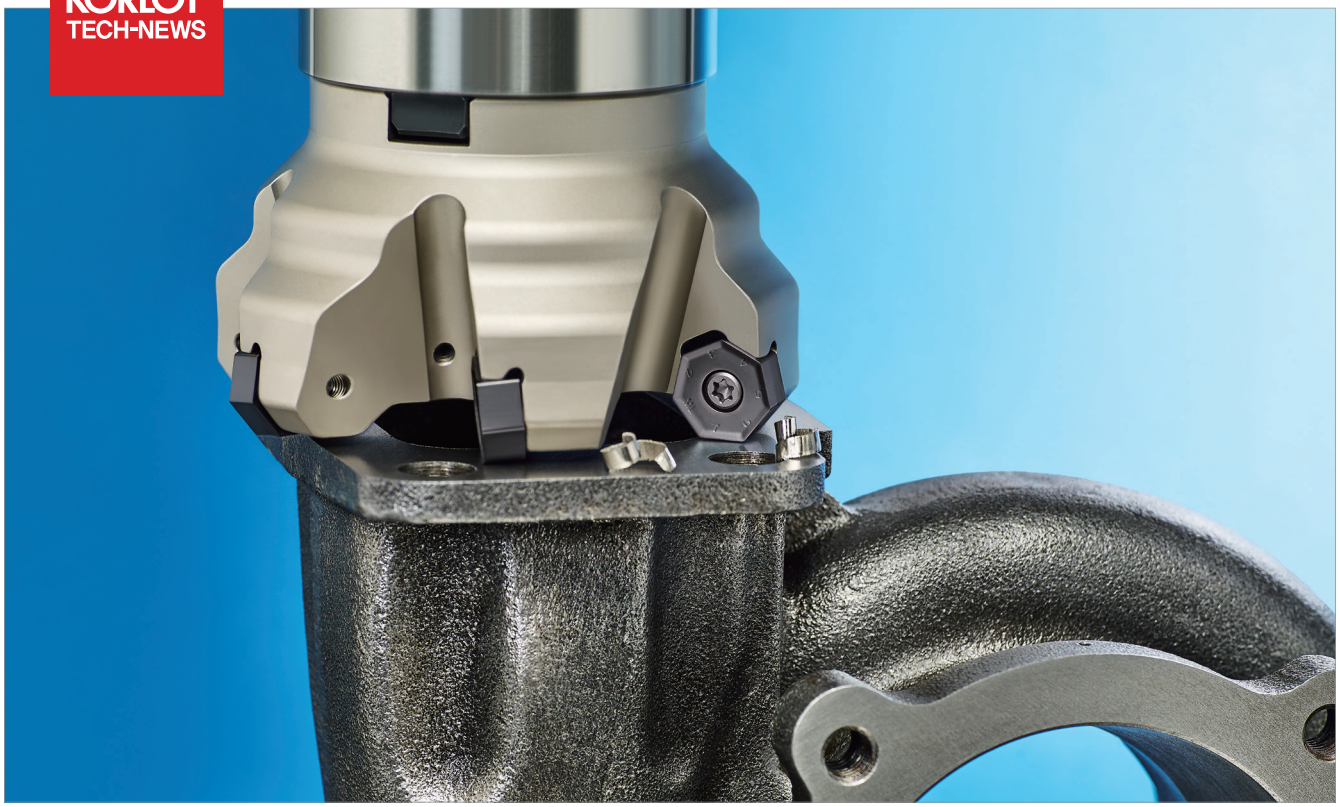
Heptagonal face mill with 14 double-sided corners

RM14

KORLOY TECH-NEWS



- Economical face mill with 14 double-sided corners
- Minimized chattering of workpiece due to maximum lead angle and sharp cutting edge
- Reduced cutting resistance and improved chip emissions by high helix angle application

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TECH-NEWS

Heptagonal face mill with 14 double-sided corners

RM14

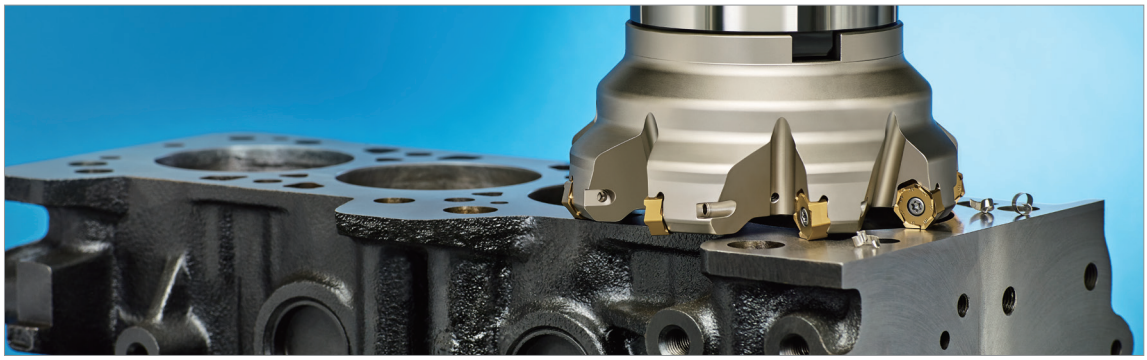
In the various industries including automotive components business, workpieces are manufactured with casting for easy-producing complicated shapes and lowering cost. However, due to the characteristic of casting manufacturing, facing is necessary on each uneven facing surface for assembling. In casting machining, complicated shapes of workpiece and uneven surface creates low clamping force, chattering, unstable tool life, bad surface finish and even shortening life of equipment.

