

THE NEW VALUE FRONTIER

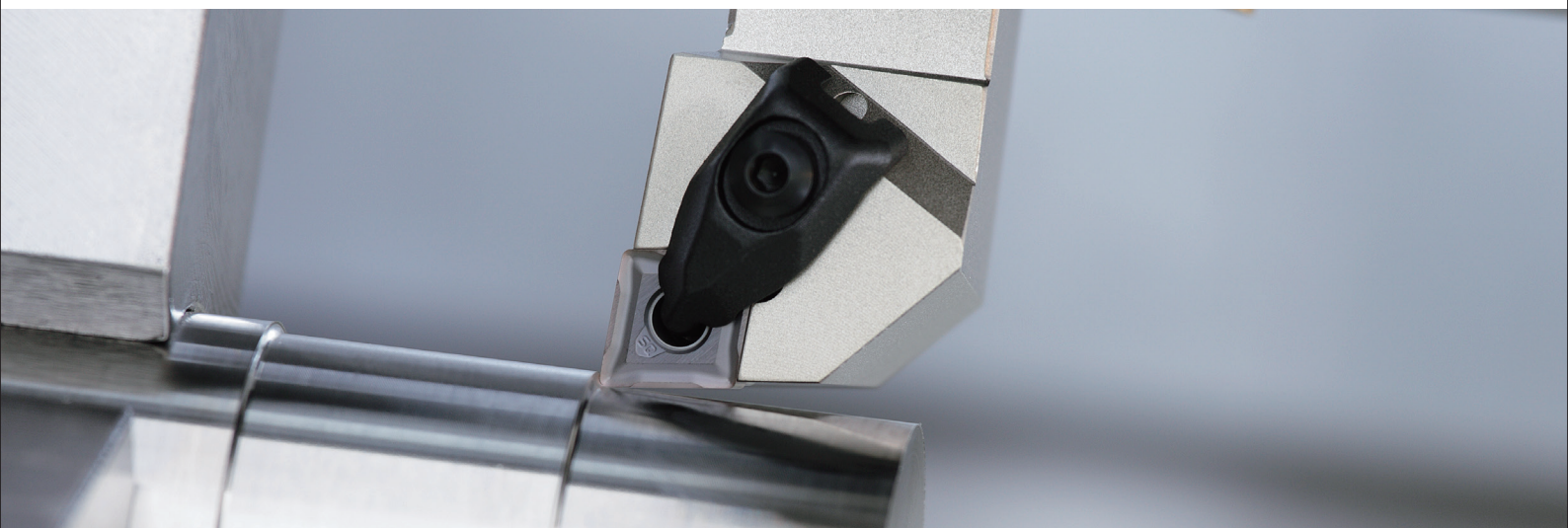


For Machining Heat-Resistant Alloy

PR005S
PR015S

For Machining Heat-Resistant Alloy

PR005S/PR015S



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

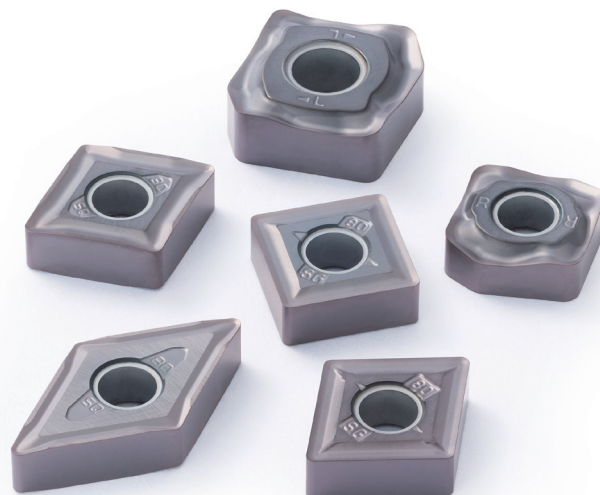
Improved Thermal Properties Help to Reduce Sudden Fracture and Decrease Edge Wear

