiding stage you need. Please take note of the designs on page 18 for this. The name of the indexable insert is supplemented with the selected chip guiding stage and the cutting material type. Example: RDKW1003M0N-PMU-HP635					



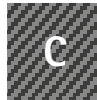
High-feed milling cutter



Shell end face milling cutter



Cast iron



Composite materials



Non-ferrous metals and plastics



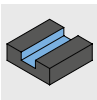
Super alloy and titanium



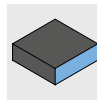
Finishing



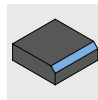
**Unfavourable:**  
 - Ratio  $a_e / D > 0.6$   
 - High stock removal  
 - Part/clamping fixture/machine susceptible to vibration



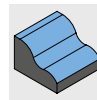
Groove milling



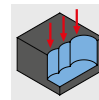
Trimming



Chamfering and deburring



Profile milling



Plunge milling / Groove milling



High-feed milling



Pocket milling

Contact angle

Number of cutting edges

Coolant supply



# Face milling cutter

Material suitability								Manufacturing processes			Process conditions		Application											
P	M	K	N	C	S	H																		
★	☐							■	■		■	■	■											
■	★	★						■	■		■	☐	■											



# Shoulder milling cutter

Material suitability								Manufacturing processes			Process conditions		Application											
P	M	K	N	C	S	H																		
■	☐							■	☐		■	■	■	■			☐	■	■				■	
■	■	■						■	■		■	■	■	■			☐	■	■				■	
■	■	■	■					■	■		■	■	■	■			☐	■	■				■	
■	★	■						■	■		■	■	■	■										
★	☐							■	■		■	■	■	■			☐							
■	☐	★						■	■		■	■	☐											

★ 1st choice    ■ highly suitable    ☐ suitable in some situations

Step 1:  
Type of milling cutter



Step 2:  
Material suitability



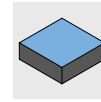
Step 3:  
Manufacturing processes



Step 4:  
Process conditions



Step 5:  
Application



Step 6:  
Design



	Technical design						Tool body			Indexable insert		
	dia. [mm]	a <sub>p</sub> max. [mm]	Cutting edges	Contact angle	Technology		Product name	Design	Page	Product name		Page
	63 - 200	5	8	45°	Radial	✓**	NeoMill-8-Face		28	OFMT07		29
	63 - 200	4	16	45°	Radial	✓**	NeoMill-16-Face		30	ONKU07		31

	Technical design						Tool body			Indexable insert		
	dia. [mm]	a <sub>p</sub> max. [mm]	Cutting edges	Contact angle	Technology		Product name	Design	Page	Product name		Page
	10 - 50	5,2	2	90°	Radial	✓	NeoMill-2-HiFeed90		44	LPMX06		52
	20 - 63	11	2	90°	Radial	✓**	NeoMill-2-Corner		34	AOKT12		35
	25 - 160	17	2	90°	Radial	✓	NeoMill-2-HiFeed90		48	LD_X18		52
	25 - 100	10	4	90°	Radial	✓**	NeoMill-4-Corner		36	ANMU12		37
	40 - 160	7	4	90°	Radial	✓**	NeoMill-4S-Corner		38	SDKT10		39
	50 - 160	8	8	90°	Radial	✓**	NeoMill-8-Corner		40	SNMU12		41

\* in the case of heat-resistant cast steel

\*\* up to dia. 125 mm



# High-feed milling cutter

Material suitability								Manufacturing processes			Process conditions		Application										
P	M	K	N	C	S	H																	
■	■					■	■			■	■	■	■					■	■	■	■	■	
■	■	■				■	■	■		■	■	■	■					■	■	■	■	■	
■	■					■	■	■		■	■	■	■					■	■	■	■	■	
■	■	■				■	■	■		■	■	■	■					■	■	■	■	■	
■	■	■				■	■	■		■	■	■	■					■	■	■	■	■	
■	■	■				■	■	■		■	■	■	■					■	■	■	■	■	

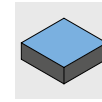
















# Shell end face milling cutter







Material suitability								Manufacturing processes			Process conditions		Application										
P	M	K	N	C	S	H																	
■	■	★					■	■		■	■		■	■									
■	■	■					■	■		■	■		■	■									

★ 1. Wahl    ■ bestens geeignet    ■ bedingt geeignet



Step 1:  
Type of milling cutterStep 2:  
Material suitabilityStep 3:  
Manufacturing processesStep 4:  
Process conditionsStep 5:  
ApplicationStep 6:  
Design

	Technical design						Tool body			Indexable insert		
	dia. [mm]	a <sub>p</sub> max. [mm]	Cutting edges	Contact angle	Technology		Product name	Design	Page	Product name		Page
	10 - 50	0,7	2	High feed	Radial	✓	NeoMill-2-HiFeed90		44	LPMX06		50
	16 - 80	1,4	2	High feed	Radial	✓	NeoMill-2-HiFeed90		46	LD_X10		50
	16 - 35	1	4	High feed	Radial	✓	NeoMill-4-HiFeed90		54	SD__06		60
	25 - 80	1,5	4	High feed	Radial	✓	NeoMill-4-HiFeed90		56	SD__10		60
	50 - 125	2,4	4	High feed	Radial	✓	NeoMill-4-HiFeed90		58	SD__14		60
	80 - 200	3,5	4	High feed	Radial	✓	NeoMill-4-HiFeed90		59	SD__18		60

	Technical design						Tool body			Indexable insert		
	dia. [mm]	a <sub>p</sub> max. [mm]	Cutting edges	Contact angle	Technology		Product name	Design	Page	Product name		Page
	32 - 63	62	4	90°	Radial	✓	NeoMill-4-Shell		68	ANMU12		69
	25 - 40	62	2	90°	Radial	✓	NeoMill-2-Shell		66	AOKT12		67

# Cutting Material Overview: Selecting the Right Cutting Material

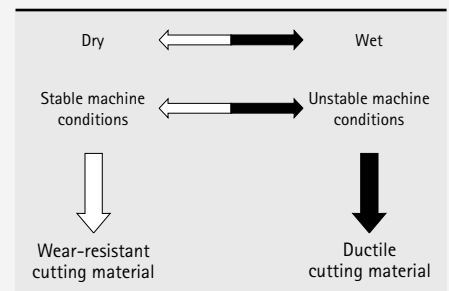
The new cutting materials cover a broad spectrum between wear resistance and ductility. The designation of the cutting material indicates the level of ductility; the ductility increases as the number increases.

PVD-coated cutting materials (HP...) are the first choice for milling K, P and M workpiece materials. These cutting materials have the longest tool life. If high cutting speeds are to be realised, CVD-coated cutting materials (HC...) should be selected.

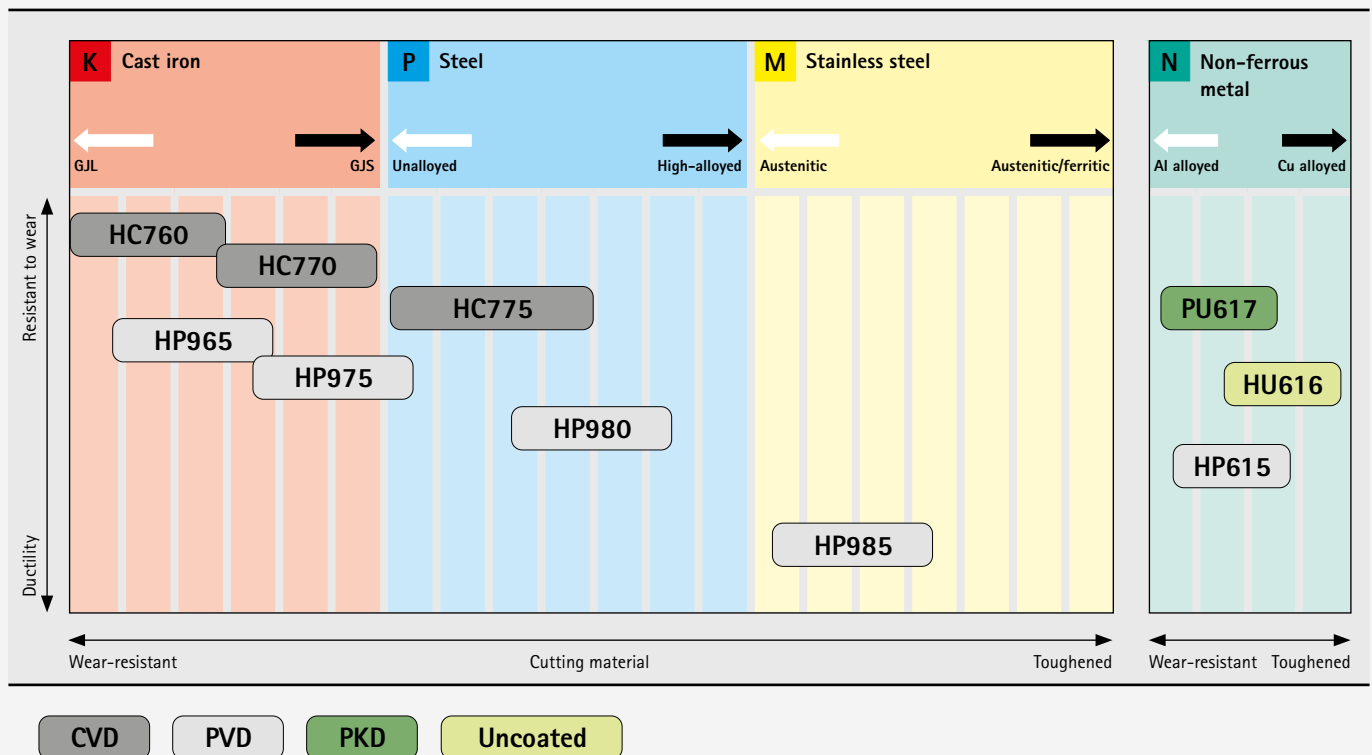
**Example:** HP980 is more ductile than HP965 (the more ductile the cutting material, the less resistant it is to wear).

1. Choose your\* workpiece material using the MMGs (MAPAL Machining Groups). You will find these on page 87.
2. Select the material type below the desired workpiece material in the "Cutting material overview" table.
3. Depending on the general conditions (see table "General conditions") a more wear-resistant or more ductile PVD-coated cutting material is to be selected.

### General conditions

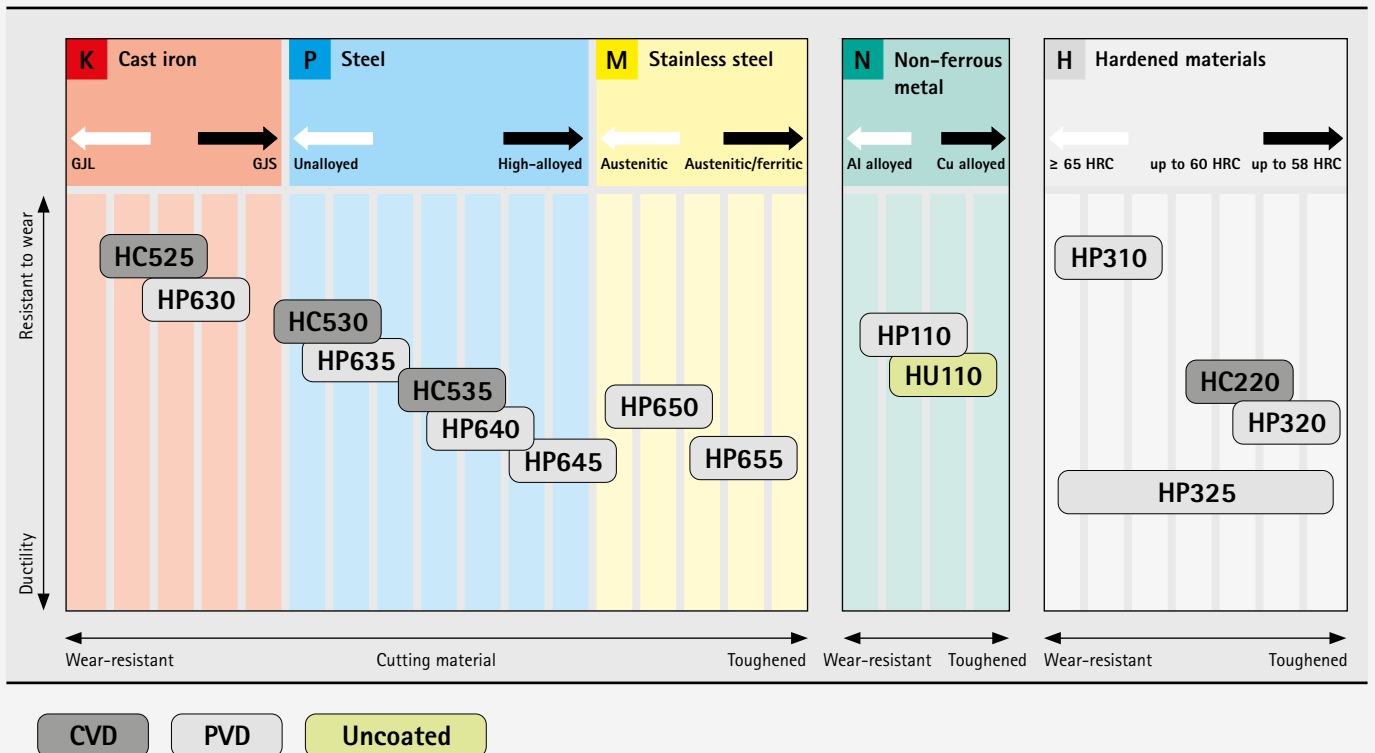


### Cutting material overview | Face, shoulder and shell end face milling cutters



\* depending on the tool type, select from the corresponding table "Cutting material overview" the type, etc.

Cutting material overview | High-feed milling cutters from the die and mould sector



# Cutting Material Overview: Types and Type Description

Cutting material	Name of cutting material	Coating composition	Colour of coating	Field of application	Recommended application
Carbide PVD-coated	HP110	AlTiN	dark grey	●	TiAlN-coated carbide for machining aluminium materials and other non-ferrous metals. Due to the very thin layer, the cutting material is also well suited for finishing stainless steels and grey cast iron.
	HP310	TiSiN	reddish brown	●	Finest grain-carbide grade with high wear resistance and temperature stable PVD coating. Suitable for the finishing of steel materials in the area of the highest cutting speeds.
	HP320	AlTiN	light grey	●	Universal ultra-fine grain-carbide grade, which is highly resistant to wear and has good breakage resistance and edge stability. Suitable for the machining of hard steel materials up to max. 60 HRC thanks to the temperature resistant PVD coating.
	HP325	AlTiN	light grey	✚	Finest grain-carbide grade with a balanced ratio between ductility and resistance to wear. Wide field of applications for steel materials due to the stress-optimised PVD coating.
	HP615	TiB2	silver-grey	●	Fine grain carbide with a partially reduced PVD coating for machining adhesive materials. First choice for increasing tool life compared to uncoated cutting edges in aluminium alloys with 7–12 % Si.
	HP630	AlTiN	dark grey	●	Ductile carbide grade with an AlTiN coating. Suitable for the machining of cast iron materials. Also suitable for the finishing of steel materials and cold-work steels with a hardening agent greater than 54 HRC.
	HP635	AlTiN-TiN	gold	●	Carbide grade with PVD coating. Suitable for milling unalloyed, low-alloyed, high-alloyed and stainless steels. Particularly suitable for high cutting speeds in both dry and wet machining under stable conditions.
	HP640	AlTiN-TiN	gold	●	Universal carbide grade with high ductility and an AlTiN-TiN coating. Suitable for the machining of steel materials. Particularly suitable for dry milling at low to medium cutting speeds under difficult conditions.
	HP645	AlTiN-TiN	gold	✚	Ductile carbide grade with a PVD coating. Suitable in the event that the cutting of steel materials such as tool steels, heat-treated steel, case hardening steels and austenitic stainless materials is sharply interrupted.
	HP650	AlTiN	dark grey	●	Finest grain-carbide grade with a wear-resistant AlTiN coating. Suitable for the machining of stainless and austenitic stainless materials. Suitable for both wet and dry machining.
	HP655	AlTiN	dark grey	●	Fine grain-carbide grade with extreme ductility. A thin, smooth PVD coating is ideal for the milling of austenitic stainless steels and duplex group workpiece materials at low to medium cutting speeds.
	HP965	AlTiN	black anthracite	●	PVD-coated fine grain carbide grade for medium machining and for roughing GJL, GJV and GJS. Suitable for wet or dry machining at medium to high cutting speeds.
	HP975	AlTiN	black anthracite	✚	Ductile carbide grade with PVD thick layer for challenging milling in cast materials. Particularly suitable for spheroidal graphite cast iron or ADI material and low-alloy steel in unstable conditions.
	HP980	AlTiN	black anthracite	✚	Ductile, coated carbide grade for the general machining of steel and alloyed steel. Increased wear resistance with good impact resistance at the same time.
	HP985	AlTiN	black anthracite	✚	Coated carbide grade for milling stainless and heat-resistant steels. Combination of good ductility and heat-resistant coating.

	P Steel						M Stainless steel / Heat-resistant cast steel						K Cast iron						N Non-ferrous metal						S High temperature alloys and titanium alloys						H Hardened steel / Cast steel								
	Wear-resistant			Toughened			Wear-resistant			Toughened			Wear-resistant			Toughened			Wear-resistant			Toughened			Wear-resistant			Toughened			Wear-resistant			Toughened					
	05	15	25	35	45		05	15	25	35	45		05	15	25	35	45		05	15	25	35	45		05	15	25	35	45		05	15	25	35	45				
	01	10	20	30	40	50	01	10	20	30	40	50	01	10	20	30	40	50	01	10	20	30	40	50	01	10	20	30	40	50	01	10	20	30	40	50			
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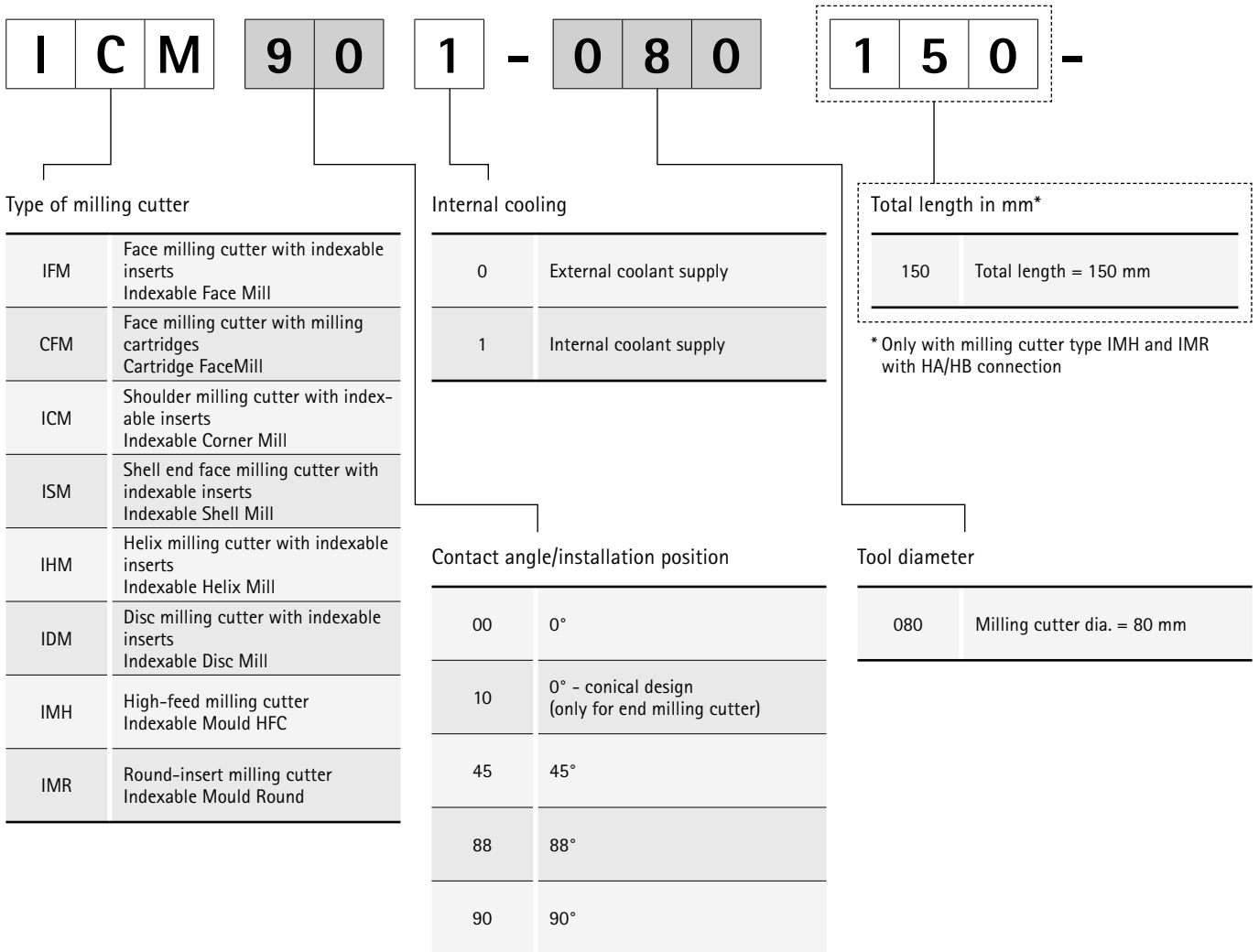
# Cutting Material Overview: Types and Type Description

Cutting material	Name of cutting material	Coating composition	Colour of coating	Field of application	Recommended application
Carbide CVD-coated	HC220	AlTiN	black anthracite	●	Wear-resistant finest grain-carbide grade for a wide range of applications. Suitable for steel materials under stable conditions. New CVD coating with high temperature hardness, which is resistant to wear and tear.
	HC525	AlTiN	black anthracite	●	Optimised carbide substrate with an extremely hard and wear-resistant CVD multilayer coating. Ideally suited for dry machining of grey cast iron (GJL), spheroidal graphite cast iron (GJS), malleable cast iron and alloyed cast iron.
	HC530	AlTiN	black anthracite	●	Harder alternative to HP635 with a CVD coating that is highly resistant to abrasive wear and tear. Excellent for the face milling of steel materials with increased cutting speed under stable conditions.
	HC535	AlTiN	black anthracite	●	This ductile carbide grade with a modern CVD coating offers economical dry machining at high cutting speeds. Particularly suitable for face milling for a wide range of steel materials.
	HC760	TiCN+Al2O3	black	●	Fine grain carbide with high resistance to wear and a multi-layer CVD coating with Al2O3 top coating for medium machining to roughing of GJL at high cutting speeds.
	HC770	TiCN+Al2O3	black	●	Fine grain carbide with high wear resistance and a multi-layer CVD coating with Al2O3 top coating. Wide range of applications for medium machining to roughing in GJS to unalloyed and low alloy steels.
	HC775	TiCN+Al2O3	black	⚡	Fine grain carbide with a balanced relationship between resistance to wear and ductility and a multi-layer CVD coating with Al2O3 top coating for machining at higher cutting speeds. For unstable conditions and workpiece material with increased tensile strength.
Carbide Uncoated	HU110	-	-	●	Uncoated carbide grade for the machining of aluminium and other non-ferrous metals.
	HU616	-	-	●	Fine grain carbide with very smooth surface for the general machining of aluminium wrought alloys and aluminium cast alloys with Si contents < 3 %.
Not coated with PVD	PU617	-	-	●	PCD grade with medium particle size for roughing to semi-machining in non-ferrous metals and for machining very abrasive materials.

