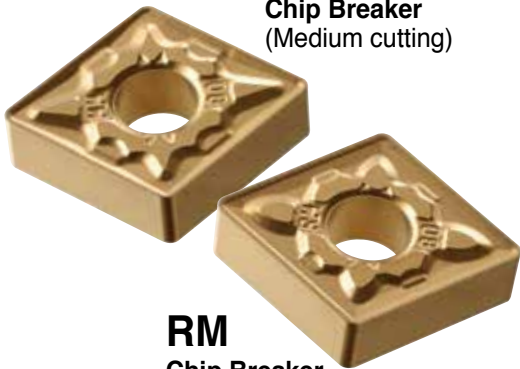


NC9115/NC9125/NC9135

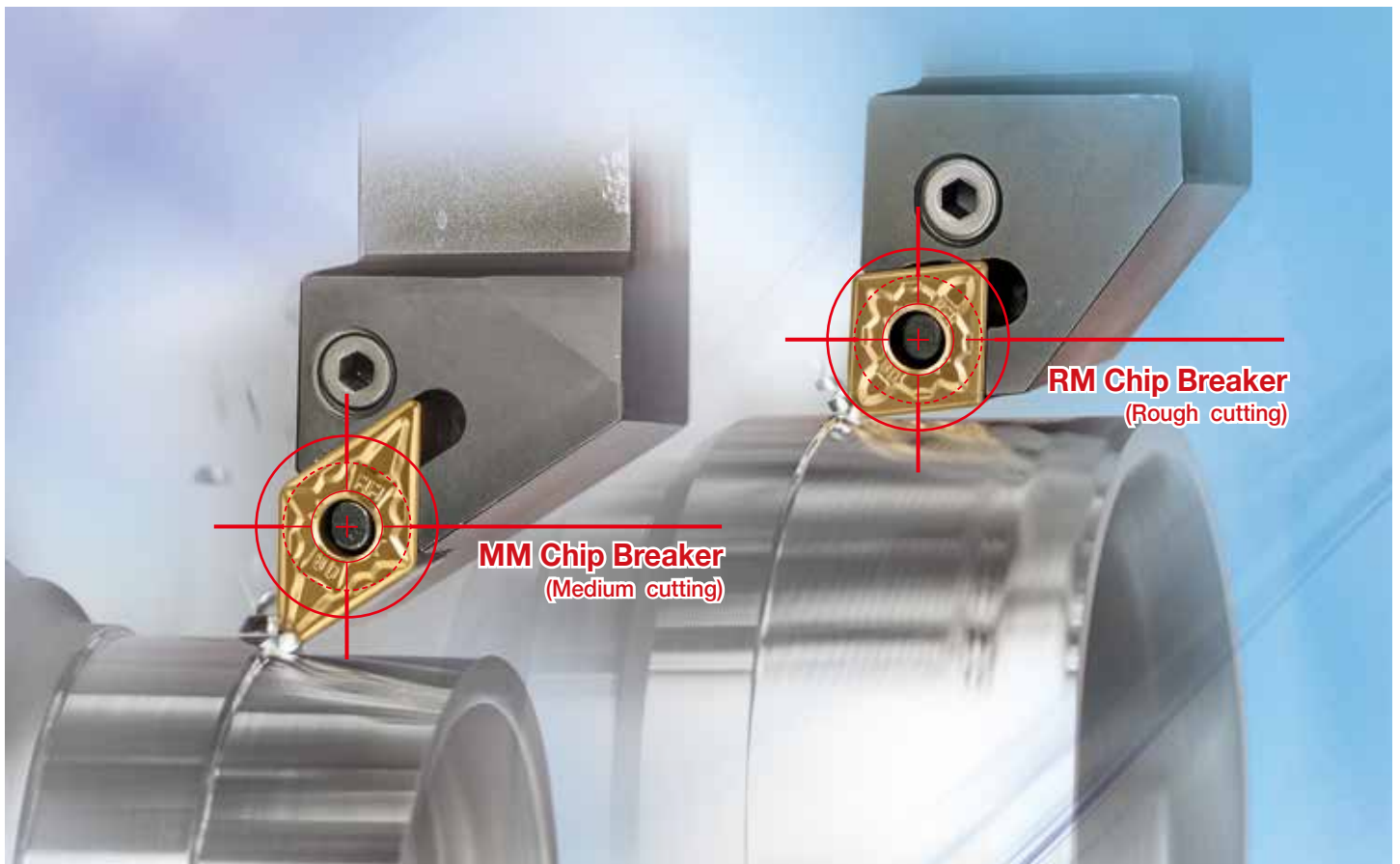
MM
Chip Breaker
(Medium cutting)



RM
Chip Breaker
(Rough cutting)

