THE NEW VALUE FRONTIER

KYOCERA

For Machining
Heat-Resistant Alloy

PR005S
PR015S

For Machining Heat-Resistant Alloy

PR005S/PR015S

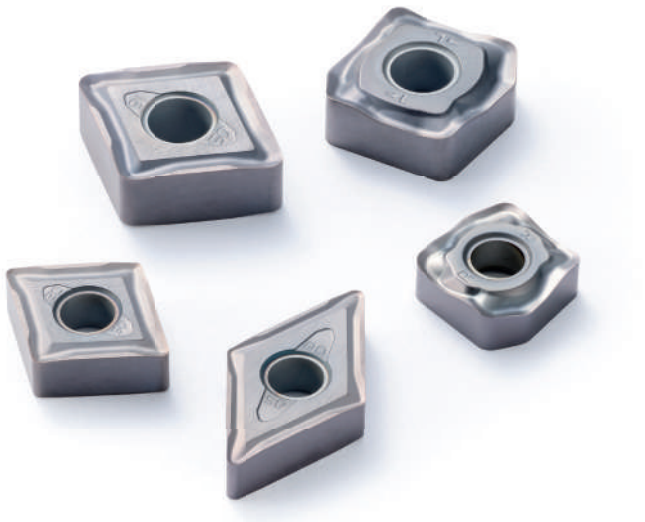
Providing Stable and Consistent Performance while Machining of Heat-Resistant Alloys

Improved thermal properties help to reduce sudden fracture and decrease edge wear

Improved wear resistance with MEGACOAT HARD coating

New chipbreaker designs improve machining stability

Finishing to Medium Machining	SQ Chipbreaker
For Roughing Applications	SX Chipbreaker



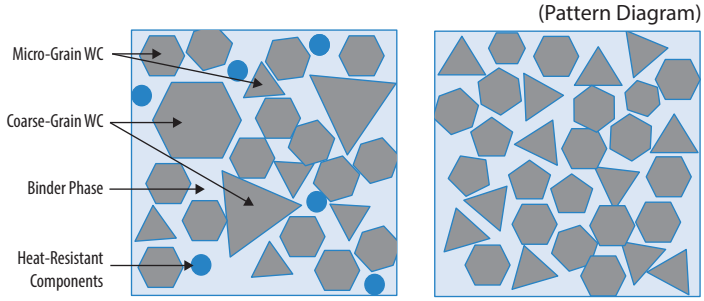
For Machining Heat-Resistant Alloy

PR005S/PR015S

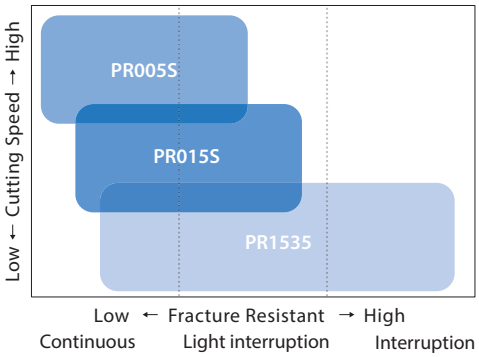
Improved Thermal Properties Help to Reduce Sudden Fracture and Edge Wear

1 Newly Developed Substrate Helps to Reduce Sudden Fracture and Notch Wear

(Pattern Diagram)

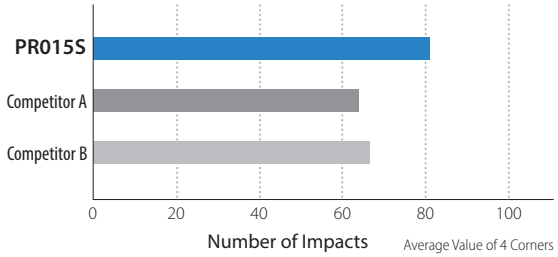


Improved thermal conductivity by optimum distribution of WC coarse grains
Resists heat concentration at the cutting edge to promote stable machining