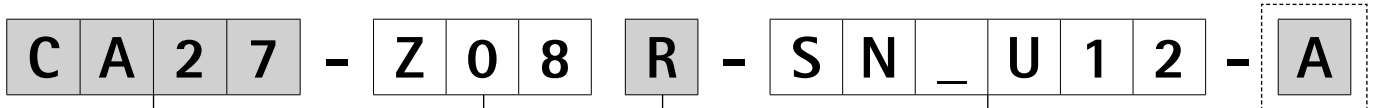


# Product ID Codes

## Milling cutters with replaceable inserts







Connection (Examples)

HA32	Cylindrical shank dia. = 32 mm Shape HA
HB32	Cylindrical shank dia. = 32 mm Shape HB
CA16	Milling cutter arbor dia. = 16 mm
CA22	Milling cutter arbor dia. = 22 mm
CA27	Milling cutter arbor dia. = 27 mm
CA32	Milling cutter arbor dia. = 32 mm
CA40	Milling cutter arbor dia. = 40 mm
CA60	Milling cutter arbor dia. = 60 mm
A063	HSK-A63
A080	HSK-A80
A100	HSK-A100
M045	Thread M4.5
M010	Thread M10
M012	Thread M12
M016	Thread M16
S050	SK50 Form AD/AF ISO 7388-1

Rotational direction

R	Right
L	Left
R1	Right   Disc milling cutter (left-side cutting)
R2	Right   Disc milling cutter (right-side cutting)
R3	Right   Disc milling cutter (both sides, 3-sided cutting)

Effective number of cutting edges (eff.) (Examples)

Z05	Number of teeth eff. = 5
Z10	Number of teeth eff. = 10
Z9+3	Number of teeth eff. = 12 of which three are adjustable inserts
Z12+4	Number of teeth eff. = 16 of which four are adjustable inserts
Z6+6	Disc milling cutter Number of teeth eff. = 6 (both sides, 3-sided cutting)
Z7+7	Face milling cutter LT_U Number of teeth eff. = 14 (alternating installation)

Workpiece material tool body\*

A	Tool body made of aluminium
S	Tool body made of steel

\* Only with milling cutter type CFM

Indexable insert/milling cartridge

2nd letter "T"	CT... Tangential LT... Tangential
2nd letter "D, F, N, O, P"	AN... Radial AO... Radial OF... Radial ON... Radial SD... Radial SN... Radial LP... Radial LD... Radial RD... Radial
3rd letter "C"	PMC... PowerMill EMC... EcoMill FMC... FlyCutter EBC... EcoMill-Blue RBC... RapidMill-Blue PBC... PowerMill-Blue

# Product ID Codes

## Radial indexable inserts

S

N

M

U

1

2




0

5

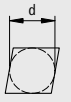
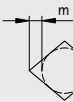
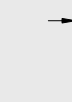
0

8

**Blade form**

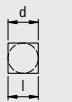
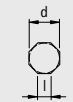
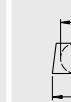
S (90°)	
O (135°)	
A (85°)	

**Tolerance**

			
	d [mm]	m [mm]	s [mm]
M	from ±0.05 to ±0.15*	from ±0.08 to ±0.20*	from ±0.05 to ±0.13*
K	from ±0.05 to ±0.15*	±0.013	±0.013
H	±0.013	±0.013	±0.025

\* Tolerance depends on the insert size

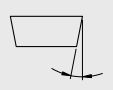
**Insert size**

Insert size			
d [mm]	S	O	A
7.5	-	-	12
7.5	-	-	12
10	10	-	-
11.5	12	-	-
19	-	07	-
20	-	07	-

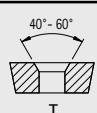
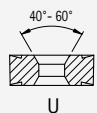
**Insert thickness**

Identification number	s [mm]
T3	3.97
04	4.76
05	5.56

**Clearance angle**

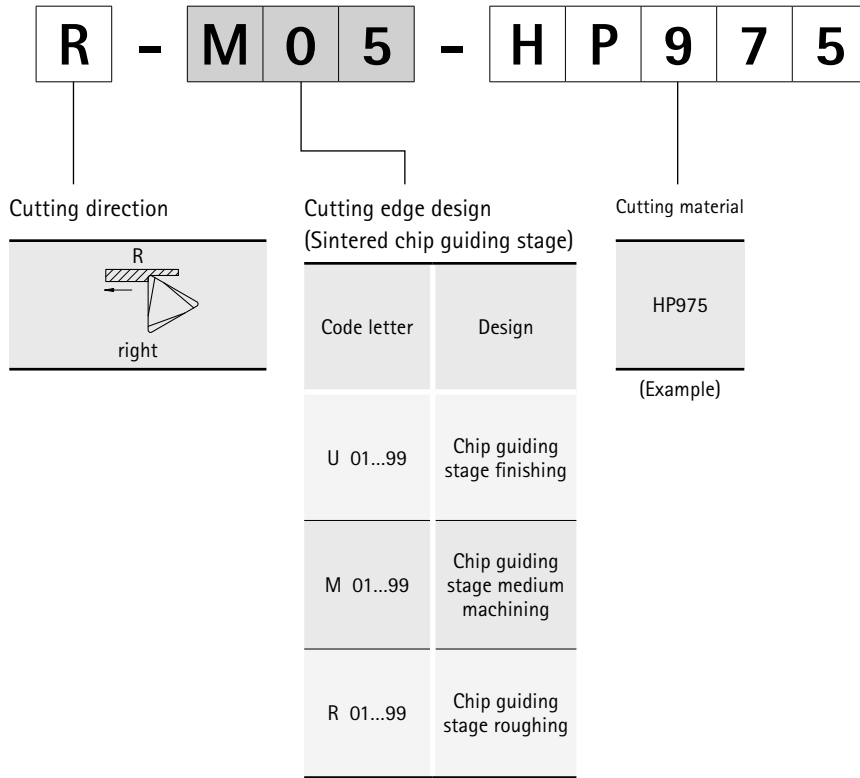
	
N	0°
D	15°
O	Custom
F	25°

**Insert type**

	T
	U
Custom	X

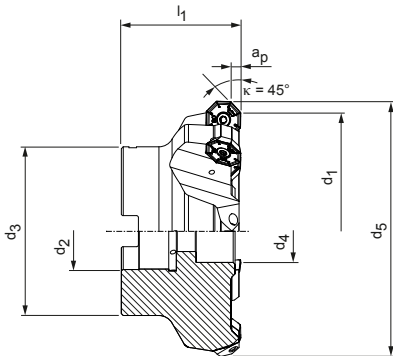
**Corner radius**

Identification number	r [mm]
08	0.8
12	1.2



# NeoMill®-8-Face

45° face milling cutter, with radial technology  
OFMT07



## Milling cutter, close spacing

Dimensions						Z <sub>eff</sub>	a <sub>p</sub> max.	Weight [kg]	max. operating speed [rpm]	Internal cooling	Specification	Order no.
d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	d <sub>5</sub>	l <sub>1</sub>							
63	22	48	18	75,5	40	5	3	0,6	15.800	✓	IFM451-063-CA22-Z05R-OF_T07	31002131
80	27	60	20	92,4	50	6	3	1,2	14.300	✓	IFM451-080-CA27-Z06R-OF_T07	31002132
100	32	78	27	111,3	55	8	3	2,1	12.900	✓	IFM451-100-CA32-Z08R-OF_T07	31002133
125	40	89	33	137,3	63	10	3	3,6	11.700	✓	IFM451-125-CA40-Z10R-OF_T07	31002134
160	40	89	65	172	63	13	3	5,4	10.400	-	IFM450-160-CA40-Z13R-OF_T07	31002136
200	60	140	-	212,3	63	15	3	9,1	9.400	-	IFM450-200-CA60-Z15R-OF_T07	31002137

Dimensions in mm.

The maximum operating speeds refer only to the cutting edge system.

# OFMT

Radial indexable insert, eight cutting edges



Workpiece material	<b>P</b>				<b>M</b>			
	Unalloyed Wear-resistant	Alloyed Toughened	Unalloyed Wear-resistant	Alloyed Toughened	Austenitic Wear-resistant	Ferritic Toughened	Austenitic Wear-resistant	Ferritic Toughened
Substrate	Carbide				Carbide			
Coating	PVD		CVD		PVD		CVD	
Cutting material type	HP980		HC775		HP985		HP980	
Cutting edge design	M03		M03		M03		M03	
<b>OFMT07</b>	<b>a<sub>p</sub> max. [mm]</b>							
OFMT070405R-	*	31029307	31124599	31029341	31029307			

## Feed per tooth

Chip breaker		Medium machining
		M03
Edge rounding		++
Feed/tooth [mm]	<b>P</b>	0.1–0.3
	<b>M</b>	0.1–0.25
	<b>K</b>	
	<b>N</b>	

Legend: ++ = medium rounded

## Accessories

	Milling cutter arbor for milling cutter see MAPAL catalogue "CLAMPING"	
	Milling cutter clamping screws for milling cutter	Page 74

## Spare parts\*\*

	OFMT0704	Clamping screw for indexable insert TORX PLUS® M5x13-TX20-IP	Order no. 10105084
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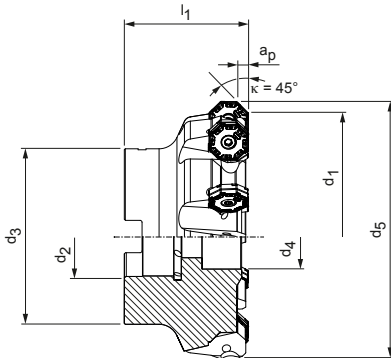
\* a<sub>p</sub> max. depends on the type of milling cutter and application.

\*\* Included in scope of delivery.

For cutting data recommendations, see end of chapter.

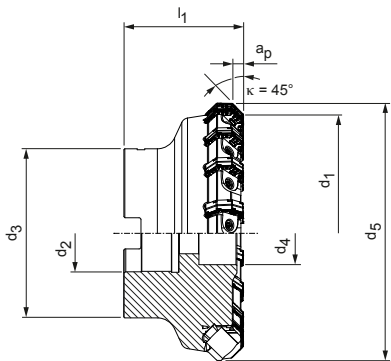
# NeoMill®-16-Face

45° face milling cutter, with radial technology  
ONKU07



## Milling cutter, medium spacing

Dimensions						$Z_{eff}$	$a_p$ max.	Weight [kg]	max. operating speed [rpm]	Internal cooling	Specification	Order no.
$d_1$	$d_2$	$d_3$	$d_4$	$d_5$	$l_1$							
63	22	48	18	75,1	50	6	4	0,8	6.800	✓	IFM451-063-CA22-Z06R-ON_U07	31002143
80	27	60	20	92,1	50	7	4	1,2	6.100	✓	IFM451-080-CA27-Z07R-ON_U07	31002144
100	32	78	27	112,1	55	9	4	2,2	5.500	✓	IFM451-100-CA32-Z09R-ON_U07	31002145
125	40	89	33	137,1	63	10	4	3,7	5.000	✓	IFM451-125-CA40-Z10R-ON_U07	31002146
160	40	89	65	172,1	63	12	4	5,4	4.400	-	IFM450-160-CA40-Z12R-ON_U07	31002148
200	60	140	-	212,1	63	14	4	9,1	4.000	-	IFM450-200-CA60-Z14R-ON_U07	31002149



## Milling cutter, close spacing

Dimensions						$Z_{eff}$	$a_p$ max.	Weight [kg]	max. operating speed [rpm]	Internal cooling	Specification	Order no.
$d_1$	$d_2$	$d_3$	$d_4$	$d_5$	$l_1$							
63	22	48	18	75,1	55	7	3	1,1	9.000	-	IFM450-063-CA22-Z07R-ON_U07	31002155
80	27	60	20	92,1	50	11	3	1,5	7.800	-	IFM450-080-CA27-Z11R-ON_U07	31002156
100	32	78	27	112,1	55	14	3	2,5	6.800	-	IFM450-100-CA32-Z14R-ON_U07	31002157
125	40	89	33	137,1	63	18	3	4,1	5.900	-	IFM450-125-CA40-Z18R-ON_U07	31002158
160	40	89	65	172,1	63	23	3	6,1	5.000	-	IFM450-160-CA40-Z23R-ON_U07	31002160
200	60	140	-	212,1	63	30	3	10,1	4.200	-	IFM450-200-CA60-Z30R-ON_U07	31002161

Dimensions in mm.

The maximum operating speeds refer only to the cutting edge system.

# ONKU

Radial indexable insert, 16 cutting edges



Workpiece material	P			M <sub>2</sub>		K				
	Unalloyed Wear-resistant	Alloyed Toughened		Austenitic Wear-resistant	Ferritic Toughened	GJL Wear-resistant	GJS Toughened	GJL Wear-resistant	GJS Toughened	
Substrate	Carbide			Carbide		Carbide				
Coating	PVD		CVD	PVD		PVD		CVD		
Cutting material type	HP975	HP980	HC775	HP980	HP985	HP965	HP975	HC760	HC770	
Cutting edge design	R03	R05	R03	R03	R03	R05	R05	R05	R05	
<b>ONKU07</b>	<i>a<sub>p</sub> max. [mm]</i>									
ONKU070508R-	*	31029360	31029361	31272655	31029361	31029362	31029363	31029360	31218299	31175603
Cutting edge design	M03	M05	M03	M03	M03	M05	M05	M05	M05	
<b>ONKU07</b>	<i>a<sub>p</sub> max. [mm]</i>									
ONKU070508R-	*	31029344	31029345	31271446	31029345	31029346	31029347	31029344	31122900	31122898

## Feed per tooth

Chip breaker	Medium machining		Roughing		
	M03	M05	R03	R05	
Edge rounding	++	+++	△+	△++	
Feed/tooth [mm]	P	0.1–0.3	0.12–0.35	0.12–0.3	0.15–0.4
	M	0.1–0.25		0.12–0.25	
	K		0.12–0.4		0.15–0.5
	N				

Legend: ++ = medium rounded | +++ = sharp edged | △+ = bevelled and slightly rounded | △++ = chamfered and medium rounded

## Accessories

	Milling cutter arbor for milling cutter see MAPAL catalogue "CLAMPING"	
	Milling cutter clamping screws for milling cutter	Page 74

## Spare parts\*\*

	ONKU0705 (close spacing)	Indexable insert clamping wedge	Order no. 31071645
	ONKU0705 (close spacing)	Threaded spindle M6x0.75 LH/RHx23.4 TX15-IP	Order no. 31041869
	ONKU0705 (wide spacing)	Clamping screw for indexable insert TORX PLUS® M5x13-TX20-IP	Order no. 10105084

\* *a<sub>p</sub> max.* depends on the type of milling cutter and application.

\*\* Included in scope of delivery.

For cutting data recommendations, see end of chapter.

**M<sub>2</sub>** Heat-resistant cast steel (turbocharger materials)

# Cutting Data Recommendation for Face Milling Cutter with Indexable Inserts

Feed and cutting speed

## Face milling cutter

MMG*	Workpiece material	Strength/hardness [N/mm <sup>2</sup> ] [HRC]	Cooling		
			MQL/Air	Dry	KSS
P	P1.1	Construction steels, machining steels, hardening and tempering steels, unalloyed	< 700		✓
	P1.2	Construction steels, machining steels, hardening and tempering steels, unalloyed	< 1200		✓
	P2.1	Nitriding, hardening and tempering steels, alloyed	< 900		✓
	P2.2	Nitriding, hardening and tempering steels, alloyed	< 1400		✓
	P3.1	Tool steels, roller bearing steels, spring steels and high-speed steels**	< 800		✓
	P3.2	Tool steels, roller bearing steels, spring steels and high-speed steels**	< 1000		✓
	P3.3	Tool steels, roller bearing steels, spring steels and high-speed steels**	< 1500		✓
	P4.1	Stainless steels, ferritic and martensitic			
	P5.1	Cast steel			
	P6.1	Stainless cast steels, ferritic and martensitic			
M	M1.1	Stainless steels, austenitic	< 700		✓
	M1.2	Stainless steels, ferritic/austenitic (Duplex)	< 1000		
	M2.1	Stainless cast steel, austenitic	< 700		
	M3.1	Stainless cast steel, ferritic/austenitic (Duplex)	< 1000		
K	K1.1	Cast iron with lamellar graphite (grey cast iron), GJL	< 300		✓
	K2.1	Cast iron with spheroidal graphite, GJS	< 500		✓
	K2.2	Cast iron with spheroidal graphite, GJS	500–800		
	K2.3	Cast iron with spheroidal graphite, GJS	> 800		
	K3.1	Cast iron with vermicular graphite, GJV; malleable cast iron, GJM	< 500		
	K3.2	Cast iron with vermicular graphite, GJV; malleable cast iron, GJM	> 500		
N	N1.1	Aluminium, unalloyed and alloyed < 3 % Si			✓
	N1.2	Aluminium, alloyed < 7 % Si			
	N1.3	Aluminium, alloyed > 7–12 % Si			
	N1.4	Aluminium, alloyed > 12 % Si			
	N2.1	Copper, unalloyed and low alloyed	< 300		✓
	N2.2	Copper, alloyed	> 300		
	N2.3	Brass, bronze, gunmetal	< 1200		
	N3.1	Graphite, > 8 µm			
	N3.2	Graphite, ≤ 8 µm			
	N4.1	Plastic, thermoplastics			
N4.2	Plastic, duroplastics				
N4.3	Plastic, foam materials				

\* MAPAL machining groups

\*\* If the alloy parts Cr, Mo, Ni, V, W in total > 8 % then select the next highest MAPAL machining group.

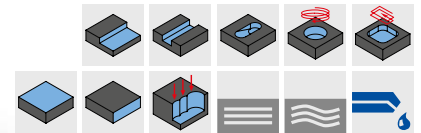
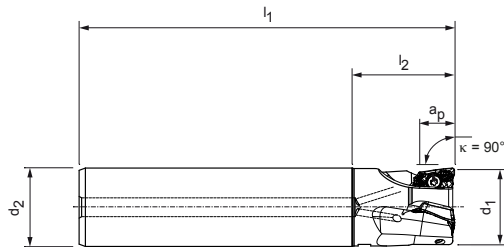


		Cutting material type according to contact ratio $a_e/D$													
		Carbide PVD-coated								Carbide CVD-coated					
		HP965		HP975		HP980		HP985		HC760		HC770		HC775	
		> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6
			180	220	180	220					260	280			
			150	180	150	180					250	270	240	260	
			160	200	160	200					240	260	230	250	
					130	160							220	240	
					130	160									
					130	160									
					120	150									
					120	150									
					130	160									
					110	140									
					160	180	140	170							
					140	160	120	150							
							100	120							
							90	110							
	220	270	200	240					330	350	320	330			
	200	240	180	220					300	330	300	320			
	180	220	160	200							260	300			
	160	200	140	170							220	260			
	170	210	150	180					210	240	200	220			
	160	200	140	170					200	220	180	200			

The specified machining values are guide values. The optimum data for the respective machining task should be determined during the test or machining.

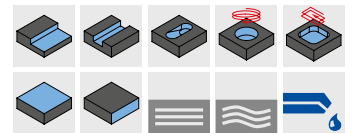
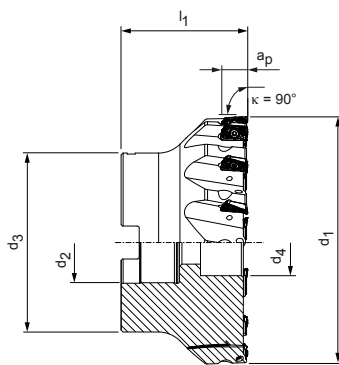
# NeoMill®-2-Corner

Shoulder milling cutter, with radial technology  
AOKT12



## End milling cutter

Dimensions				$z_{\text{eff}}$	$a_p$ max.	Weight [kg]	max. operating speed [rpm]	Cylindrical shank form	Internal cooling	Specification	Order no.
$d_1$	$d_2$	$l_1$	$l_2$								
20	20	110	30	2	11	0,2	55.000	HA	✓	ICM901-020-HA20-Z02R-AO_T12	31002166
20	20	81	30	2	11	0,2	55.000	HB	✓	ICM901-020-HB20-Z02R-AO_T12	31002167
25	25	120	32	3	11	0,4	49.000	HA	✓	ICM901-025-HA25-Z03R-AO_T12	31002168
25	25	88	32	3	11	0,3	49.000	HB	✓	ICM901-025-HB25-Z03R-AO_T12	31002169
32	32	130	40	4	11	0,7	43.000	HA	✓	ICM901-032-HA32-Z04R-AO_T12	31002170
32	32	100	40	4	11	0,5	43.000	HB	✓	ICM901-032-HB32-Z04R-AO_T12	31002171
40	32	150	88	5	11	0,9	39.000	HA	✓	ICM901-040-HA32-Z05R-AO_T12	31002174
40	32	110	48	5	11	0,7	39.000	HB	✓	ICM901-040-HB32-Z05R-AO_T12	31002175



## Milling cutter

Dimensions					$z_{\text{eff}}$	$a_p$ max.	Weight [kg]	max. operating speed [rpm]	Internal cooling	Specification	Order no.
$d_1$	$d_2$	$d_3$	$d_4$	$l_1$							
40	16	32	14	40	5	11	0,2	39.000	✓	ICM901-040-CA16-Z05R-AO_T12	31002184
50	22	48	18,5	40	6	11	0,4	35.000	✓	ICM901-050-CA22-Z06R-AO_T12	31002185
63	22	48	18,5	40	8	11	0,6	31.000	✓	ICM901-063-CA22-Z08R-AO_T12	31002187

Dimensions in mm.

