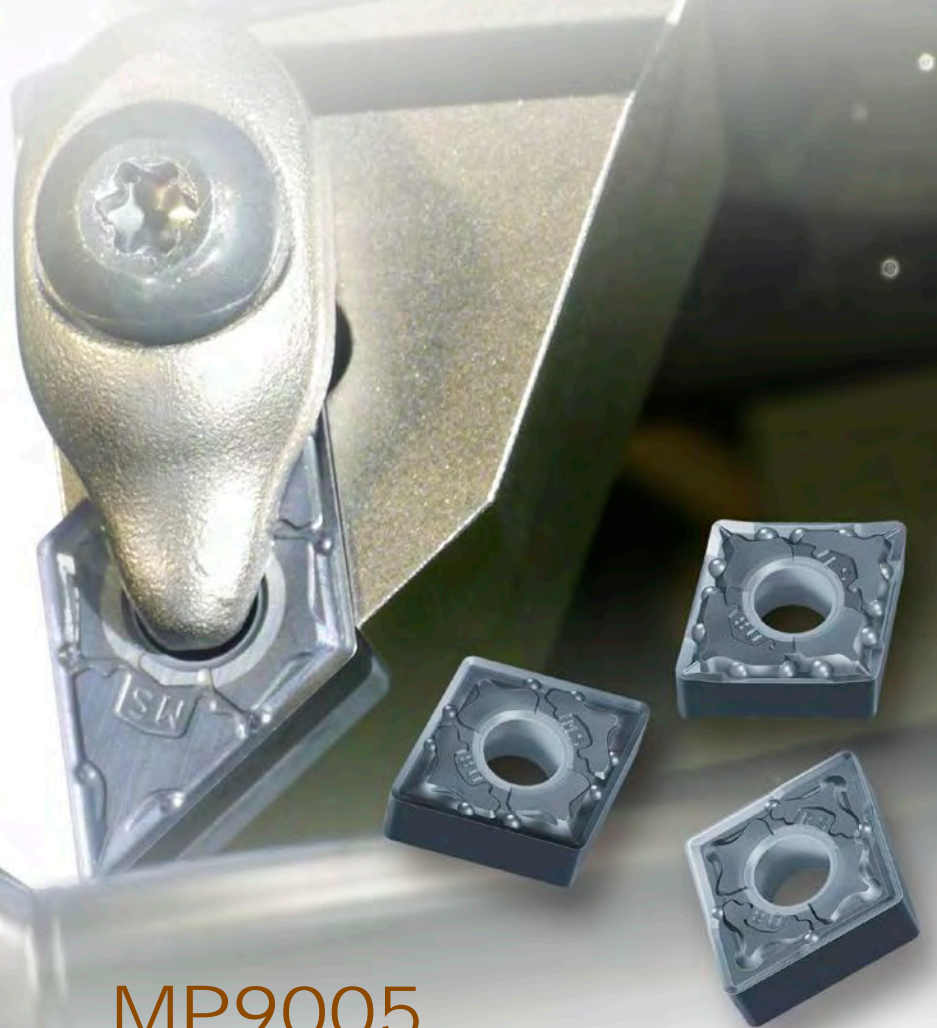


9000 Series Grades for Difficult-to-cut Materials



Series
Expansion

The high Al-rich (Al,Ti)N single layer coating significantly reduces edge fracturing.