Improved Wear Resistance with MEGACOAT HARD Coating

Low-cutting Force and Stable Machining with Newly Designed Chipbreakers (SQ/SX/SG)



For Roughing Applications
SG Chipbreaker



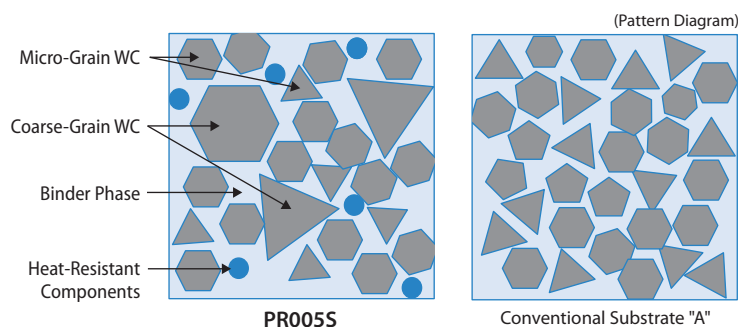
For Machining Heat-Resistant Alloy

PR005S/PR015S

Improved Thermal Properties Help to
Reduce Sudden Fracture and Edge Wear

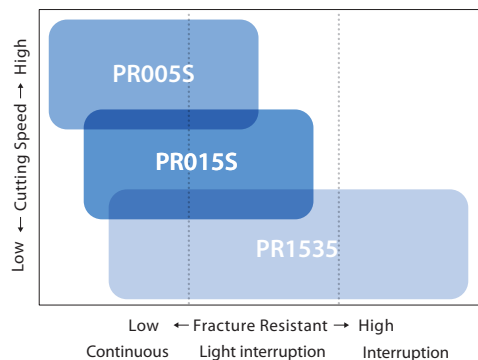
1

Newly Developed Substrate Helps to Reduce Sudden Fracture and Notch Wear



Improved thermal conductivity by optimum distribution of WC coarse grains

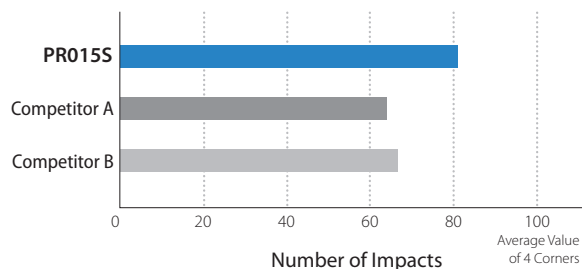
Resists heat concentration at the cutting edge to promote stable machining



PR005S: Hard, Wear-resistant Grade for High-speed Machining

PR015S: General Purpose Grade with Excellent Wear Resistance and Stability

Fracture Resistance Comparison (Internal Evaluation)

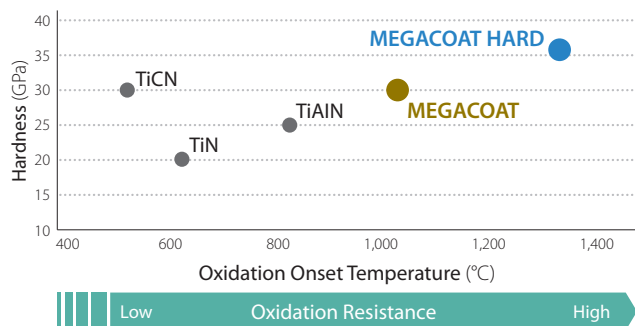


Cutting Conditions: $V_c = 25$ m/min, $a_p = 1.0$ mm, $f = 0.10$ mm/rev, Wet
CNMG120408 Type Workpiece: Nickel-based Superalloy Cylindrical Workpiece with 1 Flat Face

2

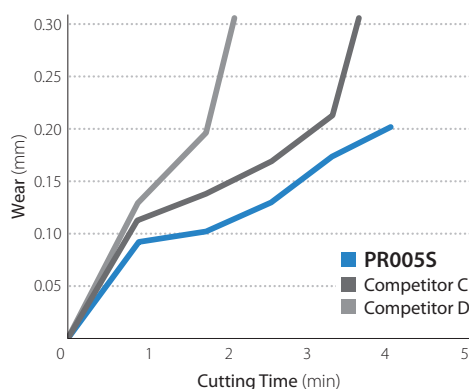
Improved Wear Resistance with MEGACOAT HARD Coating

