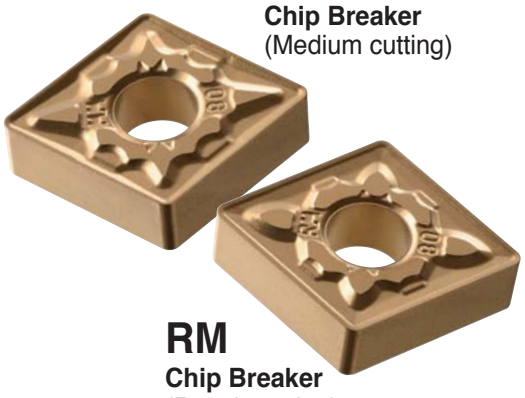
KORLOY
TECH-NEWS

NC9115/NC9125/NC9135

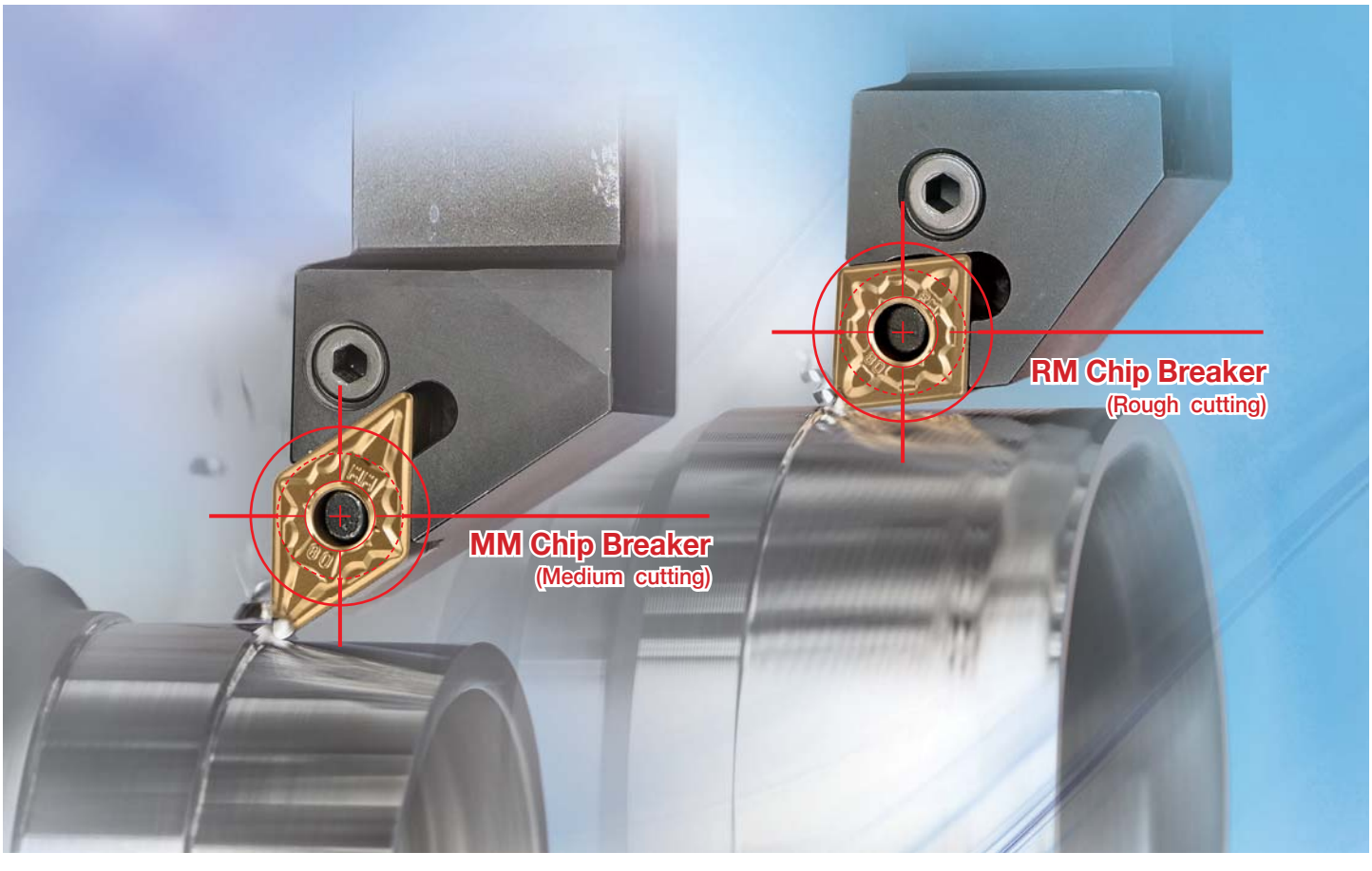


MM
Chip Breaker
(Medium cutting)

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



KORLOY

High-performance Turning Grade and Chip Breaker