The maximum operating speeds refer only to the cutting edge system.

# AOKT

Radial indexable insert, double edge



Workpiece material	P			M		K	
	Unalloyed Wear-resistant	Alloyed Toughened		Austenitic Wear-resistant	Ferritic Toughened		
Substrate	Carbide			Carbide		Carbide	
Coating	PVD		CVD	PVD		PVD	CVD
Cutting material type	HP975	HP980	HC775	HP980	HP985	HP975	HC770
Cutting edge design	M05	M03	M03	M03	M03	M05	M05
<b>AOKT12</b>	<b><math>a_p</math> max. [mm]</b>						
AOKT12T304R-	*	31029366			31029367	31029366	31218303
AOKT12T308R-	*	31029368	31200903	31124557	31200903	31029369	31029368 31124556

## Feed per tooth

Chip breaker	Medium machining		
	M03	M05	
Edge rounding	++	+++	
Feed/tooth [mm]	P	0.08–0.25	0.1–0.25
	M	0.08–0.2	
	K		0.1–0.3
	N		

Legend: ++ = medium rounded | +++ = sharp edged

## Accessories

	Chuck for end milling cutter see MAPAL catalogue "CLAMPING"	
	Milling cutter arbor for milling cutter see MAPAL catalogue "CLAMPING"	
	Milling cutter clamping screws for milling cutter	Page 74

## Spare parts\*\*

	End milling cutter Milling cutter	Clamping screw for indexable insert TORX® M3x6.5-TX8-IP M3x7.5-TX8-IP	Order no. 10105074 10105075
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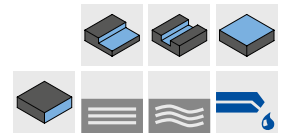
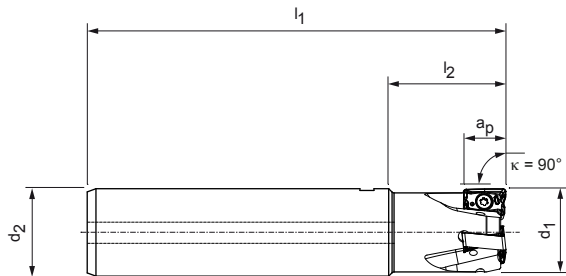
\*  $a_p$  max. depends on the type of milling cutter and application.

\*\* Included in scope of delivery.

For cutting data recommendations, see end of chapter.

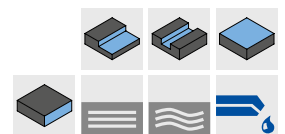
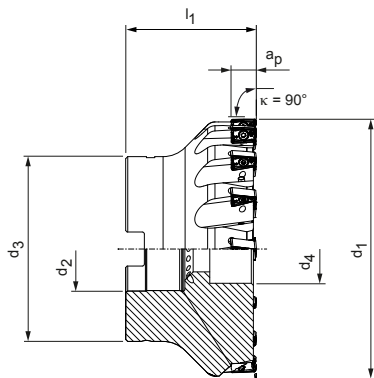
# NeoMill®-4-Corner

Shoulder milling cutter, with radial technology  
ANMU12



## End milling cutter

Dimensions				Z <sub>eff</sub>	a <sub>p</sub> max.	Weight [kg]	max. operating speed [rpm]	Cylindrical shank form	Internal cooling	Specification	Order no.
d <sub>1</sub>	d <sub>2</sub>	l <sub>1</sub>	l <sub>2</sub>								
25	25	120	32	3	10	0,41	42.000	HA	✓	ICM901-025-HA25-Z03R-AN_U12	31002200
25	25	88	32	3	10	0,29	42.000	HB	✓	ICM901-025-HB25-Z03R-AN_U12	31002201
32	32	130	40	4	10	0,74	31.500	HA	✓	ICM901-032-HA32-Z04R-AN_U12	31002202
32	32	100	40	4	10	0,55	31.500	HB	✓	ICM901-032-HB32-Z04R-AN_U12	31002203
40	32	150	50	5	10	0,98	25.000	HA	✓	ICM901-040-HA32-Z05R-AN_U12	31002206
40	32	110	50	5	10	0,73	25.000	HB	✓	ICM901-040-HB32-Z05R-AN_U12	31002207

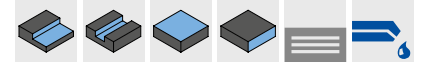


## Milling cutter, medium spacing

Dimensions					Z <sub>eff</sub>	a <sub>p</sub> max.	Weight [kg]	max. operating speed [rpm]	Internal cooling	Specification	Order no.
d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	l <sub>1</sub>							
50	22	48	18,5	40	6	10	0,4	23.000	✓	ICM901-050-CA22-Z06R-AN_U12	31018838
63	22	48	18,5	40	8	10	0,6	21.000	✓	ICM901-063-CA22-Z08R-AN_U12	31018870
80	27	60	20,5	50	10	10	1,2	18.000	✓	ICM901-080-CA27-Z10R-AN_U12	31018871
100	32	78	27,5	55	12	10	2,1	16.000	✓	ICM901-100-CA32-Z12R-AN_U12	31018872

Dimensions in mm.

The maximum operating speeds refer only to the cutting edge system.



## Milling cutter, close spacing

Dimensions					Z <sub>eff</sub>	a <sub>p</sub> max.	Weight [kg]	max. operating speed [rpm]	Internal cooling	Specification	Order no.
d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	d <sub>4</sub>	l <sub>1</sub>							
40	16	32	14	40	6	6	0,2	26.000	✓	ICM901-040-CA16-Z06R-AN_U12	31002214
50	22	48	18,5	40	8	6	0,5	23.000	✓	ICM901-050-CA22-Z08R-AN_U12	31002215
63	22	48	18,5	40	10	6	0,6	21.000	✓	ICM901-063-CA22-Z10R-AN_U12	31002217
80	27	60	20,5	50	12	6	1,2	18.000	✓	ICM901-080-CA27-Z12R-AN_U12	31002218

## ANMU

Radial indexable insert, four cutting edges



Workpiece material	P			M		K			
	Unalloyed Wear-resistant	Alloyed Toughened		Austenitic Wear-resistant	Ferritic Toughened	GJL Wear-resistant	GJS Toughened	GJL Wear-resistant	GJS Toughened
Substrate	Carbide			Carbide		Carbide			
Coating	PVD		CVD	PVD		PVD		CVD	
Cutting material type	HP975	HP980	HC775	HP980	HP985	HP965	HP975	HC760	HC770
Cutting edge design	M05	M03	M03	M03	M03	M05	M05	M05	M05
<b>ANMU12</b>	a <sub>p</sub> max. [mm]								
ANMU120504R-	*	31029427					31029427		31218310
ANMU120508R-	*	30968178	31027000	31124584	31027000	31029429	31029430	30968178	31124582 31124583
Cutting edge design	U05	U03	U03	U03	U03	U05	U05	U05	U05
<b>ANMU12</b>	a <sub>p</sub> max. [mm]								
ANMU120508R-	*	31253944	31253948	31273152	31253948	31290794	31273129	31253944	31273153 31253947

## Feed per tooth

Chip breaker		Medium machining		Difficult conditions	
		M03	M05	U03	U05
Edge rounding		++	+++	++	+++
Feed/tooth [mm]	P	0.08-0.25	0.1-0.25	0.08-0.25	0.1-0.25
	M	0.08-0.2		0.08-0.2	
	K		0.1-0.3		0.1-0.3
	N				

Legend: ++ = medium rounded | +++ = sharp edged

## Accessories

	Chuck for end milling cutter see MAPAL catalogue "CLAMPING"	
	Milling cutter arbor for milling cutter see MAPAL catalogue "CLAMPING"	
	Milling cutter clamping screws for milling cutter	Page 74

## Spare parts\*\*

	Clamping screw for indexable insert TORX® M3x8.5-TX8-IP	Order no. 10105076
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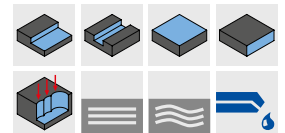
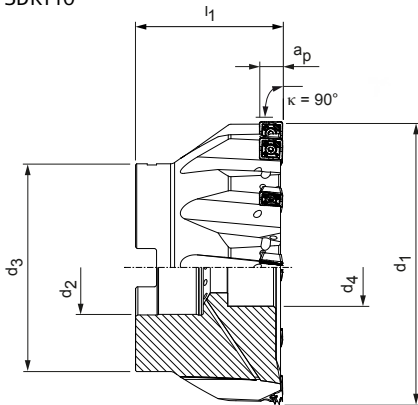
\* a<sub>p</sub> max. depends on the type of milling cutter and application.

\*\* Included in scope of delivery.

For cutting data recommendations, see end of chapter.

# NeoMill®-4S-Corner



Shoulder milling cutter, with radial technology  
SDKT10




## Milling cutter

Dimensions					$Z_{\text{eff}}$	$a_p$ max.	Weight [kg]	max. operating speed [rpm]	Internal cooling	Specification	Order no.
$d_1$	$d_2$	$d_3$	$d_4$	$l_1$							
40	16	32	13,8	40	5	5	0,2	37.000	✓	ICM901-040-CA16-Z05R-SD_T10	31002262
50	22	48	18,5	40	6	5	0,4	33.000	✓	ICM901-050-CA22-Z06R-SD_T10	31002263
63	22	48	18,5	40	7	5	0,6	30.000	✓	ICM901-063-CA22-Z07R-SD_T10	31002264
80	27	60	20	50	9	5	1,1	26.000	✓	ICM901-080-CA27-Z09R-SD_T10	31002265
100	32	78	27	55	10	5	2,1	23.000	✓	ICM901-100-CA32-Z10R-SD_T10	31002266
125	40	89	33	63	12	5	3,5	21.000	✓	ICM901-125-CA40-Z12R-SD_T10	31002267
160	40	89	65	63	15	5	5	18.000	-	ICM900-160-CA40-Z15R-SD_T10	31002269

## Accessories

	Milling cutter arbor for milling cutter see MAPAL catalogue "CLAMPING"	
	Milling cutter clamping screws for milling cutter	Page 74

## Spare parts\*

	SDKT10T3	Clamping screw for indexable insert TORX® M3x7.5-TX8-IP	Order no. 10105075
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Dimensions in mm.

The maximum operating speeds refer only to the cutting edge system.

\* Included in scope of delivery.

# SDKT

Radial indexable insert, four cutting edges



Workpiece material	P				M			
	Unalloyed Wear-resistant	Alloyed Toughened	Unalloyed Wear-resistant	Alloyed Toughened	Austenitic Wear-resistant	Ferritic Toughened	Austenitic Wear-resistant	Ferritic Toughened
Substrate	Carbide				Carbide			
Coating	PVD		CVD		PVD			
Cutting material type	HP980		HC775		HP980		HP985	
Cutting edge design	M03		M03		M03		M03	
<b>SDKT10</b>	<b><math>a_p</math> max. [mm]</b>							
SDKT10T308R-	*	31029463	31271444	31029463	31029463	31029463	31029465	31029465

## Feed per tooth

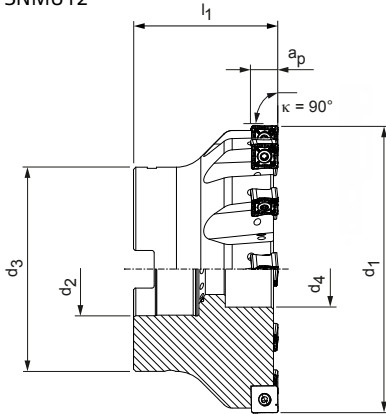
Chip breaker		Medium machining
		M03
Edge rounding		++
Feed/tooth [mm]	P	0.08–0.25
	M	0.08–0.2
	K	
	N	

Legend: ++ = medium rounded

\*  $a_p$  max. depends on the type of milling cutter and application.  
For cutting data recommendations, see end of chapter.

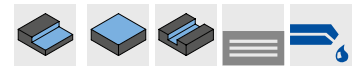
# NeoMill®-8-Corner

Shoulder milling cutter, with radial technology  
SNMU12



## Milling cutter, medium spacing



Dimensions					$Z_{\text{eff}}$	$a_p$ max.	Weight [kg]	max. operating speed [rpm]	Internal cooling	Specification	Order no.
$d_1$	$d_2$	$d_3$	$d_4$	$l_1$							
50	22	48	18,5	40	4	8	0,4	17.000	✓	ICM901-050-CA22-Z04R-SN_U12	31002271
63	22	48	18,5	40	6	8	0,5	15.000	✓	ICM901-063-CA22-Z06R-SN_U12	31002272
80	27	60	20,5	50	8	8	1,2	13.000	✓	ICM901-080-CA27-Z08R-SN_U12	31002273
100	32	78	27,5	55	10	8	2,2	12.000	✓	ICM901-100-CA32-Z10R-SN_U12	31002274
125	40	89	33	63	12	8	3,7	11.000	✓	ICM901-125-CA40-Z12R-SN_U12	31002275
160	40	89	65	63	16	8	4,9	9.000	-	ICM900-160-CA40-Z16R-SN_U12	31002277
200	60	89	-	63	18	8	8,5	8.000	-	ICM900-200-CA60-Z18R-SN_U12	31002278




## Milling cutter, close spacing

50	22	48	18,5	40	6	6	0,4	17.000	✓	ICM901-050-CA22-Z06R-SN_U12	31002279
63	22	48	18,5	40	8	6	0,6	15.000	✓	ICM901-063-CA22-Z08R-SN_U12	31002280
80	27	60	20,5	50	10	6	1,1	13.000	✓	ICM901-080-CA27-Z10R-SN_U12	31002281
100	32	78	27,5	55	12	6	2,2	12.000	✓	ICM901-100-CA32-Z12R-SN_U12	31002282
125	40	89	33	63	14	6	3,6	11.000	✓	ICM901-125-CA40-Z14R-SN_U12	31002283
160	40	89	65	63	18	6	4,8	9.000	-	ICM900-160-CA40-Z18R-SN_U12	31002285

## Accessories

	Milling cutter arbor for milling cutter see MAPAL catalogue "CLAMPING"	
	Milling cutter clamping screws for milling cutter	Page 74

## Spare parts\*

	SNMU1205	Clamping screw for indexable insert TORX PLUS® M4x11-TX15-IP	Order no. 10018468
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Dimensions in mm.

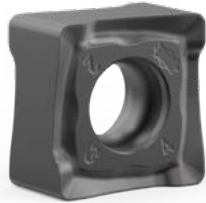
The maximum operating speeds refer only to the cutting edge system.

\* Included in scope of delivery.



# SNMU

Radial indexable insert, eight cutting edges



Workpiece material	P			M		K			
	Unalloyed Wear-resistant	Alloyed Toughened		Austenitic Wear-resistant	Ferritic Toughened	GJL Wear-resistant	GJS Toughened	GJL Wear-resistant	GJS Toughened
Substrate	Carbide			Carbide		Carbide			
Coating	PVD		CVD	PVD		PVD		CVD	
Cutting material type	HP975	HP980	HC775	HP980	HP985	HP965	HP975	HC760	HC770
Cutting edge design	M05	M03	M03	M03	M03	M05	M05	M05	M05
<b>SNMU12</b>	<b><math>a_p</math> max. [mm]</b>								
SNMU120508R-	30968200	31124590	31029466	31029466	31029469	31029480	30968200	31124588	31124589
SNMU120512R-	31029482					31029483	31029482	31170977	31170976
SNMU120516R-	31175561						31175561		31218330
SNMU120520R-	31175564						31175564		31218332

## Feed per tooth

Chip breaker		Medium machining	
		M03	M05
Edge rounding		++	+++
Feed/tooth [mm]	P	0.08–0.25	0.1–0.25
	M	0.08–0.2	
	K		0.1–0.3
	N		

Legend: ++ = medium rounded | +++ = sharp edged

# Cutting Data Recommendations for Shoulder Milling Cutters

Feed and cutting speed

## Shoulder milling cutter

MMG*	Workpiece material	Strength/hardness [N/mm <sup>2</sup> ] [HRC]	Cooling		
			MQL/Air	Dry	KSS
P	P1.1	Construction steels, machining steels, hardening and tempering steels, unalloyed	< 700		✓
	P1.2	Construction steels, machining steels, hardening and tempering steels, unalloyed	< 1200		✓
	P2.1	Nitriding, hardening and tempering steels, alloyed	< 900		✓
	P2.2	Nitriding, hardening and tempering steels, alloyed	< 1400		✓
	P3.1	Tool steels, roller bearing steels, spring steels and high-speed steels**	< 800		✓
	P3.2	Tool steels, roller bearing steels, spring steels and high-speed steels**	< 1000		✓
	P3.3	Tool steels, roller bearing steels, spring steels and high-speed steels**	< 1500		✓
	P4.1	Stainless steels, ferritic and martensitic			
	P5.1	Cast steel			
	P6.1	Stainless cast steels, ferritic and martensitic			
M	M1.1	Stainless steels, austenitic	< 700		✓
	M1.2	Stainless steels, ferritic/austenitic (Duplex)	< 1000		
	M2.1	Stainless cast steel, austenitic	< 700		
	M3.1	Stainless cast steel, ferritic/austenitic (Duplex)	< 1000		
K	K1.1	Cast iron with lamellar graphite (grey cast iron), GJL	< 300		✓
	K2.1	Cast iron with spheroidal graphite, GJS	< 500		✓
	K2.2	Cast iron with spheroidal graphite, GJS	500–800		
	K2.3	Cast iron with spheroidal graphite, GJS	> 800		
	K3.1	Cast iron with vermicular graphite, GJV; malleable cast iron, GJM	< 500		
	K3.2	Cast iron with vermicular graphite, GJV; malleable cast iron, GJM	> 500		
N	N1.1	Aluminium, unalloyed and alloyed < 3 % Si			✓
	N1.2	Aluminium, alloyed < 7 % Si			
	N1.3	Aluminium, alloyed > 7–12 % Si			
	N1.4	Aluminium, alloyed > 12 % Si			
	N2.1	Copper, unalloyed and low alloyed	< 300		✓
	N2.2	Copper, alloyed	> 300		
	N2.3	Brass, bronze, gunmetal	< 1200		
	N3.1	Graphite, > 8 µm			
	N3.2	Graphite, ≤ 8 µm			
	N4.1	Plastic, thermoplastics			
N4.2	Plastic, duroplastics				
N4.3	Plastic, foam materials				

\* MAPAL machining groups

\*\* If the alloy parts Cr, Mo, Ni, V, W in total > 8 % then select the next highest MAPAL machining group.

Cutting material type according to contact ratio $a_e/D$																			
Carbide PVD-coated										Carbide CVD-coated						Carbide - uncoated		PVD	
HP615		HP965		HP975		HP980		HP985		HC760		HC770		HC775		HU616		PU617	
> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6
				180	220	180	220					260	280						
				150	180	150	180					250	270	240	260				
				160	200	160	200					240	260	230	250				
						130	160							220	240				
						130	160												
						130	160												
						120	150												
						120	150												
						130	160												
						110	140												
						160	180	140	170										
						140	160	120	150										
								100	120										
								90	110										
		220	270	200	240					330	350	320	330						
		200	240	180	220					300	330	300	320						
		180	220	160	200							260	300						
		160	200	140	170							220	260						
		170	210	150	180					210	240	200	220						
		160	200	140	170					200	220	180	200						
700	700															500	500	2000	2000
400	480															300	360	1500	1800
300	360															230	280	1200	1440
270	330																	700	840
250	300															250	300	600	720
130	160															120	150	500	600
190	230															180	220	450	540
320	390															300	360		
320	390																		
220	270															300	360	500	600
210	260															250	300	400	480

The specified machining values are guide values.  
 The optimum data for the respective machining task should be determined during the test or machining.