MP9005
MP9015
MP9025
MT9005
MT9015

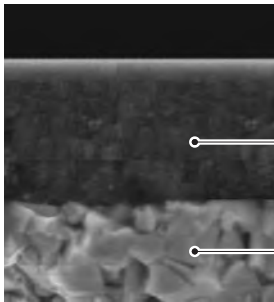
+ FS/LS
MS/RS

9000 Series Grades for Difficult-to-cut Materials

PVD Coated Grade

NEW

MP9005/MP9015/MP9025



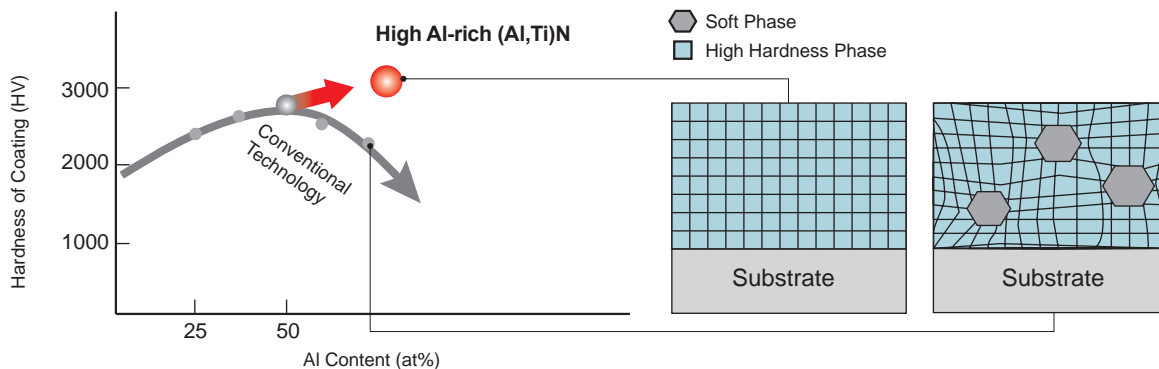
High Al-rich (Al,Ti)N Single Layer Coating Technology

Special Cemented Carbide Substrate

MP9005/MP9015/MP9025

High Al and Conventional Coating Comparison

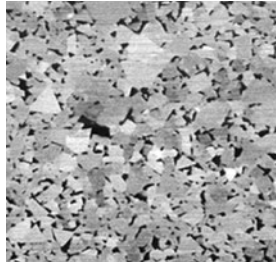
The high Al-rich (Al,Ti)N single layer coating provides stabilization of the high hardness phase and succeeds in dramatically improving wear, crater and welding resistance.



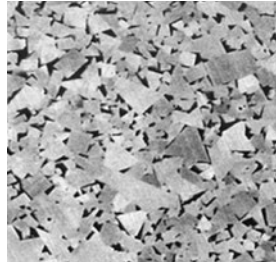
ISO Grade	Grade	Concept	Application
S01	MP9005	Top-quality grade focusing on wear resistance.	Heat Resistant Alloys Finish-Medium Cutting
S10	MP9015	First recommendation for general applications.	Heat Resistant Alloys Medium-Rough Cutting
S30	MP9025	Prevents severe damage for Increased stability.	Heat Resistant Alloys Interrupted • Light-Rough Cutting

Carbide Grade (Non Coated)

MT9005/MT9015

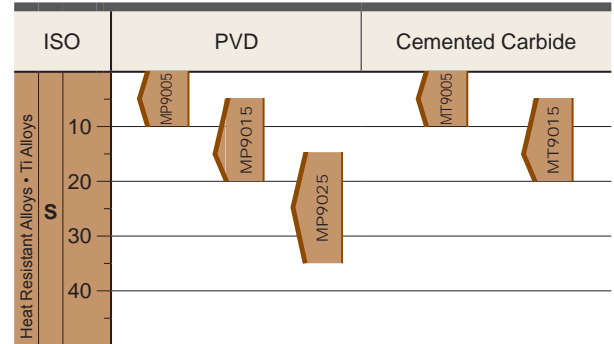


MT9005



MT9015

Application Range



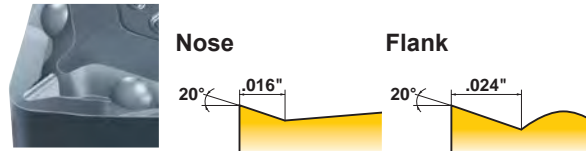
ISO Grade	Grade	Concept	Application
S01	MT9005	Cemented carbide with unmatched resistance to heat and plastic deformation.	Titanium Alloys High Speed Cutting
S10	MT9015	Cemented carbide with sharp cutting edge, excellent wear and fracture resistance.	Titanium Alloys General Cutting

Chip Breaker System

Negative Inserts

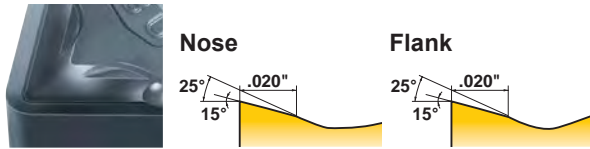
LS Breaker for Light Cutting

Enhanced chip disposal for depths of cut smaller than the corner R.