for Austenitic, Martensitic, and Ferritic Stainless Steel

MM Chip Breaker — Medium cutting

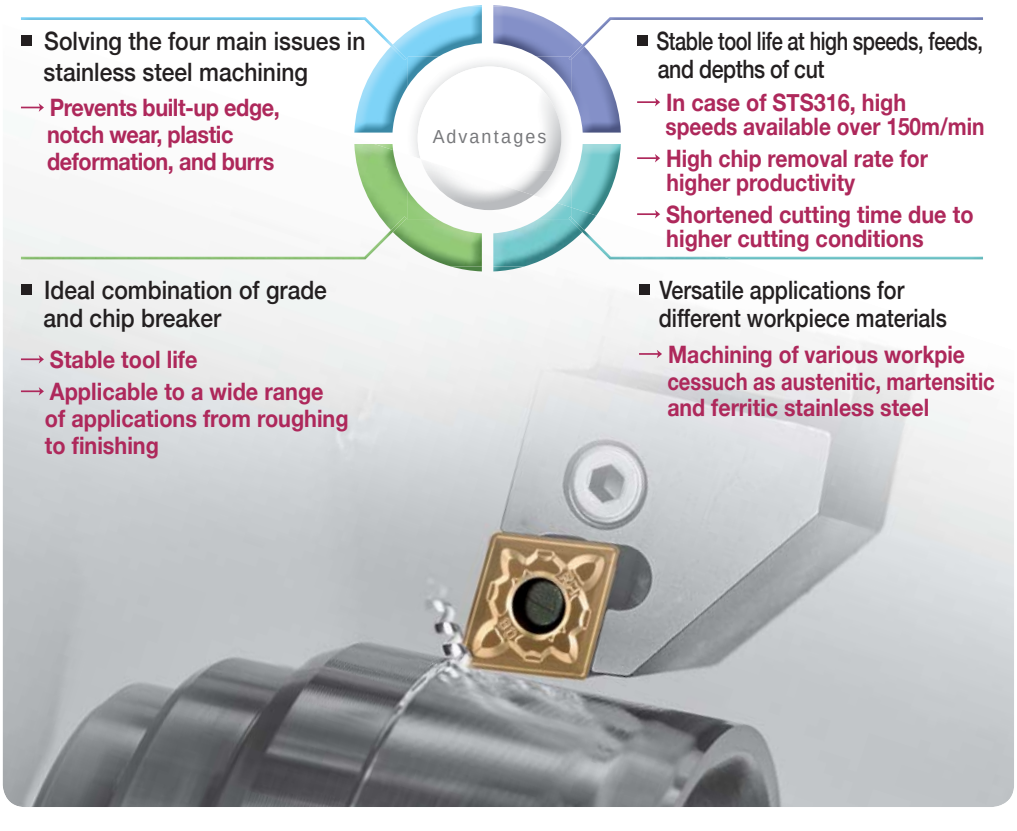
RM Chip Breaker — Rough cutting

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.

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.