PR005S: Hard, Wear-resistant Grade for High-speed Machining
PR015S: General Purpose Grade with Excellent Wear Resistance and Stability

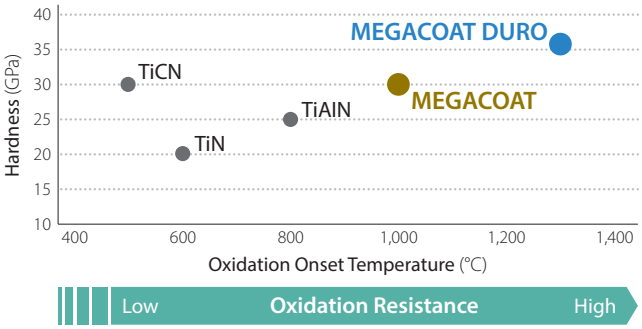
Fracture Resistance Comparison (Internal Evaluation)



Cutting Conditions: Vc = 25 m/min, ap = 1.0 mm, f = 0.10 mm/rev, Wet
CNMG120408 Type Workpiece: Nickel-based Superalloy Cylindrical Workpiece with 1 Flat Face

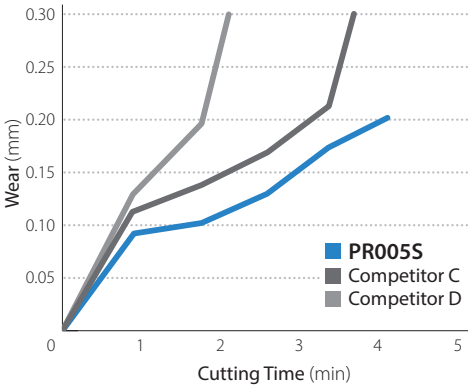
2 Improved Wear Resistance with MEGACOAT HARD coating

Coating Film Property (Internal Evaluation)

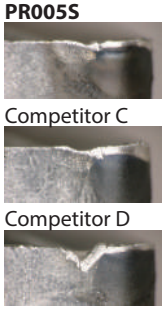


Excellent wear resistance with high-hardness and resists boundary damage with improved thermal properties

Wear Resistance Comparison (Internal Evaluation)



Machining Time: 3.5 min
Competitor D could only reach 2.6 minutes.



Cutting Conditions: Vc= 60 m/min, ap = 1.0 mm, f = 0.20 mm/rev, Wet, CNMG120408 Type
Workpiece: Nickel-based Superalloy

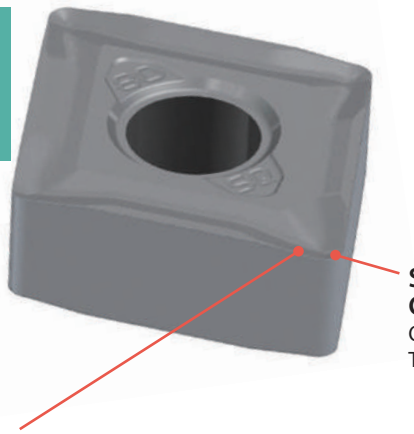
3 New Chipbreaker Designs Improve Machining Stability

Finishing to Medium Machining SQ Chipbreaker

Double-sided 4-Corner Design

Extended Tool Life and Improved Efficiency for Mid-range to Finishing Applications in Heat-Resistant Alloys

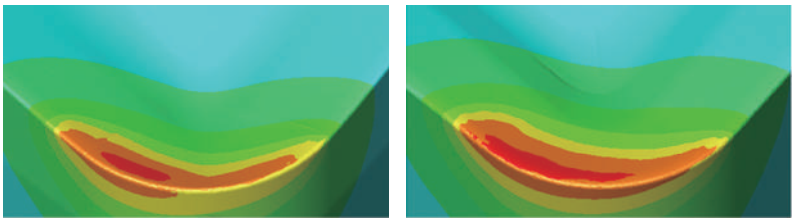
SQ Chipbreaker Benefits
Reduced Temperature at the Cutting Edge
→ Extended Tool Life
Reduces Burring
→ Extended Tool Life and Efficiency Improvements