# NeoMill®-2-HiFeed90

High-feed and 90° shoulder milling cutter  
LP\_\_06



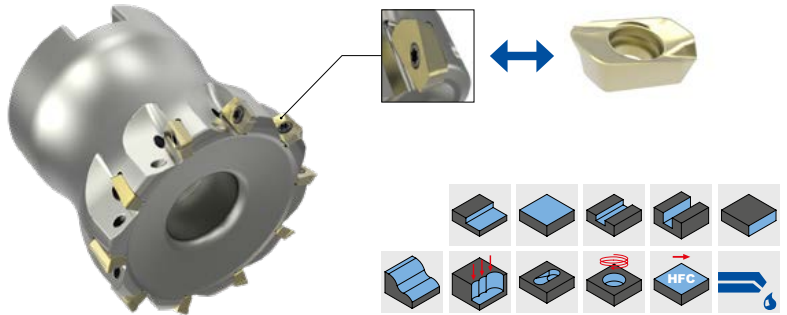
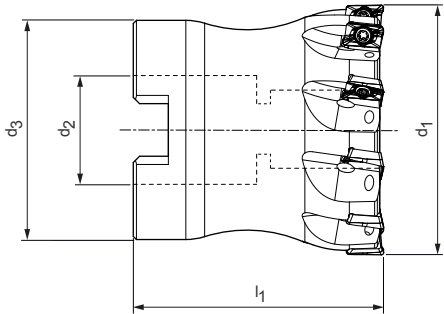
## End milling cutter

Dimensions				Z <sub>eff</sub>	a <sub>p</sub> max.		Weight [kg]	Internal cooling	Specification	Order no.
d <sub>1</sub>	d <sub>2</sub>	l <sub>1</sub>	l <sub>2</sub>		90°	HFC				
10	10	80	28	2	5,2	0,7	0,04	✓	IMH901-010-080-HA10-Z2R-LP__06	31146637
12	12	80	30	3	5,2	0,7	0,06	✓	IMH901-012-080-HA12-Z3R-LP__06	31146638
16	16	85	35	4	5,2	0,7	0,11	✓	IMH901-016-085-HB16-Z4R-LP__06	31146639
20	20	90	40	5	5,2	0,7	0,18	✓	IMH901-020-090-HB20-Z5R-LP__06	31146640
25	25	106	50	7	5,2	0,7	0,34	✓	IMH901-025-106-HB25-Z7R-LP__06	31146641



## Screw-in milling cutter

Dimensions				Z <sub>eff</sub>	a <sub>p</sub> max.		Weight [kg]	Internal cooling	Specification	Order no.
d <sub>1</sub>	M	d <sub>3</sub>	l <sub>1</sub>		90°	HFC				
10	6	9,8	15,5	2	5,2	0,7	0,01	✓	IMH901-010-M006-Z02R-LP__06	31146651
12	6	9,8	15,5	3	5,2	0,7	0,01	✓	IMH901-012-M006-Z03R-LP__06	31146652
16	8	13,8	20,5	4	5,2	0,7	0,03	✓	IMH901-016-M008-Z04R-LP__06	31146653
20	10	18	27	5	5,2	0,7	0,06	✓	IMH901-020-M010-Z05R-LP__06	31146654
25	12	21	30	7	5,2	0,7	0,09	✓	IMH901-025-M012-Z07R-LP__06	31146655
32	16	29	43	8	5,2	0,7	0,23	✓	IMH901-032-M016-Z08R-LP__06	31146656



**Milling cutter**

Dimensions				Z <sub>eff</sub>	a <sub>p</sub> max.		Weight [kg]	Internal cooling	Specification	Order no.
d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	l <sub>1</sub>		90°	HFC				
32	16	25	40	8	5,2	0,7	0,11	✓	IMH901-032-CA16-Z08R-LP__06	31146643
40	16	35	40	10	5,2	0,7	0,23	✓	IMH901-040-CA16-Z10R-LP__06	31146644
50	22	43	40	11	5,2	0,7	0,35	✓	IMH901-050-CA22-Z11R-LP__06	31146645

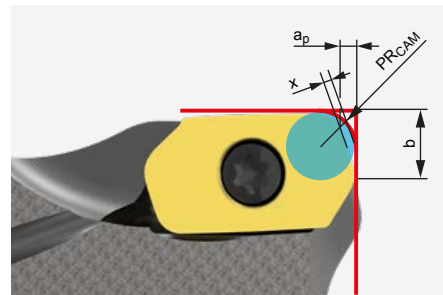
**Accessories**

	LP__06	Indexable insert 90°	Page 52
	LP__06	Indexable insert HFC	Page 50
		Milling cutter arbor for milling cutter see MAPAL catalogue "CLAMPING"	
		Milling cutter clamping screws for milling cutter	Page 74
		Chuck for end milling cutter see MAPAL catalogue "CLAMPING"	
		MFS milling head holder for screw-in milling cutter see MAPAL catalogue "CLAMPING"	

**Spare parts\***

	LP__06	Clamping screw for indexable insert M1.8X4.09-TX6-IP	Order no. 31164571
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**CAM programming note**



When using an HFC indexable insert, the programme radius PRCAM must be observed.

**LP\_\_06**

Dimensions [mm]			
PRCAM	a <sub>p</sub>	x	b
1,2	0,7	0,2	1,4

Dimensions in mm.

The maximum operating speeds refer only to the cutting edge system.

\* Included in scope of delivery.

Depending on the clamping device used, different maximum operating speeds must be observed.

# NeoMill®-2-HiFeed90

High-feed and 90° shoulder milling cutter  
LD\_\_10



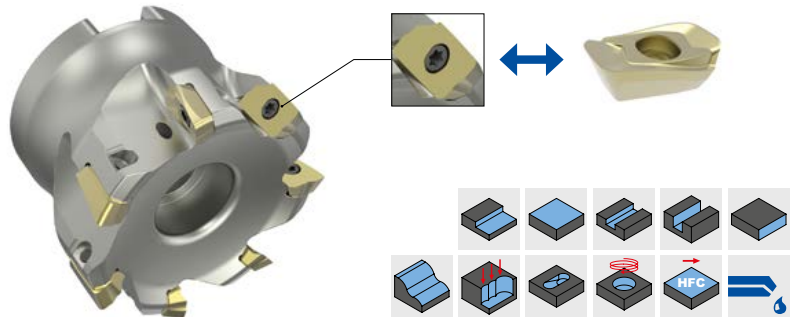
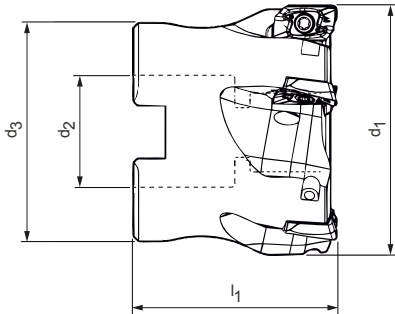
## End milling cutter

Dimensions				Z <sub>eff</sub>	a <sub>p</sub> max.		Weight [kg]	Internal cooling	Specification	Order no.
d <sub>1</sub>	d <sub>2</sub>	l <sub>1</sub>	l <sub>2</sub>		90°	HFC				
16	16	85	37	2	9	1,4	0,10	✓	IMH901-016-085-HB16-Z2R-LD__10	31144149*
20	20	90	40	2	9	1,4	0,17	✓	IMH901-020-090-HB20-Z2R-LD__10	31144159*
20	20	90	40	3	9	1,4	0,17	✓	IMH901-020-090-HB20-Z3R-LD__10	31144151
25	25	106	50	3	9	1,4	0,32	✓	IMH901-025-106-HB25-Z3R-LD__10	31144152
25	25	106	50	4	9	1,4	0,32	✓	IMH901-025-106-HB25-Z4R-LD__10	31144153
32	32	124	64	3	9	1,4	0,65	✓	IMH901-032-124-HB32-Z3R-LD__10	31144154
32	32	124	64	5	9	1,4	0,64	✓	IMH901-032-124-HB32-Z5R-LD__10	31144155



## Screw-in milling cutter

Dimensions				Z <sub>eff</sub>	a <sub>p</sub> max.		Weight [kg]	Internal cooling	Specification	Order no.
d <sub>1</sub>	M	d <sub>3</sub>	l <sub>1</sub>		90°	HFC				
16	8	13,8	31	2	9	1,4	0,03	✓	IMH901-016-M008-Z02R-LD__10	31144195*
20	10	18	29,8	3	9	1,4	0,04	✓	IMH901-020-M010-Z03R-LD__10	31144196*
25	12	21	32	3	9	1,4	0,07	✓	IMH901-025-M012-Z03R-LD__10	31144197*
25	12	21	32	4	9	1,4	0,07	✓	IMH901-025-M012-Z04R-LD__10	31144198*
32	16	29	43	3	9	1,4	0,22	✓	IMH901-032-M016-Z03R-LD__10	31144204
32	16	29	43	5	9	1,4	0,19	✓	IMH901-032-M016-Z05R-LD__10	31144199



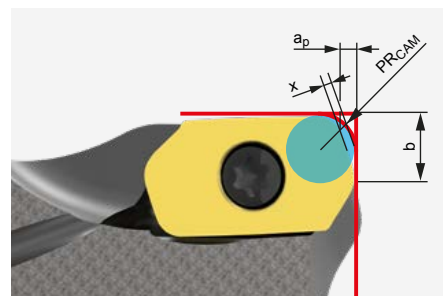
**Milling cutter**

Dimensions				Z <sub>eff</sub>	a <sub>p</sub> max.		Weight [kg]	Internal cooling	Specification	Order no.
d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	l <sub>1</sub>		90°	HFC				
40	16	35	40	4	9	1,4	0,19	✓	IMH901-040-CA16-Z04R-LD__10	31144049
40	16	35	40	6	9	1,4	0,19	✓	IMH901-040-CA16-Z06R-LD__10	31144050
50	22	43	40	5	9	1,4	0,29	✓	IMH901-050-CA22-Z05R-LD__10	31144051
50	22	43	40	7	9	1,4	0,29	✓	IMH901-050-CA22-Z07R-LD__10	31144052
63	22	48	40	6	9	1,4	0,48	✓	IMH901-063-CA22-Z06R-LD__10	31144053
63	22	48	40	8	9	1,4	0,46	✓	IMH901-063-CA22-Z08R-LD__10	31144054
80	27	60	50	10	9	1,4	0,92	✓	IMH901-080-CA27-Z10R-LD__10	31144055

**Accessories**

	LD__10	Indexable insert 90°	Page 52
	LD__10	Indexable insert HFC	Page 50
		Milling cutter arbor for milling cutter see MAPAL catalogue "CLAMPING"	
		Milling cutter clamping screws for milling cutter	Page 75
		Chuck for end milling cutter see MAPAL catalogue "CLAMPING"	
		MFS milling head holder for screw-in milling cutter see MAPAL catalogue "CLAMPING"	

**CAM programming note**



When using an HFC indexable insert, the programme radius PR<sub>CAM</sub> must be observed.

**LD\_\_10**

Dimensions [mm]			
PR <sub>CAM</sub>	a <sub>p</sub>	x	b
2,2	1,4	0,4	3,52

**Spare parts\*\***

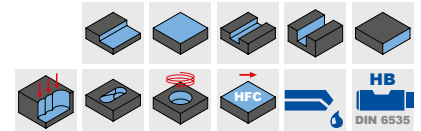
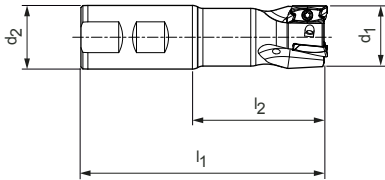
		Clamping screw for indexable insert	Order no.
	***	M2.5X5.9-TX8-IP	31161842
	LD__10	M2.5X6.8-TX8-IP	31161843

Dimensions in mm.  
 The maximum operating speeds refer only to the cutting edge system.  
 \* Use with clamping screw M2.5X5.9  
 \*\* Included in scope of delivery.  
 \*\*\* Use the order numbers marked with \*.  
 Depending on the clamping device used, different maximum operating speeds must be observed.

# NeoMill®-2-HiFeed90

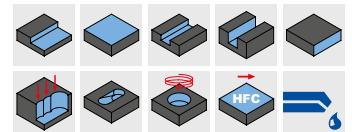
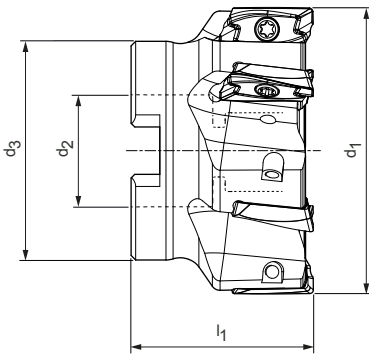
90° shoulder milling cutter

LD\_\_18



## End milling cutter

Dimensions				$Z_{eff}$	$a_p$ max.	Weight [kg]	Internal cooling	Specification	Order no.
$d_1$	$d_2$	$l_1$	$l_2$						
25	25	106	50	2	17	0,30	✓	IMH901-025-106-HB25-Z2R-LD__18	31144161
32	32	124	64	3	17	0,61	✓	IMH901-032-124-HB32-Z3R-LD__18	31144162
40	32	124	65	4	17	0,70	✓	IMH901-040-130-HB32-Z4R-LD__18	31144163







## Milling cutter


Dimensions				$Z_{eff}$	$a_p$ max.	Weight [kg]	Internal cooling	Specification	Order no.
$d_1$	$d_2$	$d_3$	$l_1$						
40	16	35	40	4	17	0,16	✓	IMH901-040-CA16-Z04R-LD__18	31144077
50	22	43	40	5	17	0,27	✓	IMH901-050-CA22-Z05R-LD__18	31144074
52	22	43	40	5	17	0,28	✓	IMH901-052-CA22-Z05R-LD__18	31144078
63	22	48	40	5	17	0,43	✓	IMH901-063-CA22-Z05R-LD__18	31144079
66	22	48	40	6	17	0,51	✓	IMH901-066-CA22-Z06R-LD__18	31144080
80	27	60	50	7	17	0,85	✓	IMH901-080-CA27-Z07R-LD__18	31144081
100	32	78	50	8	17	1,49	✓	IMH901-100-CA32-Z08R-LD__18	31144082
125	40	90	60	9	17	2,79	✓	IMH901-125-CA40-Z09R-LD__18	31144083
160	40	115	60	10	17	3,65	-	IMH900-160-CA40-Z10R-LD__18	31144084



## Accessories

	LD__18	Indexable insert 90°	Page 52
		Milling cutter arbor for milling cutter see MAPAL catalogue "CLAMPING"	
		Milling cutter clamping screws for milling cutter	Page 75
		Chuck for end milling cutter see MAPAL catalogue "CLAMPING"	

## Spare parts\*

	LD__18	Clamping screw for indexable insert M3.5X10-TX15-IP	Order no. 30870699
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Dimensions in mm.

The maximum operating speeds refer only to the cutting edge system.

\* Included in scope of delivery.

Depending on the clamping device used, different maximum operating speeds must be observed.

# LPMX – LDMX

Radial indexable insert, double edge, for high-feed machining



## For high-feed machining

	Carbide					
Workpiece material	P			M		
	Unalloyed ← Wear-resistant	Alloyed → Toughened	Unalloyed ← Wear-resistant	Alloyed → Toughened	Austenitic ← Wear-resistant	Ferritic → Toughened
Coating	PVD		CVD		PVD	
Cutting material type	HP635	HP640	HC530	HC535	HP650	HP655
Cutting edge design	PMS	PMS	PMS		MQL	MQL
<b>LPMX</b>	<b><math>a_p</math> max. [mm]</b>					
LPMX060210R-	0.7*	31146693	31146692		31146694	
Cutting edge design	PMS	PMS	PMS	PMS	MQL	MQL
<b>LDMX</b>	<b><math>a_p</math> max. [mm]</b>					
LDMX100415R-	1.4*	31144267	31144268	31144265	31144266	31144263 31144264

## Feed per tooth (selection according to chip guiding stage)

MMG*	Chip breaker	LP_06						LD_10							
		KV	$a_p$ max. [mm]			$f_z$ [mm/tooth]			KV	$a_p$ max. [mm]			$f_z$ [mm/tooth]		
P	PMS	-	0.2	<b>0.4</b>	0.7	0.2	<b>0.5</b>	0.8	Δ+	0.4	<b>0.9</b>	1.4	0.6	<b>1</b>	1.5
M	MQL	-	0.2	<b>0.4</b>	0.7	0.2	<b>0.4</b>	0.7	Δ+	0.4	<b>0.9</b>	1.4	0.5	<b>0.9</b>	1.3
K	KMS								Δ+	0.4	<b>0.9</b>	1.4	0.6	<b>1.2</b>	1.5
H	HMS	-	0.4	<b>0.4</b>	0.7	0.2	<b>0.5</b>	0.8	Δ+	0.4	<b>0.9</b>	1.4	0.6	<b>1.2</b>	1.5

Legend: KV = edge rounding | - = not specified | Δ+ = bevelled and slightly rounded

\*  $a_p$  max. depends on the type of milling cutter and application.

\*\* MAPAL machining groups

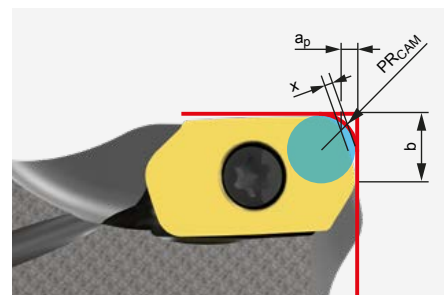
Carbide			
K		H	
PVD	CVD	PVD	CVD
HP630	HC525	HP320	HC220
		HMS	HMS
		31146696	31146695
KMS	KMS	HMS	HMS
31144262	31144261	31146721	31146723

Dimensions [mm]				
l	d	s	d <sub>1</sub>	R
0,7	3,64	2,15	2,05	1
1,5	6,6	4,76	2,8	1,5

**Plunge angle | High-feed machining**

Diameter [mm]	Plunge angle [°]	
	LP__06	LD__10
10	6.3	-
12	4.5	-
16	3.5	8.8
18	3	-
20	1.8	6.1
25	1.5	4.4
32	1.1	3.2
40	0.8	2.4
50	0.6	1.9
63	-	1.4
80	-	1.1

**CAM programming note**



When using an HFC indexable insert, the programme radius  $PR_{CAM}$  must be observed.

Dimensions [mm]				
	$PR_{CAM}$	$a_p$	x	b
LP__06	1,2	0,7	0,2	1,4
LD__10	2,2	1,4	0,4	3,52

# LPMX – LDGX – LDMX – LDHX

Radial indexable insert, double edge, for 90° machining



For 90° machining

		Carbide					
Workpiece material	<b>P</b>						
	Unalloyed					Alloyed	
Coating		PVD					
Cutting material type		HP635		HP640		HP645	
Cutting edge design		PMU		PMU			
<b>LPMX</b>	<b>a<sub>p</sub> max. [mm]</b>						
LPMX060204R-	5.2*	31146697		31146698			
Cutting edge design							
<b>LDGX</b>	<b>a<sub>p</sub> max. [mm]</b>						
LDGX180508R-	17*						
Cutting edge design		PMU	PRU	PMU	PRU	PMU	PRU
<b>LDMX</b>	<b>a<sub>p</sub> max. [mm]</b>						
LDMX100404R-	9*	31146722		31146724			
LDMX100408R-	9*	31144258		31144259		31144260	
LDMX100420R-	9*	31144269		31144270			
LDMX100430R-	9*	31144271		31144272			
LDMX180508R-	17*	31144276		31144277		31144278	
LDMX180512R-	17*		31144280		31144281		31144282
LDMX180516R-	17*		31146720		31146719		
Cutting edge design							
<b>LDHX</b>	<b>a<sub>p</sub> max. [mm]</b>						
LDHX100404R-	9*						
LDHX100408R-	9*						

## Feed per tooth (selection according to chip guiding stage)

MMG*	Chip breaker	LP_06						LD_10						LD_18								
		KV	a <sub>p</sub> max. [mm]			f <sub>z</sub> [mm/tooth]			KV	a <sub>p</sub> max. [mm]			f <sub>z</sub> [mm/tooth]			KV	a <sub>p</sub> max. [mm]			f <sub>z</sub> [mm/tooth]		
P	PMU	-	0.5	2	5.2	0.1	<b>0.13</b>	0.17	△+	1	<b>3</b>	9	0.1	<b>0.18</b>	0.25	△+	1	<b>6</b>	17	0.1	<b>0.19</b>	0.25
	PRU								△+	1	<b>6</b>	17	0.15	<b>0.22</b>	0.8							
M	MMU	-	0.5	2	5.2	0.8	<b>0.1</b>	0.15	△+	1	<b>3</b>	9	0.1	<b>0.15</b>	0.2	△+	1	<b>6</b>	17	0.1	<b>0.15</b>	0.22
K	KMU								△+	1	<b>3</b>	9	0.15	<b>0.2</b>	0.27	△+	1	<b>6</b>	17	0.15	<b>0.21</b>	0.26
	KRU								△+	1	<b>6</b>	17	0.15	<b>0.24</b>	0.3							
N	NMU								0	1	<b>3</b>	9	0.1	<b>0.14</b>	0.26	0	1	<b>6</b>	17	0.1	<b>0.14</b>	0.26

Legend: KV = edge rounding | - = not specified | 0 = sharp edged | △+ = bevelled and slightly rounded

\* a<sub>p</sub> max. depends on the type of milling cutter and application.