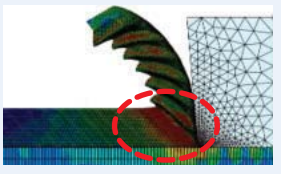
The RM chip breaker for roughing is recommended in rough machining and in cases where burrs are an issue. It has a wide land and rake angle lowering cutting resistance. Cutting heats can flow around the gentle slope of rake surface and can be effectively dispersed and evacuated at high feeds and high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



CVD Coated Grade NC9100 Series M

Common Problems when Machining Stainless Steel

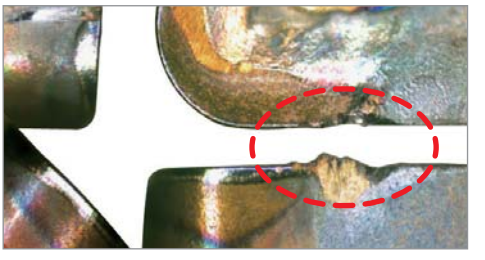
- Sheared chips impact cutting edges repeatedly and cause edge damage.
- Difficult chip breakage leads to built-up edge, work hardening, and promotes excessive notch wear.



• 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

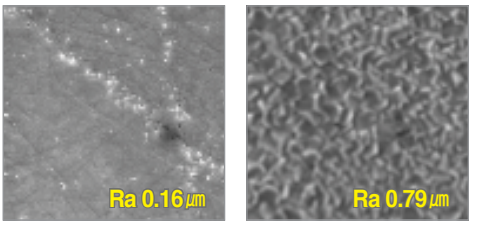


NC9100 Series (NC9115 / NC9125 / NC9135) Development

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

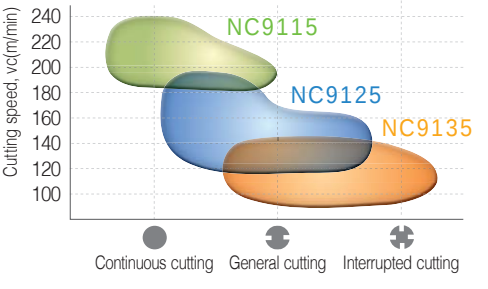
• The NC9100 series shows improved surface finish compared to the existing coating film

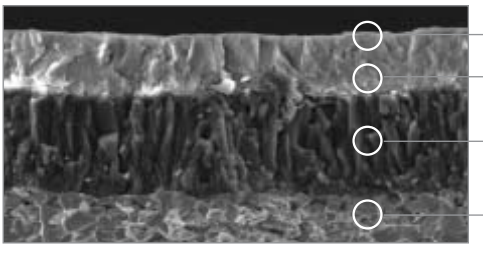
Lubricative coating layer to prevent built-up edge



[NC9100 Series] [Existing coating]

Grade lineup





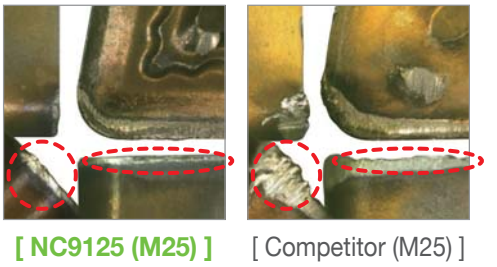
① Top coat with higher welding resistance
② Alumina layer for high speed machining
③ MT CVD-TiCN layer with higher chipping resistance
④ High toughness substrate optimal for all continuous/low or high interrupted machining

Development Effects

• Improved chipping resistance and high toughness substrate
→ **Reduces notch wear**

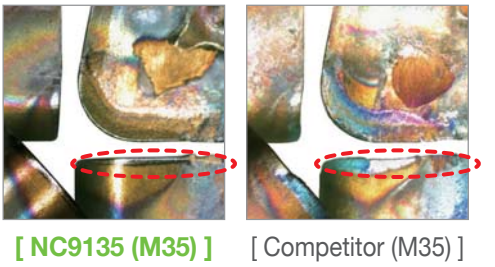
• Lubricative coating film
→ **Higher welding resistance**

1. Inhibited built-up edge and blade damage



[NC9125 (M25)] [Competitor (M25)]

2. Inhibited notch wear and relief surface wear



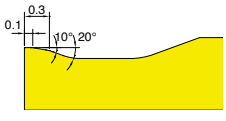
[NC9135 (M35)] [Competitor (M35)]