Special Axial Face Design Decreases Cutting Edge Temperature
Optimal Design Achieved with Simulation Technology

Slant Cutting Edge
Inclined in (-) Direction
Effective for Burr Suppression and Reducing Notching

Simulation of Edge-Temperature Comparison (Internal Evaluation)

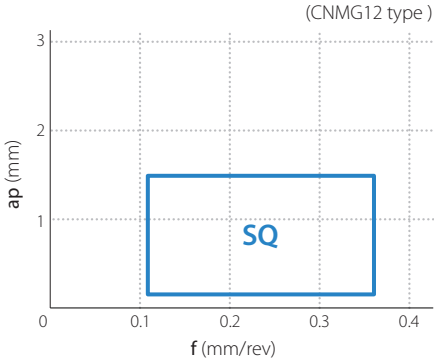


SQ Chipbreaker Conventional B

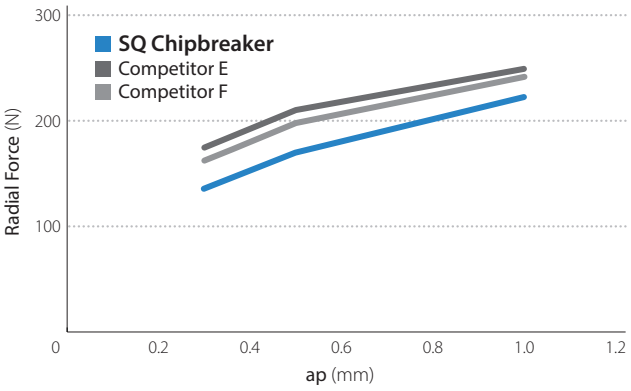
Cutting Conditions: Vc = 40 m/min, ap = 1.0 mm, f = 0.15 mm/rev, CNMG120408 Type, Dry
Workpiece: Nickel-based Superalloy

The newly developed chipbreaker reduces temperature at the cutting edge, thereby improving tool life and machining efficiency in semi-finishing applications

Applicable Chipbreaker Range
(ap Indicates Radial Depth of Cut per Side)

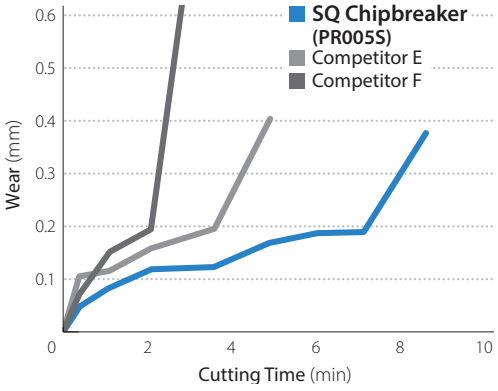


Cutting Force Comparison (Radial Force) (Internal Evaluation)



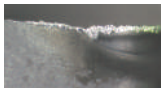
Cutting Conditions: Vc = 40 m/min, f = 0.15 mm/rev, Wet, CNMG120408 Type
Workpiece: Nickel-based Superalloy

Wear Resistance Comparison (Internal Evaluation)

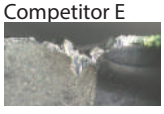


Machining Time: 5 min
Competitor F could only reach 3.6 minutes.

SQ Chipbreaker (PR005S)



Competitor E



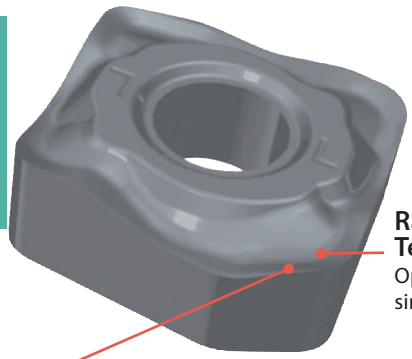
Competitor F

Cutting Conditions: Vc = 40 m/min, ap = 1.0 mm, f = 0.20 mm/rev, Wet, CNMG120408 Type
Workpiece: Nickel-based Superalloy

