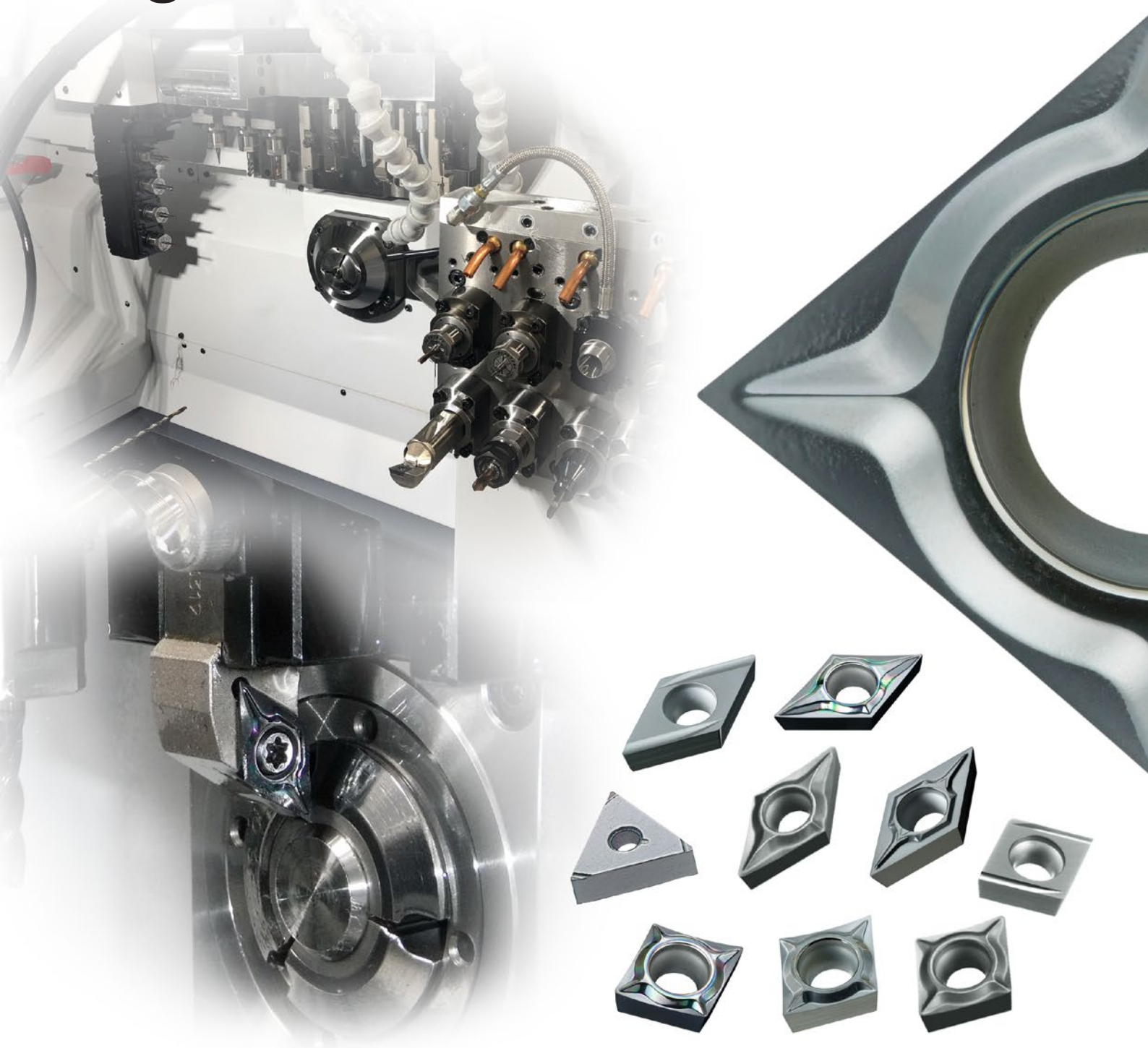


MS Series - PVD Coated Grades for High Precision and Small Parts Machining

MS6015/MS7025/MS9025

Series
Expansion

Contemporary Machining of High Precision Small Parts



Transformation of Machining on Swiss-type Automatic Lathes

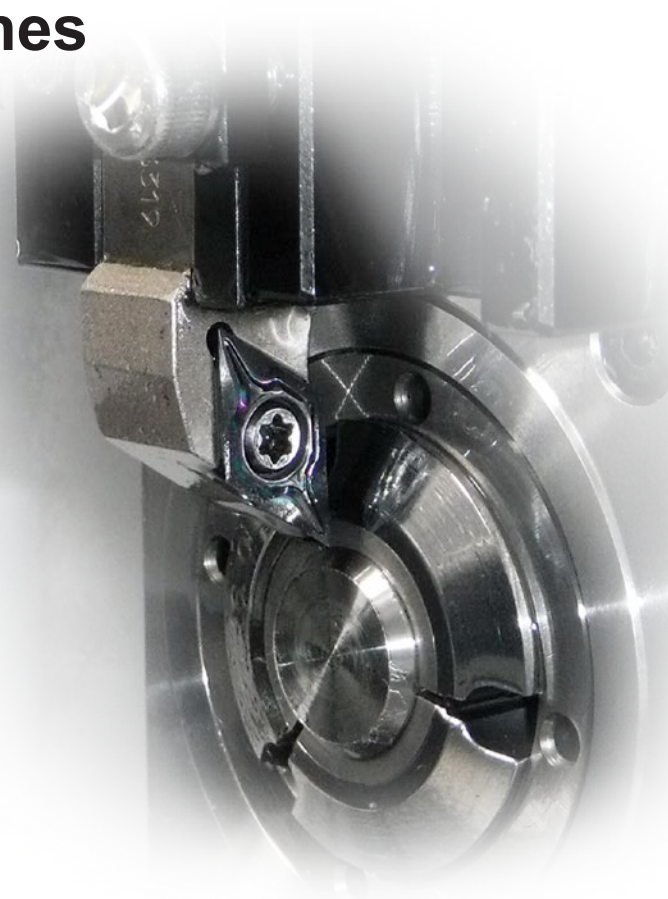
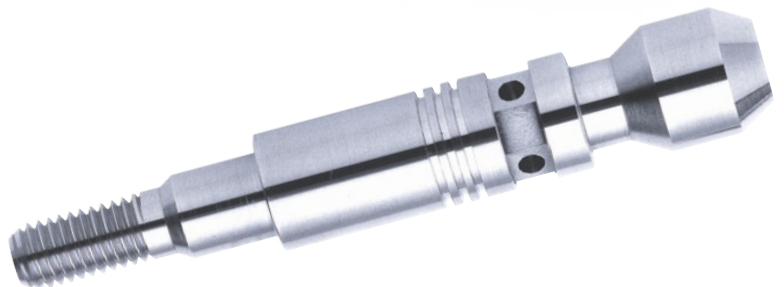
The first parts to be machined on Swiss-type automatic lathes were watch components. The use soon expanded to machining electrical part for home appliances, printers as well as automobile component applications such as sensors and electrification technology parts. The high precision capability of Swiss-type lathes has also lent itself to the machining of parts essential to daily life. These parts include robotic and medical implants as well as simple but essential parts for water taps. Expanding the type of workpieces is not the only modern advancement, even higher precision, productivity and quality has become necessary.

Due to changes in materials and component geometries, various problems have arisen that need solutions:

- Complex workpiece shapes
- Ever more difficult-to-cut materials
- Tighter dimensional tolerances

MITSUBISHI MATERIALS is committed to product development and the commercialisation of new tools that have the cutting capability and machine tool adaptability that customers desire as follows:

- Development of new coating adapted to workpiece materials and machining methods
- Optimisation of welding, wear and fracture resistance
- High precision machining enabled by developments of high quality cutting edge geometries



MS Series - PVD Coated Grades for High Precision and Small Parts Machining

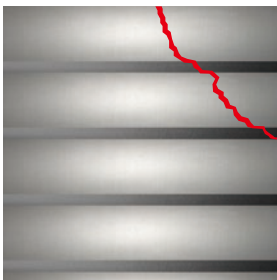
MS7025 NEW

Dramatically improved welding and wear resistance in low feed machining with a more precise nano-multilayer coating

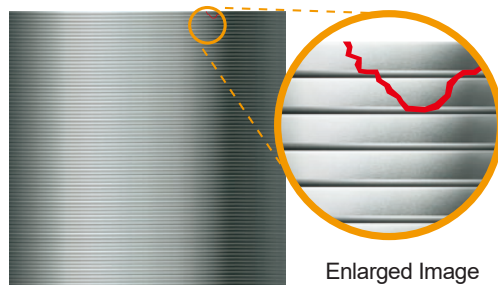
Features

Nano-Multilayer Coating

By combining the high lubrication layer with excellent welding resistance, and the high hardness layer with a greater wear resistance that suppresses the progress of wear at the nano-level, the film damage is significantly reduced and the welding and wear resistance are dramatically improved.



Conventional Multilayer Coating

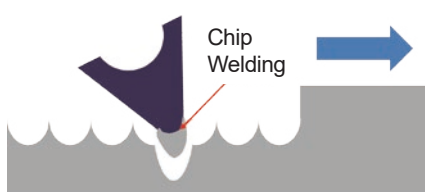


Nano-multilayer Coating

Effects of the High Lubrication Layer

The nano-level, high lubrication layer suppresses built-up edge caused by chip welding which tends to occur in low feed machining and in addition reduces on the machined surface.

Surface Finish



Conventional



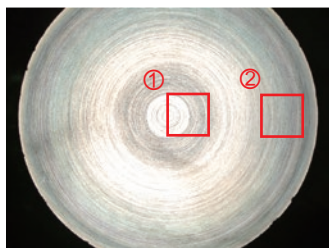
MS7025

Cutting Performance

Comparison of End Face Machined Surfaces Using 3D Analysis

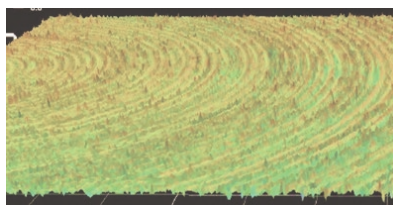
Achieves stable machining even during end face machining where the cutting speed is liable to change.