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

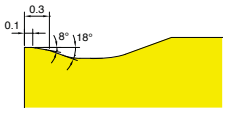
MM Chip Breaker Features

Variable Land

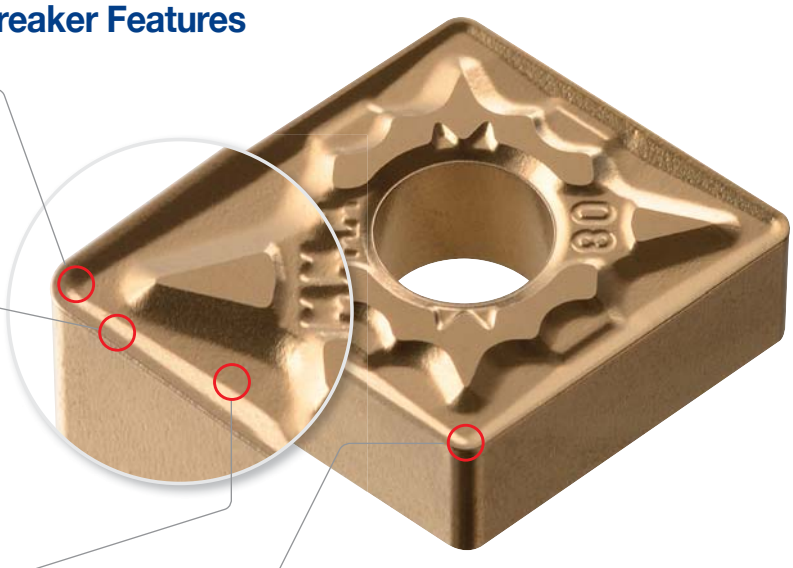


- Excellent chip control and sharp cutting at low depths of cut
- Delays crater wear
- Prevents plastic deformation

Dual Land



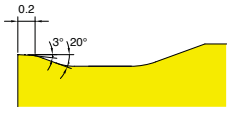
- Balance between requirements of sharp and tough cutting edges
- Sharp cutting edge for high speed machining
- Prevents chipping in interrupted machining



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

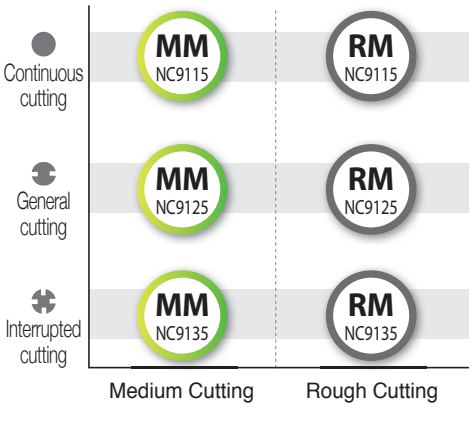
[Chip Breaker Code]

M M

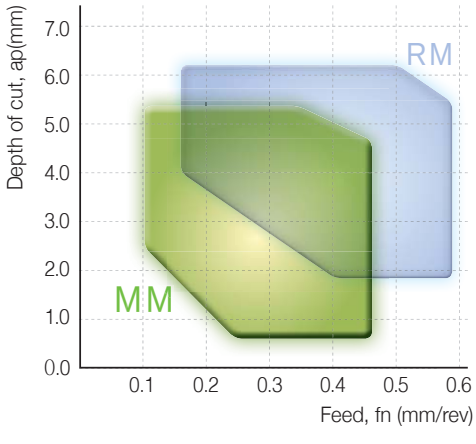
Workpiece range
- P : Steel
- **M : Stainless Steel**
- K : Cast iron