For Roughing SX Chipbreaker

Improved Efficiency for Roughing Applications in Heat-Resistant Alloys

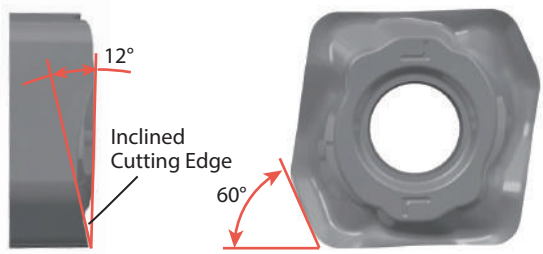
SX Chipbreaker Benefits
Decreased Edge Temperature
→ Longer Tool Life
Suppresses Burr Formation
→ Greater Depths of Cut
Decreased Radial Forces
→ Resists Edge Build-up and Improves Efficiency



Single-sided 2-Corner Design

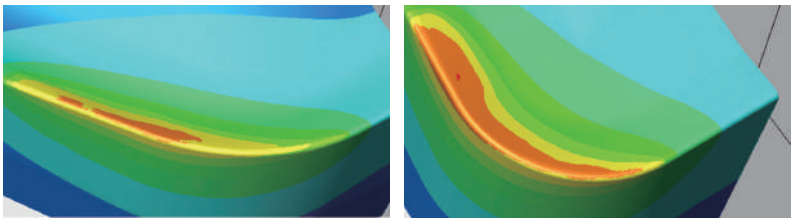
Rake Design Decreases Temperature at the Cutting Edge
Optimal design achieved with CNC simulation technology

Unique Cutting Edge Design (Handed Insert)
- 60 Degree Lead Angle (when Installed in the Toolholder)
- 12 Degree Rake Angle



- Can be installed in standard Kyocera 80° (C type) toolholders by changing to corresponding SX shim
- Single-sided Handed Insert

Simulation of Edge-Temperature Comparison (Internal Evaluation)



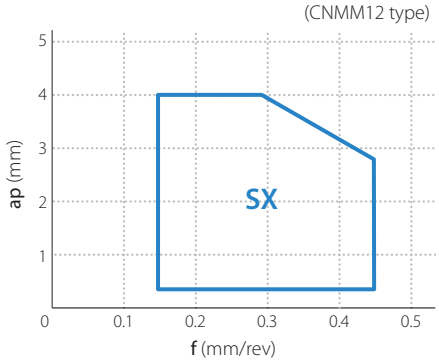
SX Chipbreaker Conventional C

Cutting Conditions: Vc = 40 m/min, ap = 2.0 mm, f = 0.25 mm/rev, Dry
CNMM1204XL-SX, CNMG120412 Type Workpiece: Nickel-based Superalloy

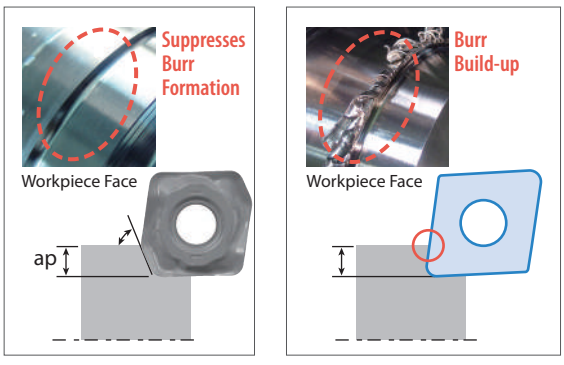
The SX Chipbreaker provides longer tool life and improved efficiency with its unique cutting edge and rake angle design

Applicable Chipbreaker Range

(ap Indicates Radial Depth of Cut per Side)



Burr Comparison (Internal Evaluation)