Workpiece Material : JIS S45C



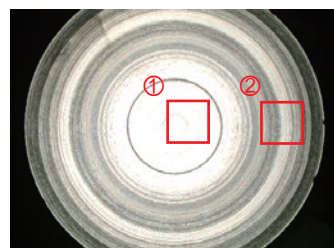
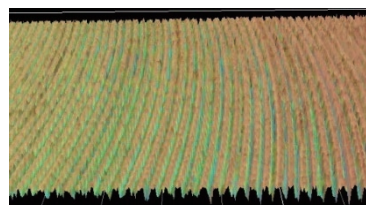
MS7025

①

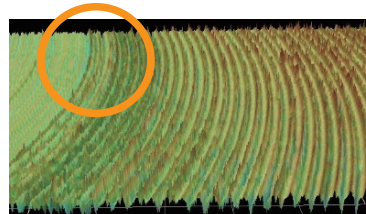
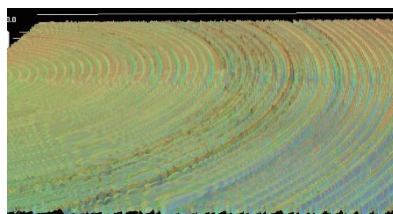


Good Surface Finish

②

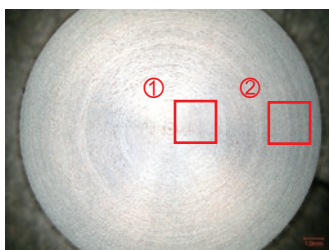


Conventional



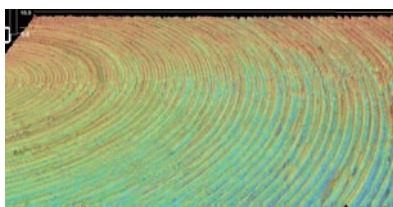
Changes in surface quality that cause machining marks

Workpiece Material : JIS SUS304



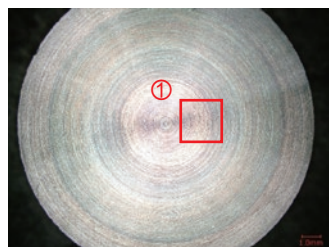
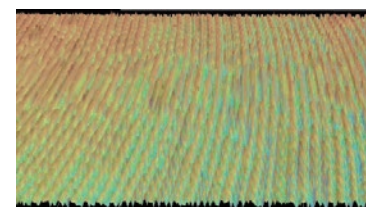
MS7025

①

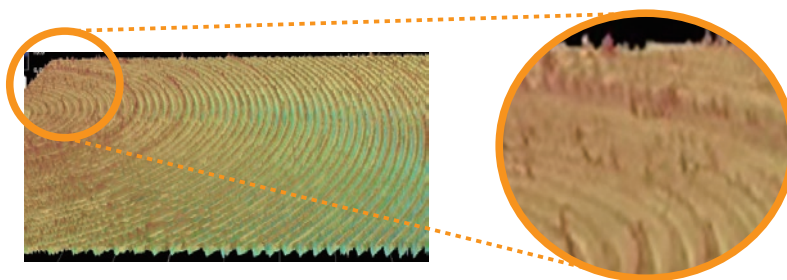


Good Surface Finish

②

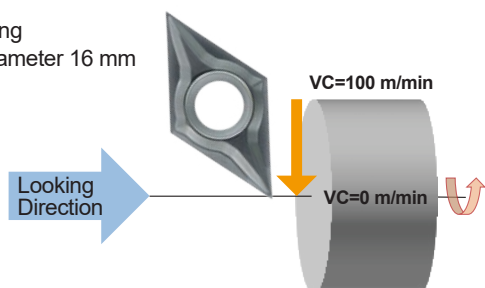


Conventional



Roughness can occur in the low speed area (near the centre)

Image of Facing
Workpiece Diameter 16 mm



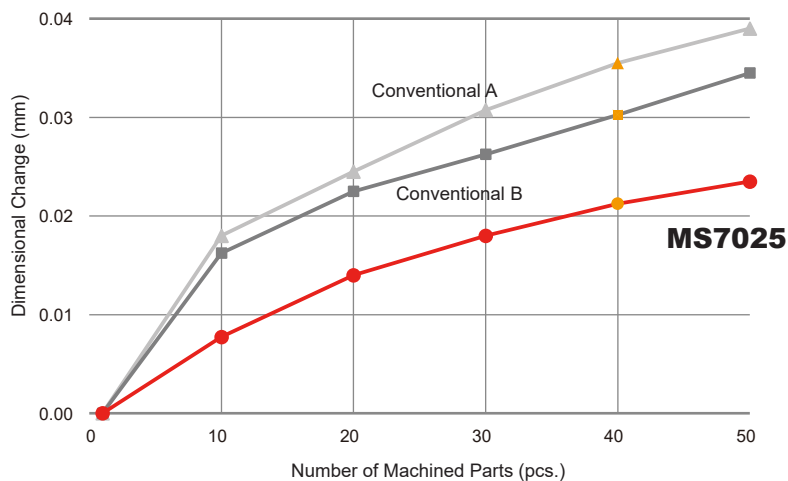
<Cutting Conditions>

Workpiece Material	: Notation Above
Inserts	: DCGT11T302
Cutting Speed	: vc = Max. 100 m/min
Feed per Rev.	: f = 0.02 mm/rev
Depth of Cut	: ap = 0.2 mm
Cutting Mode	: Wet Cutting (Oil)

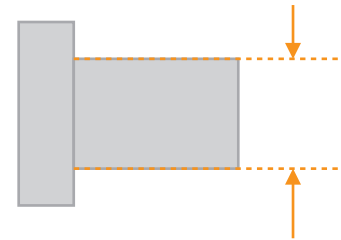
Comparison of Dimensional Change in Low Feed Machining

When machining at low feed rate conditions, dimensional changes are reduced and the quality of the machined surface is improved.

Workpiece Material : JIS SUS440C



Dimensional Change
The amount of dimensional change is based on the first machining

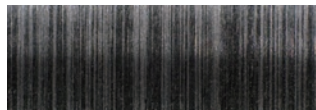


<Cutting Conditions>
 Workpiece Material : JIS SUS440C
 Inserts : DCGT11T301
 Cutting Speed : $v_c = 70$ m/min
 Feed per Rev. : $f = 0.02$ mm/rev
 Depth of Cut : $a_p = 1.5$ mm
 Cutting Mode : Wet Cutting (Oil)

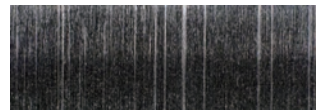
After 40 piece machining



MS7025

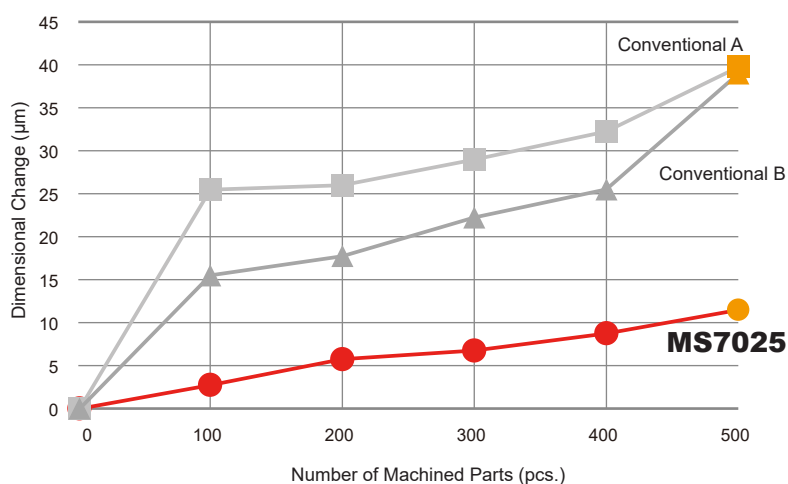


Conventional A



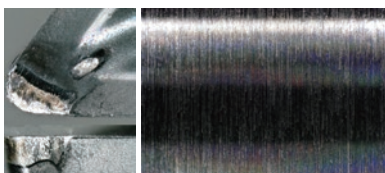
Conventional B

Workpiece Material : ELCH2S

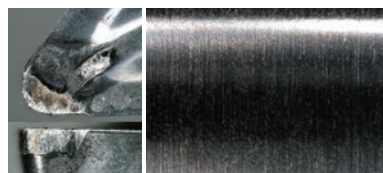


<Cutting Conditions>
 Workpiece Material : ELCH2S
 Inserts : DCGT11T302
 Cutting Speed : $v_c = 240$ m/min
 Feed per Rev. : $f = 0.03$ mm/rev
 Depth of Cut : $a_p = 0.3$ mm
 Workpiece Material Length : 15 mm
 Cutting Mode : Wet Cutting (Oil)

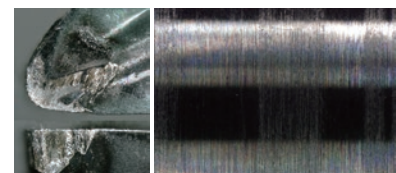
After 500 piece machining



MS7025



Conventional A



Conventional B

MS Series - PVD Coated Grades for High Precision and Small Parts Machining

MS9025

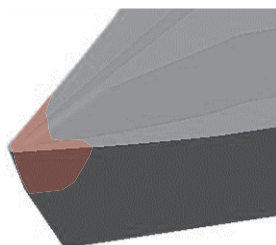
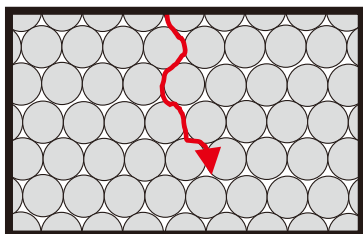
Effective reduction of notch wear with a balance of wear and fracture resistance.

Features

Improved Cemented Carbide

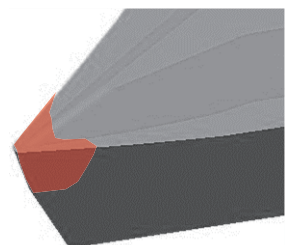
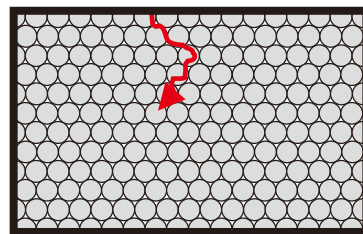
Thermal conductivity has been improved by optimising the grain size and therefore reducing the boundary contact between the WC particles. This optimisation reduces the temperature of the cutting edge during machining.

MS9025



Reducing the cutting edge temperature by improved thermal conductivity.

Conventional

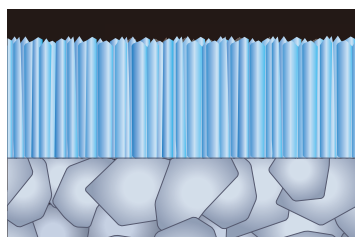


Higher cutting edge temperatures due to more particle boundary contact.

Smooth Surface of The Coating

The even surface of the coating has been achieved by first making the the carbide substrate smooth then by promoting straight growth of the coating crystals. This leads to excellent welding resistance.

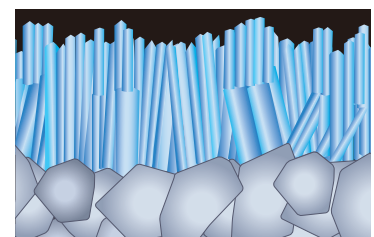
MS9025



Smooth Cemented Carbide

Straight crystal growth.
Smooth carbide surface.
Excellent welding resistance.

Conventional

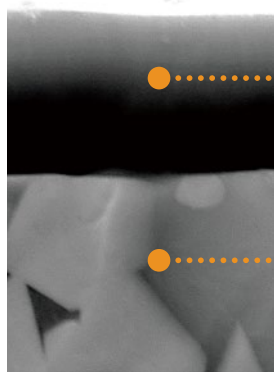


Rough Cemented Carbide

Random crystal growth direction.
Performance is variable due to defects and voids in the surface.