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

Application Range



Recommended Cutting Range



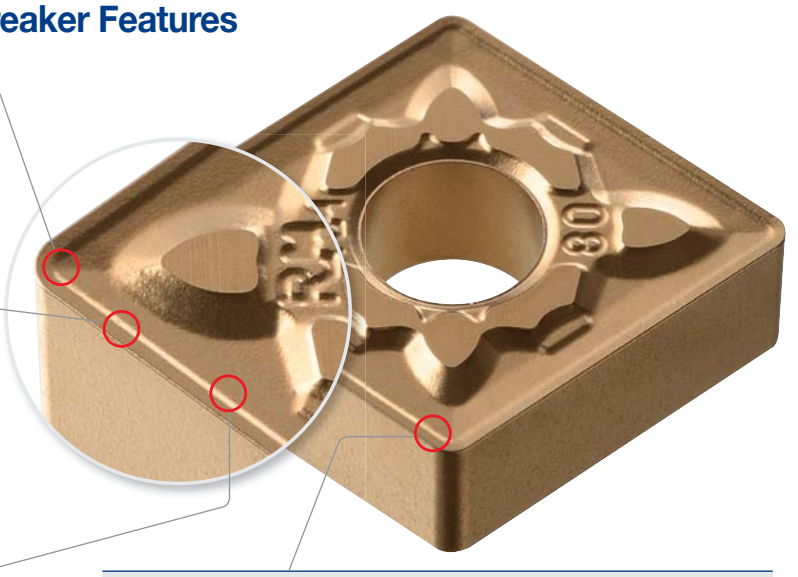
Recommended Cutting Conditions

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

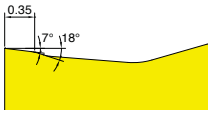
RM Chip Breaker (For rough cutting) M

- 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

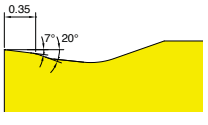


Variable Land



- 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

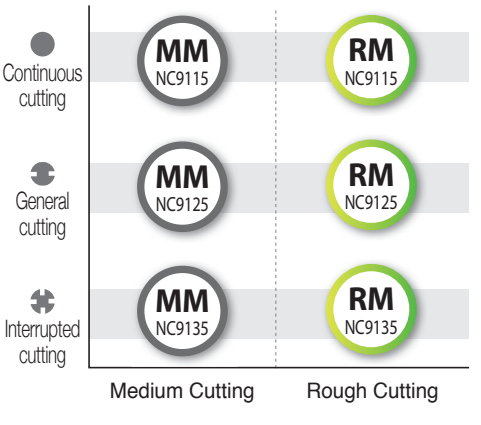
[Chip Breaker Code]

R M

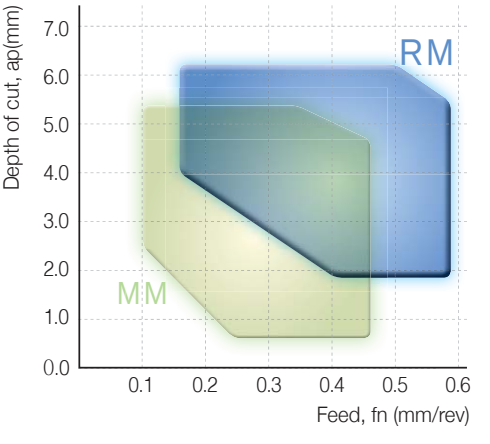
Workpiece range
- P : Steel
- **M : Stainless Steel**
- K : Cast iron

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

Application Range



Recommended Cutting Range



Recommended Cutting Conditions

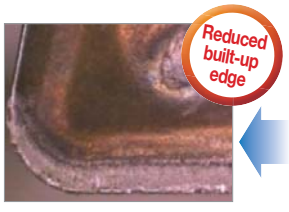
Application	Chip breaker	Recommended Cutting conditions					
		Depth of cut, ap (mm)			Feed, fn (mm/rev)		
		Min.	Recommended	Max.	Min.	Recommended	Max.
Rough cutting	RM	2.0	4.0	6.0	0.15	0.3	0.55

Cutting Performance

Built-up edge

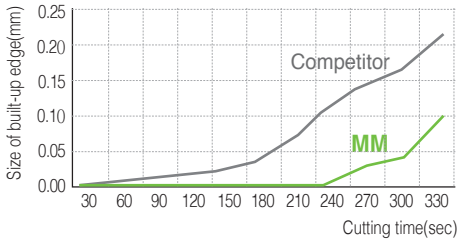
- **A gentle slope** of MM chip breaker **minimizes built-up edge**
- **Improved surface finish and chip control** from inhibited built-up edges