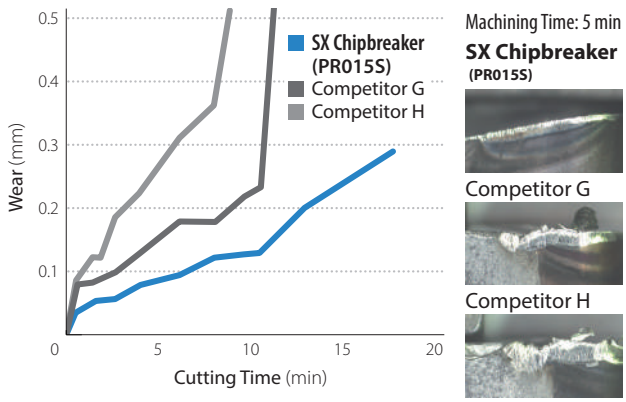


SX Chipbreaker Conventional D

Cutting Conditions: Vc = 40 m/min, ap = 2.0 mm, f = 0.25 mm/rev, Wet
CNMM1204XL-SX, CNMG120412 Type
After Machining 9.4 min. Workpiece: Nickel-based Superalloy

Even in larger depths of cut, the SX chipbreaker is able to suppress burr build-up
Increased D.O.C capability and reduced notch wear combine to provide greater machining efficiency

Wear Resistance Comparison (Internal Evaluation)



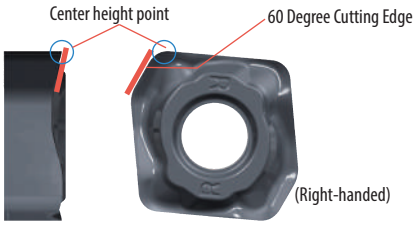
Cutting Conditions: Vc = 40 m/min, ap = 2.0 mm, f = 0.25 mm/rev, Wet
CNMM1204XL-SX, CNMG120412 Type Workpiece: Nickel-based Superalloy

SX Chipbreaker and PR015S resist notching, thereby improving tool life

Caution when Using SX Chipbreaker

1. Cutting Edge Height

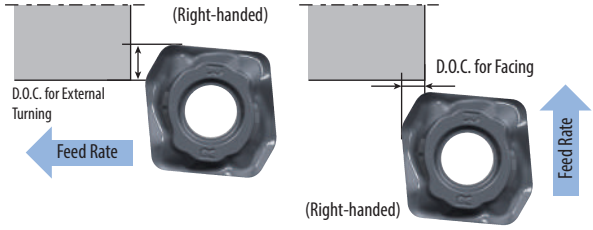
The center of the cutting edge height of the nose is slanted by 60 degrees based on circled portions in image below



2. Recommended D.O.C.

Recommended depth of cut is no greater than the 60° lead angle; however, larger depths of cut are possible

Description	Recommended D.O.C. External Turning (mm)	Max. D.O.C. Facing (mm)
CNMM1204X R/L-SX	0.5 - **2.0** - 4.0	2.0
CNMM1606X R/L-SX	0.5 - **2.5** - 4.5	2.0
CNMM1906X R/L-SX	0.5 - **3.0** - 5.0	2.5



3. Applicable Toolholder

The SX chipbreaker insert requires a different shim than standard inserts
No additional toolholder modifications are necessary when using the applicable Kyocera holders

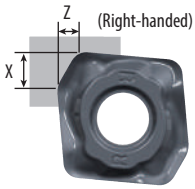
Insert Description	Applicable Toolholder (Kyocera)	Standard Shim	Shim for SX Chipbreaker
CNMM1204X R/L-SX	DCLN R/L2020K-12 DCLN R/L2525M-12	DC-44	DC-44-C
	PCLN R/L2020H-12 PCLN R/L2020K-12 PCLN R/L2525M-12 PCLN R/L3225P-12	LC-42N	LC-42N-C
CNMM1606X R/L-SX	PCLN R/L2525M-16 PCLN R/L3232P-16	LC-53N	LC-53N-C
CNMM1906X R/L-SX	PCLN R/L3232P-19	LC-63	LC-63-C