CVD Coated Turning Inserts for Stainless Steel

- **Increased Productivity**
Extended tool life at high speeds, feeds, and depths of cut
- **Comprehensive Use**
A wide grade lineup for most workpiece sizes and types, including heavy interruption (NC9115/NC9125/NC9135)
- **Solutions for Most Common Issues in Stainless Steel Machining**
Prevents built-up edge, notch wear, plastic deformation, and burr creation



High-performance Turning Grade and Chip Breaker for Austenitic, Martensitic, and Ferritic Stainless Steel

Stainless steels can be roughly divided into three types - the austenite, the martensite and the ferrite. They feature smooth surfaces and excellent corrosion resistance. Their use typically requires no need for surface paints or colors. The most commonly used stainless steels are high hardness types such as 13Cr, 18Cr, 18Cr-8Ni, etc.



MM Chip Breaker

Medium cutting



RM Chip Breaker

Rough cutting

The reason Stainless Steel is often considered a hard-to-cut material is its large shearing resistance that can easily cause work hardening, built-up edges, and edge fracture. Its combination of tough and hard material characteristics require the prudent selection of grades and chip breakers. These challenges led KORLOY to develop the CVD coated turning grade series, NC9115 / NC9125 / NC9135 along with new chip breakers MM (for medium cutting) and RM (for roughing). **The NC9100 Series** can solve most Stainless Steel machining problems with its combination of three layers – the top coat protects against welding, the coating layers protect against wear even at high speeds over 150m/min, and the tough substrate against chipping.

The MM chip breaker for medium cutting is the 1st recommended for stainless steel. Its dual angle land design allows for both sharp cutting performance and strong cutting edges, which promotes extended tool life and minimized cutting force and built-up edge. In addition, wide chip pockets prevent chips from interrupting the minor cutting edges and instead lets the chips out of the cutting area. These chip breaker features help prevent plastic deformation and excessive wear.

The RM chip breaker for roughing is recommended in rough machining and in cases where burrs are an issue. It has a wide land and rake angle lowering cutting resistance. Cutting heats can flow around the gentle slope of rake surface and can be effectively dispersed and evacuated at high feeds and high depths of cut.

- Solving the four main issues in stainless steel machining

→ Prevents built-up edge, notch wear, plastic deformation, and burrs
- Stable tool life at high speeds, feeds, and depths of cut

→ In case of STS316, high speeds available over 150m/min

→ High chip removal rate for higher productivity

→ Shortened cutting time due to higher cutting conditions
- Ideal combination of grade and chip breaker

→ Stable tool life

→ Applicable to a wide range of applications from roughing to finishing
- Versatile applications for different workpiece materials

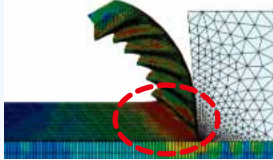
→ Machining of various workpiece such as austenitic, martensitic and ferritic stainless steel

CVD Coated Grade NC9100 Series



Common Problems when Machining Stainless Steel

- Sheared chips impact cutting edges repeatedly and cause edge damage.
- Difficult chip breakage leads to built-up edge, work hardening, and promotes excessive notch wear.

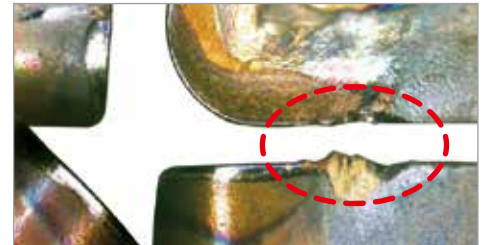


• Low heat conductivity in stainless steel machining involves high cutting heat and shear chips, all of which are **concentrated on the cutting edge**

1. Built-up edge



2. Notch wear

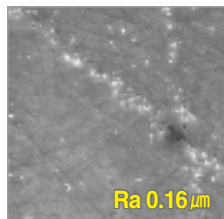


NC9100 Series (NC9115/NC9125/NC9135) Development

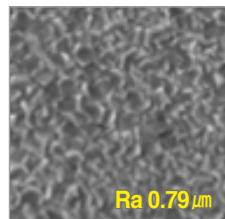
- Excellent coating film for medium/rough turning of stainless steel
- Optimized substrate for different cutting speeds, feeds, and degrees of interruption

• The NC9100 series shows improved surface finish compared to the existing coating film