KORLOY launches the double-sided face mill, RM14 to solve those troubles in machining.

RM14 designed with the maximum lead angle, 51˚ of heptagonal shape reduces cutting load and chattering comparing to the conventional face mill with lead angle, 45˚. Its strong wedge type clamping system ensures stable tool life even in poor cutting conditions.

In addition, there are two types of RM14 insert which are neutral (flat cutting edge) and right-handed (helix cutting edge) and it is possible for both of them to clamp to a single holder. The thicker RM14 insert with sharp cutting edge ensures good performance and stability and its optimal grade realizes long tool life.

RM14 is an economic tool using maximum 14 corners and ensures stable machining and high productivity.



Good performance

- Less cutting load due to high rake and high helix

Improved surface finish

- Less chattering due to lead angle of 51˚
- Good chip evacuation

Stable tool life

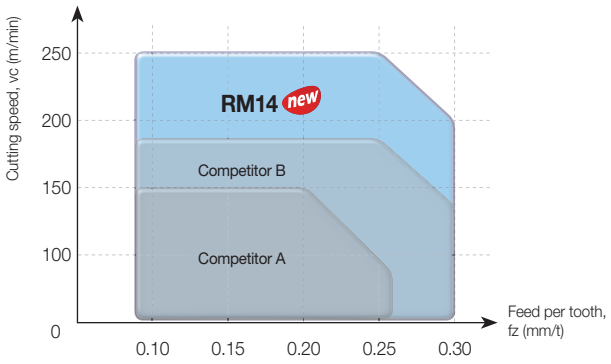
- High rigidity from thick insert

Stable clamping system

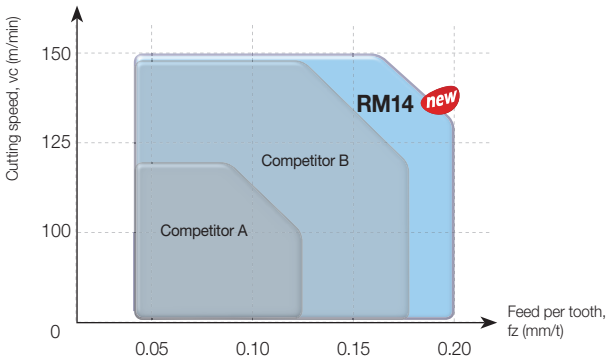
- Wide supporting area and acute angled clamping structure

Application range

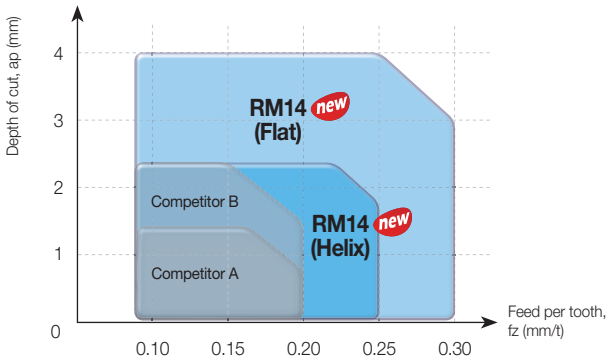
Ductile cast iron (500-7/600-3)



Stainless steel (X5CrNiMo17-12-2)



Heat resistance stainless steel [1.4849 (DIN)]