\*\* MAPAL machining groups

Carbide					
M		K		N	
Austenitic	Ferritic	GJL	GJS		
← Wear-resistant	→ Toughened	← Wear-resistant	→ Toughened		
PVD		PVD		Uncoated	PVD
HP650	HP655	HP630		HU110	HP110
MMU					
31146699					
				NMU	NMU
				31144411	31144254
MMU	MMU	KMU	KRU		
31146690	31146691				
31144256	31144257	31144255			
31144274	31144275	31144273			
31146715	31146717		31144279		
31146716	31146718				
				NMU	NMU
				31144409	31144252
				31144410	31144253

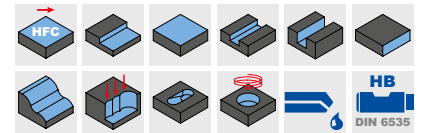
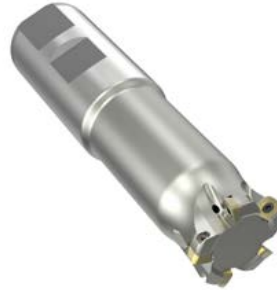
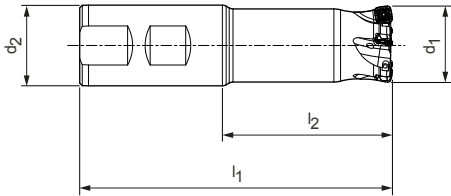
Dimensions [mm]				
l	d	s	d <sub>1</sub>	R
6	3,64	2,15	2,05	0,4
18	9,65	5	4,15	0,8
10	6,6	4,76	2,8	0,4
10	6,6	4,76	2,8	0,8
10	6,6	4,76	2,8	2
10	6,6	4,76	2,8	3
18	9,65	5	4,15	0,8
18	9,65	5	4,15	1,2
18	9,65	5	4,15	1,6
10	6,6	4,76	2,8	0,4
10	6,6	4,76	2,8	0,8

**Plunge angle | 90° machining**

Diameter [mm]	Plunge angle [°]		
	LP__06	LD__10	LD__18
10	8.4	-	-
12	6.3	-	-
16	5	18	-
18	3.5	-	-
20	2.3	12.2	-
25	1.8	8.7	-
32	1.3	6.2	-
40	1	4.6	5
50	0.8	3.5	4
52	-	-	3.8
63	-	2.7	3.18
66	-	-	2.9
80	-	2.1	2.51
100	-	-	2
125	-	-	1.6
160	-	-	1.25

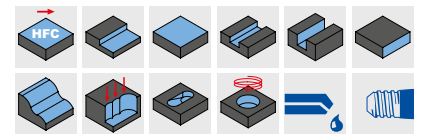
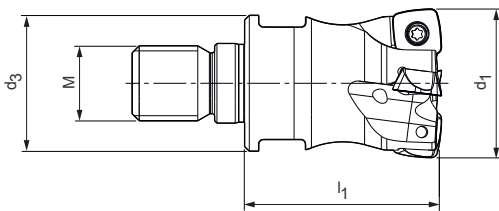
# NeoMill®-4-HiFeed90

High-feed milling cutter  
SD\_\_06



## End milling cutter



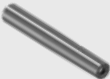
Dimensions				$Z_{eff}$	$a_p$ max.	Weight [kg]	Internal cooling	Specification	Order no.
$d_1$	$d_2$	$l_1$	$l_2$						
16	16	85	37	2	1	0,10	✓	IMH901-016-085-HB16-Z2R-SD__06	31146632
20	20	90	40	3	1	0,17	✓	IMH901-020-090-HB20-Z3R-SD__06	31146633
25	25	106	50	4	1	0,33	✓	IMH901-025-106-HB25-Z4R-SD__06	31146634
32	32	124	64	5	1	0,66	✓	IMH901-032-124-HB32-Z5R-SD__06	31146635
35	32	124	64	5	1	0,67	✓	IMH901-035-124-HB35-Z5R-SD__06	31146636



## Screw-in milling cutter

Dimensions				$Z_{eff}$	$a_p$ max.	Weight [kg]	Internal cooling	Specification	Order no.
$d_1$	M	$d_3$	$l_1$						
16	8	13,8	31	2	1	0,03	✓	IMH901-016-M008-Z02R-SD__06	31146646
20	10	18	29,8	3	1	0,05	✓	IMH901-020-M010-Z03R-SD__06	31146647
25	12	21	32	4	1	0,09	✓	IMH901-025-M012-Z04R-SD__06	31146648
32	16	29	43	5	1	0,21	✓	IMH901-032-M016-Z05R-SD__06	31146649
35	16	29	43	5	1	0,23	✓	IMH901-035-M016-Z05R-SD__06	31146650

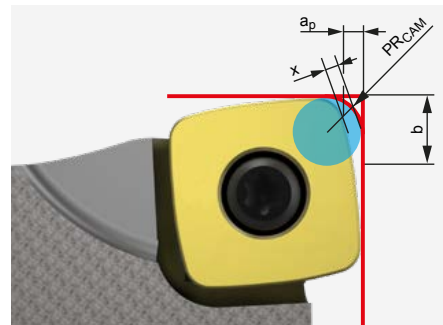
**Accessories**

	SD__06	Indexable insert HFC	Page 60
		Chuck for end milling cutter see MAPAL catalogue "CLAMPING"	
		MFS milling head holder for screw-in milling cutter see MAPAL catalogue "CLAMPING"	

**Spare parts\***

	SD__06	Clamping screw for indexable insert M2.2X5.2-TX7-IP	Order no. 31161853
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**CAM programming note**



When using an HFC indexable insert, the programme radius  $PR_{CAM}$  must be observed.

**SD\_\_06**

Dimensions [mm]			
$PR_{CAM}$	$a_p$	$x$	$b$
1,77	1,0	0,45	5,12

Dimensions in mm.  
The maximum operating speeds refer only to the cutting edge system.  
\* Included in scope of delivery.

Depending on the clamping device used, different maximum operating speeds must be observed.

# NeoMill®-4-HiFeed90

High-feed and 90° shoulder milling cutter  
SD\_\_10



## End milling cutter

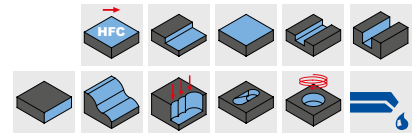
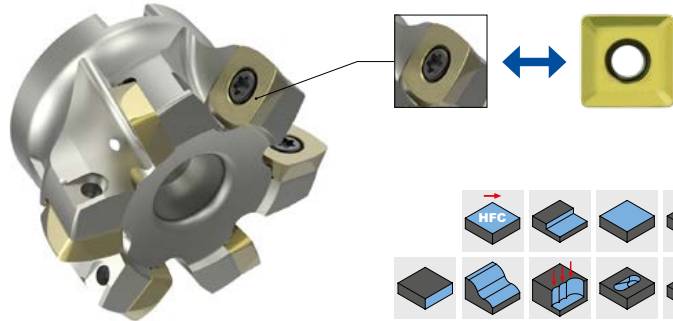
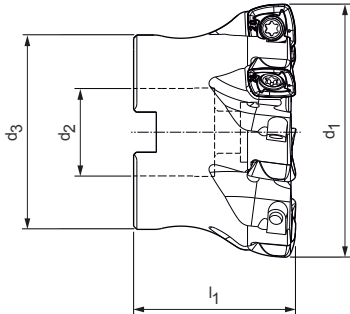
Dimensions				Z <sub>eff</sub>	a <sub>p</sub> max.		Weight [kg]	Internal cooling	Specification	Order no.
d <sub>1</sub>	d <sub>2</sub>	l <sub>1</sub>	l <sub>2</sub>		90°	HFC				
25	25	106	50	2	9	1,5	0,31	✓	IMH901-025-106-HB25-Z2R-SD__10	31144156
25	25	106	50	3	9	1,5	0,30	✓	IMH901-025-106-HB25-Z3R-SD__10	31144157
32	32	124	64	3	9	1,5	0,64	✓	IMH901-032-124-HB32-Z3R-SD__10	31144158



## Screw-in milling cutter

Dimensions				Z <sub>eff</sub>	a <sub>p</sub> max.		Weight [kg]	Internal cooling	Specification	Order no.
d <sub>1</sub>	M	d <sub>3</sub>	l <sub>1</sub>		90°	HFC				
25	12	21	32	2	9	1,5	0,08	✓	IMH901-025-M012-Z02R-SD__10	31144200
25	12	21	32	3	9	1,5	0,07	✓	IMH901-025-M012-Z03R-SD__10	31144201
32	16	29	42	3	9	1,5	0,20	✓	IMH901-032-M016-Z03R-SD__10	31144206
32	16	29	43	4	9	1,5	0,17	✓	IMH901-032-M016-Z04R-SD__10	31144202
40	16	29	43	4	9	1,5	0,21	✓	IMH901-040-M016-Z04R-SD__10	31144203





**Milling cutter**

Dimensions				Z <sub>eff</sub>	a <sub>p</sub> max.		Weight [kg]	Internal cooling	Specification	Order no.
d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	l <sub>1</sub>		90°	HFC				
40	16	35	40	4	9	1,5	0,17	✓	IMH901-040-CA16-Z04R-SD__10	31144056
40	16	35	40	6	9	1,5	0,17	✓	IMH901-040-CA16-Z06R-SD__10	31144057
50	22	43	40	5	9	1,5	0,26	✓	IMH901-050-CA22-Z05R-SD__10	31144059
50	22	43	40	7	9	1,5	0,25	✓	IMH901-050-CA22-Z07R-SD__10	31144060
52	22	43	40	5	9	1,5	0,30	✓	IMH901-052-CA22-Z05R-SD__10	31144061
63	22	48	40	6	9	1,5	0,42	✓	IMH901-063-CA22-Z06R-SD__10	31144062
63	22	48	40	8	9	1,5	0,42	✓	IMH901-063-CA22-Z08R-SD__10	31144063
66	22	48	40	5	9	1,5	0,46	✓	IMH901-066-CA22-Z05R-SD__10	31144085
80	27	60	50	8	9	1,5	0,91	✓	IMH901-080-CA27-Z08R-SD__10	31144064

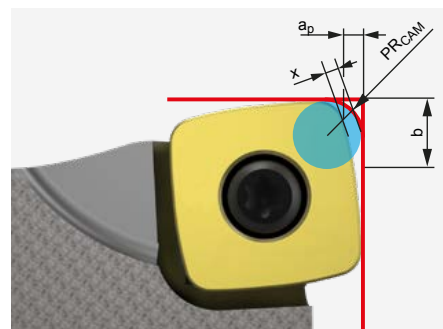
**Accessories**

	SD__10	Indexable insert 90°	Page 62
	SD__10	Indexable insert HFC	Page 60
		Milling cutter arbor for milling cutter see MAPAL catalogue "CLAMPING"	
		Milling cutter clamping screws for milling cutter	Page 75
		Chuck for end milling cutter see MAPAL catalogue "CLAMPING"	
		MFS milling head holder for screw-in milling cutter see MAPAL catalogue "CLAMPING"	

**Spare parts\***

	SD__10	Clamping screw for indexable insert M3X8.3-TX9-IP	Order no. 31161852
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**CAM programming note**



When using an HFC indexable insert, the programme radius PR<sub>CAM</sub> must be observed.

**SD\_\_10**

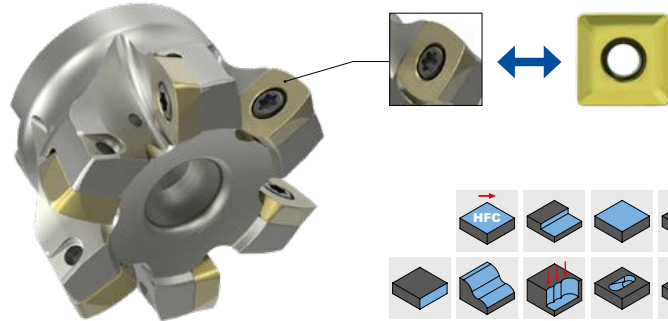
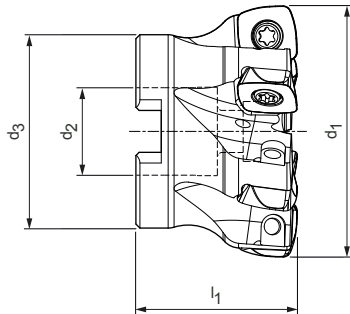
Dimensions [mm]			
PR <sub>CAM</sub>	a <sub>p</sub>	x	b
2,25	1,5	0,62	8,033

Dimensions in mm.  
The maximum operating speeds refer only to the cutting edge system.  
\* Included in scope of delivery.

Depending on the clamping device used, different maximum operating speeds must be observed.

# NeoMill®-4-HiFeed90

High-feed and 90° shoulder milling cutter  
SD\_\_14



## Milling cutter

Dimensions				Z <sub>eff</sub>	a <sub>p</sub> max.		Weight [kg]	Internal cooling	Specification	Order no.
d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	l <sub>1</sub>		90°	HFC				
50	22	43	40	5	12,5	2,4	0,22	✓	IMH901-050-CA22-Z05R-SD__14	31144065
52	22	43	40	5	12,5	2,4	0,28	✓	IMH901-052-CA22-Z05R-SD__14	31144067
63	22	48	40	6	12,5	2,4	0,38	✓	IMH901-063-CA22-Z06R-SD__14	31144068
66	22	48	40	6	12	2,5	0,43	✓	IMH901-066-CA22-Z06R-SD__14	31144069
80	27	60	50	7	12,5	2,4	0,85	✓	IMH901-080-CA27-Z07R-SD__14	31144070
100	32	78	50	7	12,5	2,4	1,49	✓	IMH901-100-CA32-Z07R-SD__14	31144071
100	32	78	50	9	12,5	2,4	1,49	✓	IMH901-100-CA32-Z09R-SD__14	31144072
125	40	90	60	11	12,5	2,4	2,79	✓	IMH901-125-CA40-Z11R-SD__14	31144073

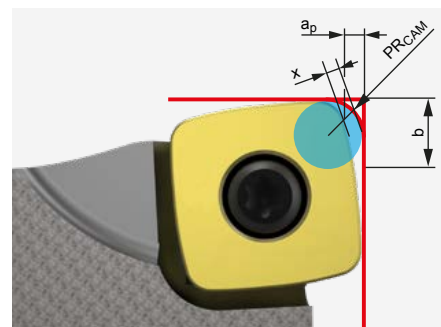
## Accessories

	SD__14	Indexable insert 90°	Page 60
	SD__14	Indexable insert HFC	Page 60
		Milling cutter arbor for milling cutter see MAPAL catalogue "CLAMPING"	
		Milling cutter clamping screws for milling cutter	Page 75

## Spare parts\*

	SD__14	Clamping screw for indexable insert M5X10.8-TX20-IP	Order no. 31161851
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## CAM programming note



When using an HFC indexable insert, the programme radius PR<sub>CAM</sub> must be observed.

## SD\_\_14

Dimensions [mm]			
PR <sub>CAM</sub>	a <sub>p</sub>	x	b
3,45	2,4	0,93	10,868

Dimensions in mm.

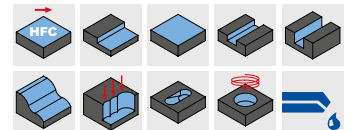
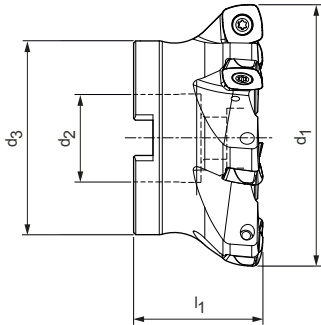
The maximum operating speeds refer only to the cutting edge system.

\* Included in scope of delivery.

Depending on the clamping device used, different maximum operating speeds must be observed.

# NeoMill®-4-HiFeed90

High-feed milling cutter  
SD\_\_18



## Milling cutter

Dimensions				$Z_{eff}$	$a_p$ max.	Weight [kg]	Internal cooling	Specification	Order no.
$d_1$	$d_2$	$d_3$	$l_1$						
80	27	60	50	5	3,5	0,79	✓	IMH901-080-CA27-Z05R-SD__18	31144075
100	32	78	50	6	3,5	1,49	✓	IMH901-100-CA32-Z06R-SD__18	31144087
125	40	90	60	7	3,5	2,43	✓	IMH901-125-CA40-Z07R-SD__18	31144088
160	40	115	60	9	3,5	4,09	-	IMH900-160-CA40-Z09R-SD__18	31144089
200	60	140	65	11	3,5	5,83	-	IMH900-200-CA60-Z11R-SD__18	31144090

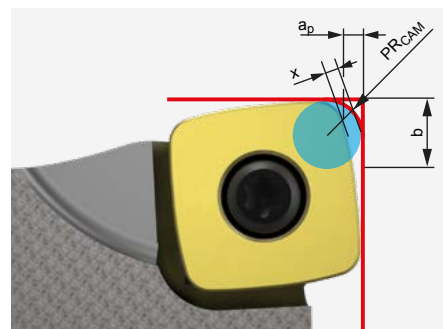
## Accessories

	SD__18	Indexable insert HFC	Page 60
		Milling cutter arbor for milling cutter see MAPAL catalogue "CLAMPING"	
		Milling cutter clamping screws for milling cutter	Page 75

## Spare parts\*

	SD__18	Clamping screw for indexable insert M6X15-T25	Order no. 31161862
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## CAM programming note



When using an HFC indexable insert, the programme radius  $PR_{CAM}$  must be observed.

## SD\_\_18

Dimensions [mm]			
$PR_{CAM}$	$a_p$	$x$	$b$
4,82	3,5	1,24	13,77

Dimensions in mm.

The maximum operating speeds refer only to the cutting edge system.

\* Included in scope of delivery.

Depending on the clamping device used, different maximum operating speeds must be observed.

# SDMT – SDMW

Radial indexable insert, with four cutting edges, for high-feed machining



## For high-feed machining

	Carbide				
Workpiece material	<b>P</b>				
	Unalloyed ← Wear-resistant		Alloyed → Toughened		Unalloyed ← Wear-resistant
Coating	PVD			CVD	
Cutting material type	HP635	HP640	HP645	HC530	HC535
Cutting edge design	PMS	PMS		PMS	PMS

### SDMT

$a_p$  max. [mm]

SDMT060212R-	1*	31144355				
SDMT100415R-	1.5*	31144367	31144368		31144365	31144366
SDMT140520R-	2.4*	31144380	31144381		31144378	31144379
SDMT180630R-	3.5*	31144384	31144385			

Cutting edge design

PRS

PRS

PRS

PRS

PRS

### SDMW

$a_p$  max. [mm]

SDMW100415R-	1.5*	31144393	31144394		31144391	31144392
SDMW140520R-	2.4*	31144402	31144403		31144400	31144401
SDMW180630R-	3.5*		31144407	31144408		

## Feed per tooth (selection according to chip guiding stage) and plunge angle

MMG*	Chip breaker	SD_06			SD_10			SD_14			SD_18		
		KV	$a_p$ max. [mm]	$f_z$ [mm/tooth]	KV	$a_p$ max. [mm]	$f_z$ [mm/tooth]	KV	$a_p$ max. [mm]	$f_z$ [mm/tooth]	KV	$a_p$ max. [mm]	$f_z$ [mm/tooth]
P	PMS	-	0.3 0.5 1	0.4 0.6 1.1	△+	0.5 0.8 1.3	0.6 1 1.4	△+	0.6 1.2 2.2	0.7 1.4 2.2	△+	1 2.2 3.2	1.2 1.8 2.8
	PRS				△+	0.5 1 1.5	0.7 1.1 1.6	△+	0.7 1.5 2.4	0.8 1.6 2.4	△+	1 2.5 3.5	1.4 2.2 3
M	MQL	-	0.3 0.5 1	0.3 0.5 1	+	0.5 0.8 1.3	0.5 0.9 1.4	+	0.6 1.2 2.2	0.8 1.2 2.2	△+	1 2 3	1 1.6 2.5
K	KRS				△+	0.5 1 1.5	0.7 1.2 1.6	△+	0.7 1.6 2.4	0.8 1.7 2.4	△+	1 2.8 3.5	1.4 2.5 3
H	HMS	-	0.3 0.5 1	0.4 0.6 1.1					0.4 1.2 2.2	0.4 1.2 2.2			
	HRS				△+	0.4 0.8 1.2	0.4 1.1 1.6	△+	0.5 1.5 2.4	0.5 1.6 2.4	△+	1 2.2 3.5	0.8 1.8 2.8

Legend: KV = edge rounding | - = not specified | + = slightly rounded | △+ = bevelled and slightly rounded

\*  $a_p$  max. depends on the type of milling cutter and application.

\*\* MAPAL machining groups

Carbide						
M		K		H		
Austenitic		Ferritic		$\geq 65$ HRC		
Wear-resistant		Toughened		58 HRC		
PVD		PVD	CVD	PVD		CVD
HP650	HP655	HP630	HC525	HP320	HP325	HC220
MQL	MQL			HMS	HMS	

Dimensions [mm]				
l	d	s	d <sub>1</sub>	R

31144354				31144353	
31144363	31144364			31144362	31146714
31144376	31144377			31144375	
31144382	31144383				

1	6,75	2,5	2,5	1,2
1,1	10,2	4,86	3,5	1,5
2,2	14,7	5	5,5	2
3	18,7	6	6,5	3

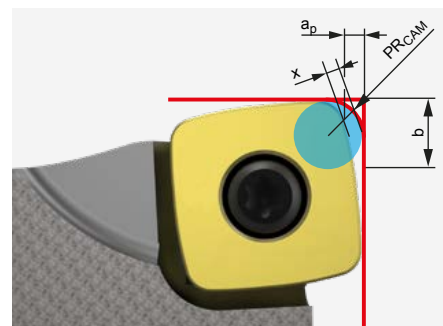
		KRS	KRS	HRS	HRS	HRS
		31144390	31144389	31144387	31144388	31144386
		31144399	31144398	31144396	31144397	31144395
		31144406	31144405		31144404	

1,1	10,2	4,86	3,5	1,5
2,2	14,7	5	5,5	2
3	18,7	6	6,5	3

**Plunge angle | High-feed machining**

Diameter [mm]	Plunge angle [°]			
	SDM_06	SDM_10	SDM_14	SDM_18
16	9	-	-	-
20	4.8	-	-	-
25	3	4.4	-	-
32	2	2.9	-	-
35	1.7	-	-	-
40	-	2	-	-
50	-	1.5	2.4	-
52	-	1.3	2.2	-
63	-	1.1	1.7	-
66	-	1	1.5	-
80	-	0.8	1.3	2.5
100	-	0.7	1	2
125	-	0.5	0.7	1.6
160	-	-	-	1.3
200	-	-	-	1

**CAM programming note**

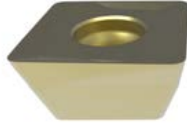


When using an HFC indexable insert, the programme radius  $PR_{CAM}$  must be observed.