*By Image

High Al-rich(Al,Ti)N Single Layer Coating Technology



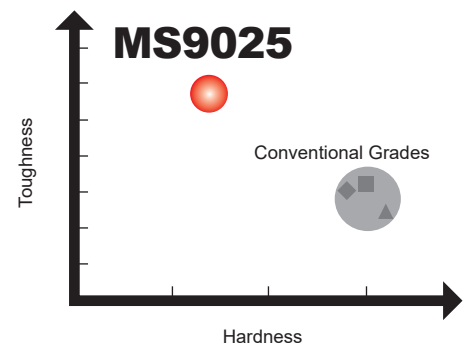
Al-rich (Al,Ti)N

Superior Flank Wear Resistance
Superior Crater Wear Resistance
Excellent Welding Resistance

Special Cemented Carbide for MS9025

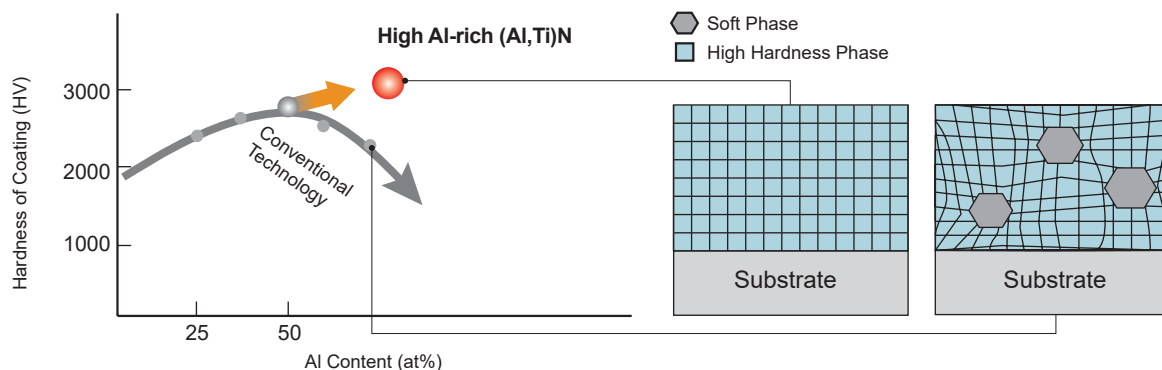
Superior Fracture Resistance
Excellent Chipping Resistance

Cemented Carbide Base Material Properties



High Al and Conventional Coating Comparison

The high Al-rich (Al,Ti)N single layer coating provides stabilization of the high hardness phase and succeeds in dramatically improving wear, crater and welding resistance.

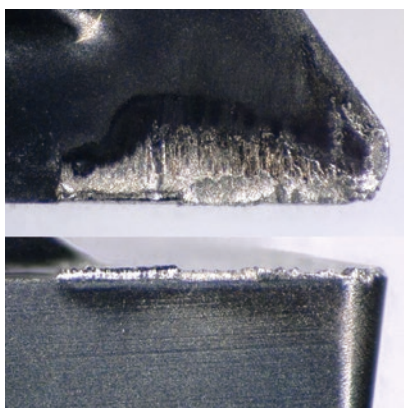


Stainless Steel SUS304, Cutting Edge Comparison

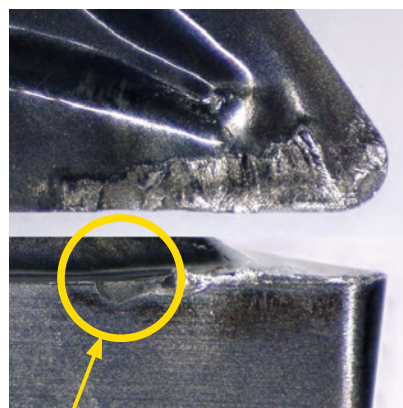
After machining 500 parts

MS9025

Conventional



VB=0.03mm



Notch Wear

VB=0.07mm

<Cutting Conditions>

Workpiece Material : JIS SUS304
Inserts : DCGT11T302
Machining Methods : External
Continuous Cutting
Cutting Speed : $v_c = 57$ m/min
Feed per Rev. : $f = 0.03$ mm/rev
Depth of Cut : Rough $a_p = 0.05$ mm
Finish $a_p = 0.02$ mm
Cutting Mode : Wet Cutting (Oil)

MS Series - PVD Coated Grades for High Precision and Small Parts Machining

MS6015

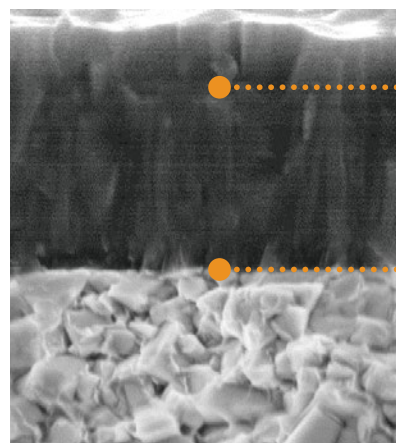
Ideal for turning pure iron, carbon and free cutting steels whilst also providing excellent dimensional accuracy and good surface finishes.

Features

A unique combination of a special carbide substrate and a new PVD coating that greatly improves wear resistance.

	MS6015	Conventional
Coating	TiCN Multi-layer	TiAlN
Hardness (HV)	3000	2800
Wear Coefficient (Carbon Steels)	Low	High
Base Material Hardness (HRA)	92.0	92.0
T.R.S (GPa)	2.0	2.0

Ti-C-N Multi-layer Coating



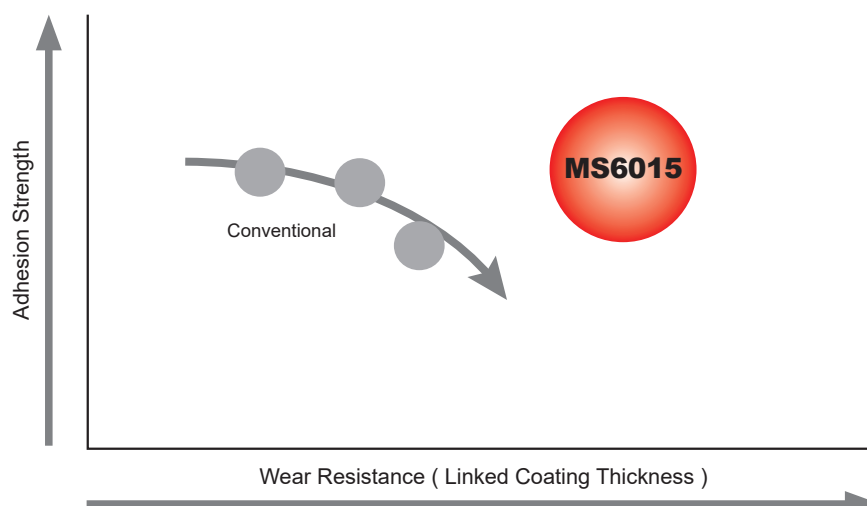
Superior wear and welding resistance and demonstrating the best possible results for carbon steels.

Minute multi-layers remarkably improves adhesion between layers.

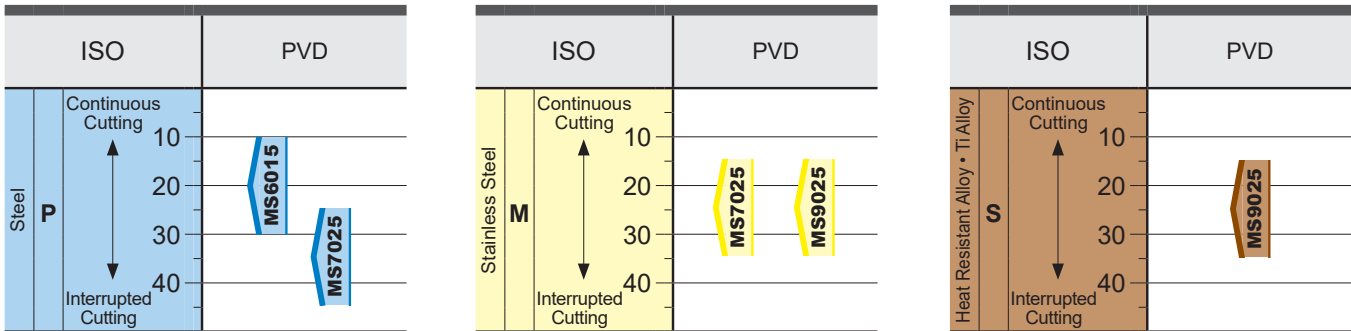
Excellent chip discharge with a reduced coefficient of friction creates a stable surface finish.

Optimising the Laminated Structure

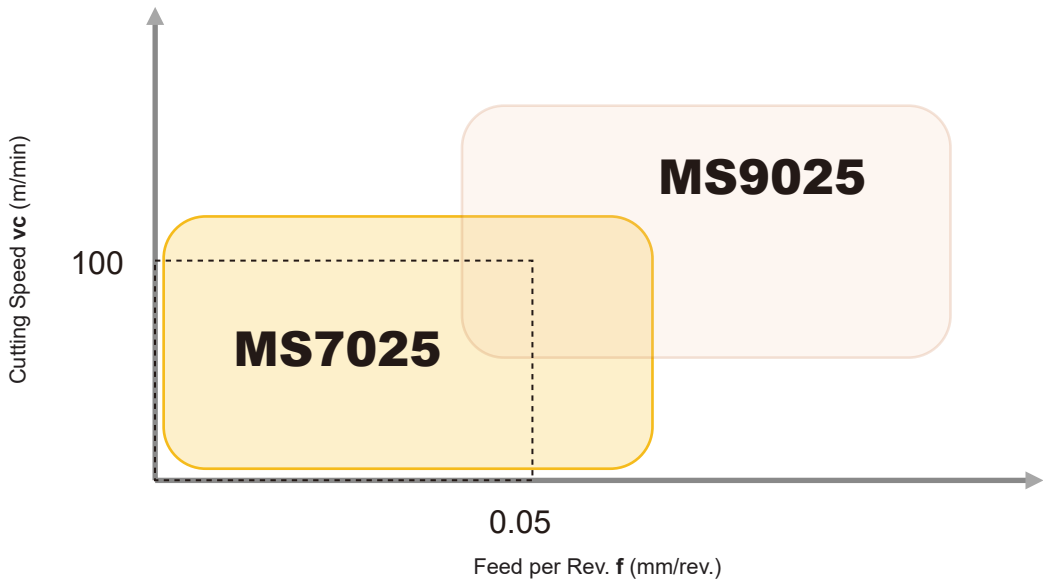
Optimising the laminated structure enables the thickening of coating which leads to significant wear resistance.



Application Range



Correct Use for Cutting Stainless Steel



PVD Coated Grade for High Precision and Small Parts Machining

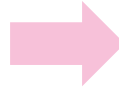
MS6015/MS7025/MS9025

Ideal Inserts for Turning Small Parts.

Set the corner radius to a minus tolerance.