- 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]



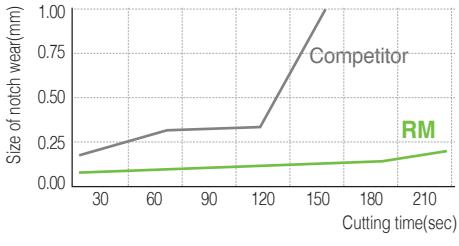
Notch wear

- 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

- 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)]

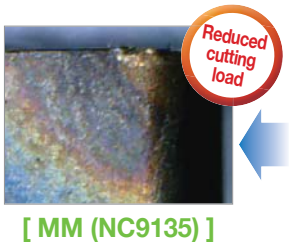
[Competitor]



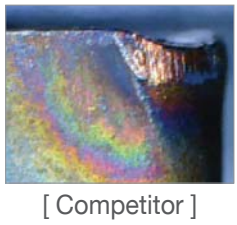
Plastic deformation

- 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

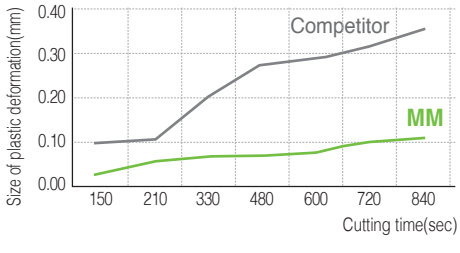
- Workpiece X5CrNiMo17-12-2 (Austenite)
- Cutting conditions vc(m/min) = 200, fn(mm/rev) = 0.35, ap(mm) = 2.0, dry
- Tools Insert CNMG120408-MM (NC9135) Holder PCLNL2525-M12



[MM (NC9135)]



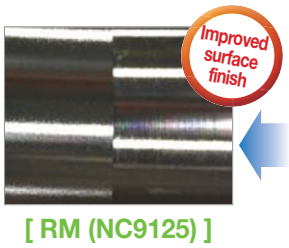
[Competitor]



Burr

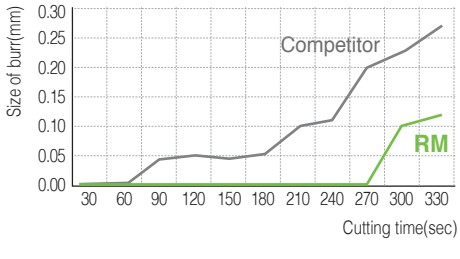
- The wide land and rake angle of the RM chip breaker **improves cutting performance and prevents burrs**
- Improved chip control improves surface finish and **extends tool life**

- 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]

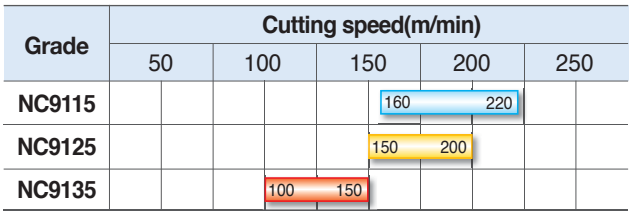


Recommended Grade and Chip Breaker per Stainless Steel Type

- Machinability is related to the type of stainless steel.
- The Ferritite and the Martensite types are more machinable.
- The Duplex and PH types are the most difficult type to machine.

Austenitic Stainless Steel

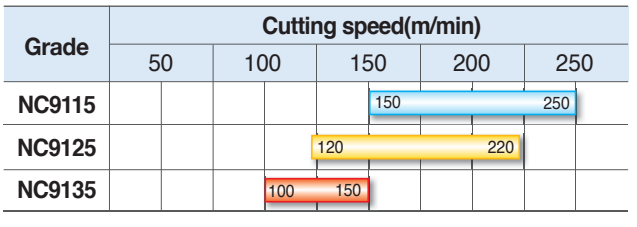
- Heavy work hardening (Edge chipping accelerates wear)
- Poor heat conductivity (Three times lower than carbon steel → Increase in cutting area temperature)
- High ductility (Strong chance for deformation at high temperature → Long chips or tough chips occurs)
- Type : X10CrNiS18-9, X5CrNi18-9, X5CrNiMo17-12-2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