Dimensions [mm]				
	$PR_{CAM}$	$a_p$	x	b
SD_06	1,77	1,0	0,45	5,12
SD_10	2,25	1,5	0,62	8,033
SD_14	3,45	2,4	0,93	10,868
SD_18	4,82	3,5	1,24	13,77

# SDHT – SDMT

Radial indexable insert, with four cutting edges, for 90° machining



## For 90° machining

		Carbide		
Workpiece material	<b>P</b>			
	Unalloyed	Alloyed		
Coating		PVD		
Cutting material type		HP635	HP640	HP645
Cutting edge design				
<b>SDHT</b>		<b>a<sub>p</sub> max. [mm]</b>		
SDHT100404R-		9*		
SDHT100408R-		9*		
SDHT140508R-		12.5*		
SDHT140512R-		12.5*		
Cutting edge design		PMU	PMU	PMU
<b>SDMT</b>		<b>a<sub>p</sub> max. [mm]</b>		
SDMT100408R-		9*	31144359	31144360
SDMT140512R-		12.5*	31144372	31144373

## Feed per tooth (selection according to chip guiding stage)

MMG*	Chip breaker	SD_10							SD_14						
		KV	a <sub>p</sub> max. [mm]			f <sub>z</sub> [mm/tooth]			KV	a <sub>p</sub> max. [mm]			f <sub>z</sub> [mm/tooth]		
<b>P</b>	PMU	△+	0.8	<b>3</b>	9	0.1	<b>0.18</b>	0.23	△+	1.2	<b>6</b>	12.5	0.1	<b>0.2</b>	0.25
<b>M</b>	MMU	+	0.8	<b>3</b>	9	0.08	<b>0.14</b>	0.2	+	1.2	<b>6</b>	12.5	0.1	<b>0.15</b>	0.22
<b>K</b>	KMU	△+	0.8	<b>3</b>	9	0.1	<b>0.2</b>	0.26	△+	1.2	<b>6</b>	12.5	0.1	<b>0.22</b>	0.28
<b>N</b>	NMU	0	0.8	<b>5</b>	9	0.05	<b>0.12</b>	0.2	0	1.2	<b>8</b>	12.5	0.06	<b>0.14</b>	0.22

Legend: KV = edge rounding | 0 = sharp edged | + = slightly rounded | △+ = bevelled and slightly rounded

\* a<sub>p</sub> max. depends on the type of milling cutter and application.

\*\* MAPAL machining groups

Carbide				
M		K	N	
Austenitic ← Wear-resistant		Ferritic → Toughened		
PVD		PVD	Uncoated	PVD
HP650	HP655	HP630	HU110	HP110
			NMU	NMU

Dimensions [mm]				
l	d	s	d <sub>1</sub>	R

			31144412	31144349
			31144413	31144350
			31144414	31144351
			31144415	31144352

10,4	10,4	4,86	3,5	0,4
10,4	10,4	4,86	3,5	0,8
14,8	14,8	5,2	5,5	0,8
14,8	14,8	5,2	5,5	1,2

MMU	MMU	KMU		
31144357	31144358	31144356		
31144370	31144371	31144369		

10,4	10,4	4,86	3,5	0,8
14,8	14,8	5,2	5,5	1,2

**Plunge angle | 90° machining**

Diameter [mm]	Plunge angle [°]	
	SD__10	SD__14
25	7	-
32	4.6	-
40	3.3	-
50	2.4	5.5
52	2.2	5.3
63	1.8	3.7
66	1.6	3.4
80	1.3	2.6
100	1	1.9
125	0.8	1.5
160	0.5	-

# Cutting Data Recommendations for High-Feed Milling Cutters

Feed and cutting speed

## High-feed milling cutter

MMG*		Workpiece material	Strength/hardness [N/mm <sup>2</sup> ] [HRC]	Cooling			
				MQL/Air	Dry	Wet	
P	P1	P1.1	Construction steels, machining steels, hardening and tempering steels, unalloyed	< 700		✓	
		P1.2	Construction steels, machining steels, hardening and tempering steels, unalloyed	< 1200		✓	
	P2	P2.1	Nitriding, hardening and tempering steels, alloyed	< 900		✓	
		P2.2	Nitriding, hardening and tempering steels, alloyed	< 1400		✓	
	P3	P3.1	Tool steels, roller bearing steels, spring steels and high-speed steels**	< 800		✓	
		P3.2	Tool steels, roller bearing steels, spring steels and high-speed steels**	< 1000		✓	
		P3.3	Tool steels, roller bearing steels, spring steels and high-speed steels**	< 1500		✓	
	P4	P4.1	Stainless steels, ferritic and martensitic				
	P5	P5.1	Cast steel				
	P6	P6.1	Stainless cast steels, ferritic and martensitic				
M	M1	M1.1	Stainless steels, austenitic	< 700		✓	
		M1.2	Stainless steels, ferritic/austenitic (Duplex)	< 1000			
	M2	M2.1	Stainless cast steel, austenitic	< 700			
	M3	M3.1	Stainless cast steel, ferritic/austenitic (Duplex)	< 1000			
K	K1	K1.1	Cast iron with lamellar graphite (grey cast iron), GJL	< 300		✓	
		K2.1	Cast iron with spheroidal graphite, GJS	< 500		✓	
	K2	K2.2	Cast iron with spheroidal graphite, GJS	500–800			
		K2.3	Cast iron with spheroidal graphite, GJS	> 800			
	K3	K3.1	Cast iron with vermicular graphite, GJV; malleable cast iron, GJM	< 500			
		K3.2	Cast iron with vermicular graphite, GJV; malleable cast iron, GJM	> 500			
N	N1	N1.1	Aluminium, unalloyed and alloyed < 3 % Si			✓	
		N1.2	Aluminium, alloyed < 7 % Si				
		N1.3	Aluminium, alloyed > 7–12 % Si				
		N1.4	Aluminium, alloyed > 12 % Si				
	N2	N2.1	Copper, unalloyed and low alloyed	< 300		✓	
		N2.2	Copper, alloyed	> 300			
		N2.3	Brass, bronze, gunmetal	< 1200			
H	H1	H1.1	Hardened steel / cast steel	< 44 HRC		✓	
		H1.2	Hardened steel / cast steel	< 55 HRC		✓	
	H2	H2.1	Hardened steel / cast steel	< 60 HRC		✓	
		H2.2	Hardened steel / cast steel	< 65 HRC		✓	
	H3	H2.3	Hardened steel / cast steel	< 68 HRC		✓	
		H3.1	Wear-resistant cast / chill casting, GJN			✓	

\* MAPAL machining groups

\*\* If the alloy parts Cr, Mo, Ni, V, W in total > 8 % then select the next highest MAPAL machining group.

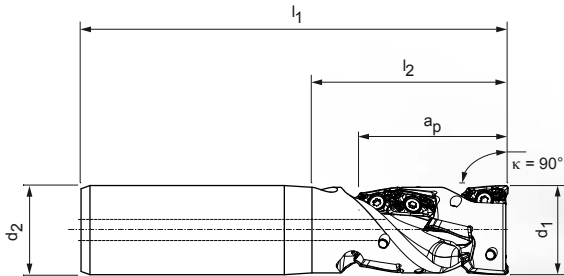


Cutting material type according to contact ratio $a_e/D$																													
Carbide PVD-coated														Carbide CVD-coated								HM uncoated							
HP110		HP320		HP325		HP630		HP635		HP640		HP645		HP650		HP655		HC220		HC525		HC530		HC535		HU110			
> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6		
								220	290	180	230	130	220									220	310	180	250				
								190	260	150	200	100	190									190	280	150	220				
								190	230	160	180	180	220									190	250	160	200				
								160	200	130	150	150	190									160	220	130	170				
								170	210	130	160	160	190									170	230	130	180				
								150	190	120	150	150	180									150	210	120	180				
								130	170	100	130	130	160									130	190	100	160				
								130	170													130	190	120	180				
								140	180													140	200	130	190				
								120	160													120	180	110	170				
														140	180	130	160												
														110	150	100	130												
														110	130	100	120												
														80	100	70	90												
						180	320														210	360							
						150	200														180	250							
						140	180														170	230							
						130	160														160	210							
						140	180														170	230							
						130	160														160	210							
500	3000																										400	2500	
400	500																										300	400	
400	500																										300	400	
400	500																										300	400	
160	500																										120	400	
200	300																										160	250	
200	300																										160	250	
		100	180	90	140															110	190								
		90	150	70	130															100	160								
		60	80																	60	90								
		65	95	60	90															70	100								

The specified machining values are guide values.  
The optimum data for the respective machining task should be determined during the test or machining.

# NeoMill®-2-Shell


Shell end face milling cutter with radial technology  
AOKT12




## End milling cutter

Dimensions				Z <sub>eff</sub>	Number of indexable inserts	a <sub>p</sub> max.	Weight [kg]	max. operating speed [rpm]	Cylindrical shank form	Internal cooling	Specification	Order no.
d <sub>1</sub>	d <sub>2</sub>	l <sub>1</sub>	l <sub>2</sub>									
25	25	120	55	2	8	41	0	49.000	HA	✓	ISM901-025-HA25-Z02R-AO_T12	31002194
25	25	104	46	2	8	41	0	49.000	HB	✓	ISM901-025-HB25-Z02R-AO_T12	31002195
32	32	140	75	3	15	51	1	43.000	HA	✓	ISM901-032-HA32-Z03R-AO_T12	31002196
32	32	120	57	3	15	51	1	43.000	HB	✓	ISM901-032-HB32-Z03R-AO_T12	31002197
40	32	150	80	4	20	51	1	39.000	HA	✓	ISM901-040-HA32-Z04R-AO_T12	31002198
40	32	126	64	4	20	51	1	39.000	HB	✓	ISM901-040-HB32-Z04R-AO_T12	31002199

## Accessories

	Chuck for end milling cutter see MAPAL catalogue "CLAMPING"	
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## Spare parts\*

	AOKT12T3	Clamping screw for indexable insert TORX® M3x7.5-TX8-IP	Order no. 10105075
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Dimensions in mm.

The maximum operating speeds refer only to the cutting edge system.

\* Included in scope of delivery.

# AOKT

Radial indexable insert, double edge



Workpiece material	P			M		K	
	Unalloyed Wear-resistant	Alloyed Toughened		Austenitic Wear-resistant	Ferritic Toughened		
Substrate	Carbide			Carbide		Carbide	
Coating	PVD		CVD	PVD		PVD	CVD
Cutting material type	HP975	HP980	HC775	HP980	HP985	HP975	HC770
Cutting edge design	M05	M03	M03	M03	M03	M05	M05
<b>AOKT12</b>	<b><math>a_p</math> max. [mm]</b>						
AOKT12T304R-	*	31029366			31029367	31029366	31029368
AOKT12T308R-	*	31029368	31200903	31124557	31200903	31029369	31029368 31124556

## Feed per tooth

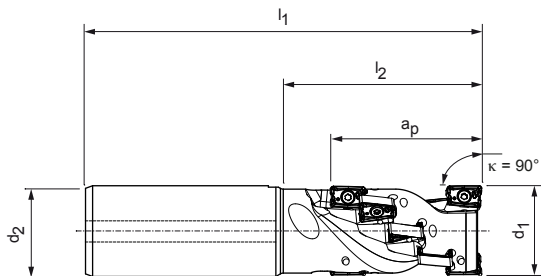
Chip breaker		Medium machining	
		M03	M05
Edge rounding		++	+++
Feed/tooth [mm]	P	0.08–0.25	0.1–0.25
	M	0.08–0.2	
	K		0.1–0.3
	N		

Legend: ++ = medium rounded | +++ = sharp edged

\*  $a_p$  max. depends on the type of milling cutter and application.  
For cutting data recommendations, see end of chapter.

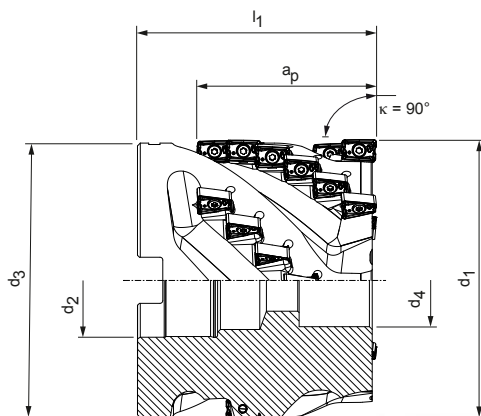
# NeoMill®-4-Shell

Shell end face milling cutter with radial technology  
ANMU12



## End milling cutter

Dimensions					$Z_{eff}$	Number of indexable inserts	$a_p$ max.	Weight [kg]	max. operating speed [rpm]	Cylindrical shank form	Internal cooling	Specification	Order no.
$d_1$	$d_2$	$l_1$	$l_2$										
32	32	140	70	2	10	52	1	29.000	HA	✓	ISM901-032-HA32-Z02R-AN_U12	31002236	
32	32	125	61	2	10	52	1	29.000	HB	✓	ISM901-032-HB32-Z02R-AN_U12	31002237	
40	32	150	80	3	18	62	1	26.000	HA	✓	ISM901-040-HA32-Z03R-AN_U12	31002238	
40	32	135	73	3	18	62	1	26.000	HB	✓	ISM901-040-HB32-Z03R-AN_U12	31002239	



## Milling cutter

Dimensions					$Z_{eff}$	Number of indexable inserts	$a_p$ max.	Weight [kg]	max. operating speed [rpm]	Internal cooling	Specification	Order no.
$d_1$	$d_2$	$d_3$	$d_4$	$l_1$								
40	16	38	14	60	3	12	42	0,4	26.000	-	ISM900-040-CA16-Z03R-AN_U12	31002240
50	22	48	18,5	70	4	20	52	0,7	23.000	-	ISM900-050-CA22-Z04R-AN_U12	31002241
63	27	60,6	20,5	75	4	20	52	1,2	21.000	-	ISM900-063-CA27-Z04R-AN_U12	31002242

Dimensions in mm.

The maximum operating speeds refer only to the cutting edge system.

# ANMU

Radial indexable insert, four cutting edges



Workpiece material	P			M		K				
	Unalloyed Wear-resistant	Alloyed Toughened		Austenitic Wear-resistant	Ferritic Toughened	GJL Wear-resistant	GJS Toughened	GJL Wear-resistant	GJS Toughened	
Substrate	Carbide			Carbide		Carbide				
Coating	PVD		CVD	PVD		PVD		CVD		
Cutting material type	HP975	HP980	HC775	HP980	HP985	HP965	HP975	HC760	HC770	
Cutting edge design	M05	M03	M03	M03	M03	M05	M05	M05	M05	
<b>ANMU12</b>	$a_p$ max. [mm]									
ANMU120504R-	*	31029427					31029427		31218310	
ANMU120508R-	*	30968178	31027000	31124584	31027000	31029429	31029430	30968178	31124582	31124583
Cutting edge design	U05	U03	U03	U03	U3	U05	U05	U05	U05	
<b>ANMU12</b>	$a_p$ max. [mm]									
ANMU120508R-	*	31253944	31253948	31273152	31253948	31290794	31273129	31253944	31273153	31253947

## Feed per tooth

Chip breaker		Medium machining		Finishing	
		M03	M05	U03	U05
Edge rounding		++	+++	++	+++
Feed/tooth [mm]	P	0.08-0.25	0.1-0.25	0.08-0.25	0.1-0.25
	M	0.08-0.2		0.08-0.2	
	K		0.1-0.3		0.1-0.3
	N				

Legend: ++ = medium rounded | +++ = sharp edged

## Accessories

	Chuck for end milling cutter see MAPAL catalogue "CLAMPING"	
	Milling cutter arbor for milling cutter see MAPAL catalogue "CLAMPING"	
	Milling cutter clamping screws for milling cutter	Page 75

## Spare parts\*\*

	Clamping screw for indexable insert TORX® M3x8.5-TX8-IP	Order no. 10105076
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\*  $a_p$  max. depends on the type of milling cutter and application.

\*\* Included in scope of delivery.

For cutting data recommendations, see end of chapter.

# Cutting Data Recommendation for Shell End Face Milling Cutter

Feed and cutting speed

## Shell end face milling cutter

MMG*		Workpiece material	Strength/hardness [N/mm <sup>2</sup> ] [HRC]	Cooling		
				MQL/Air	Dry	KSS
P	P1	P1.1 Construction steels, machining steels, hardening and tempering steels, unalloyed	< 700		✓	
		P1.2 Construction steels, machining steels, hardening and tempering steels, unalloyed	< 1200		✓	
	P2	P2.1 Nitriding, hardening and tempering steels, alloyed	< 900		✓	
		P2.2 Nitriding, hardening and tempering steels, alloyed	< 1400		✓	
	P3	P3.1 Tool steels, roller bearing steels, spring steels and high-speed steels**	< 800		✓	
		P3.2 Tool steels, roller bearing steels, spring steels and high-speed steels**	< 1000		✓	
		P3.3 Tool steels, roller bearing steels, spring steels and high-speed steels**	< 1500		✓	
	P4	P4.1 Stainless steels, ferritic and martensitic				
	P5	P5.1 Cast steel				
	P6	P6.1 Stainless cast steels, ferritic and martensitic				
M	M1	M1.1 Stainless steels, austenitic	< 700		✓	
		M1.2 Stainless steels, ferritic/austenitic (Duplex)	< 1000			
	M2	M2.1 Stainless cast steel, austenitic	< 700			
	M3	M3.1 Stainless cast steel, ferritic/austenitic (Duplex)	< 1000			
K	K1	K1.1 Cast iron with lamellar graphite (grey cast iron), GJL	< 300		✓	
		K2.1 Cast iron with spheroidal graphite, GJS	< 500		✓	
	K2	K2.2 Cast iron with spheroidal graphite, GJS	500–800			
		K2.3 Cast iron with spheroidal graphite, GJS	> 800			
	K3	K3.1 Cast iron with vermicular graphite, GJV; malleable cast iron, GJM	< 500			
		K3.2 Cast iron with vermicular graphite, GJV; malleable cast iron, GJM	> 500			
N	N1	N1.1 Aluminium, unalloyed and alloyed < 3 % Si			✓	
		N1.2 Aluminium, alloyed < 7 % Si				
		N1.3 Aluminium, alloyed > 7–12 % Si				
		N1.4 Aluminium, alloyed > 12 % Si				
	N2	N2.1 Copper, unalloyed and low alloyed	< 300		✓	
		N2.2 Copper, alloyed	> 300			
		N2.3 Brass, bronze, gunmetal	< 1200			
	N3	N3.1 Graphite, > 8 µm				
		N3.2 Graphite, ≤ 8 µm				
	N4	N4.1 Plastic, thermoplastics				
N4.2 Plastic, duroplastics						
N4.3 Plastic, foam materials						




\* MAPAL machining groups

\*\* If the alloy parts Cr, Mo, Ni, V, W in total > 8 % then select the next highest MAPAL machining group.

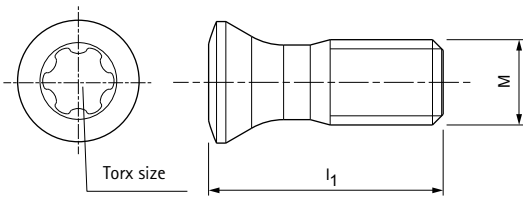
Cutting material type according to contact ratio $a_e/D$																			
Carbide PVD-coated										Carbide CVD-coated						Carbide - uncoated		PCD	
HP615		HP965		HP975		HP980		HP985		HC760		HC770		HC775		HU616		PU617	
> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6	> 0.6	< 0.6
				180	220	180	220					260	280						
				150	180	150	180					250	270	240	260				
				160	200	160	200					240	260	230	250				
						130	160							220	240				
						130	160												
						130	160												
						120	150												
						120	150												
						130	160												
						110	140												
						160	180	140	170										
						140	160	120	150										
								100	120										
								90	110										
		220	270	200	240					330	350	320	330						
		200	240	180	220					300	330	300	320						
		180	220	160	200							260	300						
		160	200	140	170							220	260						
		170	210	150	180					210	240	200	220						
		160	200	140	170					200	220	180	200						
700	700															500	500	2000	2000
400	480															300	360	1500	1800
300	360															230	280	1200	1440
270	330																	700	840
250	300															250	300	600	720
130	160															120	150	500	600
190	230															180	220	450	540
320	390															300	360		
320	390																		
220	270															300	360	500	600
210	260															250	300	400	480

The specified machining values are guide values.  
 The optimum data for the respective machining task should be determined during the test or machining.


## Accessories and Spare Parts for Milling Cutter with Indexable Inserts

	Dimension	Comments	Wrench size / Torx size	Order no.
<b>Threaded pin</b>				
	M3X5-45H	Threaded pin ISO 4026	Wrench size 1.5	10003421
	M3x8	Reducer of the coolant bore with helix and shell end face milling cutter	Wrench size 1.5	30433620
<b>Threaded spindle</b>				
	M6x0.75	M6x0.75 LH/RHx23.4 for ONKU0705	15IP	31041869
<b>Clamping wedge</b>				
	M6X0.75 LH	for ONKU0705 (close spacing)		31071645










**Clamping screw for radial indexable inserts**

	Indexable insert	Size of indexable insert	Clamping screw					Screwdriver	
			Dimension	Description	Tightening torque [Nm]	Torx size	Order no.	Order no.	
	OF...	0704	M5x13	MN659 M5x13-TX20-IP	7,5	20IP	10105084	30414766	
	ON...	0705	M5x13	MN659 M5x13-TX20-IP	7,5	20IP	10105084	30414766	
	AO...	12T3	M3x6.5	MN659 M3x6.5-TX8-IP	1,8	8IP	10105074	30414760	
			M3x7.5	MN659 M3x7.5-TX8-IP	1,8	8IP	10105075	30414760	
	AN...	1205	M3x8.5	MN659 M3x8.5-TX8-IP	1,8	8IP	10105076	30414760	
	SD...	10T3	M3x7.5	MN659 M3x7.5-TX8-IP	1,8	8IP	10105075	30414760	
	SN...	1205	M4x11	MN659 M4x11-TX15-IP	4	15IP	10018468	30414764	
	LP...	0602	M1.8X4.09	M1.8X4.09-TX6-IP	0,9	6IP	31164571	30414758	
	LD...	1004	M2.5X5.9	M2.5X5.9-TX8-IP	1,5	8IP	31161842	30414760	
			M2.5X6.8	M2.5X6.8-TX8-IP	2	8IP	31161843	30414760	
			1804	M3.5X10	M3.5X10-TX15-IP	3,5	15IP	30870699	30414764
	SD...		0602	M2.2X5.2	M2.2X5.2-TX7-IP	1,2	7IP	31161853	30414759
			1004	M3X8.3	M3X8.3-TX9-IP	2	9IP	31161852	30414761
			1405	M5X10.8	M5X10.8-TX20-IP	5	20IP	31161851	30414766
0806			M6X15	M6X15-T25	6	T25	31161862	10019476	

**High-temperature screw paste**

	Description	Order no.
	Ceramic paste/re-sealable PE tube 100 g	30515526




## Allocating milling cutter clamping screws for milling cutters with indexable inserts

Series	Diameter of milling cutter	Diameter of milling cutter arbor	Milling cutter clamping screw		
			Without internal cooling**	Without internal cooling*	With internal cooling
					
NeoMill®-8-Face, OFMT07	63	22	-	10003660	31006800
	80	27	-	10003677	31008546
	100	32	-	10003690	31008547
	125	40	-	10111521	31009716
	160	40	10004066	10006594 (x4)	-
	200	60	-	10022995 (x4)	-
NeoMill®-16-Face, ONKU07	63	22	-	10003660	31006800
	80	27	-	10003677	31008546
	100	32	-	10003690	31008547
	125	40	-	10111521	31009716
	160	40	10004066	10006594 (x4)	-
	200	60	-	10022995 (x4)	-
NeoMill®-2-Corner, AOKT12 NeoMill®-4S-Corner, SDKT10 NeoMill®-8-Corner, SNMU12	40	16	-	10003638	31006779
	50	22	-	10003660	31006800
	63	22	-	10003660	31006800
	80	27	-	10003677	31008546
	100	32	-	10003690	31008547
	125	40	-	10111521	31009716
	160	40	10004066	10006594 (x4)	-
	200	60	-	10022995 (x4)	-
NeoMill®-4-Corner, ANMU12	40	16	-	10003640	-
	50	22	-	10003663	-
	63	27	-	10003679	-
	80	32	-	10007775	-
	100	40	-	10015925	-
NeoMill®-2-HiFeed90, LP__06	32	16	-	10003638	-
	40	16	-	10003638	-
	50	22	-	10003659	-

Dimensions in mm.