Code system

【Cutter type】

RM	14	X	C	M	080	R	-	27	-	7	-	XN06

Rich Mill

No. of edges
14: 14 edges

Approach angle
X: special

Type
C: Cutter

Arbors type
M: Metric
A: Inch
None: Asia

Tool Dia.
080: Ø80 mm

Coolant type & hand
R: Coolant, right-handed
NR: No coolant, right-handed

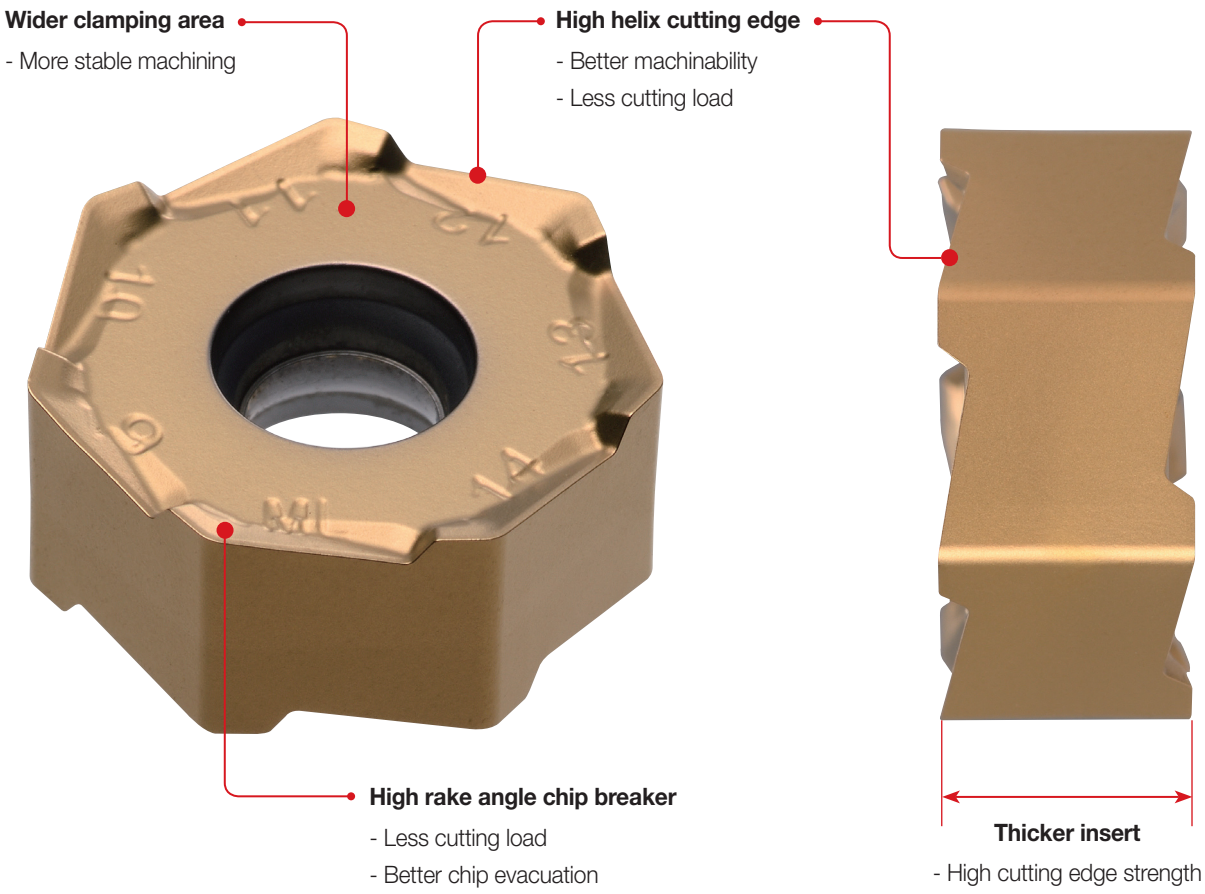
Internal
27: Ø27 mm

No. of teeth
7: 7 teeth

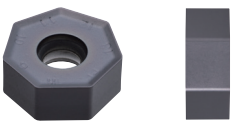
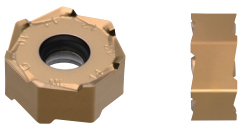
Insert
XN06: XNMX06

Insert features

- Wide supporting area of insert ensures stable clamping system.
- High rake angle cutting edge reduces cutting load and increases chip evacuation.
- Thicker insert realizes stability in machining.

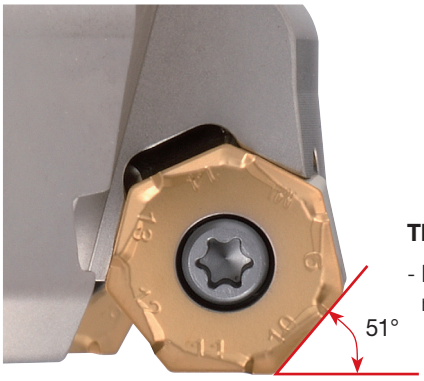


Features of insert per types

Type		Features	Application range
Flat		• Neutral type • Flat cutting edge	• 1st recommended for heat resistant stainless steel machining • Generally applied in various machining • Applicable for both right handed and left handed
Helix		• Right handed type • High helix cutting edge	• 1st recommended for cast iron machining • Applicable for stainless steel machining with less than 3 mm depth of cut • For high speed and high feed machining

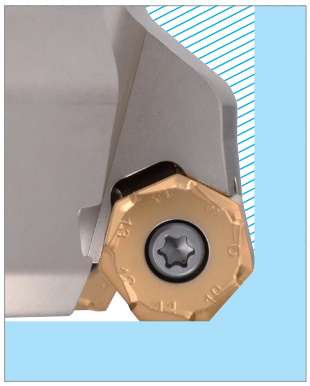
Cutter features

- The biggest heptagonal lead angle reduces chatter in machining.
- Wedge type clamping system ensures stable clamping.
- Stepped machining is available without interruption of side wall of insert.