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

Ferritic / Martensitic Stainless Steel

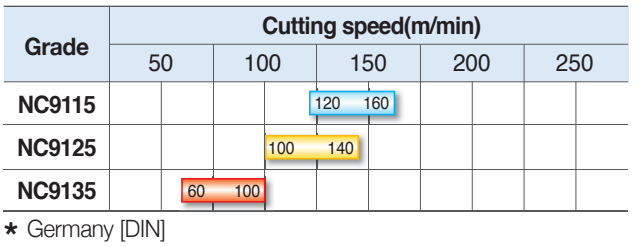
- Strong chance for work hardening at high temperature (Crater wear is promoted)
- High toughness through tempering and annealing (Long chips are easily created)
- High carbon contents increase its hardness)
- Type : X20Cr13, X12Cr13, X12CrS13, X70CrMo15 etc.



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*

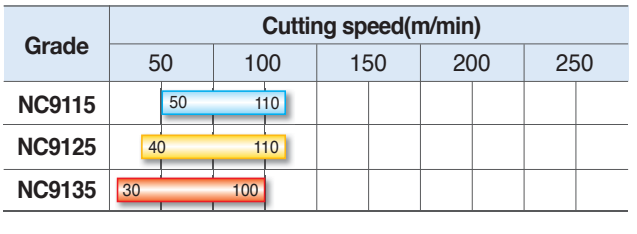


Continuous	Low interrupted	High interrupted
MM / RM	MM	-
MM / RM	MM / RM	RM
MM / RM	MM / RM	RM

* Germany [DIN]

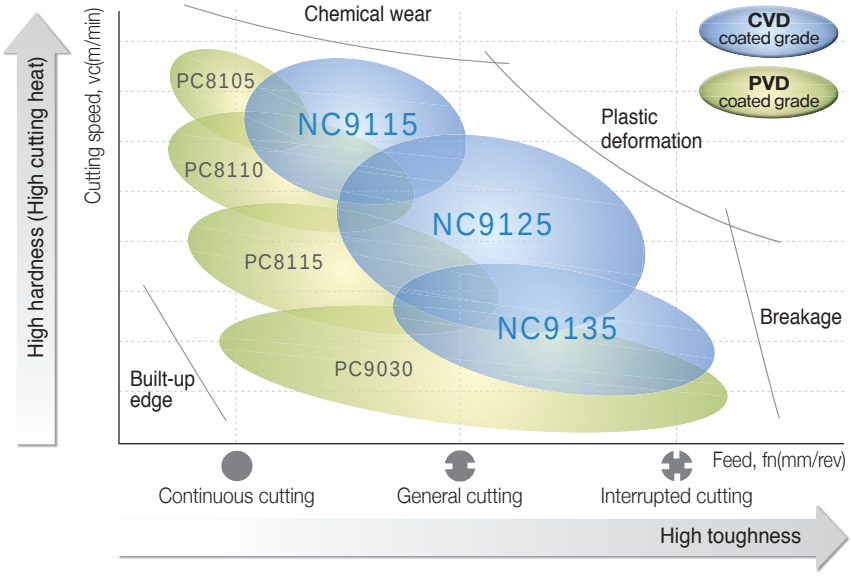
Precipitation Hardened(PH) Stainless Steel

- 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



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

Grade Lineup



Chip Removal Volume per Cutting Speed

Grade	ISO	Cutting speed (m/min)	Chip removal volume(㎤)
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

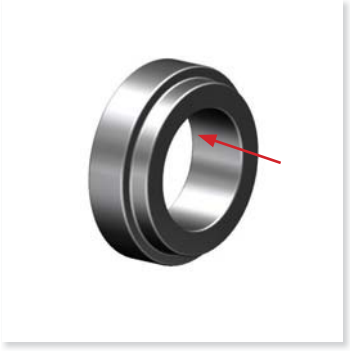
Turning Chip Breaker Comparison Chart for Stainless Steel (Negative type)