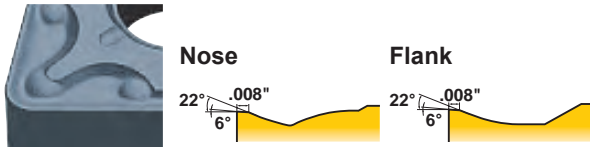
MS Breaker Newly Designed for Medium Cutting

The large 2-step rake angle generates chips smoothly and without tangling during low feed cutting.



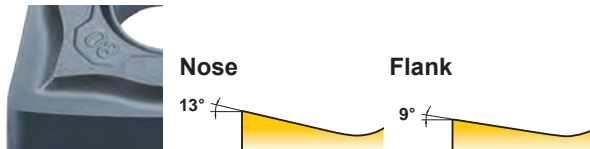
MA Breaker for Medium Cutting

Suitable for medium cutting range.



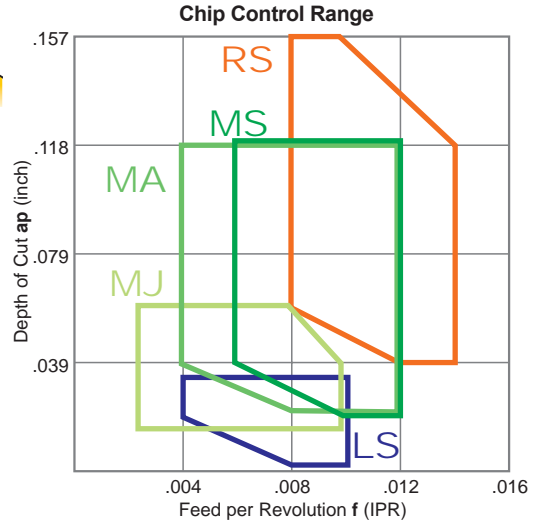
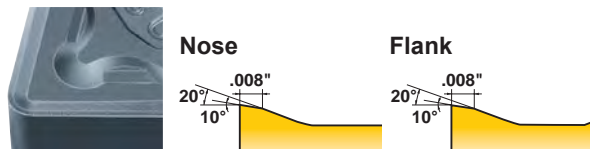
NEW MJ Breaker Sub Breaker

Alternative chip breaker of main chip breaker LS and MS. Excellent notch wear resistance for light to medium cutting.



RS Breaker for Rough Cutting

During low speed cutting the positive land controls chip welding and abrasion at the depth of cut line.

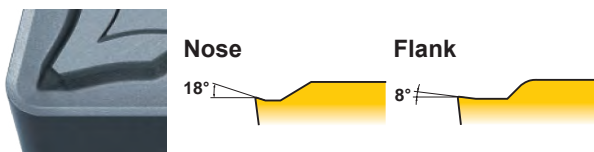


The chip breaker control range was tested for optimum chip evacuation when cutting Inconel718 with a CNMG432 insert.

Positive Inserts

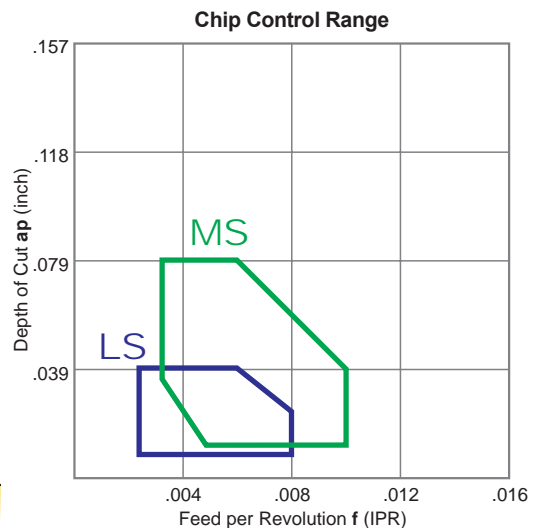
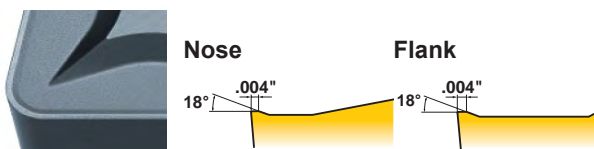
LS Breaker for Light Cutting

Prevents welding of the insert and controls white turbidity of the surface finish.



MS Breaker for Medium Cutting

The wide chip pocket reduces cutting resistance, vibration and chip jamming at large depths of cut.



The chip breaker control range was tested for optimum chip evacuation when cutting Inconel718 with a DCMT32.51 insert.