Coating Properties (Internal Evaluation)



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

Wear Resistance Comparison (Internal Evaluation)

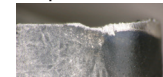


Machining Time: 3.5 min
Competitor D could only reach 2.6 minutes

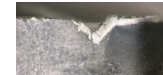
PR005S



Competitor C



Competitor D



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

3

New Chipbreaker Designs Improve Machining Stability

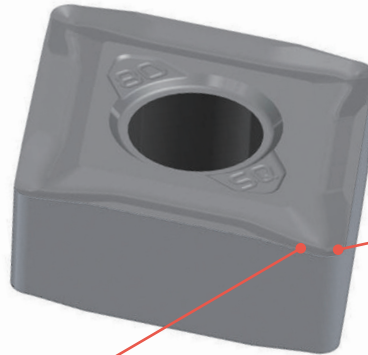
Finishing to Medium Machining SQ Chipbreaker

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

Double-sided 4-Corner Design

SQ Chipbreaker Benefits

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



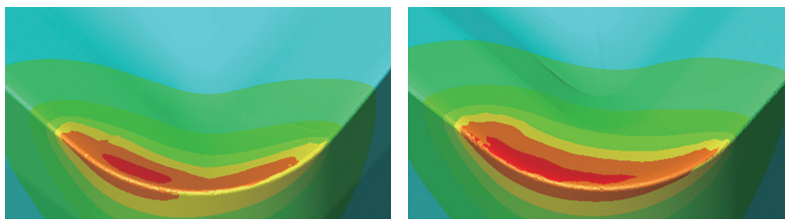
Special Axial Face Design
Decreases Cutting Edge Temperature

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)



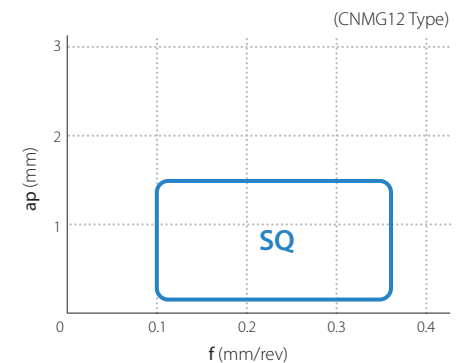
SQ Chipbreaker

Conventional B

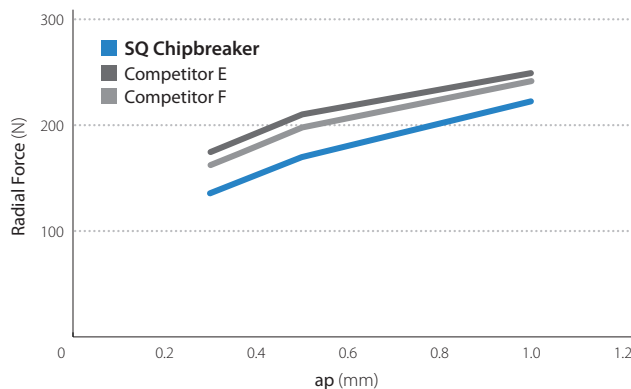
Cutting Conditions: $V_c = 40$ m/min, $a_p = 1.0$ mm, $f = 0.15$ mm/rev, CNMG120408 Type, Dry
Workpiece: Nickel-based Superalloy

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

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

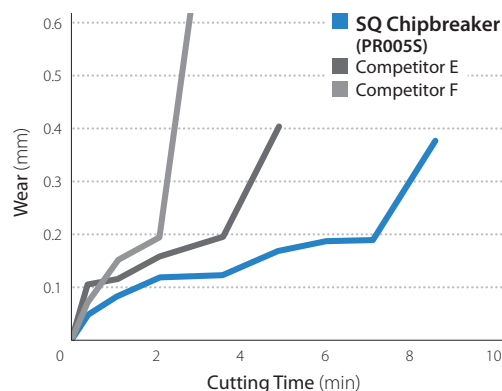


Cutting Force Comparison (Radial Force) (Internal Evaluation)