Lubricative coating layer to prevent built-up edge

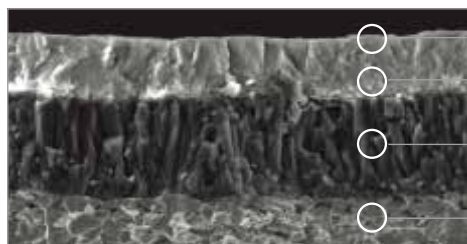
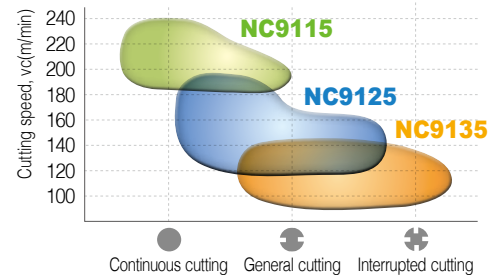


[NC9100 Series]



[Existing coating]

Grade lineup



- Top coat with higher welding resistance
- Alumina layer for high speed machining
- MT CVD-TiCN layer with higher chipping resistance
- High toughness substrate optimal for all continuous/low or high interrupted machining

Development Effects

- Improved chipping resistance and high toughness substrate → **Reduces notch wear**
- Lubricative coating film → **Higher welding resistance**

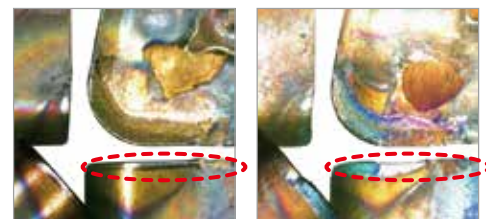
1. Inhibited built-up edge and blade damage



[NC9125 (M25)]

[Competitor (M25)]

2. Inhibited notch wear and relief surface wear



[NC9135 (M35)]

[Competitor (M35)]

MM Chip Breaker (For medium cutting) M

- The 1st recommended chip breaker for stainless steel machining
- Sharp cutting performance and insert toughness achieved by the use of a dual land
- Wide chip pockets for stable chip evacuation at high feeds/depths of cut

MM Chip Breaker Features

Variable Land

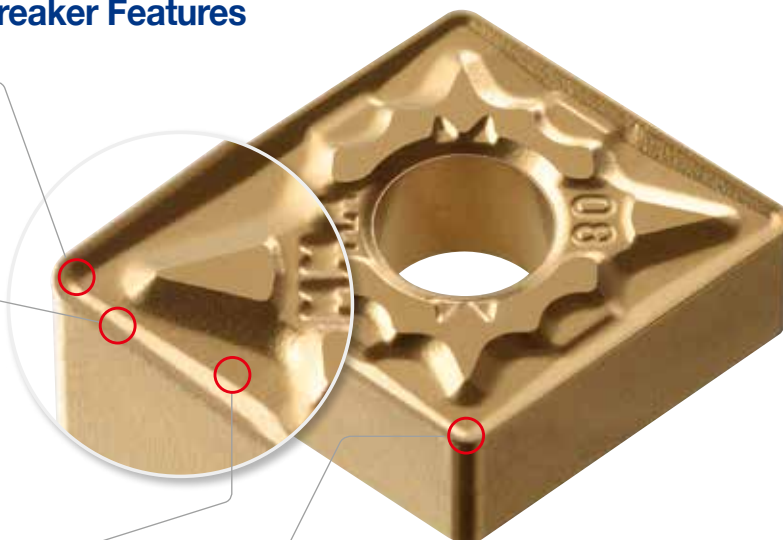
- Excellent chip control and sharp cutting at low depths of cut
- Delays crater wear
- Prevents plastic deformation

Dual Land

- Balance between requirements of sharp and tough cutting edges
- Sharp cutting edge for high speed machining
- Prevents chipping in interrupted machining

Wide Chip Pocket

- Stable chip evacuation at high speeds/feeds
- Improved surface finishes by reduced workpiece scratches caused by work-hardened chips at high depths of cut
- Prevents built-up edge



Low Cutting Force at 100° corner

- 100° corner angle is recommended for roughing outer diameters and preventing burrs
- Reduced cutting load for high feed machining

[Chip Breaker Code]

MM

Workpiece range

- P : Steel
- **M : Stainless Steel**
- K : Cast iron

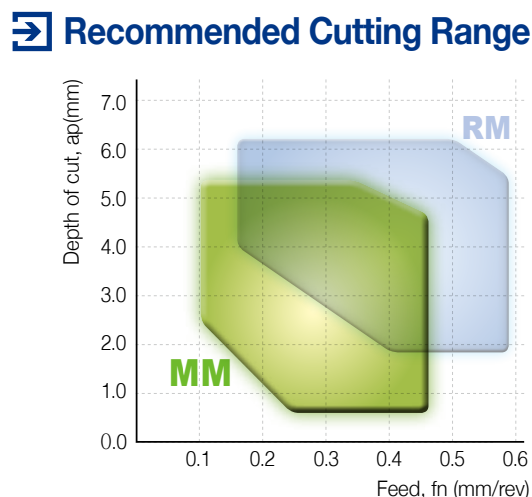
Application range

- F : Finish
- **M : Medium**
- R : Rough

Application Range

Continuous cutting	MM NC9115	RM NC9115
General cutting	MM NC9125	RM NC9125
Interrupted cutting	MM NC9135	RM NC9135