Order
Number

DCGT11T302 M R-SN
DCGT11T304 M -SMG



02M R0.2mm (R0.15 – R0.20mm)
04M R0.4mm (R0.35 – R0.40mm)

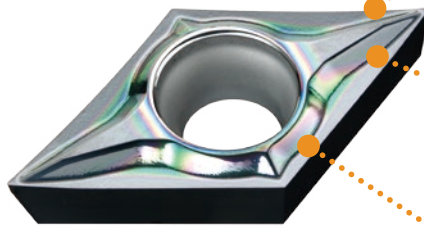
New Breaker System for Front Turning

FS-P Breaker

LS-P Breaker

For Micro-Low Depth of Cut

FS-P Breaker



Curved Cutting Edge

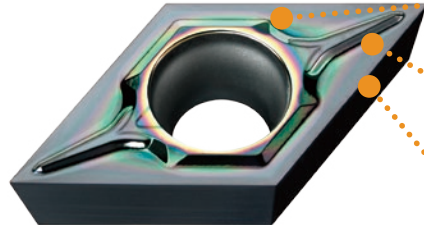
The curved cutting edge reduces cutting resistance and enables smooth chip evacuation. It also enables good initial entry to the workpiece and resists vibration and oscillation during machining.

High Breaker Wall

The high chip breaker wall ensures that the chips separate properly and prevents the workpiece from being damaged when chips are discharged.

For Medium to High Depth of Cut

LS-P Breaker



Polishing (Mirror-Surface)

Welding resistance and chip evacuation are greatly improved.

Large Pocket

The large pocket enhances chip evacuation during high depths of cut and suppresses chip clogging.

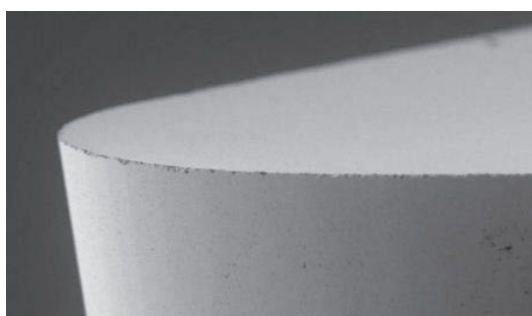
Parallel Cutting Edge

The parallel cutting edge greatly improves fracture resistance during high depths of cut.

Extremely High Quality Cutting Edge

Technology that provides superior dimensional stability and reduces burrs.

MS9025



Rz=0.14 μ m

Conventional

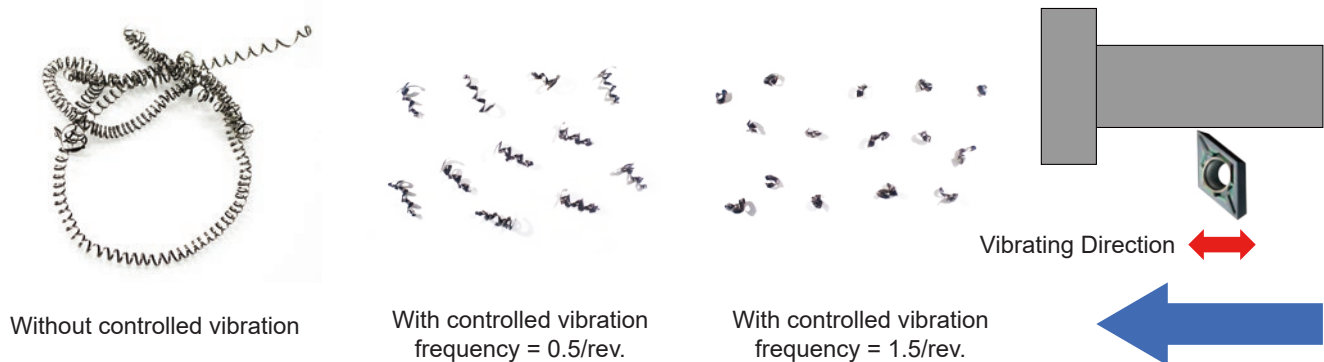


Rz=0.61 μ m

New Technology - Controlled Vibration of the Cutting Tool

Using new machine technology to deliberately vibrate the tool in relation to the cutting direction is an effective way of breaking chips.

This reduces production costs by reducing chip entanglement.



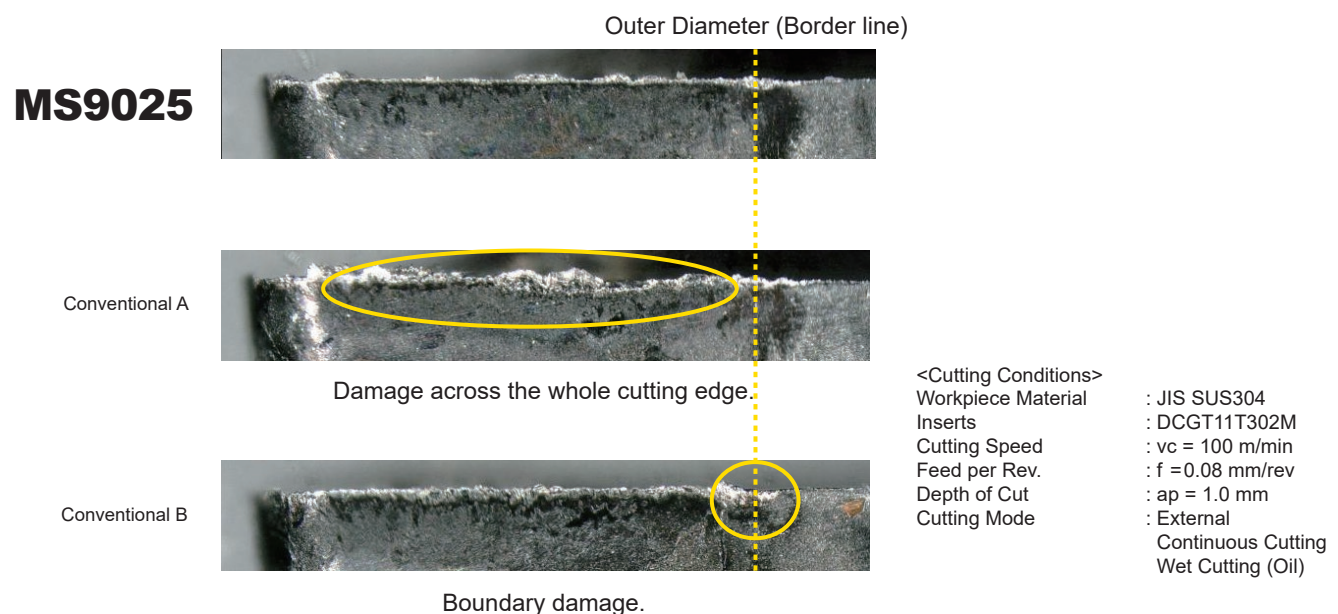
Challenges of controlled vibration machining:

Compared to standard machining there is a greater chance of edge chipping due to the extra stress on the cutting edge and also because of the impact of work hardening.

Benefits of using MS9025 for Controlled Vibration Machining

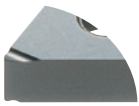
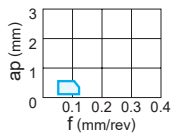
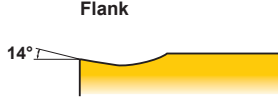
1. Excellent fracture resistance due to the inherent toughness of the base material.
2. Effectively suppresses boundary wear damage during machining of difficult-to-cut materials. This is achieved by the optimised cemented carbide grain size that reduces thermal conductivity and heating of the cutting edge.

After 500 passes at 15m per pass

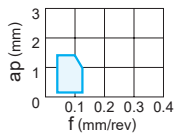
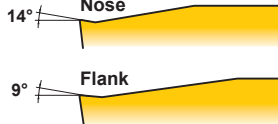
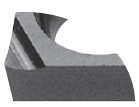
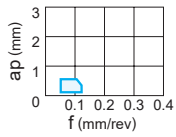
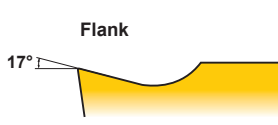
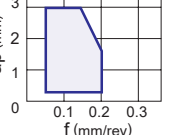
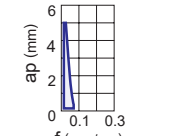
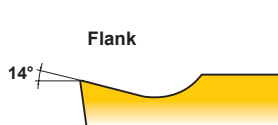
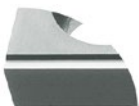
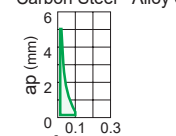
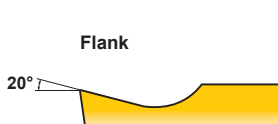
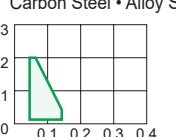
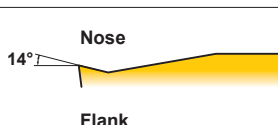


Breaker System

Negative Inserts

Application	Tolerance	Breaker Name and Picture	Features	Cross Section Geometry
Finish Cutting	G	R/L-FS 	Precise Finishing Double-sided chip breaker. A narrow lead chip breaker for good chip control. Sharp cutting edge gives a good surface finish.	Carbon Steel • Alloy Steel  

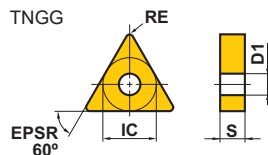
Positive Inserts

Application	Tolerance	Breaker Name and Picture	Features	Cross Section Geometry
Finish Cutting	G	FS-P 	First recommendation for finishing titanium alloys Ideal for Cobalt chromium alloy and Copper alloy. The sharp edge produces a good surface finish. The curved edge allows smooth chip discharge. Lapping of the top surface gives a mirror finish for improved welding resistance.	Titanium alloys  
	G	R/L-F 	Finish Cutting of Automatic Lathe Machining Lead chip breaker controls chip flow. Sharp cutting edge gives a good surface finish.	Carbon Steel • Alloy Steel  
Light Cutting	G	LS-P 	Light Cutting of Automatic Lathe Machining Designed with parallel cutting edges. Achieves stable chip control over a wide range from low to medium depths of cut. Polished (mirror-surface) finish of insert surface drastically improves welding resistance extending tool life.	Carbon Steel • Alloy Steel  
	G	R/L-SS 	Light Cutting of Automatic Lathe Machining A parallel chip breaker. Excellent chip control at low feed rates.	Carbon Steel • Alloy Steel  
Medium Cutting	G	R/L-SN 	Medium Cutting of Automatic Lathe Machining A parallel chip breaker. Excellent chip control at low to medium feed rates.	Carbon Steel • Alloy Steel  
	G	SMG 	Medium Cutting of Automatic Lathe Machining 3D molded chip breaker provides good chip control. G class insert gives sharp cutting action, allowing high precision machining. Breaker geometry appropriate for copying and back turning.	Carbon Steel • Alloy Steel  

MS6015/MS7025/MS9025

Negative Inserts (With Hole)

G Class



Finish		
R/L-FS		
		

(mm)

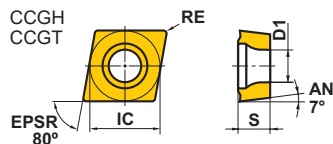
Order Number	Cutting Area	MS6015	NEW		IC	S	RE	D1
			MS7025	MS9025				
TNGG160402R-FS	F	●			9.525	4.76	0.2	3.81
TNGG160402L-FS	F	●			9.525	4.76	0.2	3.81
TNGG160404R-FS	F	●			9.525	4.76	0.4	3.81
TNGG160404L-FS	F	●			9.525	4.76	0.4	3.81
TNGG160408R-FS	F	●			9.525	4.76	0.8	3.81
TNGG160408L-FS	F	●			9.525	4.76	0.8	3.81

● : Inventory maintained in Japan. (10 inserts in one case)