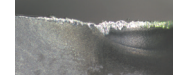
Cutting Conditions: $V_c = 40$ m/min, $f = 0.15$ mm/rev, Wet, CNMG120408 Type
Workpiece: Nickel-based Superalloy

Wear Resistance Comparison (Internal Evaluation)



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

SQ Chipbreaker (PR005S)



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

High Efficiency Roughing SX Chipbreaker

Improved Efficiency for Roughing Applications in Heat-Resistant Alloys

Single-sided 2-Corner Design

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

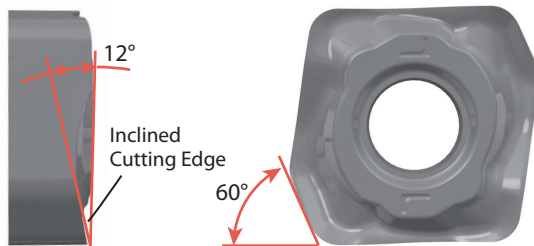
The SG chipbreaker is recommended if a double-sided 4-corner design for roughing is required

See P5 for details



Unique Cutting Edge Design (Handed Insert)

- 60 Degree Lead Angle (when Installed in the Toolholder)
- 12 Degree Rake Angle

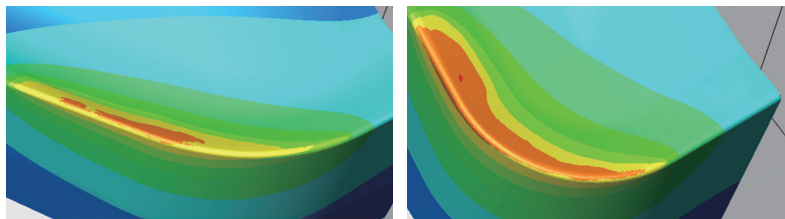


Rake Design Decreases Temperature at the Cutting Edge

Optimal design achieved with CNC simulation technology

- 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)



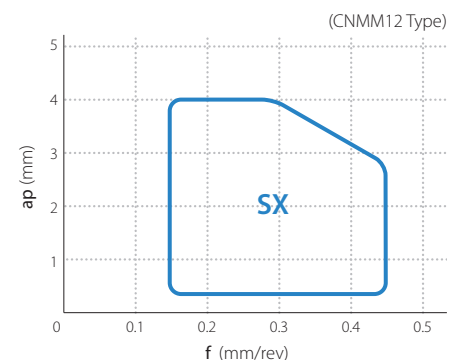
SX Chipbreaker

Conventional C

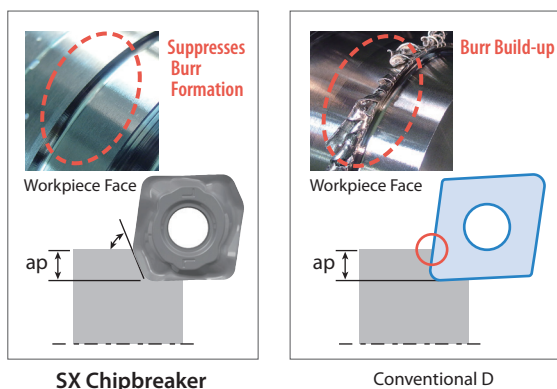
Cutting Conditions: $V_c = 40$ m/min, $a_p = 2.0$ mm, $f = 0.25$ mm/rev, Dry
CNMM1204XL-SX, CNMG120412 Type Workpiece: Nickel-based Superalloy

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

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



Burr Comparison (Internal Evaluation)