Medium Cutting Rough Cutting



Recommended Cutting Conditions

Application	Chip breaker	Recommended Cutting conditions					
		Depth of cut, ap (mm)			Feed, fn (mm/rev)		
		Min.	Recommended	Max.	Min.	Recommended	Max.
Medium cutting	MM	0.5	3.0	5.5	0.12	0.25	0.45

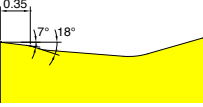
RM Chip Breaker (For rough cutting)

M

- The 1st recommended chip breaker for rough and interrupted machining of stainless steel
- Prevents notch wear and burrs at high feeds and depths of cut
- Reduced cutting force extends tool life in high feed machining

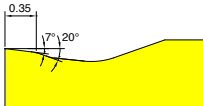
RM Chip Breaker Features

Variable Land



- Excellent chip control and sharp cutting at low depths of cut
- Delays crater wear
- Prevents plastic deformation

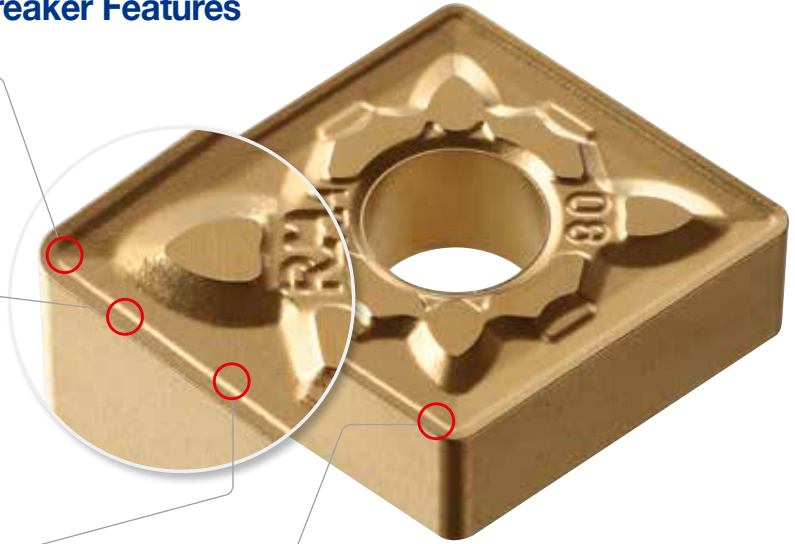
Wide Land & Gentle Front Angle



- Sharp cutting edges and wide land reduce cutting force
- Reduced burrs
- Dispersed cutting load enables higher toughness

Stepped Design

- Stepped design makes chip evacuation easier
- Smooth chip evacuation prevents plastic deformation



Low Cutting Force at 100° corner

- 100° corner angle is recommended for roughing outer diameters and preventing notch wear
- Stepped design reduces cutting load

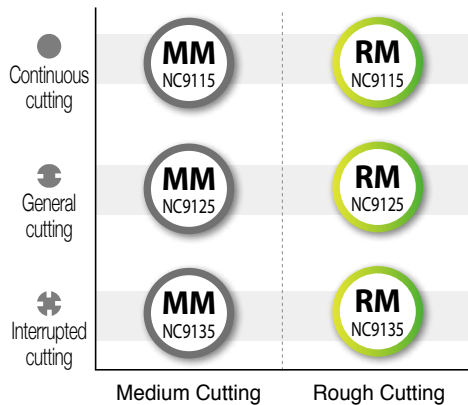
[Chip Breaker Code]

R M

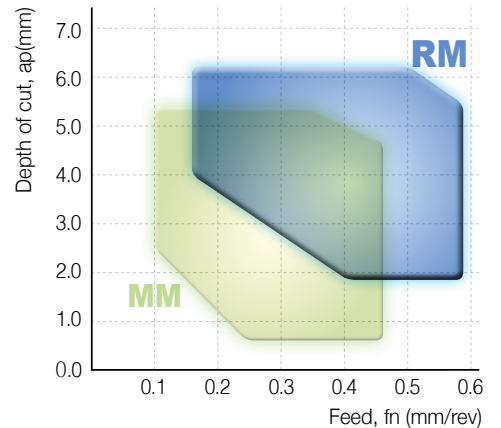
- Workpiece range**
- P : Steel
 - **M : Stainless Steel**
 - K : Cast iron