MS6015/MS7025/MS9025

7° Positive Inserts (With Hole)

G Class



Finish	Finish	
FS-P	R/L-F	
		

(mm)

Order Number	Cutting Area		NEW		IC	S	RE*2	D1
		MS6015	MS7025	MS9025				
CCGT060201M-FS-P	F		●	●	6.35	2.38	0.1	2.8
CCGT060202M-FS-P	F		●	●	6.35	2.38	0.2	2.8
CCGT09T301M-FS-P	F		●	●	9.525	3.97	0.1	4.4
CCGT09T302M-FS-P	F		●	●	9.525	3.97	0.2	4.4
CCGT09T304M-FS-P	F		●	●	9.525	3.97	0.4	4.4
CCGT03S101MR-F	F	●			3.57*1	1.39	0.1	2.0
CCGT03S101ML-F	F	●			3.57*1	1.39	0.1	2.0
CCGT03S102MR-F	F	●			3.57*1	1.39	0.2	2.0
CCGT03S102ML-F	F	●			3.57*1	1.39	0.2	2.0
CCGT03S104MR-F	F	●			3.57*1	1.39	0.4	2.0
CCGT03S104ML-F	F	●			3.57*1	1.39	0.4	2.0
CCGT04T001MR-F	F	●			4.37*1	1.79	0.1	2.4
CCGT04T001ML-F	F	●			4.37*1	1.79	0.1	2.4
CCGT04T002MR-F	F	●			4.37*1	1.79	0.2	2.4
CCGT04T002ML-F	F	●			4.37*1	1.79	0.2	2.4
CCGT04T004MR-F	F	●			4.37*1	1.79	0.4	2.4
CCGT04T004ML-F	F	●			4.37*1	1.79	0.4	2.4
CCGH060202MR-F	F	●			6.35	2.38	0.2	2.8
CCGH060202ML-F	F	●			6.35	2.38	0.2	2.8
CCGH060204MR-F	F	●			6.35	2.38	0.4	2.8
CCGH060204ML-F	F	●			6.35	2.38	0.4	2.8

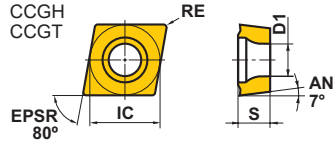
*1 Diameter of inscribed circle is non-ISO standard. (For SCLC type)

*2 Nominal Value (Max.)

● : Inventory maintained in Japan. (10 inserts in one case)

7° Positive Inserts (With Hole)

G Class



Light	Light	Medium
LS-P	R/L-SS	R/L-SN
		
Medium		
SMG		
		

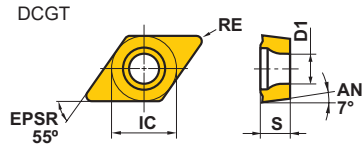
(mm)								
Order Number	Cutting Area	NEW			IC	S	RE*	D1
		MS6015	MS7025	MS9025				
CCGT060201M-LS-P	L	●	●	●	6.35	2.38	0.1	2.8
CCGT060202M-LS-P	L	●	●	●	6.35	2.38	0.2	2.8
CCGT09T301M-LS-P	L	●	●	●	9.525	3.97	0.1	4.4
CCGT09T302M-LS-P	L	●	●	●	9.525	3.97	0.2	4.4
CCGT09T304M-LS-P	L	●	●	●	9.525	3.97	0.4	4.4
CCGT060201MR-SS	L	●			6.35	2.38	0.1	2.8
CCGT060201ML-SS	L	●			6.35	2.38	0.1	2.8
CCGT060202MR-SS	L	●			6.35	2.38	0.2	2.8
CCGT060202ML-SS	L	●			6.35	2.38	0.2	2.8
CCGT09T301MR-SS	L	●			9.525	3.97	0.1	4.4
CCGT09T301ML-SS	L	●			9.525	3.97	0.1	4.4
CCGT09T302MR-SS	L	●			9.525	3.97	0.2	4.4
CCGT09T302ML-SS	L	●			9.525	3.97	0.2	4.4
CCGT09T304MR-SS	L	●			9.525	3.97	0.4	4.4
CCGT09T304ML-SS	L	●			9.525	3.97	0.4	4.4
CCGT060201MR-SN	M	●	●	●	6.35	2.38	0.1	2.8
CCGT060201ML-SN	M	●			6.35	2.38	0.1	2.8
CCGT060202MR-SN	M	●	●	●	6.35	2.38	0.2	2.8
CCGT060202ML-SN	M	●			6.35	2.38	0.2	2.8
CCGT09T301MR-SN	M	●	●	●	9.525	3.97	0.1	4.4
CCGT09T301ML-SN	M	●			9.525	3.97	0.1	4.4
CCGT09T302MR-SN	M	●	●	●	9.525	3.97	0.2	4.4
CCGT09T302ML-SN	M	●			9.525	3.97	0.2	4.4
CCGT09T304MR-SN	M	●	●	●	9.525	3.97	0.4	4.4
CCGT09T304ML-SN	M	●			9.525	3.97	0.4	4.4
CCGT060201M-SMG	M	●			6.35	2.38	0.1	2.8
CCGT060202M-SMG	M	●			6.35	2.38	0.2	2.8
CCGT060204M-SMG	M	●			6.35	2.38	0.4	2.8
CCGT09T301M-SMG	M	●			9.525	3.97	0.1	4.4
CCGT09T302M-SMG	M	●			9.525	3.97	0.2	4.4
CCGT09T304M-SMG	M	●			9.525	3.97	0.4	4.4

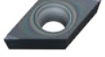
* Nominal Value (Max.)

MS6015/MS7025/MS9025

7° Positive Inserts (With Hole)

G Class



Finish	Finish	Light
FS-P	R-SRF	LS-P
		
Light		
R/L-SS		
		

(mm)

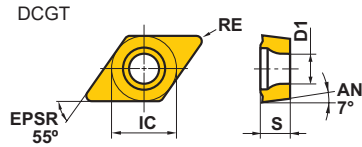
Order Number	Cutting Area	NEW			IC	S	RE*	D1
		MS6015	MS7025	MS9025				
DCGT070201M-FS-P	F		●	●	6.35	2.38	0.1	2.8
DCGT070202M-FS-P	F		●	●	6.35	2.38	0.2	2.8
DCGT070204M-FS-P	F		●	●	6.35	2.38	0.4	2.8
DCGT11T301M-FS-P	F		●	●	9.525	3.97	0.1	4.4
DCGT11T302M-FS-P	F		●	●	9.525	3.97	0.2	4.4
DCGT11T304M-FS-P	F		●	●	9.525	3.97	0.4	4.4
DCGT11T301MR-SRF	F		●	●	9.525	3.97	0.1	4.4
DCGT11T302MR-SRF	F		●	●	9.525	3.97	0.2	4.4
DCGT11T304MR-SRF	F		●	●	9.525	3.97	0.4	4.4
DCGT070201M-LS-P	L	●	●	●	6.35	2.38	0.1	2.8
DCGT070202M-LS-P	L	●	●	●	6.35	2.38	0.2	2.8
DCGT070204M-LS-P	L	●	●	●	6.35	2.38	0.4	2.8
DCGT11T301M-LS-P	L	●	●	●	9.525	3.97	0.1	4.4
DCGT11T302M-LS-P	L	●	●	●	9.525	3.97	0.2	4.4
DCGT11T304M-LS-P	L	●	●	●	9.525	3.97	0.4	4.4
DCGT070201MR-SS	L	●			6.35	2.38	0.1	2.8
DCGT070201ML-SS	L	●			6.35	2.38	0.1	2.8
DCGT070202MR-SS	L	●			6.35	2.38	0.2	2.8
DCGT070202ML-SS	L	●			6.35	2.38	0.2	2.8
DCGT11T301MR-SS	L	●			9.525	3.97	0.1	4.4
DCGT11T301ML-SS	L	●			9.525	3.97	0.1	4.4
DCGT11T302MR-SS	L	●			9.525	3.97	0.2	4.4
DCGT11T302ML-SS	L	●			9.525	3.97	0.2	4.4
DCGT11T304MR-SS	L	●			9.525	3.97	0.4	4.4
DCGT11T304ML-SS	L	●			9.525	3.97	0.4	4.4

* Nominal Value (Max.)

● : Inventory maintained in Japan. (10 inserts in one case)

7° Positive Inserts (With Hole)

G Class



Medium	Medium	
R/L-SN	SMG	
		

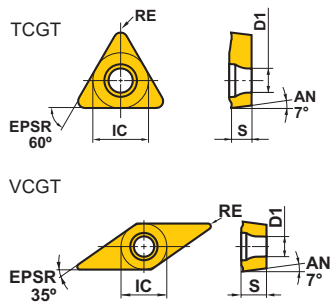
(mm)								
Order Number	Cutting Area	NEW			IC	S	RE*	D1
		MS6015	MS7025	MS9025				
DCGT070201MR-SN	M	●	●	●	6.35	2.38	0.1	2.8
DCGT070201ML-SN	M	●			6.35	2.38	0.1	2.8
DCGT070202MR-SN	M	●	●	●	6.35	2.38	0.2	2.8
DCGT070202ML-SN	M	●			6.35	2.38	0.2	2.8
DCGT070204MR-SN	M		●	●	6.35	2.38	0.4	2.8
DCGT11T301MR-SN	M	●	●	●	9.525	3.97	0.1	4.4
DCGT11T301ML-SN	M	●			9.525	3.97	0.1	4.4
DCGT11T302MR-SN	M	●	●	●	9.525	3.97	0.2	4.4
DCGT11T302ML-SN	M	●			9.525	3.97	0.2	4.4
DCGT11T304MR-SN	M	●	●	●	9.525	3.97	0.4	4.4
DCGT11T304ML-SN	M	●			9.525	3.97	0.4	4.4
DCGT070201M-SMG	M	●			6.35	2.38	0.1	2.8
DCGT070202M-SMG	M	●			6.35	2.38	0.2	2.8
DCGT070204M-SMG	M	●			6.35	2.38	0.4	2.8
DCGT11T301M-SMG	M	●			9.525	3.97	0.1	4.4
DCGT11T302M-SMG	M	●			9.525	3.97	0.2	4.4
DCGT11T304M-SMG	M	●			9.525	3.97	0.4	4.4

* Nominal Value (Max.)

MS6015/MS7025/MS9025

7° Positive Inserts (With Hole)

G Class



Finish	Light	
R/L-F	LS-P	
		

(mm)

Order Number	Cutting Area	NEW			IC	S	RE*	D1
		MS6015	MS7025	MS9025				
TCGT060101MR-F	F	●			3.97	1.59	0.1	2.3
TCGT060101ML-F	F	●			3.97	1.59	0.1	2.3
TCGT060102MR-F	F	●			3.97	1.59	0.2	2.3
TCGT060102ML-F	F	●			3.97	1.59	0.2	2.3
TCGT060104MR-F	F	●			3.97	1.59	0.4	2.3
TCGT060104ML-F	F	●			3.97	1.59	0.4	2.3
VCGT110301M-LS-P	L		●		6.35	3.18	0.1	2.8
VCGT110302M-LS-P	L		●		6.35	3.18	0.2	2.8
VCGT110304M-LS-P	L		●		6.35	3.18	0.4	2.8

* Nominal Value (Max.)