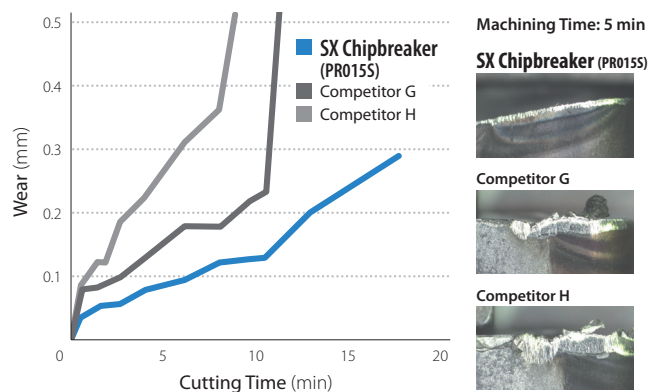
SX Chipbreaker

Conventional D

Cutting Conditions: $V_c = 40$ m/min, $a_p = 2.0$ 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)

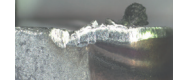


Machining Time: 5 min

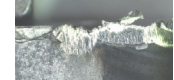
SX Chipbreaker (PR015S)



Competitor G



Competitor H



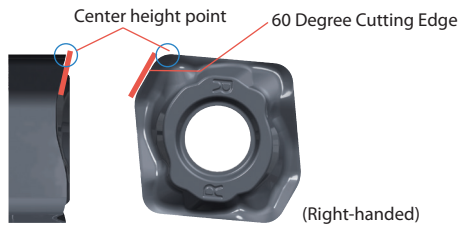
Cutting Conditions: $V_c = 40$ m/min, $a_p = 2.0$ mm, $f = 0.25$ mm/rev, Wet
CNMM1204XL-SX, CNMG120412 Type Workpiece: Nickel-based Superalloy

SX Chipbreaker and PR015S resist notching, thereby improving tool life

Caution when Using SX Chipbreaker

1. Cutting Edge Height

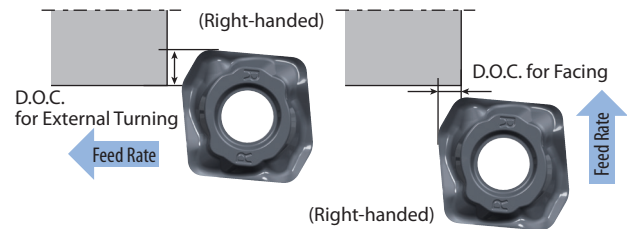
The center of the cutting edge height of the nose is slanted by 60 degrees based on circled portions in image below



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

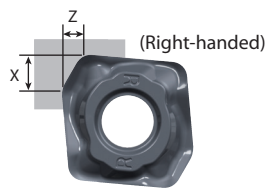
Insert Description	Applicable Toolholder (Kyocera)	Standard Shim	Shim for SX Chipbreaker
CNMM1204X R/L -SX	DCLN R/L 2020K-12	DC-44	DC-44-C
	DCLN R/L 2525M-12		
	PCLN R/L 2020H-12	LC-42N	LC-42N-C
	PCLN R/L 2020K-12		
	PCLN R/L 2525M-12		
CNMM1606X R/L -SX	PCLN R/L 2525M-16	LC-53N	LC-53N-C
	PCLN R/L 3232P-16		
CNMM1906X R/L -SX	PCLN R/L 3232P-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

The SX chipbreaker is uniquely designed for high efficiency roughing. It differs from standard inserts by the following

- Handed single-sided 2-corner insert
- Requires a dedicated shim
- Unmachined portion remains at corner (4. Unmachined portion varies with insert size)
- Position of insert is below the center when facing (5. Facing)

For Roughing Applications **SG Chipbreaker** NEW

For Roughing Applications in Heat-resistant Alloys

Double-sided 4-Corner Design

SG Chipbreaker Benefits

Well-balanced Axial Face Shape → Extended Tool Life
Shallow Bottom Chipbreaker Design → Smooth Chip Control