- Application range**
- F : Finish
 - M : Medium
 - **R : Rough**

Application Range



Recommended Cutting Range



Recommended Cutting Conditions

Application	Chip breaker	Recommended Cutting conditions					
		Depth of cut, ap (mm)			Feed, fn (mm/rev)		
		Min.	Recommended	Max.	Min.	Recommended	Max.
Rough cutting	RM	2.0	4.0	6.0	0.15	0.3	0.55

⇒ Cutting Performance

• A gentle slope of MM chip breaker **minimizes built-up edge**

• Improved surface finish and **chip control** from inhibited built-up edges

Built-up edge

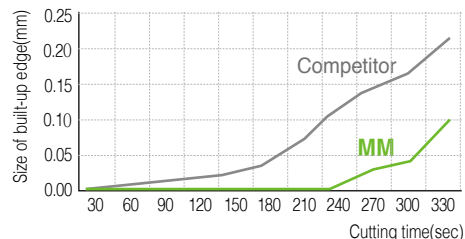
- Workpiece X6CrAl13 (Ferrite)
- Cutting conditions $vc(m/min) = 180$, $fn(mm/rev) = 0.3$, $ap(mm) = 3.0$, wet
- Tools Insert CNMG120408-MM (NC9125) Holder PCLNL2525-M12



[MM (NC9125)]



[Competitor]



• A wide land and rake angle of RM chip breaker **disperse cutting loads and prevents notch wear**

• Improved surface finish and **reduced burrs** by preventing notch wear

Notch wear

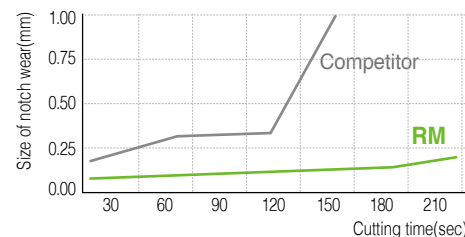
- Workpiece X12Cr13 (Martensite)
- Cutting conditions $vc(m/min) = 150$, $fn(mm/rev) = 0.25$, $ap(mm) = 3.0$, wet
- Tools Insert CNMG120408-RM (NC9115) Holder PCLNL2525-M12



[RM (NC9115)]



[Competitor]



• The MM chip breaker promptly dissipates the concentrated cutting edge heat to **prevent plastic deformation** during machining

• **Less vibration and cutting load** due to reduced plastic deformation

Plastic deformation

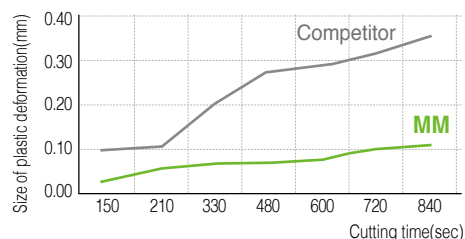
- Workpiece X5CrNiMo17-12-2 (Austenite)
- Cutting conditions $vc(m/min) = 200$, $fn(mm/rev) = 0.35$, $ap(mm) = 2.0$, dry
- Tools Insert CNMG120408-MM (NC9135) Holder PCLNL2525-M12



[MM (NC9135)]



[Competitor]



• The wide land and rake angle of the RM chip breaker **improves cutting performance and prevents burrs**

• Improved chip control improves surface finish and **extends tool life**

Burr

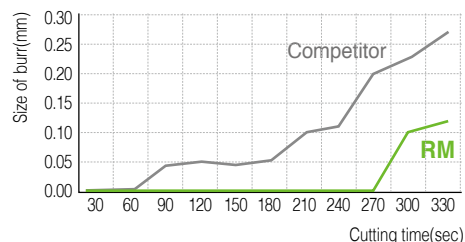
- Workpiece Duplex
- Cutting conditions $vc(m/min) = 120$, $fn(mm/rev) = 0.2$, $ap(mm) = 2.0$, dry
- Tools Insert CNMG120408-RM (NC9125) Holder PCLNL2525-M12



[RM (NC9125)]



[Competitor]



➔ Recommended Grade and Chip Breaker per Stainless Steel Type

• Machinability is related to the type of stainless steel.

• The Ferritic and the Martensite types are more machinable.

• The Duplex and PH types are the most difficult type to machine.

Austenitic Stainless Steel

- Heavy work hardening (Edge chipping accelerates wear)
- Poor heat conductivity (Three times lower than carbon steel → Increase in cutting area temperature)
- High ductility (Strong chance for deformation at high temperature → Long chips or tough chips occurs)
- Type : X10CrNiS18-9, X5CrNi18-9, X5CrNiMo17-12-2 etc.