Boring is not recommended

4. Unmachined portion varies with insert size

Unmachined portion is reflected below

Description	Amount Uncut (mm)	
	X	Z
CNMM1204X R/L-SX	4.1	2.9
CNMM1606X R/L-SX	4.8	3.3
CNMM1906X R/L-SX	5.4	3.6



5. Facing

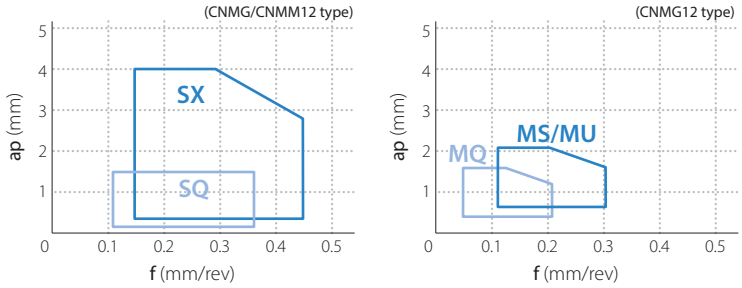
Facing is possible, but turning is recommended
Cutting edge may drop below center in facing operations
(Boss remains at the center of the workpiece)

Description	Run-out Amount when Facing (mm)
CNMM1204X R/L-SX	0.75
CNMM1606X R/L-SX	0.85
CNMM1906X R/L-SX	1.05

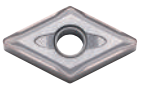
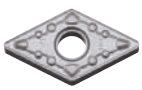
Recommended Cutting Conditions

Workpiece	Cutting Range	Application	Recommended Chipbreaker	Recommended Grade	Min. - **Recommendation** - Max.		
					Vc (m/min)	ap (mm)	f (mm/rev)
Heat-Resistant Alloys	Finishing	Continuous	MQ	PR005S	30 – **55** – 90	0.2 – **0.3** – 1.0	0.05 – **0.08** – 0.15
		Interruption		PR015S	25 – **45** – 70	0.2 – **0.5** – 1.0	0.05 – **0.1** – 0.2
	Medium	Continuous	MU	PR005S	30 – **55** – 90	0.5 – **1.0** – 2.0	0.1 – **0.15** – 0.3
		Interruption		PR015S	25 – **45** – 70	0.5 – **1.0** – 2.0	0.1 – **0.15** – 0.3
		Continuous	MS	PR005S	30 – **55** – 90	0.5 – **1.0** – 2.0	0.1 – **0.15** – 0.3
		Interruption		PR015S	25 – **45** – 70	0.5 – **1.0** – 2.0	0.1 – **0.15** – 0.3
		Continuous	SQ	PR005S	30 – **55** – 90	0.3 – **0.5** – 1.5	0.1 – **0.17** – 0.35
		Interruption		PR015S	25 – **45** – 70	0.3 – **0.5** – 1.5	0.1 – **0.17** – 0.35
	Roughing	Continuous	SX	PR005S	30 – **55** – 90	0.5 – **2.0** – 4.0	0.15 – **0.3** – 0.45
		Interruption		PR015S	25 – **45** – 70	0.5 – **2.0** – 4.0	0.15 – **0.3** – 0.45

Applicable Chipbreaker Range (ap Indicates Radial Depth of Cut per Side)