● : Inventory maintained in Japan. (10 inserts in one case)

Recommended Cutting Conditions

(mm)

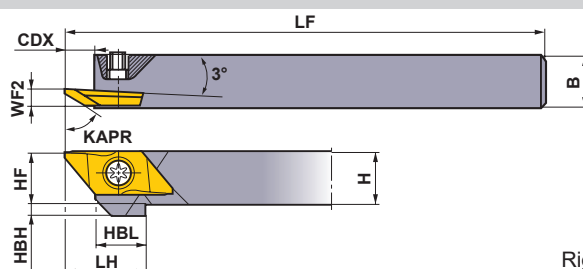
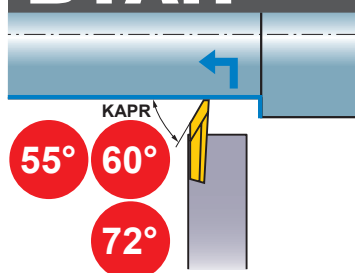
	Workpiece Material	Properties	Cutting Area	Chip Breaker	Grade	Cutting Speed vc (m/min)	Feed per Rev. f (mm/rev)	Depth of Cut ap
P	Pure Irons Free Cutting Steels	—	●	F	FS	MS6015	150(50—250)	0.01—0.15
			●	F	R/L-F	MS6015	150(50—250)	0.01—0.15
			●	L	LS-P	MS6015	150(50—250)	0.01—0.15
			●	L	R/L-SS	MS6015	150(50—250)	0.01—0.15
			●	M	R/L-SN	MS6015	150(50—250)	0.01—0.15
			●	M	SMG	MS6015	150(50—250)	0.01—0.15
	Carbon Steels Alloy Steels	180—280HB	●	F	FS	MS6015	100(50—150)	0.01—0.15
			●	F	R/L-F	MS6015	100(50—150)	0.01—0.15
			●	L	LS-P	MS6015	100(50—150)	0.01—0.15
			●	L	R/L-SS	MS6015	100(50—150)	0.01—0.15
			●	M	R/L-SN	MS6015	100(50—150)	0.01—0.15
			●	M	SMG	MS6015	100(50—150)	0.01—0.15
M	Austenitic Stainless Steels	—	●	F	FS	MS7025	60(40—100)	0.01—0.08
			●	F	FS-P	MS9025	100(60—150)	0.04—0.15
			●	F	R/L-F	MS7025	60(40—100)	0.01—0.08
			●	F	R-SRF	MS9025	100(60—150)	0.04—0.15
			●	L	LS-P	MS7025	60(40—100)	0.01—0.08
			●	L	LS-P	MS9025	100(60—150)	0.05—0.15
			●	M	R-SN	MS7025	60(40—100)	0.01—0.08
			●	M	R-SN	MS9025	100(60—150)	0.05—0.15
	Ferritic and Martensitic Stainless Steels	—	●	F	FS-P	MS7025	60(40—100)	0.01—0.08
			●	F	R-SRF	MS7025	60(40—100)	0.01—0.08
			●	L	LS-P	MS7025	60(40—100)	0.01—0.08
			●	L	R-SN	MS7025	60(40—100)	0.01—0.08
	Electromagnetic Stainless Steels (SUS440C, SUS420J2 etc.)	Hardness 230HBW	●	F	FS-P	MS7025	80(40—160)	0.02—0.08
			●	F	FS-P	MS9025	100(50—180)	0.04—0.12
			●	F	R-SRF	MS7025	80(40—160)	0.03—0.08
			●	F	R-SRF	MS9025	100(50—180)	0.05—0.12
			●	L	LS-P	MS7025	80(40—160)	0.02—0.10
			●	L	LS-P	MS9025	100(50—180)	0.04—0.15
			●	M	R-SN	MS7025	80(40—160)	0.01—0.10
			●	M	R-SN	MS9025	100(50—180)	0.01—0.10
	Precipitation Hardening Stainless Steels (SUS630, SUS631 etc.)	<450HB	●	F	FS-P	MS7025	60(40—80)	0.01—0.10
			●	F	FS-P	MS9025	70(50—100)	0.03—0.15
			●	F	R-SRF	MS7025	60(40—80)	0.01—0.10
			●	F	R-SRF	MS9025	70(50—100)	0.03—0.15
			●	L	LS-P	MS7025	60(40—80)	0.04—0.10
			●	L	LS-P	MS9025	70(50—100)	0.04—0.15
			●	M	R-SN	MS7025	60(40—80)	0.03—0.10
			●	M	R-SN	MS9025	70(50—100)	0.04—0.15
S	Heat Resistant Alloys (SUH etc.)	—	●	F	FS-P	MS9025	80(40—140)	0.04—0.12
			●	F	R-SRF	MS9025	80(40—140)	0.05—0.12
			●	L	LS-P	MS9025	80(40—140)	0.04—0.15
			●	M	R-SN	MS9025	80(40—140)	0.01—0.10

Cutting Conditions (Guide) :

● : Stable Cutting ● : General Cutting ✖ : Unstable Cutting

EXTERNAL BACK TURNING

BTAH



Right hand tool holder shown.

Order Number	Stock		Insert Number		Dimensions (mm)										 *	
	R	L			H	B	LF	LH	HF	WF2	HBH	HBL	CDX	Clamp Screw	Wrench	
BTAHR/L0810-50	●	●	BTAT	5528○○R/L-B	8	10	120	15	8	3.5	4	9.5	5.5	NS402W	NKY15S	
BTAHR/L1010-50	●	●		6035○○R/L-B	10	10	120	15	10	3.5	2	9.5	5.5	NS402W	NKY15S	
BTAHR/L1212-50	●	●		605000RX	12	12	120	15	12	3.5	—	9.5	5.5	NS403W	NKY15S	
BTAHR/L1616-50	●	●		7235○○R-SMB	16	16	120	15	16	3.5	—	9.5	5.5	NS403W	NKY15S	

Note 1) Please use right hand insert for right hand holder and left hand insert for left hand holder.

Note 2) Set the maximum depth of cut at under 60% of the effective cutting edge length (LE).

* Clamp Torque (N · m) : NS402W=1.0, NS403W=1.0

INSERTS

Order Number	Hand	Coated		Dimensions (mm)							LE ^{*2} (mm)	Geometry
		VP15TF	MS6015	PSIRRL *	RER/L	CF	L	W1	CW	S		
BTAT7235V5R-SMB	R	●		72°	0.05	0.3	20	8	1.4	2.5	3.5	With Breaker Right hand insert shown.
BTAT723501MR-SMB	R	●		72°	0.1 *2	0.3	20	8	1.4	2.5	3.5	
BTAT723502MR-SMB	R	●		72°	0.2 *2	0.3	20	8	1.4	2.5	3.5	
BTAT552800R-B	R	●	●	55°	0	0	20	8	0.5	2.5	2.8	
BTAT552800L-B	L	●		55°	0	0	20	8	0.5	2.5	2.8	
BTAT552801R-B	R	●	●	55°	0.1	0	20	8	0.5	2.5	2.8	
BTAT552801L-B	L	●		55°	0.1	0	20	8	0.5	2.5	2.8	
BTAT603500R-B	R	●	●	60°	0	0	20	8	0.5	2.5	3.5	
BTAT603500L-B	L	●		60°	0	0	20	8	0.5	2.5	3.5	
BTAT603501MR-B	R		●	60°	0.1 *2	0	20	8	0.5	2.5	3.5	
BTAT603501R-B	R	●	●	60°	0.1	0	20	8	0.5	2.5	3.5	
BTAT603501L-B	L	●		60°	0.1	0	20	8	0.5	2.5	3.5	
BTAT605000RX	R	●		60°	0	0	20	8	1.25	2.5	5.0	Without Breaker Right hand insert shown.

Note 1) REL, PSIRR dimensions for Right Hand Tool and RER, PSIRL dimensions for Left Hand Tool.

* Numeric value set insert on holder.

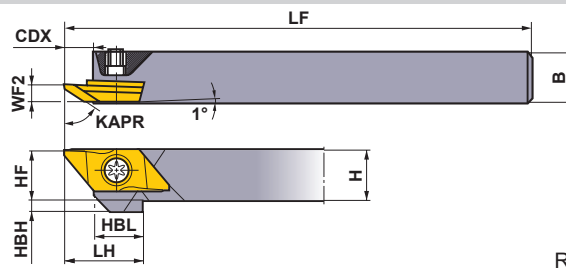
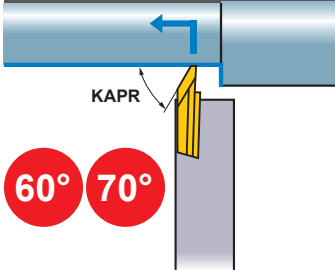
*2 Nominal Value (max.)

RECOMMENDED CUTTING CONDITIONS

Work Material	Hardness	Grade	Cutting Speed (m/min)	Feed (mm/rev)
P Carbon Steel · Alloy Steel	180HB—280HB	MS6015/VP15TF	100 (50—150)	0.08 (0.01—0.15)
	Free Cutting Steel	MS6015	110 (30—180)	0.08 (0.01—0.15)
M Stainless Steel	≤200HB	VP15TF	80 (50—120)	0.06 (0.02—0.1)
N Non-Ferrous Metal	—	MS6015	150 (70—230)	0.09 (0.03—0.15)

● : Inventory maintained in Japan. (5 inserts in one case)

CTBH



Right hand tool holder shown.

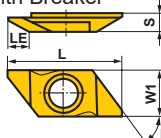
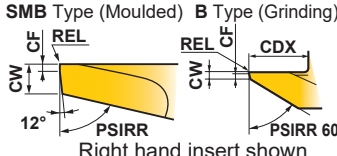
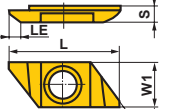
Order Number	Stock		Insert Number		Dimensions (mm)								 *				
	R	L			H	B	LF	LH	HF	WF2	HBH	HBL	CDX	Clamp Screw	Wrench		
CTBHR/L1010-160	●	●	BTBT	60450	○	R/L-B	10	10	120	19.5	10	3.4	2	12	7.5	NS402W	NKY15S
CTBHR/L1212-160	●	●		606000	R/L	12	12	120	19.5	12	3.4	—	12	7.5	NS403W	NKY15S	
CTBHR/L1616-160	●	●		7055	○	R-SMB	16	16	120	19.5	16	3.4	—	12	7.5	NS403W	NKY15S

Note 1) Please use right hand insert for right hand holder and left hand insert for left hand holder.

Note 2) Set the maximum depth of cut at under 60% of the effective cutting edge length (LE).