Grade	Cutting speed(m/min)				
	50	100	150	200	250
NC9115				160	220
NC9125			150	200	
NC9135		100	150		

Continuous	Low interrupted	High interrupted
MM / RM	MM	-
MM / RM	MM / RM	RM
MM / RM	MM / RM	RM

Ferritic / Martensitic Stainless Steel

- Strong chance for work hardening at high temperature (Crater wear is promoted)
- High toughness through tempering and annealing (Long chips are easily created)
- High carbon contents increase its hardness)
- Type : X20Cr13, X12Cr13, X12CrS13, X70CrMo15 etc.

Grade	Cutting speed(m/min)				
	50	100	150	200	250
NC9115			150	250	
NC9125		120	220		
NC9135		100	150		

Continuous	Low interrupted	High interrupted
MM / RM	MM	-
MM / RM	MM / RM	RM
MM / RM	MM / RM	RM

Duplex Stainless Steel

- Its presence of both austenitic and ferritic fine matrix requires both types of cutting characteristics for each material's attribute.
- One of the most hard to cut stainless steels as its higher yield strength makes chip control harder than the Austenite
- Type : FeMi35Cr20Cu4Mo2*, X2CrNiMoN22.5.3*, X2CrNiMoN25.7.4*

Grade	Cutting speed(m/min)				
	50	100	150	200	250
NC9115			120	160	
NC9125		100	140		
NC9135	60	100			

Continuous	Low interrupted	High interrupted
MM / RM	MM	-
MM / RM	MM / RM	RM
MM / RM	MM / RM	RM

* Germany [DIN]

Precipitation Hardened(PH) Stainless Steel

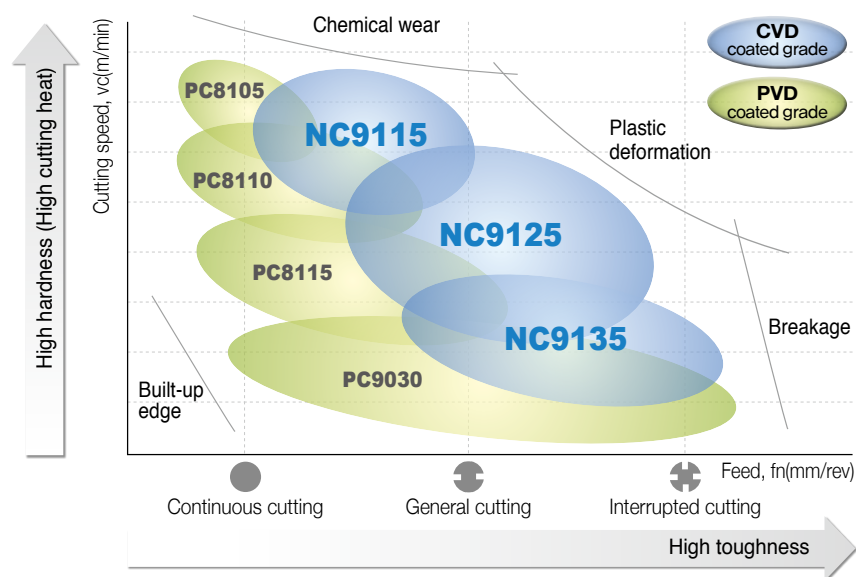
- High tensile strength (2 times higher than other stainless steels) increases cutting load
- Low heat conductivity cause cutting edge damage from high temp chips
- Type : X5CrNiCuNb16-4, X7CrNiAl17-7

Grade	Cutting speed(m/min)				
	50	100	150	200	250
NC9115	50	110			
NC9125	40	110			
NC9135	30	100			

Continuous	Low interrupted	High interrupted
MM / RM	MM	-
MM / RM	MM / RM	RM
MM / RM	MM / RM	RM

NC9115/NC9125/NC9135

Grade Lineup



Chip Removal Volume per Cutting Speed

Grade	ISO	Cutting speed (m/min)	Chip removal volume (cm ³)
NC9135	M35	150	212
PVD coated grade	M30		256
Competitor	M35		126
NC9135	M35	200	126
PVD coated grade	M30		56
Competitor	M35		66

→ Higher productivity than PVD grades at high speeds over 150m/min

- The NC9100 Series CVD coated grades are differentiated from PVD grades by their application range
- Compared to PVD coated grades with similar substrates, CVD coated ones have longer tool life over the PVD, in large scale rough machining at high speeds or in high temperature conditions
- The NC9115/NC9125/NC9135 grades are provided according to the degree of interruption or vibration during machining

Turning Grade Comparison Chart for Stainless Steel

ISO	KORLOY	Competitor A	Competitor B	Competitor C	Competitor D	Competitor E	Competitor F	Competitor G
M15	NC9115	TT9215	GC2015	CA6515	MC7015	TM2000	WAM10	AC610M
M25	NC9125	TT9225	GC2025	CA6525	MC7025	TM4000	WAM20	AC6030M
M35	NC9135	TT9235	GC235	-	US735	-	WAM30	AC630M