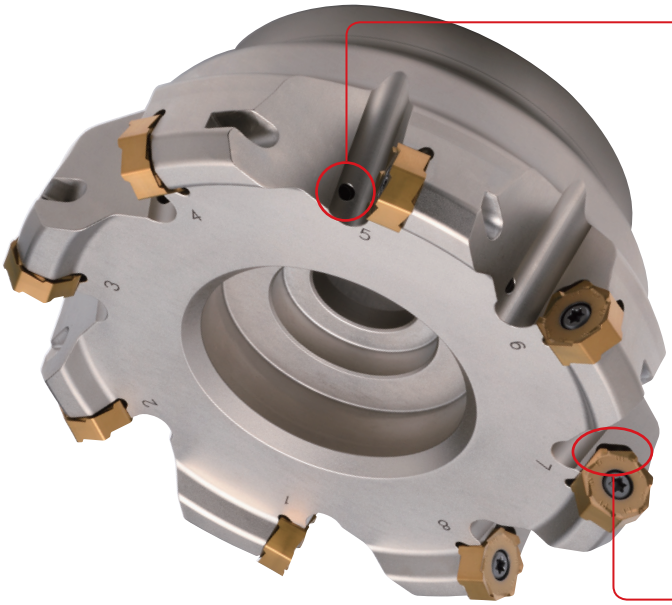
The biggest heptagonal lead angle

- Reduced workpiece chattering by reducing axial force



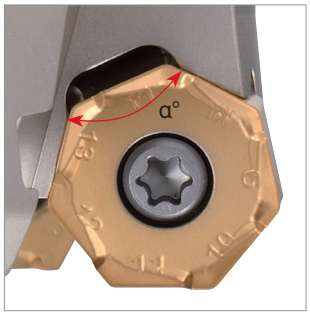
Preventing interruption of side wall

- Prevented interruption of side wall by using the most number of corners in deep facing (heptagonal 14 double-sided corners)



Internal coolant system

- Improved chip evacuation
- Increased tool life due to cooling insert



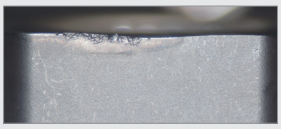
Wedge clamping system

- Stable clamping system with an acute angle structure

Longer tool life

【Stable machining】

[RM14]



[Competitor]

- **Workpiece** Ductile cast iron (500-7)
- **Cutting conditions** vc (m/min) = 150, fz (mm/t) = 0.25, ap (mm) = 3, ae (mm) = 50, wet
- **Tools** **Insert** XNMX0606XNR-ML (PC6510)
  Holder RM14XCM080R-27-6-XN06

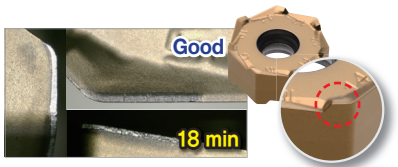
Stable machining with RM14 increases chipping resistance

▶ Longer tool life comparing to competitor's tool

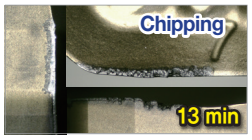
Performance evaluation

Wear resistance

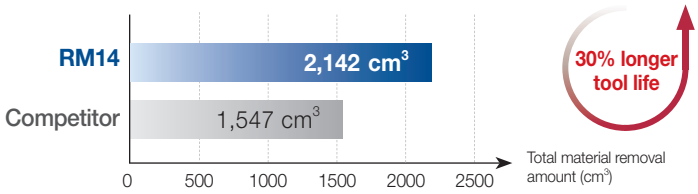
- **Workpiece** Ductile cast iron (600-3)
- **Cutting conditions** vc (m/min) = 250, fz (mm/t) = 0.2, ap (mm) = 2, wet
- **Tools** **Insert** XNMX0606XNR-ML (PC6510) **Holder** RM14XCM080R-27-6-XN06



[RM14]



[Competitor]

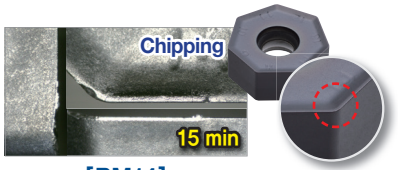


- Material removal rate Q (cm^3/min): 119
- Cutting time (min): 18

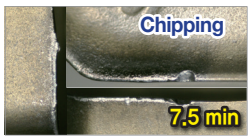
Wear resistance

(* : DIN)

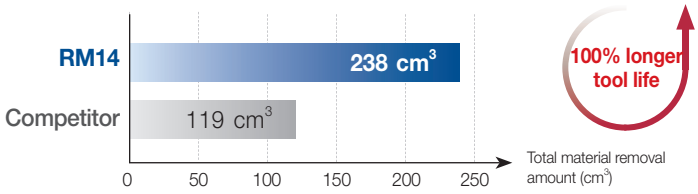
- **Workpiece** Heat resistance stainless steel (1.4849 *)
- **Cutting conditions** vc (m/min) = 100, fz (mm/t) = 0.2, ap (mm) = 2, dry
- **Tools** **Insert** XNMX060608-ML (PC9540) **Holder** RM14XCM080R-27-6-XN06



[RM14]



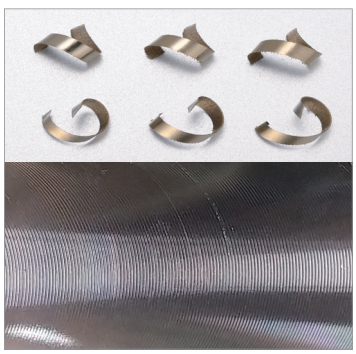
[Competitor]