\* Included in scope of delivery for the tool body.

\*\* Optional for clamping via central control.

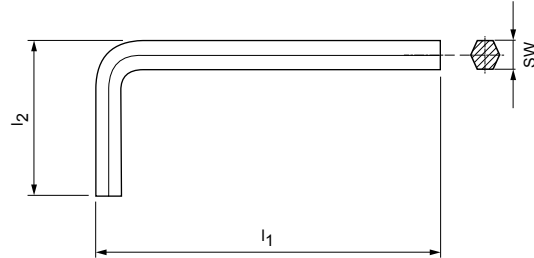
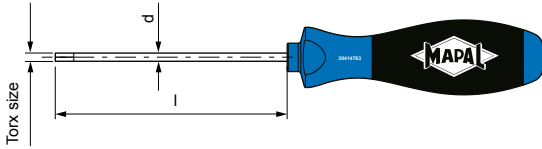
Series	Diameter of milling cutter	Diameter of milling cutter arbor	Milling cutter clamping screw	
			Without internal cooling**	Without internal cooling*
				
NeoMill®-2-HiFeed90, LD__10	40	16	-	10003637
	50 - 63	22	-	10003659
	80	27	-	10003677
NeoMill®-2-HiFeed90, LD__18	40	16	-	10003638
	50 - 66	22	-	10003659
	80	27	-	10003677
	100	32	-	10006565
	125	40	-	10009106
	160	40	10004066	10006594 (x4)
NeoMill®-4-HiFeed90, SD__10	40	16	-	31166231
	50 - 66	22	-	10003659
	80	27	-	10003677
NeoMill®-4-HiFeed90, SD__14	50 - 52	22	-	31166232
	63 - 66	22	-	10003659
	80	27	-	10003677
	100	32	-	10003690
	125	40	-	10081881
NeoMill®-4-HiFeed90, SD__18	80	27	-	10003677
	100	32	-	10003690
	125	40	-	10081881
	160	40	10004066	10006594 (x4)
	200	60	-	10006594 (x4)
NeoMill®-4-Shell, ANMU12	40	16	-	10003640
	50	22	-	10003663
	63	27	-	10003679

Dimensions in mm.

\* Included in scope of delivery for the tool body.

\*\* Optional for clamping via central control.

## General Accessories – Screwdriver

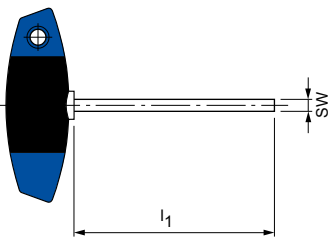


### Screwdriver

Dimensions			Description	Order no.
l [mm]	d [mm]	Torx size		
60	3,5	6IP	TORX PLUS®	30414758
60	3,5	7IP		30414759
60	3,5	8IP		30414760
60	4	9IP		30414761
80	4	10IP		30414763
80	4	15IP		30414764
100	4	20IP		30414766
100	4,5	25IP		30414767
60	3,5	TX8		TORX®
80	4	TX15	10019469	

### Allen wrench

Dimensions			Description	Order no.
l <sub>1</sub> [mm]	l <sub>2</sub> [mm]	Wrench size (SW)		
46,5	15,5	SW 1,5	ISO2936-X	10004870
52	18	SW 2		10004356



### Hexagonal T-key

Wrench size (SW)	Short design			Long design	
	l <sub>1</sub> [mm]	Specification	Order no.	l <sub>1</sub> [mm]	Order no.
SW 2,5	100	-	10006233	200	10032722
SW 3	100	MN5221-31	10006234	200	10025313
SW 4	100	MN5221-32	10006235	200	10018010
SW 5	100	MN5221-33	10006236	200	10013350
SW 6	100	MN5221-34	10006237	-	-
SW 8	100	MN5221-35	10006238	-	-
SW 10	100	-	30353270	-	-
SW 12	-	-	-	200	30353272

## General Accessories – Torque Wrench Set, Screwdriver Set



### TorqueVario®-STplus T-key torque wrench set 11-pcs. set

Model: 5–14 Nm

Scope of delivery	Features	Order no.
<ul style="list-style-type: none"> <li>• 1 T-key torque wrench</li> <li>• 1 Torque-Tplus Setter</li> <li>• 1 universal bit holder 1/4"</li> <li>• 3 TORX® standard bits T25x25 / T30x25 / T40x25</li> <li>• 3 hex standard bits 4.0x25 / 5.0x25 / 6.0x25</li> <li>• 2 adapter bits for the sockets</li> <li>• 1 Torque-Tplus adapter bit 1/4"</li> <li>• 1 Torque-Tplus adapter bit 3/8"</li> <li>• Delivery in stable metal box</li> </ul>	<ul style="list-style-type: none"> <li>• Accuracy <math>\pm 6\%</math>, can be traced to national standards</li> <li>• Numeric torque value indication on window scale</li> <li>• Torque continuously adjustable</li> <li>• Comfortable T-key with soft zones</li> <li>• Click signal on reaching the set torque</li> </ul>	30415173

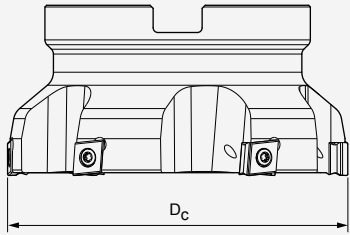
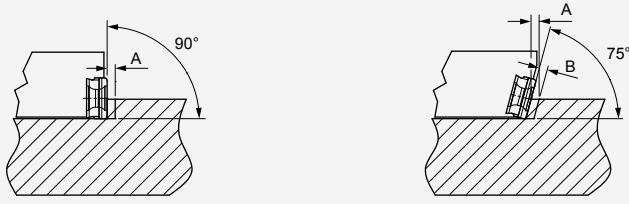
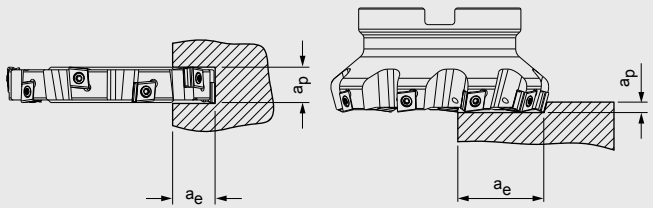


### TorqueVario®-S torque screwdriver set 13-pcs. set

Model: 1.0–5.0 Nm

Scope of delivery	Features	Order no.
<ul style="list-style-type: none"> <li>• 1 TorqueVario-S torque screwdriver</li> <li>• 1 torque setter</li> <li>• 1 universal bit holder 1/4"</li> <li>• 5 TORX® standard bits T7x25 / T8x25 / T9x25 / T10x25 / T15x25</li> <li>• 5 TORX PLUS® standard bits 7IPx25 / 8IPx25 / 9IPx25 / 10IPx25 / 15IPx25</li> <li>• Delivery in stable metal box</li> </ul>	<ul style="list-style-type: none"> <li>• Accuracy <math>\pm 6\%</math>, can be traced to national standards</li> <li>• Numeric torque value indication on window scale</li> <li>• Torque continuously adjustable</li> <li>• Ergonomic multiple component handle</li> <li>• Click signal on reaching the set torque</li> </ul>	30415174

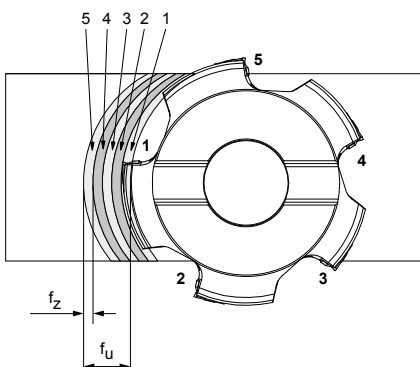
# Terminology and Formulae

<b>Diameter of milling cutter</b>	$D_c$ [mm]	<b>Setting angle</b>	$\kappa$
			
<b>Average roughness</b>	$R_a$ [ $\mu\text{m}$ ]	<b>Cutting depth</b>	$a_p$ [mm]
<b>Average roughness depth</b>	$R_z$ [ $\mu\text{m}$ ]	<b>Cutting width</b>	$a_e$ [mm]
<b>Number of blades</b>	$z$		
<b>Spindle speed</b>	$n$ [rpm]		

## Formulae

<b>Feed per turn</b>	$f_u = \left[ \frac{\text{mm}}{U} \right]$	$f_u = z \cdot f_z$
<b>Feed per tooth</b>	$f_z = \left[ \frac{\text{mm}}{\text{Tooth}} \right]$	$f_z = \frac{v_f}{n \cdot z}$

**fz during face milling:**



<b>Spindle speed</b>	$n = \left[ \frac{\text{min}^{-1}}{\text{min}^{-1}} \right]$	$n = \frac{v_c \cdot 1.000}{\pi \cdot D}$
<b>Average chip thickness</b>	$h_m = \left[ \frac{\text{mm}}{\text{mm}} \right]$	$h_m = \sin \kappa \cdot f_z \cdot \sqrt{\frac{a_e}{D}}$
<b>Cutting speed</b>	$v_c = \left[ \frac{\text{m}}{\text{min}} \right]$	$v_c = \frac{\pi \cdot D_c \cdot n}{1.000}$
<b>Feed rate</b>	$v_f = \left[ \frac{\text{mm}}{\text{min}} \right]$	$v_f = f_z \cdot z \cdot n$
<b>Material removal rate</b>	$Q = \left[ \frac{\text{cm}^3}{\text{min}} \right]$	$Q = \frac{a_e \cdot a_p \cdot v_f}{1.000}$

### Disc, groove, shoulder milling

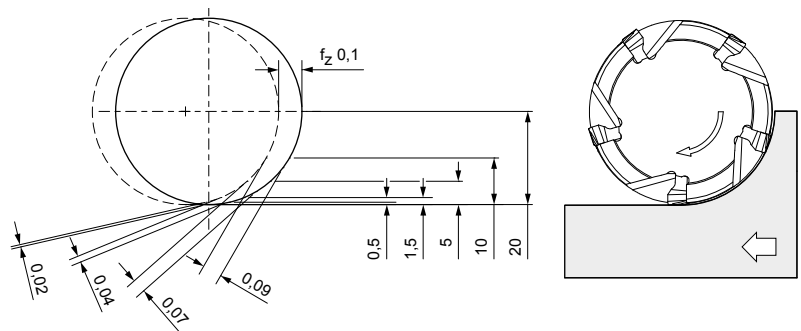
#### Feed value compensation

Machining steps with low radial cutting depth such as disc milling, groove milling or milling a shoulder require correction of the feed at the cutting edge as it enters the workpiece.

The calculated and actual feed can vary depending on the cutting depth and the diameter of milling cutter used.

If a shoulder with a cutting depth of only 0.5 mm is machined using a milling cutter diameter of 40 mm, the feed must be multiplied by a factor of 5 to arrive at the actual feed or  $f_z$  0.1 (see example below).

A major advantage of the application of this formula is the increase in productivity with the effective use of the milling cutter.



#### Example:

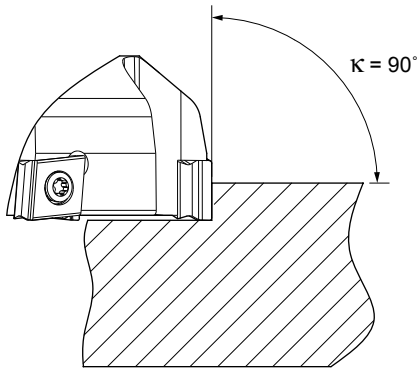
Tool: Diameter of milling cutter 40 mm  
 z: 5  
 $f_z$ : 0.1 mm/rev  
 f: 0.5 mm/rev

Radial cutting depth $a_p$ [mm]	Feed per tooth $f_z$ [mm/rev]	Maximum chip thickness $h_{max}$ [mm]	Required $v_f$ to obtain $f_z$ 0.1	Increase factor
20	0,1	0,1	1.000	1,00
10	0,1	0,09	1.111	1,11
5	0,1	0,07	1.429	1,43
1,5	0,1	0,04	2.500	2,50
0,5	0,1	0,02	5.000	5,00

**Note:** Based on the above example, the feed per tooth can be increased with a low  $a_p/D$  ratio or a setting angle  $< 90^\circ$ .

# Technical Information Milling

## Selection of the setting angle

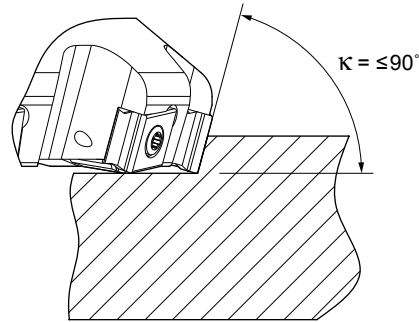


### Advantages:

- For thin-walled workpieces
- For poorly clamped workpieces
- For  $90^\circ$  shoulder machining

### Disadvantages:

- Highest radial forces
- High load on impact when penetrating the material
- Increased probability of the formation of burrs as the cutting edge exits



### Advantages:

- For general milling applications
- Good ratio of cutting edge size to maximum cutting depth
- Reduced impact load on the cutting edge on penetrating the material

### Disadvantages:

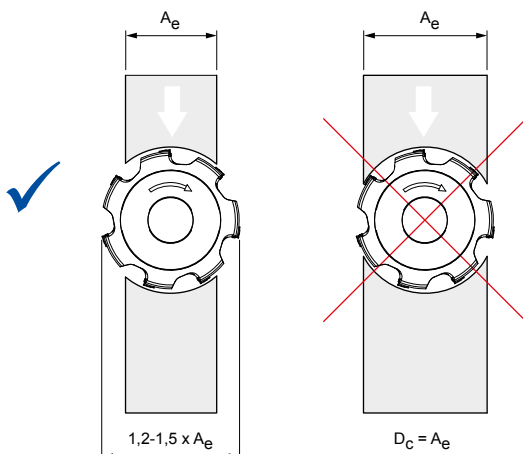
- Higher radial forces can cause problems in case of low-power machines or poorly clamped workpieces

## Position of the milling cutter diameter and the milling cutter position

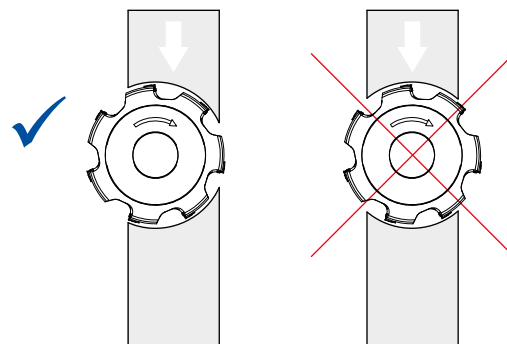
The milling cutter diameter is to be selected as a function of the size of the workpiece or the width of the workpiece as well as the power of the machine. During face milling, e.g. the milling cutter diameter should be 20–50 % larger than the cutting width on the workpiece.

The position of the milling cutter and the cutting edge contact on entering and exiting the workpiece affect the machining result.

### Optimal milling cutter diameter



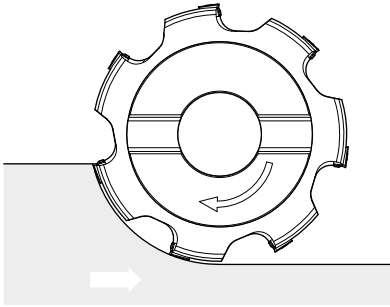
### Optimal position





### Differentiation based on running direction

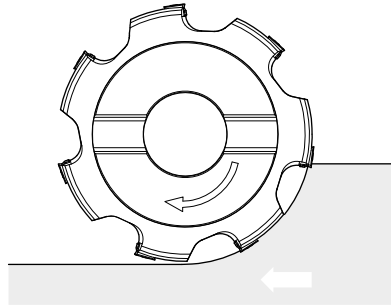
#### Counter feed milling



When the cutting edge enters the chip-removing cut, the cutting edge has the unfavourable chipping thickness zero in terms of machining technology and exits the workpiece material with the maximum chipping thickness  $h_{max}$ . Friction is produced during climb milling. This friction results in chip welding and the transfer of heat to the indexable insert and to the workpiece.

In the case of counter feed milling, the resulting forces are against the direction of feed. It is likely that material strain hardening will occur.

#### Climb milling (preferred)



Climb milling is generally recommended. When entering the material, the cutting edge has a specific feed per tooth and with a maximum chipping thickness  $h_{max}$  generates a chip that becomes thinner on exiting the chip-removing cut. This aspect reduces the heat by transferring it to the chip. The material strain hardening is minimised.

### Production of surfaces

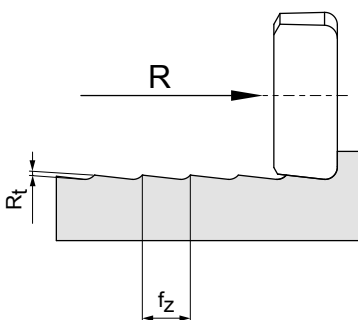
#### Axially produced surfaces:

During face milling, the surface quality is primarily generated by the cutting edge geometry and the feed.

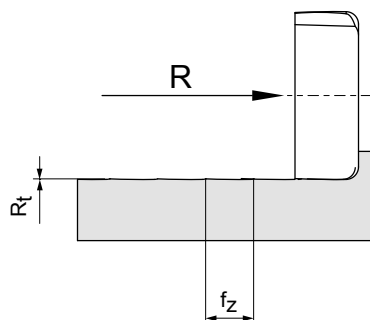
#### Improvement of surface quality:

Compared to a conventional cutting edge geometry, with a wide finishing indexable insert a  $R_a$  and  $R_z$  value several times better is achieved with the same feed.

#### Standard geometry

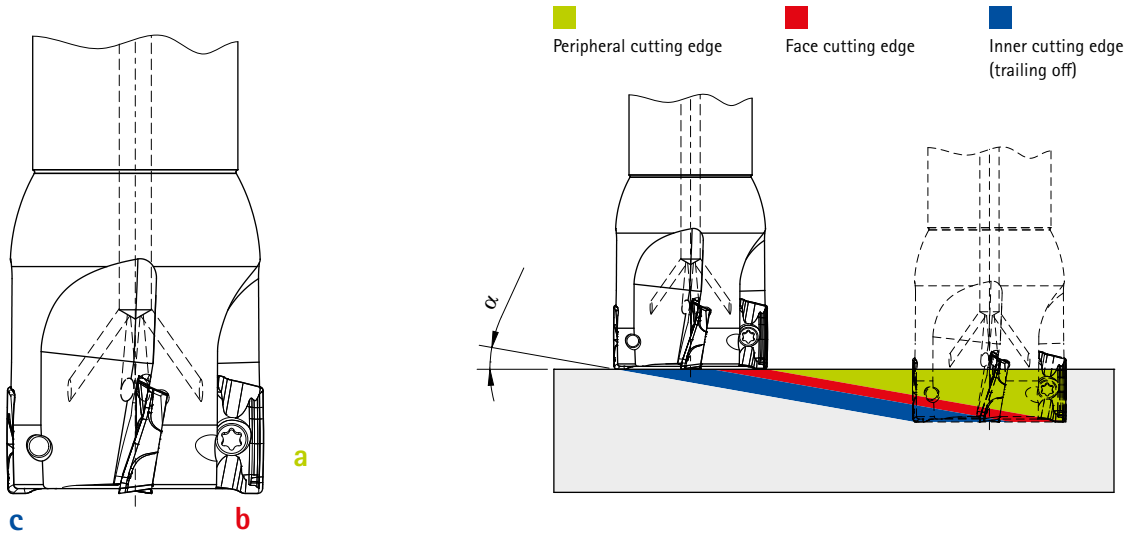


#### Wide finishing geometry



# Application Notes

## Two-axis angled entry – linear (flute)



### Ramp angle $\alpha$ :

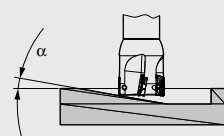
The maximum plunge angle  $\alpha$  is dependent on the tool.

In case of two-axis angled entry, various machining processes take place at the same time:

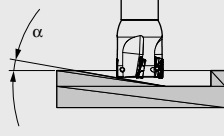
- Machining at the entire periphery of the tool (peripheral machining) with leading insert.
- Machining at the face of the milling cutter with leading insert.
- Machining at the face of the milling cutter with trailing insert.