Standard Chipbreaker

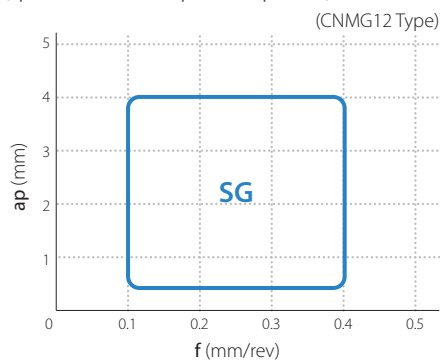
Stable chip control during heavy machining applications

Well-balanced Axial Face Shape

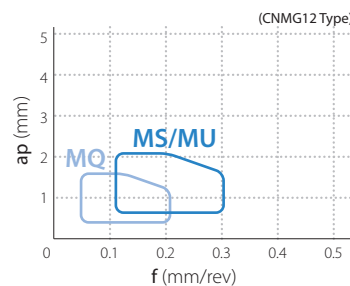
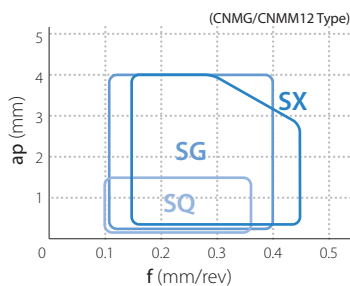
High-strength land and low cutting force design

Applicable Chipbreaker Range

(ap Indicates Radial Depth of Cut per Side)








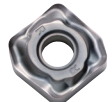
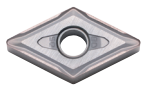

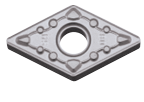


Applicable Chipbreaker Range (ap Indicates Radial Depth of Cut per Side)



















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	SG	PR005S	30 - 55 - 90	0.5 - 2.0 - 4.0	0.1 - 0.3 - 0.4
		Interruption		PR015S	25 - 45 - 70	0.5 - 2.0 - 4.0	0.1 - 0.3 - 0.4
		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

Stock Items

Shape Handed Insert shows Right-hand	Description	Dimensions (mm)				PROSS	PRO155
		I.C.	Thickness	Hole	Corner -R(re)		
	CNMG 120404SQ	12.70	4.76	5.16	0.4	●	●
	120408SQ				0.8	●	●
	120412SQ				1.2	●	●
	CNMG 160612SQ	15.875	6.35	6.35	1.2	●	●
	160616SQ				1.6	●	●
Finishing-Medium	CNMG 190612SQ	19.05	6.35	7.94	1.2	●	●
	190616SQ				1.6	●	●
	CNMG 120404MQ	12.70	4.76	5.16	0.4	●	●
	120408MQ				0.8	●	●
Finishing-Medium							
	CNMG 120404MS	12.70	4.76	5.16	0.4	●	●
	120408MS				0.8	●	●
	120412MS				1.2	●	●
	120416MS				1.6	●	●
Medium-Roughing							
	CNMG 120404MU	12.70	4.76	5.16	0.4	●	●
	120408MU				0.8	●	●
	120412MU				1.2	●	●
	CNMG 160608MU	15.875	6.35	6.35	0.8	●	●
	160612MU				1.2	●	●
	160616MU				1.6	●	●
Medium-Roughing	CNMG 190612MU	19.05	6.35	7.94	1.2	●	●
	190616MU				1.6	●	●
	CNMG 120408SG	12.70	4.76	5.16	0.8	●	●
	120412SG				1.2	●	●
	CNMG 160612SG	15.875	6.35	6.35	1.2	●	●
	160616SG				1.6	●	●
Roughing	CNMG 190612SG	19.05	6.35	7.94	1.2	●	●
	190616SG				1.6	●	●
	CNMM 1204X ^{R/L} -SX	12.70	4.42	5.16	—	●	●
	CNMM 1606X ^{R/L} -SX	15.875	5.96	6.35	—	●	●
Roughing	CNMM 1906X ^{R/L} -SX	19.05	5.93	7.94	—	●	●
	DNMG 150404SQ	12.70	4.76	5.16	0.4	●	●
	150408SQ				0.8	●	●
	150412SQ				1.2	●	●
	DNMG 150604SQ	12.70	6.35	5.16	0.4	●	●
	150608SQ				0.8	●	●
Finishing-Medium	150612SQ				1.2	●	●
	DNMG 150404MQ	12.70	4.76	5.16	0.4	●	●
	150408MQ				0.8	●	●
Finishing-Medium	DNMG 150604MQ	12.70	6.35	5.16	0.4	●	●
	150608MQ				0.8	●	●
	DNMG 150404MS	12.70	4.76	5.16	0.4	●	●
	150408MS				0.8	●	●
	150412MS				1.2	●	●
	DNMG 150604MS	12.70	6.35	5.16	0.4	●	●
	150608MS				0.8	●	●
Medium-Roughing	150612MS				1.2	●	●
	DNMG 150404MU	12.70	4.76	5.16	0.4	●	●
	150408MU				0.8	●	●
Medium-Roughing	DNMG 150604MU	12.70	6.35	5.16	0.4	●	●
	150608MU				0.8	●	●
	DNMG 150408SG	12.70	4.76	5.16	0.8	●	●
Roughing	150412SG				1.2	●	●