- Material removal rate Q (cm^3/min): 15.9
- Cutting time (min): 15

Surface finish

- **Workpiece** Stainless steel (X5CrNiMo17-12-2)
- **Cutting conditions** vc (m/min) = 100, fz (mm/t) = 0.15, ap (mm) = 2, ae (mm) = 50, dry
- **Tools** **Insert** XNMX0606XNR-ML (PC9540) **Holder** RM14XCM080R-27-6-XN06



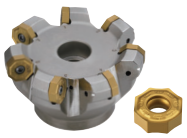
[RM14]

[Competitor]

Face mill tool selection guide

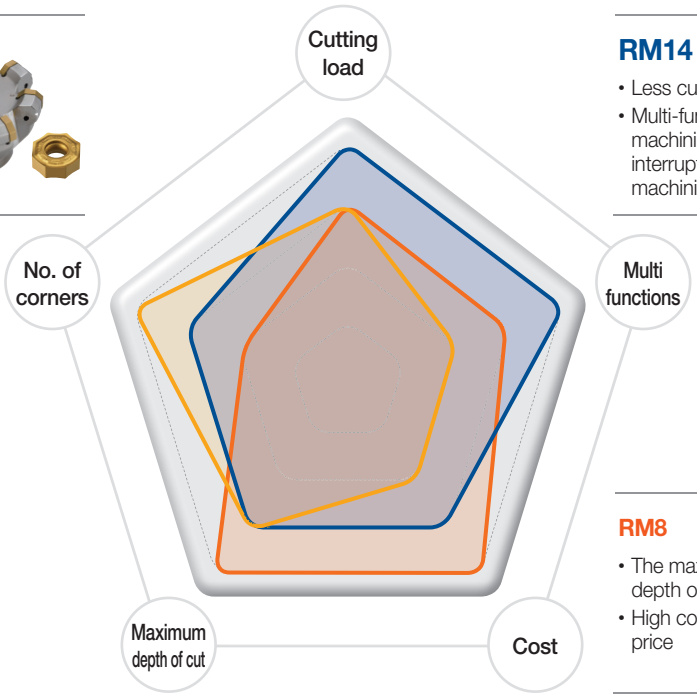
RM16

- The most no. of corners



RM14 new

- Less cutting load
- Multi-functional machining (preventing interruption in deep machining)



RM8

- The maximum depth of cut
- High competitive price

Tools	Cutting load	Multi functions	Cost	Maximum depth of cut	No. of corners
RM14 new	★★★★★	★★★★★	★★★	★★★	★★★
RM8	★★★	★★★	★★★★★	★★★★★	★★
RM16	★★★	★★	★★	★★★	★★★★★

Recommended cutting conditions

ISO	Workpiece	ISO (DIN)*	AISI	KS	HB	Grade	Cutting conditions					
							Helix			Flat		
							vc (m/min)	fz (mm/t)	ap (mm)	vc (m/min)	fz (mm/t)	ap (mm)
M	Austenite	X5CrNi18-9 X5CrNiMo17-12-2	304 316	STS304 STS316	160-180	PC9540 (PC5300)	80-160	0.3-0.05	1-3	90-150	0.25-0.05	1-3
	Heat resistance stainless steel	(1.48□□)*	-	-	160-200	PC9540 (PC5300)	60-100	0.2-0.05	1-2	60-100	0.25-0.05	1-3
K	Gray cast iron	250 (GG 25)*	No 35 B	GC250	180-240	NCM535 (PC6510)	200-300	0.3-0.1	2-3	200-300	0.25-0.1	2-3
	Ductile cast iron	500-7 (GGG 50)*	80-55-06	GCD500	150-230	PC6510 (PC5300)	110-230	0.3-0.1	2-3	150-200	0.3-0.1	2-3
		600-3 (GGG 60)*	-	GCD600	170-270	PC6510 (PC5300)	85-200	0.25-0.15	2-3	150-200	0.25-0.15	2-3

Recommended grade and cutting edge

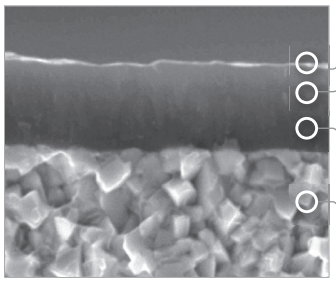
(● : 1st recommendation)

Type			Recommended grade and cutting edge by workpiece							
			M				K			
			Austenitic stainless steel		Heat resistance stainless steel		Gray cast iron		Ductile cast iron	
			Type	Grade	Type	Grade	Type	Grade	Type	Grade
Flat			-	● PC9540 ○ PC5300 ○ PC5400	●	● PC9540 ○ PC5300 ○ PC5400	-	○ PC6510 ○ PC5300 ● NCM535	-	● PC6510 ○ PC5300 ○ NCM535
Helix			●	● PC9540 ○ PC5300 ○ PC5400	-	● PC9540 ○ PC5300 ○ PC5400	●	○ PC6510 ○ PC5300 ● NCM535	●	● PC6510 ○ PC5300 ○ NCM535