Turning Chip Breaker Comparison Chart for Stainless Steel (Negative type)

Application	KORLOY		Competitor A	Competitor B	Competitor C	Competitor D	Competitor E	Competitor F	Competitor G
	Main	Sub							
Rough cutting	RM	GS	ET	MR	MU	RM	M5	NR7	MU
Medium cutting	MM	HS	EM	MM	MS	MM	MF3	NM4	GU
Finish cutting	-	HA	EA	MF	-	LM	MF1	NS4	SU

Turning Chip Breaker Comparison Chart for Stainless Steel (Positive type)

Application	KORLOY	Competitor A	Competitor B	Competitor C	Competitor D	Competitor E	Competitor F	Competitor G
Medium cutting	MP	PC, MT	MM	HQ	MV	MF2	PS5	MU
Finish cutting	VL	FA	MF	MQ	FV	FF1	PF4	SU

⇒ Application Examples



Hydraulics part (Mechanical seal)

- Workpiece X5CrNi18-9
- Cutting conditions $vc(m/min) = 140$, $fn(mm/rev) = 0.28$, $ap(mm) = 3.0$, wet
- Tools
Insert CNMG120408-MM (NC9125)
Holder S32S-PCLCR-12

MM (NC9125) 9ea/edge
Competitor A (M25) 5ea/edge

80%
more

➔ Stable chip evacuation reduces cutting load and plastic deformation, which increases tool life 80% longer tool life than competitor A (M25)



Valve part (Piston valve)

- Workpiece X5CrNi18-9 (Solution treatment)
- Cutting conditions $vc(m/min) = 140$, $fn(mm/rev) = 0.28$, $ap(mm) = 3.0$, wet
- Tools
Insert CNMG120408-MM (NC9125)
Holder DCLNL2525-M12

MM (NC9125) 5ea/edge
Competitor B (M25) 2ea/edge

150%
more

➔ Dual land design combines sharp cutting performance and high toughness in high hardness machining 150% longer tool life than competitor B (M25)



Wind power/offshore plant part (Flange)

- Workpiece X6CrNiNb18-10* (Outer diameter roughing)
- Cutting conditions $vc(m/min) = 150$, $fn(mm/rev) = 0.3\sim 0.5$, $ap(mm) = 4.0\sim 6.0$, wet
- Tools
Insert CNMG160616-MM (NC9125)
Holder PCLNR3232-P16

MM (NC9125) 15ea/edge
Competitor C (M25) 10ea/edge

50%
more

➔ 50% longer tool life than competitor C (M25)



Wind power/offshore plant part (Flange)

- Workpiece X6CrNiNb18-10* (Inner diameter finishing)
- Cutting conditions $vc(m/min) = 175$, $fn(mm/rev) = 0.45$, $ap(mm) = \sim 1.0$, wet
- Tools
Insert SNMG190616-MM (NC9125)
Holder S50U-PCLCR-19

MM (NC9125) 12ea/edge
Competitor D (M25) 8ea/edge

50%
more

➔ 50% longer tool life than competitor D (M25)

* Germany [DIN]

Application Examples



Wind power plant part (Flange)

- Workpiece X5CrNiMo17-12-2
- Cutting conditions $vc(m/min) = 175$, $fn(mm/rev) = 0.3\sim 0.8$, $ap(mm) = 0.5$, wet
- Tools
 Insert TNMG220416-RM (NC9135)
 Holder PTFNR3232-P22

RM (NC9135)	5ea/edge
Competitor E (M35)	2ea/edge

150% more

➔ Extended tool life from improved chipping resistance and reduced built-up edge
150% longer tool life than competitor E (M35)



Plant part (Flange)

- Workpiece Super Duplex
- Cutting conditions $vc(m/min) = 100$, $fn(mm/rev) = 0.5$, $ap(mm) = 3$, wet
- Tools
 Insert CNMG160616-MM (NC9125)
 Holder PCLNR3232-P16

MM (NC9125)	12ea/edge
Competitor F (M25)	8ea/edge

50% more

➔ Extended tool life from inhibited wear and chipping
50% longer tool life than competitor F (M25)



Hydraulics part

- Workpiece Duplex
- Cutting conditions $vc(m/min) = 120$, $fn(mm/rev) = 0.4$, $ap(mm) = 6$, wet
- Tools
 Insert CNMG160616-RM (NC9125)
 Holder DCLNR3232-P16

RM (NC9125)	7ea/edge
Competitor G (M25)	5ea/edge

40% more

➔ Improved blade stability compared to competitor's
40% longer tool life than competitor G (M25)