### Application notes

For end milling cutter NeoMill-2-Corner

Plunge milling	Diameter of milling cutter [mm]	Indexable insert that can be used	Maximum ramp angle $\alpha$ [°]
	$\varnothing$ 20	AOKT12T3	6,0
	$\varnothing$ 25		4,2
	$\varnothing$ 32		3,0
	$\varnothing$ 36		2,6
	$\varnothing$ 40		2,2

For milling cutter NeoMill-2-Corner

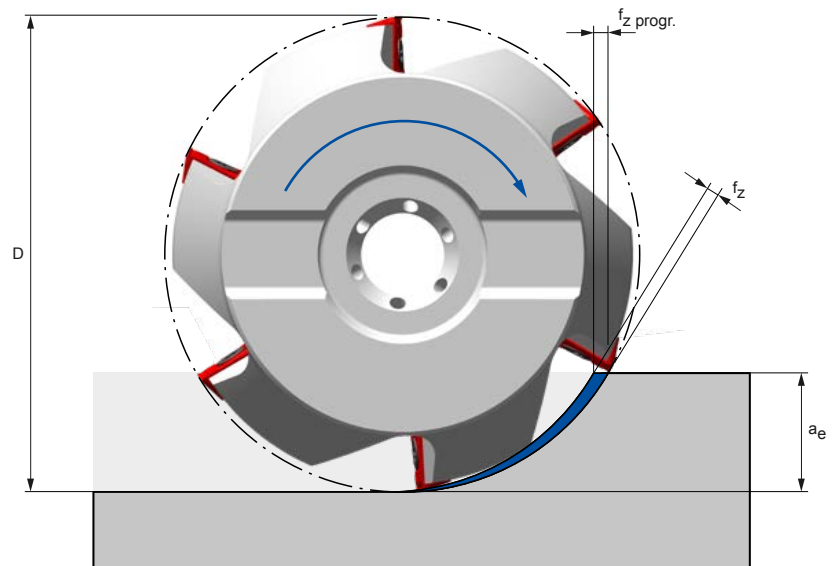
Plunge milling	Diameter of milling cutter [mm]	Indexable insert that can be used	Maximum ramp angle $\alpha$ [°]
	$\varnothing$ 40	AOKT12T3	2,2
	$\varnothing$ 50		1,7
	$\varnothing$ 55		1,5
	$\varnothing$ 63		1,3
	$\varnothing$ 80		1,0
	dia. 100 and more		not recommended

# Face and Shoulder Milling

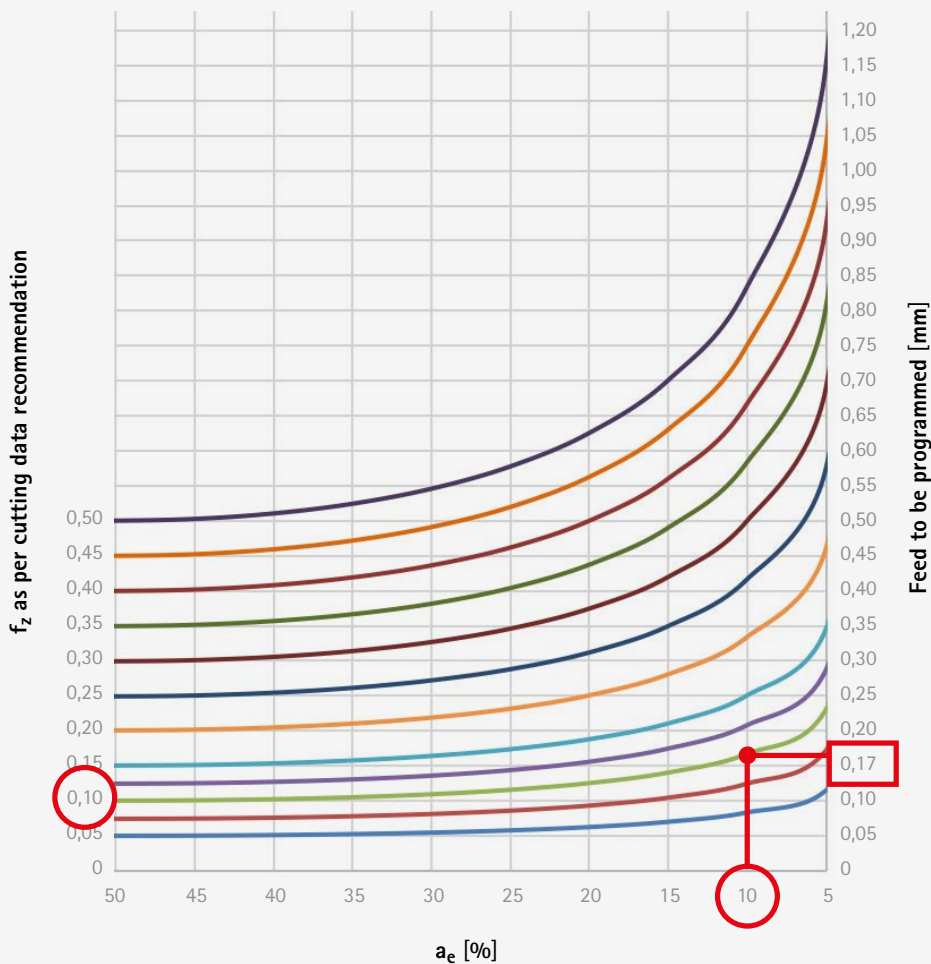
## Feed value compensation

Machining steps with low radial cutting depth, such as milling a shoulder, require correction of the feed at the cutting edge as it enters the workpiece.

The recommended feed per tooth  $f_z$  varies depending on milling cutter diameter and operational time, that is the radial contact ratio of the milling cutter  $a_e/D$ . If this is less than 50 percent, the maximum chip thickness reduces relative to the feed  $f_z$ . The feed can be increased with the aid of the correction factor in the following diagram, depending on the  $a_e/D$  ratio.



## Feed value compensation



### Example:

$D = 20$  mm  
 $a_e = 2$  mm  
 $f_z = 0,1$  mm/tooth  
 $a_e/D = 10$  %  
 $f_{z \text{ progr.}} = 0,17$  mm/tooth

# Handling Instructions for Face Milling Cutters with Radial Indexable Inserts

Applicable to milling cutters with ONKU and OFMT indexable inserts.

## Replacing the indexable inserts

### Requirements:

The face milling cutter and the indexable inserts have been checked for good condition and cleanliness.

### ONKU indexable inserts



#### Note:

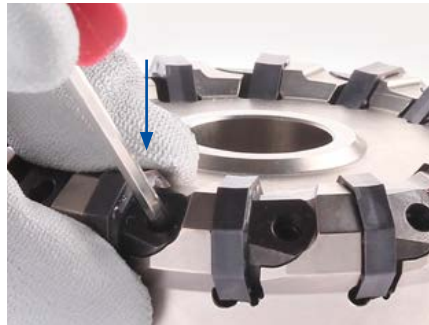
Before and during the replacement procedure, check the indexable inserts and insert seats for good condition and cleanliness.

1. Loosen the clamping wedge. To do this, use a TORX PLUS® wrench to turn the threaded spindle a few turns anticlockwise.

#### Note:

When inserting the indexable inserts, pay attention to the numbering of the chip breakers. The numbering should be identical in each insert seat.

2. Insert the indexable insert into the insert seat with repeated slight rocking movements.



3. Press the indexable insert downwards and make sure that the indexable insert is in contact with the circumference on both contact surfaces.
4. Hold the indexable insert and turn the threaded spindle clockwise with a TORX PLUS® wrench until the clamping wedge is slightly in contact with the indexable insert and fixes it.

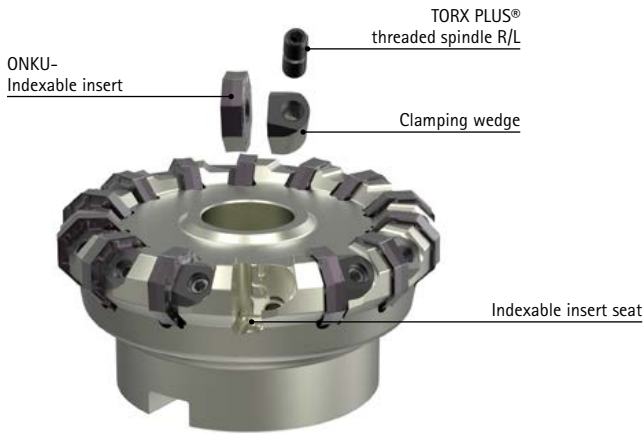
#### Note:

Before applying the tightening torque to the threaded spindle, all indexable inserts must first be mounted.

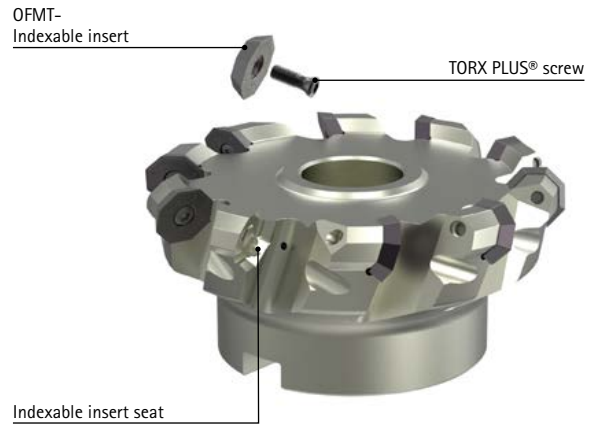
5. Tighten the threaded spindle at all clamping wedges to 7.5 Nm using a torque wrench.

#### Comment:

- Only for trained personnel.
- Clean the indexable inserts using cleaning compound.

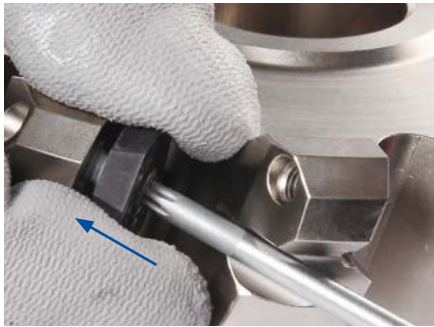


Series ONKU



Series OFMT

### OFMT indexable inserts



**Note:**

Before and during the replacement procedure, check the indexable inserts and insert seats for good condition and cleanliness.

1. Put the TORX PLUS® screw through the location bore of the indexable insert.

**Note:**

When inserting the indexable inserts, pay attention to the numbering of the chip breakers. The numbering should be identical in each insert seat.

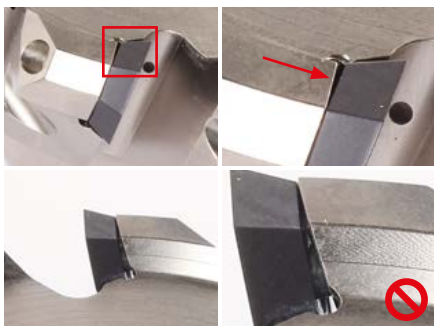
2. Insert the TORX PLUS® screw together with the indexable insert into the location bore of the indexable insert seat. The indexable insert must not yet be in contact with the insert seat.



3. Using a TORX PLUS® wrench, screw in the TORX PLUS® screw clockwise and simultaneously insert the indexable insert into the insert seat with repeated slight rocking movements.

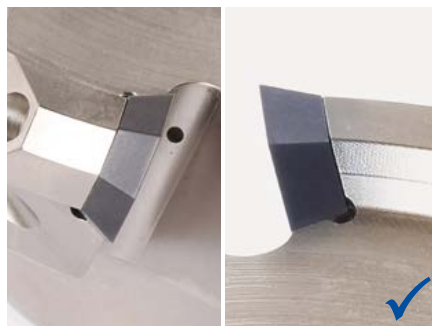


4. Pull the indexable insert outwards at a 45° angle and simultaneously screw in the TORX PLUS® screw as far as it will go.
5. Make sure that the indexable insert is flat and free of gaps.
6. Tighten the TORX PLUS® screw to 7.5 Nm using a torque wrench.



**Note:**

If the indexable insert is not flat, it must be loosened and remounted.

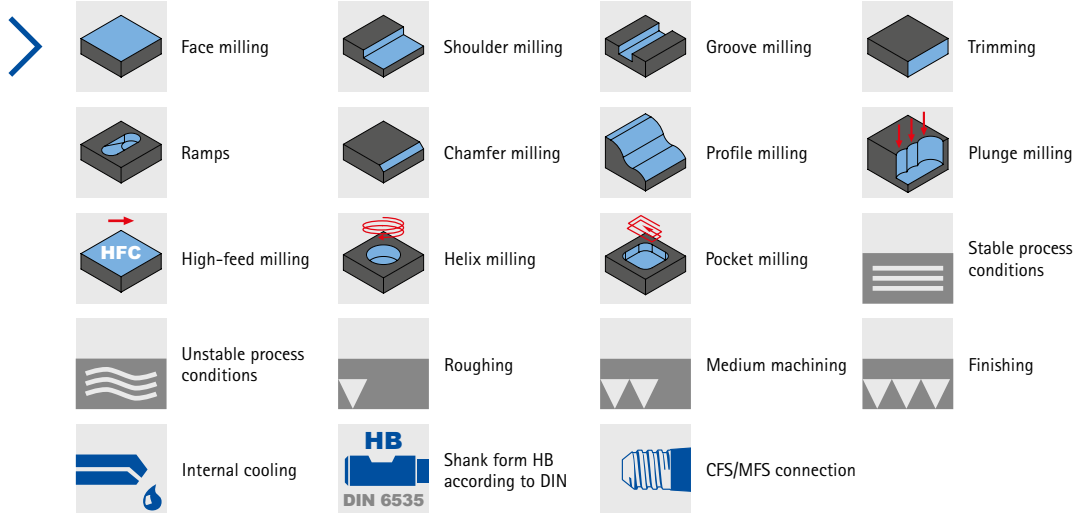


**Result:**

The indexable insert is correctly mounted and flat.

# Pictograms

## Milling



# MAPAL Machining Groups

Machining group	Workpiece material	Strength/hardness [N/mm <sup>2</sup> ] [HRC]	Frequently machined workpiece materials	
P	P1.1	Construction steels, machining steels, case-hardening and tempering steels, unalloyed	< 700 N/mm <sup>2</sup>	1.0122 (S235/St 37), 1.0401 (C15), 1.0503 (C45), 1.0570 (S355/St 52), 1.1213 (CF53)
	P1.2	Construction steels, machining steels, case-hardening and tempering steels, unalloyed	< 1200 N/mm <sup>2</sup>	1.1249 (CF70)
	P2.1	Nitriding, case-hardening and tempering steels, alloyed	< 900 N/mm <sup>2</sup>	1.7131 (16MnCr5)
	P2.2	Nitriding, case-hardening and tempering steels, alloyed	< 1400 N/mm <sup>2</sup>	1.7227 (42CrMoS4)
	P3.1	Tool steels, roller bearing steels, spring steels and high-speed steels*	< 800 N/mm <sup>2</sup>	1.2343 (X37CrMoV5-1), 1.2762 (75CrMoNiW6-7)
	P3.2	Tool steels, roller bearing steels, spring steels and high-speed steels*	< 1000 N/mm <sup>2</sup>	1.2367 (X38CrMoV5-3), 1.2713 (55NiCrMoV6)
	P3.3	Tool steels, roller bearing steels, spring steels and high-speed steels*	< 1500 N/mm <sup>2</sup>	1.2379 (X153CrMoV12), 1.2738 (40CrMnNiMo8-6-4)
	P4.1	Stainless steels, ferritic and martensitic		1.4510 (X3CrTi17), 1.4589 (X5CrNiMoTi15-2)
	P5.1	Cast steel		1.7231 (G42CrMo4)
	P6.1	Stainless cast steels, ferritic and martensitic		
M	M1.1	Stainless steels, austenitic	< 700 N/mm <sup>2</sup>	1.4301 (V2A), 1.4571 (V4A)
	M1.2	Stainless steels, ferritic/austenitic (Duplex)	< 1000 N/mm <sup>2</sup>	1.4362 (Alloy 2304), 1.4501, 1.4662 (LDX 2404)
	M2.1	Stainless cast steel, austenitic	< 700 N/mm <sup>2</sup>	
M3.1	Stainless cast steel, ferritic/austenitic (Duplex)	< 1000 N/mm <sup>2</sup>		
K	K1.1	Cast iron with lamellar graphite (grey cast iron), GJL	< 300 N/mm <sup>2</sup>	GJL-250 (GG-25), GJL-260 (GG-26 Cr)
	K2.1	Cast iron with spheroidal graphite, GJS	< 500 N/mm <sup>2</sup>	GJS-400 (GGG-40), GJS-450 (GGG-45)
	K2.2	Cast iron with spheroidal graphite, GJS	≤ 800 N/mm <sup>2</sup>	GJS-600 (GGG-60), GJS-800-2 (GGG-80), GJS-800-8 (ADI 800)
	K2.3	Cast iron with spheroidal graphite, GJS	> 800 N/mm <sup>2</sup>	GJS-900-2 (GGG-90), GJS-1000-5 (ADI 1000), GJS-1200-2 (ADI 1200), GJS-1400-1 (ADI 1400)
	K3.1	Cast iron with vermicular graphite, GJV; malleable cast iron, GJM	< 500 N/mm <sup>2</sup>	GJV-300, GJV-400, GJMW-400-5 (GTW-40)
K3.2	Cast iron with vermicular graphite, GJV; malleable cast iron, GJM	> 500 N/mm <sup>2</sup>	GJV-500, GJV-700	
N	N1.1	Aluminium, unalloyed and alloyed < 3 % Si		Alloy 2024, Alloy 7075, A199
	N1.2	Aluminium, alloyed ≤ 7 % Si		AlSi7
	N1.3	Aluminium, alloyed > 7–12 % Si		AlSi9, AlSi9Cu
	N1.4	Aluminium, alloyed > 12 % Si		AlSi12, AlSi17
	N2.1	Copper, unalloyed and low-alloyed	< 300 N/mm <sup>2</sup>	SE-Cu
	N2.2	Copper, alloyed	> 300 N/mm <sup>2</sup>	CuSn6
	N2.3	Brass, bronze, gunmetal	< 1200 N/mm <sup>2</sup>	CuZn33, CuAl9Mn3
	N3.1	Graphite, > 8 µm		
	N3.2	Graphite, ≤ 8 µm		
	N4.1	Plastic, thermoplastics		PA, PE, PC, PS, PVC, PP, PTFE, POM, PMMA
N4.2	Plastic, duroplastics		PU, PF, EP, UP, VE, CR	
N4.3	Plastic, foam materials		EPS, PUR, PVC-E, PS-E, PP-E	
C	C1.1	Plastic range, reinforced with aramid fibre (AFK)		Nomex, Kevlar, Twaron, KOREX
	C1.2	Plastic range (duroplastic), CFK/GFK		IMS, HTA
	C1.3	Plastic range (thermoplastic), CFK/GFK		GMT-PP, PEEK
	C2.1	Carbon range, reinforced with carbon fibre (CFC)		CF222, CF225, CF226, CF227, CF260
	C3.1	Metal matrix (MMC)		CeramTec AO-403 (AlSi9MgMn-Al2O3), Al/Cu/Mg-SiO2/Al2O3/AIN/TiC/SiC/BN/TiB2
	C4.1	Sandwich construction, honeycomb core (Honeycomb)		
	C4.2	Sandwich construction, foam core		PLASCORE PAMG-XR1 5052, PCGA-XR1 3003, PAMG-XR1 5056, Micro-Cell (core made of alloy 5052/5056)
	C5.1	Multilayer composite (stack), non-metallic non-ferrous metal composite		CFK-aluminium, IMS/HTA + Alloy 2024/6061/7075
	C5.2	Multilayer composite (stack), non-metallic metal composite		CFK-titanium, IMS/HTA + TiAl6V4/AMS4905
	C5.3	Multilayer composite (stack), non-metallic non-metal composite		CFK-CFK
C5.4	Multilayer composite (stack), non-ferrous metallic non-ferrous metal composite		Aluminium-aluminium	
C5.5	Multilayer composite (stack), non-ferrous metallic metal composite		Aluminium-titanium	
C5.6	Multilayer composite (stack), metallic metal composite		Titanium Inox	
S	S1.1	Titanium, titanium alloys	< 400 N/mm <sup>2</sup>	
	S2.1	Titanium, titanium alloys	< 1200 N/mm <sup>2</sup>	TiAl6V4
	S2.2	Titanium, titanium alloys	> 1200 N/mm <sup>2</sup>	
	S3.1	Nickel, unalloyed and alloyed	< 900 N/mm <sup>2</sup>	1.3912 (Invar, Ni36)
	S3.2	Nickel, unalloyed and alloyed	> 900 N/mm <sup>2</sup>	
S4.1	High-temperature super alloy, Ni-, Co-, and Fe-based		Hardox, Hastelloy, Incoloy, Inconel, NIMONIC, Stellite, Waspaloy	
S5.1	Molybdenum and tungsten alloys			
H	H1.1	Hardened steel / cast steel	< 44 HRC	1.2738 HH, 1.2085, Toolox 33, Toolox 44
	H1.2	Hardened steel / cast steel	< 55 HRC	1.2343, 1.2311, 1.2312, 1.2714, 1.2083, 1.2738
	H2.1	Hardened steel / cast steel	< 60 HRC	1.1730, 1.2379, 1.2358, 1.2767, 1.4112, ASP 2012
	H2.2	Hardened steel / cast steel	< 65 HRC	1.2379, 1.2363, 1.2436, 1.2842, ASP 2005, Vanadis 23
	H2.3	Hardened steel / cast steel	< 68 HRC	ASP 2017, ASP 2023, Vanadis 30, Vanadis 60
H3.1	Wear-resistant cast / chill casting, GJN			

\* If the alloy parts Cr, Mo, Ni, V, W in total > 8 % then select the next highest MAPAL machining group.



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B<sup>a</sup> Sta. Lucía s/n  
20709 Ezkio-Itsaso  
☎ 943 729 070

✉ ayma@ayma.es 🌐 www.ayma.es

www.mapal.com