Grade features

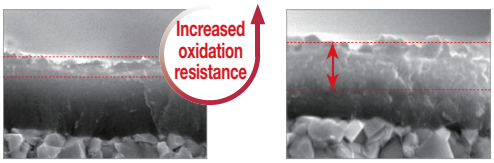
Universal grade PC5300

- PVD coating layer with high hardness and oxidation resistance during machining at high temperature
  → Superior oxidation resistance during machining of steel, cast iron, stainless steel, and heat-resistant alloys
- Ultra fine grain substrate with high toughness and special treatment on the surface
  → Improved welding resistance and chipping resistance



- Coating layer with high surface finish
  → Superior welding resistance
- Coating layer with high hardness and oxidation resistance during machining at high temperature
  → Superb wear resistance during machining at high speeds
- Coating layer with high toughness and high adhesive strength
  → Excellent chipping resistance
- Ultra fine grain substrate with high toughness
  → Great fracture resistance and stability in machining

[Coating layer with oxidation resistance during machining at high temperature (after 900°c heat treatment)]

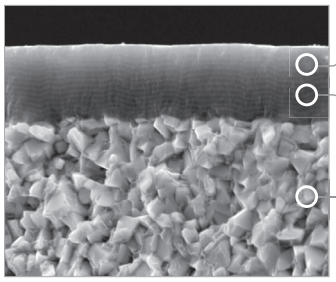


[PC5300]
No oxidized layer

[Competitor]
Oxidized between layers

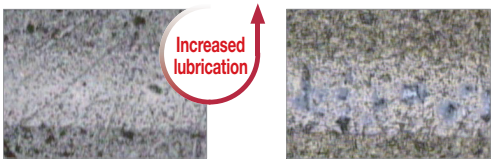
Universal grade PC5400

- Coating layer with excellent lubrication → Improved wear resistance and surface roughness at low speed machining or machining of deposited materials and mild steel
- Ultra fine and high toughness substrate and high toughness coating layer → Stable machinability due to increased chipping resistance and fracture resistance



- Increased lubrication coating layer
  → Good welding resistance and high machinability in carbon steel and mild steel machining
- Coating layer with high toughness and high adhesive strength
  → Superior chipping resistance
- Ultra fine grain substrate with high toughness
  → Fracture resistance and high stability at machining

[Surface of the layer rubbed with C45 ball]

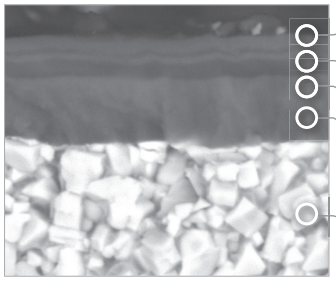


[PC5400]
The substrate is not exposed due to any welding and splintering.

[Competitor]
The substrate is exposed easily due to welding and splintering.

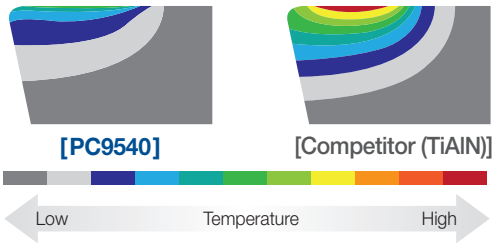
Milling grade for stainless steel machining PC9540 new

- Optimally designed PVD grade in medium to roughing of stainless steel milling and high interrupted machining
- Longer tool life due to increased fracture resistance from high toughness substrate controls spreading of cracks
- Good machinability in hard-to-cut material machining due to applying new PVD oxide film with oxidation resistance and heat resistance
- Stable machining preventing welding and chipping from special coating layer treatment technology



- Improved surface finish
  → Good welding resistance
- PVD multilayer
  → Controlling crack growth
- PVD oxide film
  → Good oxidation and heat resistance
- PVD nitride film
  → Good wear resistance
- High toughness substrate
  → Good breakage resistance

[New PVD oxide film (Comparison of thermal conductivity)]



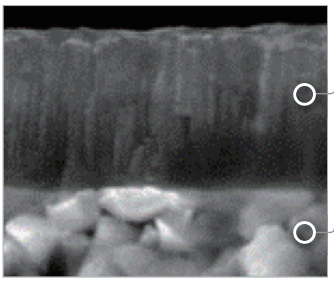
[PC9540]

[Competitor (TiAlN)]

Grade features

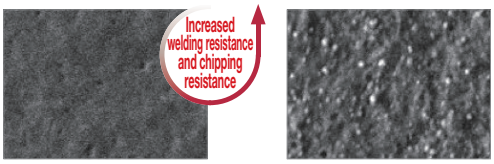
Milling grade for cast iron machining New PC6510 new

- Optimal PVD coating for universal cast iron machining controls fracture due to thermal crack.
- Surface treatment technology controls welding and compression of chip on the insert surface.
- High productivity and stable tool life are ensured.



- TiAlN coating layer with high wear resistance and toughness increases stability in machining.
- The optimal substrate with wear resistance and fracture resistance in cast iron machining ensures stable tool life.