Stock Items

Shape (Handed Insert shows Right-hand)	Description	Dimensions (mm) I.C.	Thickness	Hole	Corner-R (rε)	PR005S	PR015S
 Finishing-Medium	CNMG 120404SQ 120408SQ 120412SQ	12.70	4.76	5.16	0.4 0.8 1.2	● ● ●	● ● ●
	CNMG 160612SQ 160616SQ	15.875	6.35	6.35	1.2 1.6	● ●	● ●
	CNMG 190612SQ 190616SQ	19.05	6.35	7.94	1.2 1.6	● ●	● ●
 Finishing-Medium	CNMG 120404MQ 120408MQ	12.70	4.76	5.16	0.4 0.8	● ●	● ●
 Medium-Roughing	CNMG 120404MS 120408MS 120412MS 120416MS	12.70	4.76	5.16	0.4 0.8 1.2 1.6	● ● ● ●	● ● ● ●
 Medium-Roughing	CNMG 120404MU 120408MU 120412MU	12.70	4.76	5.16	0.4 0.8 1.2	● ● ●	● ● ●
	CNMG 160608MU 160612MU 160616MU	15.875	6.35	6.35	0.8 1.2 1.6	● ● ●	● ● ●
	CNMG 190612MU 190616MU	19.05	6.35	7.94	1.2 1.6	● ●	● ●
 Roughing	CNMM 1204X R/L-SX	12.70	4.42	5.16	–	●	●
	CNMM 1606X R/L-SX	15.875	5.96	6.35	–	●	●
	CNMM 1906X R/L-SX	19.05	5.93	7.94	–	●	●
 Finishing-Medium	DNMG 150404SQ 150408SQ 150412SQ	12.70	4.76	5.16	0.4 0.8 1.2	● ● ●	● ● ●
	DNMG 150604SQ 150608SQ 150612SQ	12.70	6.35	5.16	0.4 0.8 1.2	● ● ●	● ● ●
 Finishing-Medium	DNMG 150404MQ 150408MQ	12.70	4.76	5.16	0.4 0.8	● ●	● ●
	DNMG 150604MQ 150608MQ	12.70	6.35	5.16	0.4 0.8	● ●	● ●
 Medium-Roughing	DNMG 150404MS 150408MS 150412MS	12.70	4.76	5.16	0.4 0.8 1.2	● ● ●	● ● ●
	DNMG 150604MS 150608MS 150612MS	12.70	6.35	5.16	0.4 0.8 1.2	● ● ●	● ● ●
 Medium-Roughing	DNMG 150404MU 150408MU	12.70	4.76	5.16	0.4 0.8	● ●	● ●
	DNMG 150604MU 150608MU	12.70	6.35	5.16	0.4 0.8	● ●	● ●

CNMM…X R/L-SX inserts are single-sided with 2 cutting edges

Shape	Description	Dimensions (mm) I.C.	Thickness	Hole	Corner-R (rε)	PR005S	PR015S
 Finishing-Medium	SNMG 120404MQ 120408MQ	12.70	4.76	5.16	0.4 0.8	● ●	● ●
 Medium-Roughing	SNMG 120404MS 120408MS 120412MS 120416MS	12.70	4.76	5.16	0.4 0.8 1.2 1.6	● ● ● ●	● ● ● ●
 Medium-Roughing	SNMG 190612MU 190616MU	19.05	6.35	7.94	1.2 1.6	● ●	● ●
 Finishing-Medium	TNMG 160404MQ 160408MQ	9.525	4.76	3.81	0.4 0.8	● ●	● ●
 Medium-Roughing	TNMG 160404MS 160408MS 160412MS	9.525	4.76	3.81	0.4 0.8 1.2	● ● ●	● ● ●
 Medium-Roughing	TNMG 160404MU 160408MU	9.525	4.76	3.81	0.4 0.8	● ●	● ●
 Finishing-Medium	VNMG 160404MQ 160408MQ	9.525	4.76	3.81	0.4 0.8	● ●	● ●
 Medium-Roughing	VNMG 160404MS 160408MS 160412MS	9.525	4.76	3.81	0.4 0.8 1.2	● ● ●	● ● ●
 Medium-Roughing	VNMG 160404MU 160408MU	9.525	4.76	3.81	0.4 0.8	● ●	● ●
 Finishing-Medium	WNMG080404MQ 080408MQ	12.70	4.76	5.16	0.4 0.8	● ●	● ●
 Medium-Roughing	WNMG080404MS 080408MS 080412MS	12.70	4.76	5.16	0.4 0.8 1.2	● ● ●	● ● ●
 Medium-Roughing	WNMG080404MU 080408MU	12.70	4.76	5.16	0.4 0.8	● ●	● ●

●: Standard Stock