* Clamp Torque (N · m) : NS402W=1.0, NS403W=1.0

INSERTS

Order Number	Hand	Coated		Dimensions (mm)								*2 LE (mm)	Geometry
		VP15TF	MS6015	PSIRR/L*	RER/L	CF	L	W1	CW	S	CDX		
BTBT7055V5R-SMB	R	●		70°	0.05	0.3	25	9.4	1.35	3.5	6.5	5.5	With Breaker  SMB Type (Moulded) B Type (Grinding)  12° PSIRR 60° Right hand insert shown.
BTBT705501MR-SMB	R	●		70°	0.1 *2	0.3	25	9.4	1.35	3.5	6.5	5.5	
BTBT705502MR-SMB	R	●		70°	0.2 *2	0.3	25	9.4	1.35	3.5	6.5	5.5	
BTBT604500R-B	R	●	●	60°	0	0.2	25	9.4	0.7	3.5	5.5	4.5	
BTBT604500L-B	L	●		60°	0	0.2	25	9.4	0.7	3.5	5.5	4.5	
BTBT604501MR-B	R		●	60°	0.1 *2	0.3	25	9.4	0.7	3.5	5.5	4.5	
BTBT604501R-B	R	●	●	60°	0.1	0.3	25	9.4	0.7	3.5	5.5	4.5	
BTBT604501L-B	L	●		60°	0.1	0.3	25	9.4	0.7	3.5	5.5	4.5	
BTBT606000R	R	●		60°	0	0.2	25	9.4	0.7	3.5	7	6.0	Without Breaker  REL CF CDX PSIRR 60° Right hand insert shown.
BTBT606000L	L	●		60°	0	0.2	25	9.4	0.7	3.5	7	6.0	

Note 1) REL, PSIRR dimensions for Right Hand Tool and RER,

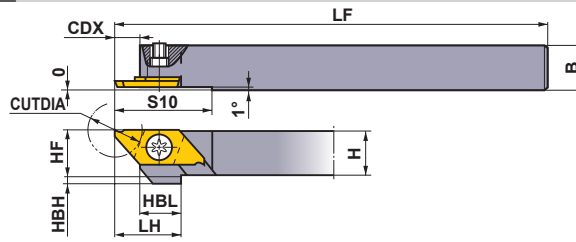
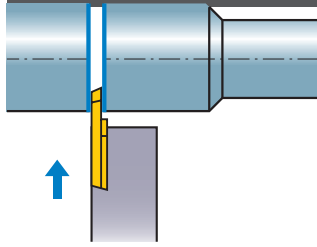
PSIRL dimensions for Left Hand Tool.

* Numeric value set insert on holder.

*2 Nominal Value (max.)

EXTERNAL CUTTING OFF

CTAH



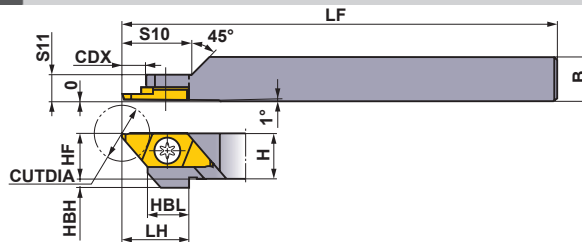
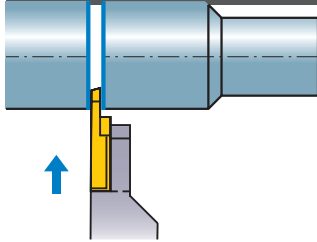
Right hand tool holder shown.

Order Number	Stock		Insert Number	Dimensions (mm)									CUTDIA (mm)	 *2		
	R	L		H	B	HF	LF	LH	CDX	HBH	HBL	S10		Clamp Screw	Wrench	
CTAHR/L0810-120	●	●	CTAT	○○○○	8	10	8	120	15	5.5	4	9.5	12 (8)*1	NS402W	NKY15S	
CTAHR/L1010-120	●	●		○○○○	10	10	10	120	15	5.5	2	9.5		22	NS402W	NKY15S
CTAHR/L1212-120	●	●		○○○○	12	12	12	120	15	5.5	—	9.5		22	NS403W	NKY15S
CTAHR/L1616-120	●	●		○○○○	16	16	16	120	15	5.5	—	9.5		22	NS403W	NKY15S

*1 When the width of cutting off (CW) is 0.7mm.

*2 Clamp Torque (N • m) : NS402W=1.0, NS403W=1.0

CTAH-S



Right hand tool holder only.

Order Number	Stock	Insert Number		Dimensions (mm)										CUTDIA (mm)	 *2	
	R			H	B	HF	LF	LH	CDX	HBH	HBL	S10	S11		Clamp Screw	Wrench
CTAHR1010-120S	●	CTAT	○○○○	10	10	10	80	15	16	2	9.5	16	5.5	12 (8)*1	NS401	NKY25R

*1 When the width of cutting off (CW) is 0.7mm.

*2 Clamp Torque (N • m) : NS401=3.5

RECOMMENDED CUTTING CONDITIONS

	Work Material	Hardness	Grade	Cutting Speed (m/min)	Feed (mm/rev)
P	Carbon Steel · Alloy Steel	180HB—280HB	MS6015/VP15TF	100 (50—150)	0.05 (0.02—0.09)
	Free Cutting Steel	—	MS6015	110 (30—180)	0.05 (0.01—0.09)
M	Stainless Steel	≤200HB	VP15TF	80 (50—120)	0.03 (0.02—0.05)
N	Non-Ferrous Metal	—	MS6015	150 (70—230)	0.07 (0.03—0.11)

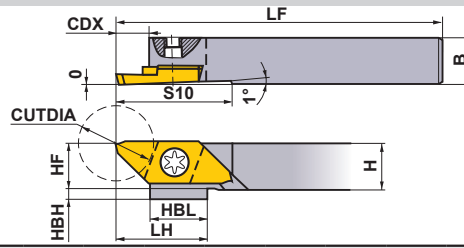
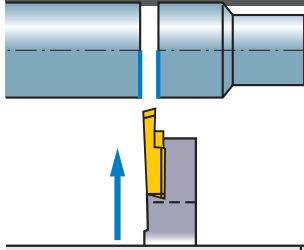
● : Inventory maintained in Japan. (5 inserts in one case)

INSERTS

Holder	Setting Geometry	Breaker	Geometry	Insert Geometry	Order Number	Hand	Coated		Dimensions (mm)								CUTDIA (mm)
							VP15TF	MS6015	CW	CDX	RER/L	L	W1	S	LBB		
Right Hand (R)		With Breaker			CTAT07080V5RR-B	R	●		0.7	4.5	0.05	20	8	2.5	1.5	8	
	CTAT10120V5RR-B			R	●	●	1.0	6.7	0.05	20	8	2.5	1.5	12			
	CTAT15120V5RR-B			R	●	●	1.5	6.7	0.05	20	8	2.5	1.5	12			
	CTAT20120V5RR-B			R	●	●	2.0	6.7	0.05	20	8	2.5	1.5	12			
				CTAT15120V5RR-BX	R	●		1.5	6.7	0.05	20	8	2.5	1.5	12		
				CTAT20120V5RR-BX	R	●		2.0	6.7	0.05	20	8	2.5	1.5	12		
				CTAT10120V5RN-B	N	●	●	1.0	6.7	0.05	20	8	2.5	1.5	12		
				CTAT15120V5RN-B	N	●	●	1.5	6.7	0.05	20	8	2.5	1.5	12		
				CTAT20120V5RN-B	N	●	●	2.0	6.7	0.05	20	8	2.5	1.5	12		
				CTAT15120V5RN-BX	N	●		1.5	6.7	0.05	20	8	2.5	1.5	12		
				CTAT20120V5RN-BX	N	●		2.0	6.7	0.05	20	8	2.5	1.5	12		
	Left Hand (L)				Without Breaker		CTAT10110V5RL-B	L	●		1.0	6.7	0.05	20	8	2.5	1.5
CTAT15110V5RL-B		L		●			1.5	6.7	0.05	20	8	2.5	1.5	11			
CTAT20110V5RL-B		L		●			2.0	6.7	0.05	20	8	2.5	1.5	11			
		CTAT1012000RR		R	●	●	1.0	6.7	0	20	8	2.5	3.5	12			
		CTAT1512000RR		R	●	●	1.5	6.7	0	20	8	2.5	3.5	12			
		CTAT2012000RR		R	●	●	2.0	6.7	0	20	8	2.5	3.5	12			
		CTAT07080V5LL-B		L	●		0.7	4.5	0.05	20	8	2.5	1.5	8			
		CTAT10120V5LL-B		L	●		1.0	6.7	0.05	20	8	2.5	1.5	12			
		CTAT15120V5LL-B		L	●		1.5	6.7	0.05	20	8	2.5	1.5	12			
		CTAT20120V5LL-B		L	●		2.0	6.7	0.05	20	8	2.5	1.5	12			
	CTAT10120V5LN-B	N		●	●	1.0	6.7	0.05	20	8	2.5	1.5	12				
	CTAT15120V5LN-B	N		●	●	1.5	6.7	0.05	20	8	2.5	1.5	12				
	CTAT20120V5LN-B	N		●	●	2.0	6.7	0.05	20	8	2.5	1.5	12				
	CTAT10110V5LR-B	R		●	●	1.0	6.7	0.05	20	8	2.5	1.5	11				
	CTAT15110V5LR-B	R		●	●	1.5	6.7	0.05	20	8	2.5	1.5	11				
	CTAT20110V5LR-B	R		●	●	2.0	6.7	0.05	20	8	2.5	1.5	11				
	CTAT1012000LL	L		●		1.0	6.7	0	20	8	2.5	3.5	12				
	CTAT1512000LL	L		●		1.5	6.7	0	20	8	2.5	3.5	12				
	CTAT2012000LL	L		●		2.0	6.7	0	20	8	2.5	3.5	12				

EXTERNAL CUTTING OFF

CTBH

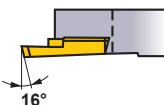
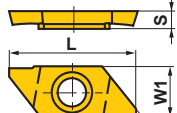
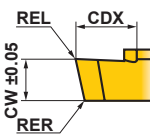
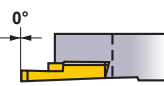
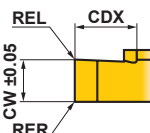
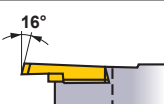
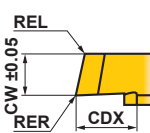
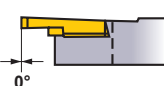
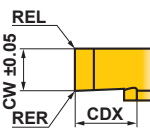
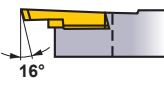
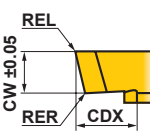


Right hand tool holder shown.