Machinery part



- Workpiece X5CrNi18-9
- Cutting conditions $vc(m/min) = 180$, $fn(mm/rev) = 0.4$, $ap(mm) = 1.5$, wet
- Tools
 Insert CNMG120408-MM (NC9125)
 Holder DCLNL2525-M12


MM (NC9125)	6ea/edge
VM (PC9030)	3ea/edge

100% more

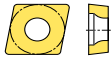


➔ Extended tool life from superior resistance to built-up edge and wear compared to PC9030
100% higher productivity than PC9030 under higher cutting conditions

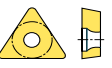
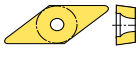
➤ Available Stock [Negative type]

Insert shape	Designation	Application	Stock				
			NC9115	NC9125	NC9135		
	CNMG	Medium cutting	120408-MM	●	●	●	
			120412-MM	●	●	●	
			120404-MP	●	●	●	
			120408-MP	●	●	●	
			120412-MP	●	●	●	
			120416-MP	●	●	●	
			160608-MP	●	●	●	
			160612-MP	●	●	●	
			190616-MP	●	●	●	
		Rough cutting	120408-RM	●	●	●	
			120412-RM	●	●	●	
			150408-MM	●	●	●	
	DNMG	Medium cutting	150412-MM	●	●	●	
			150608-MM	●	●	●	
			150612-MM	●	●	●	
			150404-MP	●	●	●	
			150408-MP	●	●	●	
			150412-MP	●	●	●	
			150604-MP	●	●	●	
			150608-MP	●	●	●	
			150612-MP	●	●	●	
			Rough cutting	150408-RM	●	●	●
				150412-RM	●	●	●
				150608-RM	●	●	●
		150612-RM	●	●	●		

Insert shape	Designation	Application	Stock			
			NC9115	NC9125	NC9135	
	SNMG	Medium cutting	120404-MM	●	●	●
			120408-MM	●	●	●
			120404-MP	●	●	●
			120408-MP	●	●	●
			120412-MP	●	●	●
			120404-RM	●	●	●
		Rough cutting	120408-RM	●	●	●
			TNMG	Medium cutting	160404-MM	●
160408-MM	●	●			●	
160404-MP	●	●			●	
160408-MP	●	●			●	
160412-MP	●	●			●	
220404-MP	●	●			●	
220408-MP	●	●			●	
220412-MP	●	●			●	
Rough cutting	160404-RM	●			●	●
	160408-RM	●		●	●	
	VNMG	Medium cutting		160404-MP	●	●
160408-MP				●	●	●
WNMG			Medium cutting	080408-MM	●	●
	080412-MM	●		●	●	
	080404-MP	●		●	●	
	080408-MP	●		●	●	
	080412-MP	●		●	●	
	Rough cutting	080408-RM		●	●	●
080412-RM		●	●	●		

➤ Available Stock [Positive type]

Insert shape	Designation	Application	Stock			
			NC9115	NC9125	NC9135	
	CCMT	Finishing	060204-VL	●	●	●
			09T304-VL	●	●	●
			09T308-VL	●	●	●
		Medium cutting	060202-MP	●	●	●
			060204-MP	●	●	●
			09T302-MP	●	●	●
			09T304-MP	●	●	●
			09T308-MP	●	●	●
			09T308-MP	●	●	●
	DCMT	Finishing	070204-VL	●	●	●
			11T304-VL	●	●	●
			11T308-VL	●	●	●
		Medium cutting	070202-MP	●	●	●
			070204-MP	●	●	●
			070208-MP	●	●	●
			11T302-MP	●	●	●
			11T304-MP	●	●	●
			11T308-MP	●	●	●
	SCMT	Finishing	09T304-VL	●	●	●
			09T308-VL	●	●	●
			09T304-MP	●	●	●
		Medium cutting	09T308-MP	●	●	●
			120408-MP	●	●	●

Insert shape	Designation	Application	Stock					
			NC9115	NC9125	NC9135			
	TCMT	Finishing	16T304-VL	●	●	●		
			16T308-VL	●	●	●		
			090204-MP	●	●	●		
		Medium cutting	090208-MP	●	●	●		
			110202-MP	●	●	●		
			110204-MP	●	●	●		
			110208-MP	●	●	●		
			16T304-MP	●	●	●		
			16T308-MP	●	●	●		
			16T312-MP	●	●	●		
			TPMT	Finishing	110304-VL	●	●	●
					VBMT	Finishing	160404-VL	●
160408-VL	●	●					●	
160412-VL	●	●	●					
Medium cutting	160404-MP	●	●	●				
	160408-MP	●	●	●				
	160412-MP	●	●	●				
	VCMT	Finishing	160404-VL	●	●	●		
			160408-VL	●	●	●		
			160404-MP	●	●	●		
		Medium cutting	160408-MP	●	●	●		
			160412-MP	●	●	●		

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