[Applied surface treatment technology]



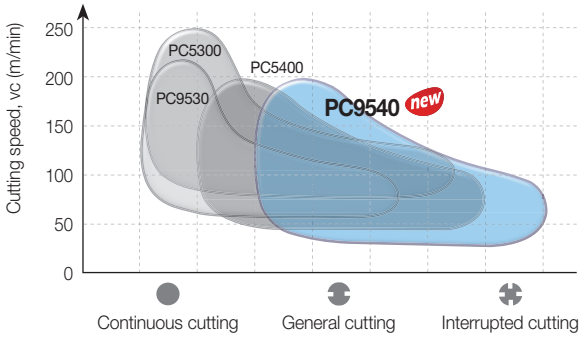
[New PC6510] [PC6510]

Grade selection guide

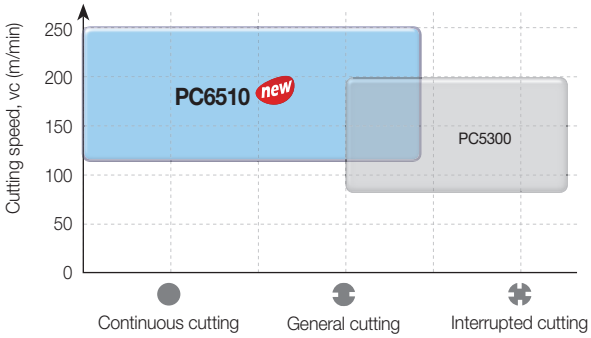
Workpiece		Machining types	Grade	Recommended cutting speed (m/min)	ISO	Application range
M	Stainless steel	Continuous cutting	PC5300	**130** (100-160)	M30	PC5300
		Interrupted cutting	PC5400	**120** (95-155)	M40	PC5400
			PC9540 new	**110** (80-140)	M50	PC9540 new
K	Cast iron	Continuous cutting	PC6510 new	**180** (140-230)	K10	PC6510 new
		Interrupted cutting	PC5300	**145** (110-180)	K20	PC5300
			PC5400	**125** (85-160)	K30	PC5400

Application range

M



K



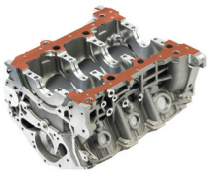
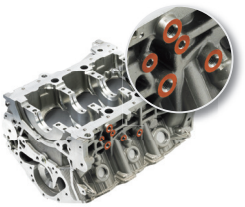
Main machining examples guideline

M 【Turbo charger turbine housings】

(* : DIN)

Type	Finishing	Medium cutting to roughing	Highly iterrupted cutting
ISO	M25 - M30	M40	M40
Recommended grade	PC5300, PC9530	PC9540	PC9540
Workpiece	Heat resistance stainless steel (1.48□□)*	Heat resistance stainless steel (1.48□□)*	Heat resistance stainless steel (1.48□□)*
Machining type	Wet machining with low depth of cut on the rough machined part	Dry machining with high depth of cut on the wide machined part	Unstable machining with high and frequent interruption
Machined part			

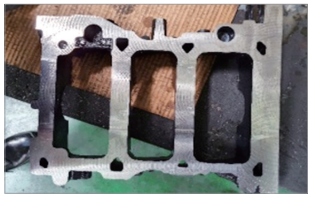
K 【Cylinder blocks】

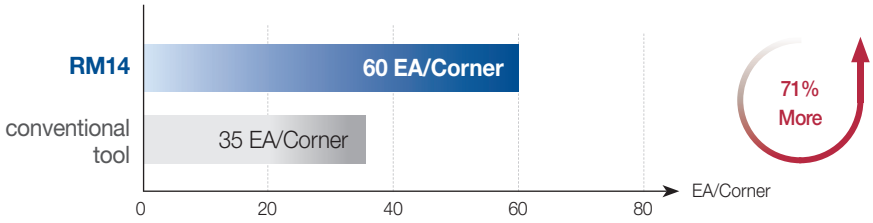
ISO	General cutting	Multi-purpose	High interruptions
Recommended grade	New PC6510	New PC6510	PC5300
Workpiece	Gray cast iron, nodular graphite cast iron (ductile cast iron)	Gray cast iron, nodular graphite cast iron (ductile cast iron)	Gray cast iron, nodular graphite cast iron (ductile cast iron)
Machining type	General cutting for wide areas	Multi-purpose cutting for various shapes	Highly interrupted and unstable cutting
Machined part	Top & Bottom face 	Front & Rear face 	Bosses 

Cutting performance

Ductile cast iron (GCD450)

- **Workpiece use** Bed plate
- **Cutting conditions** vc (m/min) = 247, fz (mm/t) = 0.22, ap (mm) = 1, wet
- **Tools** **Insert** XNMX060608-ML (PC6510) **Holder** RM14XCM125R-40-10-XN06