Order Number	Stock		Insert Number	Dimensions (mm)										CUTDIA (mm)	 *	
	R	L		H	B	HF	LF	LH	CDX	HBH	HBL	S10	Clamp Screw		Wrench	
CTBHR/L1010-160	●	●	CTBT	○○○○	10	10	10	120	19.5	7.5	2	9.5	25	16	NS402W	NKY15S
CTBHR/L1212-160	●	●		○○○○	12	12	12	120	19.5	7.5	—	9.5	25	16	NS403W	NKY15S
CTBHR/L1616-160	●	●		○○○○	16	16	16	120	19.5	7.5	—	9.5	25	16	NS403W	NKY15S

★ Clamp Torque (N · m) : NS402W=1.0, NS403W=1.0

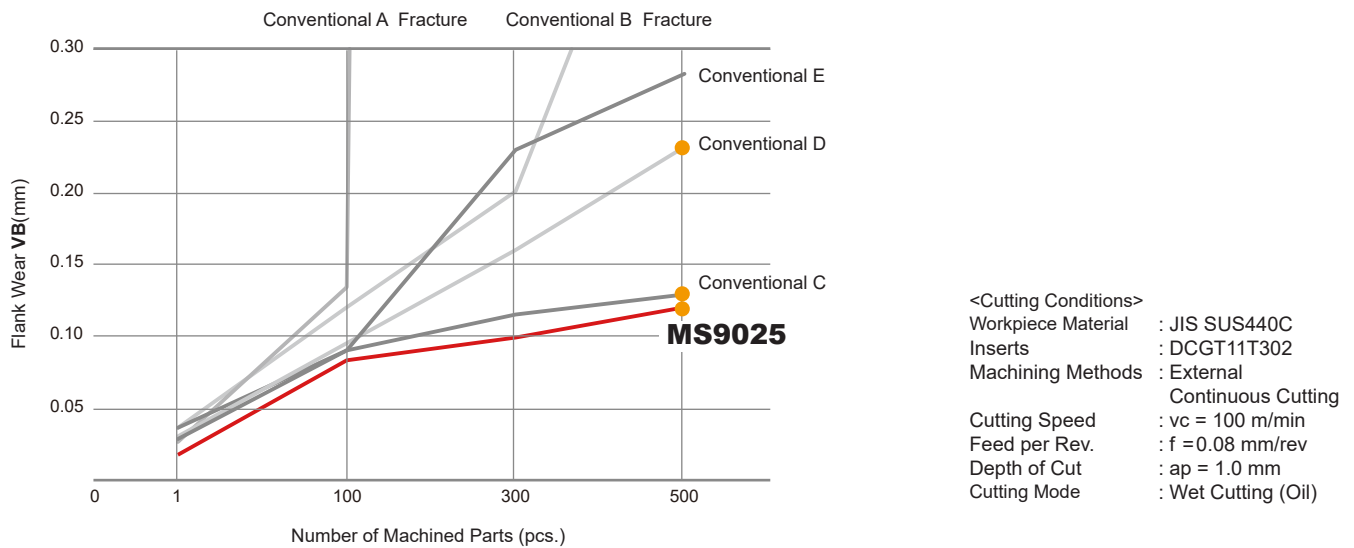
INSERTS

Holder	Setting Geometry	Breaker	Geometry	Insert Geometry	Order Number	Hand	Coated		Dimensions (mm)							CUTDIA (mm)
							VP15TF	MS6015	CW	CDX	RER/L	L	W1	S		
Right Hand (R)		With Breaker	 EPSR 45°		CTBT15160V5RR-B	R	●	●	1.5	9.2	0.05	25	9.4	3.5	16	
				CTBT20160V5RR-B	R	●	●	2.0	9.2	0.05	25	9.4	3.5	16		
				CTBT20160V5RN-B	N	●	●	2.0	9.2	0.05	25	9.4	3.5	16		
Left Hand (L)					CTBT20160V5LL-B	L	●			2.0	9.2	0.05	25	9.4	3.5	16
					CTBT20160V5LN-B	N	●	●	2.0	9.2	0.05	25	9.4	3.5	16	
			Right hand insert shown.		CTBT20145V5LR-B	R	●	●	2.0	9.2	0.05	25	9.4	3.5	14.5	

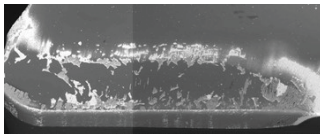
Right hand insert shown.

Cutting Performance

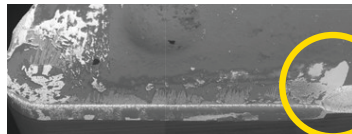
Stainless Steel SUS440C, Wear Resistance Comparison



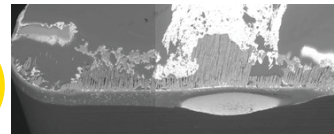
Taken after machining 500 Parts



MS9025

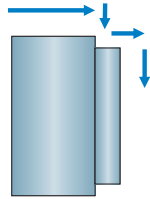
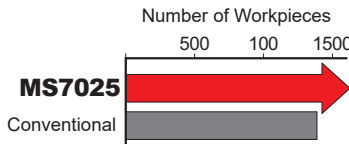


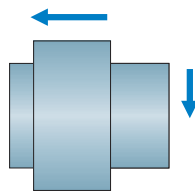
Conventional C : Flaking



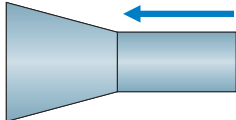
Conventional D : Base material exposure

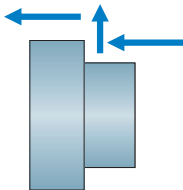
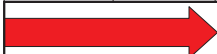
Application Examples

Insert		DCGT070202M-FS-P (MS7025)		DCGT11T302M-FS-P (MS7025)	
Workpiece	JIS SUS440C				
Component		Valve		Shaft Parts	
Application		External and Face Turning		External and Face Turning	
Cutting Conditions	Cutting Speed vc (m/min)	58		130	
	Feed per Rev. f (mm/rev)	0.04		0.03	
	Depth of Cut ap (mm)	0.15		0.56	
Cutting Mode		Wet Cutting (Oil)		Wet Cutting (Oil)	
Results	 Number of Workpieces 500 100 1500 MS7025 Conventional Compared to conventional products, the dimensional accuracy is stable and high machining quality is maintained.		Chip control has been improved and the quality of the machined surface is also good.		

Insert		DCGT11T302M-FS-P (MS7025)	
Workpiece	JIS SUS430		
Component		Machine Parts	
Application		External and Face Turning	
Cutting Conditions	Cutting Speed vc (m/min)	100	
	Feed per Rev. f (mm/rev)	0.06	
	Depth of Cut ap (mm)	0.25	
Cutting Mode		Wet Cutting (Oil)	
Results	By suppressing chip welding, cutting edge damage is reduced and the surface quality can be improved.		

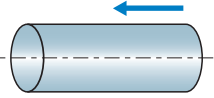
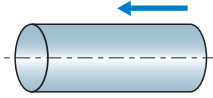
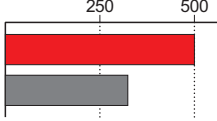
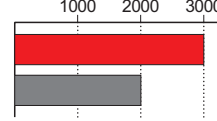
The application examples are from customers workpieces and can therefore differ from the recommended cutting conditions.

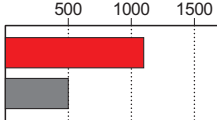
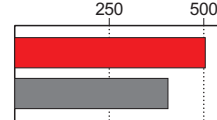
Insert		DCGT11T302M-LS-P (MS9025)	DCGT070201M-FS-P (MS9025)
Workpiece		JIS SUS420J2 Stainless Steel 	JIS SUS440C Electromagnetic Stainless Steel 
Component		Solenoid Parts	Brake Parts
Application		External Continuous Turning	External Continuous Turning
Cutting Conditions	Cutting Speed vc (m/min)	117	38
	Feed per Rev. f (mm/rev)	0.1	0.05
	Depth of Cut ap (mm)	0.2	0.2
Cutting Mode		Wet Cutting (Oil)	Wet Cutting (Oil)
Results		Number of Workpieces 5000 1000 1500 MS9025  Conventional  Improved wear resistance and tool life increased by a factor of 1.7.	Number of Workpieces 1000 2000 3000 MS9025  Conventional  Improved welding resistance and double tool life when compared to a conventional tool.

Insert		DCGT11T304M-LS-P (MS9025)
Workpiece		SUH3 Heat Resistant Alloy 
Component		Valve
Application		External and Face Continuous Turning
Cutting Conditions	Cutting Speed vc (m/min)	80
	Feed per Rev. f (mm/rev)	0.12-0.15
	Depth of Cut ap (mm)	0.3-0.5
Cutting Mode		Wet Cutting (Oil)
Results		Number of Workpieces 200 400 MS9025  Conventional  Conventional products tend to deteriorate more during machining whilst MS9025 provides stability with 5 times longer tool life.

The application examples are from customers workpieces and can therefore differ from the recommended cutting conditions.

Application Examples

Insert (Grade)		DCGT11T302M-SMG (MS6015)	DCGT11T301MR-SN (MS6015)
Workpiece		Iron-based Soft Magnetic Material (ELCH2) 	Free Cutting Steel (JIS SUM24L) 
Cutting Conditions	Cutting Speed vc (m/min)	197 (4500min-1)	125 (5000min-1)
	Feed per Rev. f (mm/rev)	0.1	0.05
	Depth of Cut ap (mm)	0.1	0.3
Cutting Mode		Wet Cutting (Water-insoluble)	Wet Cutting (Water-insoluble)
Machine		CNC Automatic Lathes	CNC Automatic Lathes
Results		Number of Workpieces (pcs. /corner) 250 500 MS6015 Conventional  An excellent finished surface and 1.4 times longer life compared with conventional products. Stable SMG breaker and chip discharge management.	Number of Workpieces (pcs. /corner) 1000 2000 3000 MS6015 Conventional  MS6015 has minimal welding and maintains secure dimensional accuracy.

Insert (Grade)		DCGT11T302MR-SN (MS6015)	DCGT11T302M-SMG (MS6015)
Workpiece		Carbon Steel (AISI 1045) 	Mild Steel (AISI 1015) 
Cutting Conditions	Cutting Speed vc (m/min)	113 (3000min-1)	100 (1300min-1)
	Feed per Rev. f (mm/rev)	0.03	0.12
	Depth of Cut ap (mm)	1.0	1.3
Cutting Mode		Wet Cutting (Water-insoluble)	Wet Cutting (Water-insoluble)
Machine		CNC Automatic Lathes	CNC Automatic Lathes
Results		Number of Workpieces (pcs. /corner) 500 1000 1500 MS6015 Conventional  MS6015 has superior wear resistance and achieves double tool life when compared with conventional products.	Number of Workpieces (pcs. /corner) 250 500 MS6015 Conventional  MS6015 has superior welding resistance and achieves 1.3 times longer tool life compared with conventional products.

The application examples are from customers workpieces and can therefore differ from the recommended cutting conditions.

For Your Safety
●Don't handle inserts and chips without gloves. ●Please machine within the recommended application range and exchange expired tools with new ones in advance of breakage. ●Please use safety covers and wear safety glasses. ●When using compounded cutting oils, please take fire precautions. ●When attaching inserts or spare parts, please use only the correct wrench or driver. ●When using rotating tools, please make a trial run to check run-out, vibration and abnormal sounds etc.

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E-mail : mb-mmci@mmc.co.jp

REGIONAL OFFICES

Pune Office

Plot No, A-27 & A-28, H-Block,
Pimpri Waghere, Pimpri Industrial Area MIDC,
Pune – 411018, Maharashtra, India
Tel :: +91 020-27456959

Gurgaon Office

#407, 4th Floor, JMD Galleria, Sohna Road,
Opposite Malibu Town, Sector-48,
Gurgaon-122 001 Haryana, India.
Tel : +91 124 4089163

Chennai Office

MM Complex, 2Nd Floor, Part 30/10 Hopman 2nd
Street, 100 Feet Main Road, Alandur,
Chennai – 600 016 Tamilnadu, India.
Tel: +91 44 4550 7006

Ahmedabad Office

210, Sigma Arcade, 2nd Floor, Visat Circle,
Ahmedabad-Mehsana Road, Chandkheda,
Ahmedabad – 382 424, Gujarat, India.
Tel : +91 79 2329 9300

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