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



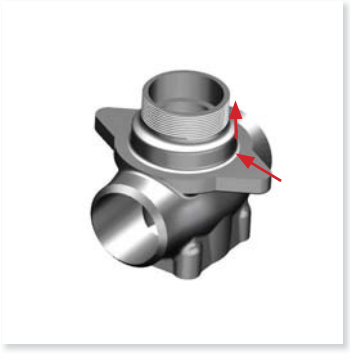
Hydraulics part (Mechanical seal)

- 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)

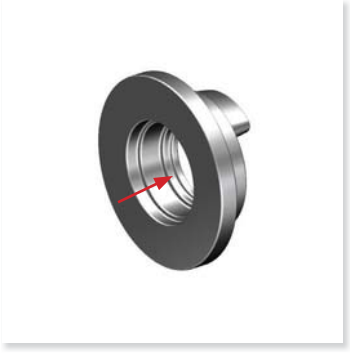
Wind power/offshore plant part (Flange)

- Workpiece: X6CrNiNb18-10* (Outer diameter roughing)
- Cutting conditions: vc(m/min) = 150, fn(mm/rev) = 0.3~0.5, ap(mm) = 4.0~6.0, 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) = ~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

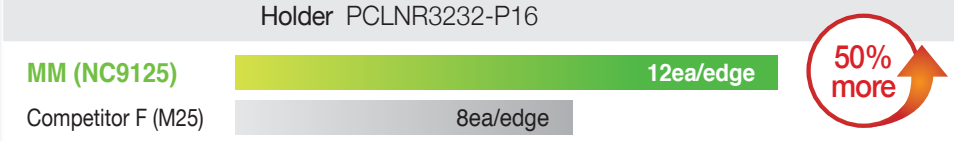
Wind power plant part (Flange)

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

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

Plant part (Flange)

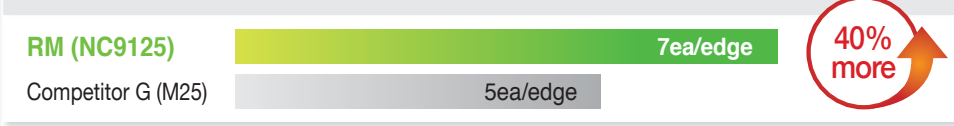
- Workpiece: Super Duplex
- Cutting conditions: vc(m/min) = 100, fn(mm/rev) = 0.5, ap(mm) = 3, wet
- Tools: Insert CNMG160616-MM (NC9125)
  Holder PCLNR3232-P16



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

Hydraulics part

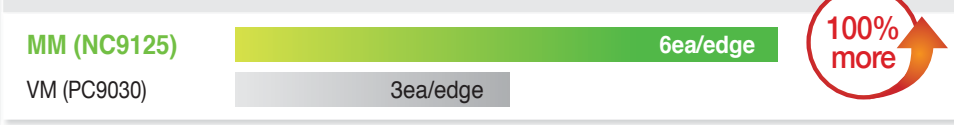
- Workpiece: Duplex
- Cutting conditions: vc(m/min) = 120, fn(mm/rev) = 0.4, ap(mm) = 6, wet
- Tools: Insert CNMG160616-RM (NC9125)
  Holder DCLNR3232-P16



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

Machinery part

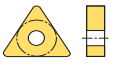
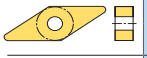
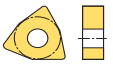
- Workpiece: X5CrNi18-9
- Cutting conditions: vc(m/min) = 180, fn(mm/rev) = 0.4, ap(mm) = 1.5, wet
- Tools: Insert CNMG120408-MM (NC9125)
  Holder DCLNL2525-M12



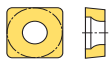
Extended tool life from superior resistance to built-up edge and wear compared to PC9030
100% higher productivity than PC9030 under higher cutting conditions

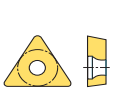
Available Stock [Negative type]

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

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

Available Stock [Positive type]

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

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

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