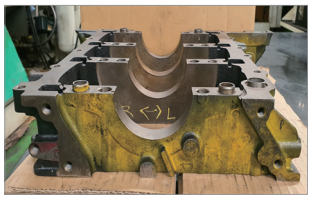


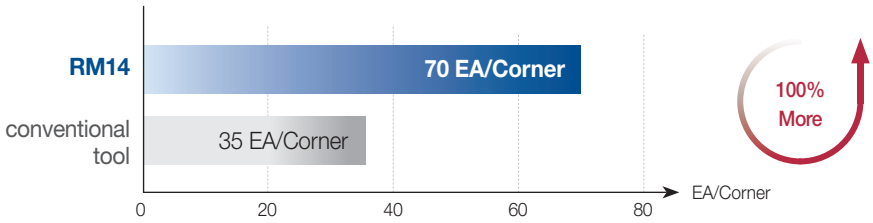


▶ 71% longer tool life than conventional tool's

Ductile cast iron (GCD450)

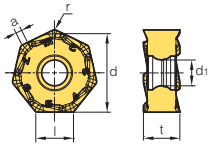
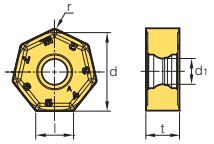
- **Workpiece use** Bed plate
- **Cutting conditions** vc (m/min) = 200, fz (mm/t) = 0.16, ap (mm) = 2, wet
- **Tools** **Insert** XNMX0606XNR-ML (PC6510) **Holder** RM14XCM100R-32-10-XN06





▶ 100% longer tool life than conventional tool's

Insert

Inserts	Designation	Dimensions (mm)						Coated					Geometries
		l	d	t	r	d_1	a	NCM535	PC6510	PC9540	PC5300	PC5400	
	XNMX0606XNR-ML	6.7	14.0	6.5	0.8	4.6	1.0	●	●	●	●	●	
	XNMX060608-ML	6.7	14.0	6.0	0.8	4.6	-			●	●	●	

RM14XCM-XN06

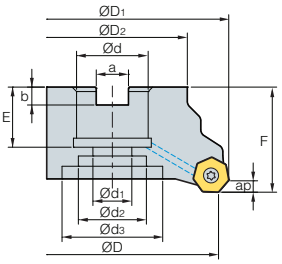


Fig. 1

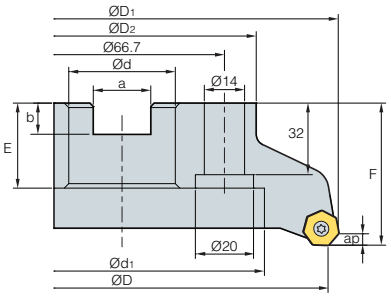


Fig. 2

AA
51°
• AR: -6°
• RR: -9°

(mm)

Designation		Stock		ØD	ØD1	ØD2	Ød	Ød1	Ød2	Ød3	a	b	E	F	ap	kg	Available inserts	Fig.
RM14XCM	050R-22-5-XN06	●	5	50	58.6	42	22	11	18	-	10.4	6.3	21	40	3.5	0.34		1
	050R-22-6-XN06	●	6	50	58.6	42	22	11	18	-	10.4	6.3	21	40	3.5	0.34		1
	063R-22-6-XN06	●	6	63	71.6	42	22	11	18	-	10.4	6.3	21	40	3.5	0.51		1
	063R-22-8-XN06	●	8	63	71.6	42	22	11	18	-	10.4	6.3	21	40	3.5	0.58		1
	080R-27-6-XN06	●	6	80	88.6	57	27	14	20	35	12.4	7.0	23	50	3.5	0.98		1
	080R-27-8-XN06	●	8	80	88.6	57	27	14	20	35	12.4	7.0	23	50	3.5	1.08		1
	080R-27-10-XN06	●	10	80	88.6	57	27	14	20	35	12.4	7.0	23	50	3.5	1.07	XNMX06	1
	100R-32-10-XN06	●	10	100	108.6	67	32	18	26	42	14.4	8.0	25	63	3.5	1.60		1
	100R-32-12-XN06	●	12	100	108.6	67	32	18	26	42	14.4	8.0	25	63	3.5	1.58		1
	125R-40-12-XN06	●	12	125	133.6	90	40	22	32	54	16.4	9.0	29	63	3.5	3.43		1
	125R-40-14-XN06	●	14	125	133.6	90	40	22	32	54	16.4	9.0	29	63	3.5	3.40		1
	160NR-40-16-XN06	●	16	160	168.6	110	40	90	-	-	16.4	9.0	32	63	3.5	4.86		2
	160NR-40-18-XN06	●	18	160	168.6	110	40	90	-	-	16.4	9.0	32	63	3.5	4.84		2

※ In applying XNMX060608-□□, Max. ap = 4.8 mm

●: Stock item None: Order made

Available inserts

XNMX-ML

XNMX-ML

Designation		Coated				
		NCM535	PC6510	PC9540	PC5300	PC5400
XNMX	0606XNR-ML	●	●	●	●	●
	060608-ML			●	●	●

Available arbors

Designation		Ød	Available arbors
RM14XCM	050R	22	BT□□-FMC22-□□
	063R		
	080R	27	BT□□-FMC27-□□
	100R	32	BT□□-FMC32-□□
	125R	40	BT□□-FMC40-□□
	160R		

Parts

Specification	Screw	Wrench
Ø50~Ø160	FTKA0412B	TW15S

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