CNMM...X^{R/L}-SX inserts are single-sided with 2 cutting edges

Shape	Description	Dimensions (mm)				PROSS	PRO155
		I.C.	Thickness	Hole	Corner -R(re)		
	SNMG 120404MQ	12.70	4.76	5.16	0.4	●	●
	120408MQ				0.8	●	●
Finishing-Medium							
	SNMG 120404MS	12.70	4.76	5.16	0.4	●	●
	120408MS				0.8	●	●
	120412MS				1.2	●	●
	120416MS				1.6	●	●
Medium-Roughing							
	SNMG 190612MU	19.05	6.35	7.94	1.2	●	●
	190616MU				1.6	●	●
Medium-Roughing							
	SNMG 120408SG	12.70	4.76	5.16	0.8	●	●
	120412SG				1.2	●	●
	SNMG 190612SG	19.05	6.35	7.94	1.2	●	●
	190616SG				1.6	●	●
Roughing							
	TNMG 160404MQ	9.525	4.76	3.81	0.4	●	●
	160408MQ				0.8	●	●
Finishing-Medium							
	TNMG 160404MS	9.525	4.76	3.81	0.4	●	●
	160408MS				0.8	●	●
	160412MS				1.2	●	●
Medium-Roughing							
	TNMG 160404MU	9.525	4.76	3.81	0.4	●	●
	160408MU				0.8	●	●
Medium-Roughing							
	TNMG 160408SG	9.525	4.76	3.81	0.8	●	●
	160412SG				1.2	●	●
Roughing	TNMG 220408SG	12.70	4.76	5.16	0.8	●	●
	220412SG				1.2	●	●
	VNMG 160404MQ	9.525	4.76	3.81	0.4	●	●
	160408MQ				0.8	●	●
Finishing-Medium							
	VNMG 160404MS	9.525	4.76	3.81	0.4	●	●
	160408MS				0.8	●	●
	160412MS				1.2	●	●
Medium-Roughing							
	VNMG 160404MU	9.525	4.76	3.81	0.4	●	●
	160408MU				0.8	●	●
Medium-Roughing							
	VNMG 160404SG	9.525	4.76	3.81	0.4	●	●
	160408SG				0.8	●	●
Roughing							
	WNMG 080404MQ	12.70	4.76	5.16	0.4	●	●
	080408MQ				0.8	●	●
Finishing-Medium							
	WNMG 080404MS	12.70	4.76	5.16	0.4	●	●
	080408MS				0.8	●	●
	080412MS				1.2	●	●
Medium-Roughing							
	WNMG 080404MU	12.70	4.76	5.16	0.4	●	●
	080408MU				0.8	●	●
Medium-Roughing							
	WNMG 080408SG	12.70	4.76	5.16	0.8	●	●
	080412SG				1.2	●	●
Roughing							

●: Standard Stock