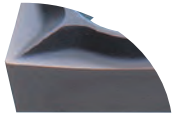
Precision Chip Breaker System Positive Inserts

Set the corner radius to a minus tolerance

CCGT21.51MLS → 1M RE .015 inch (RE .014-.016 inch)

FS/FS-P Breaker for Finish Cutting

FS



First Recommendation for Finish Cutting of Difficult-to-cut Materials

Ideal for heat resistant alloys, titanium alloys, and cobalt chromium alloys. Sharp cutting edges provide excellent surface precision and finish. Highly efficient chip discharge is possible due to curved cutting edges.

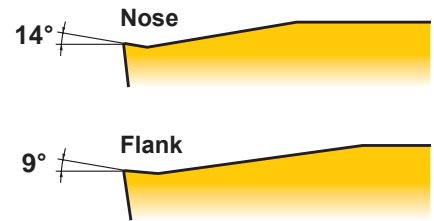
FS-P



Mirror Finish

First Recommendation for Finish Cutting of Titanium Alloys

Ideal for titanium alloys and copper alloys. Sharp cutting edges provide excellent surface precision and finish. Highly efficient chip discharge is possible due to curved cutting edges. Polished (mirror-surface) finish of insert surfaces drastically improves welding resistance extending tool life.



LS/LS-P Breaker for Light Cutting

LS



First Recommendation for Light Cutting of Difficult-to-cut Materials

Ideal for heat resistant alloys, titanium alloys, and cobalt chromium alloys. Designed with straight parallel cutting edges with high depth of cut capabilities. Achieves stable chip control over a wide depth of cut range.

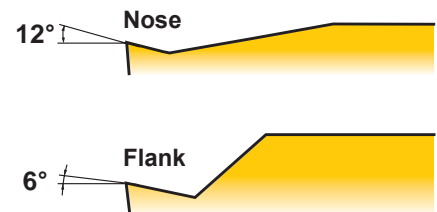
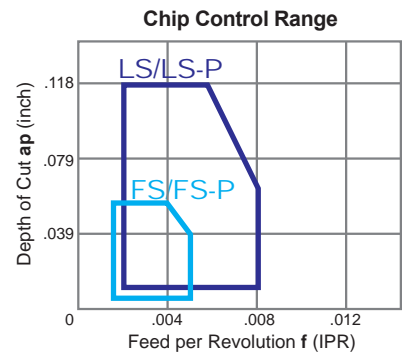
LS-P



Mirror Finish

First Recommendation for Light Cutting of Titanium Alloys

Ideal for titanium alloys and copper alloys. Designed with straight parallel cutting edges with high depth of cut capabilities. Achieves stable chip control over a wide depth of cut range. Polished (mirror-surface) finish of insert surfaces drastically improves welding resistance.

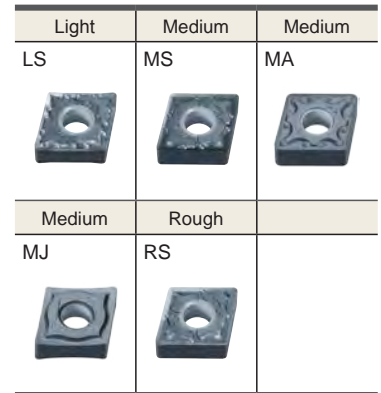
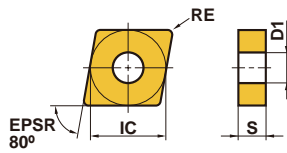


9000 Series Grades for Difficult-to-cut Materials

Negative Inserts (With Hole)

M Class

CNMG



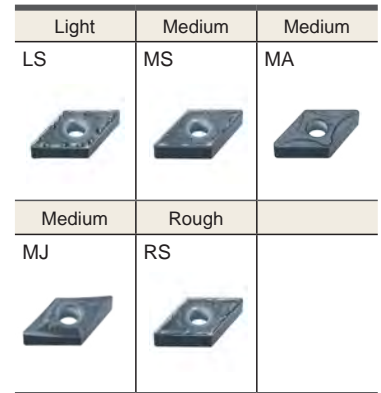
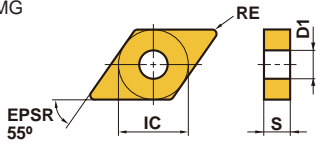
(inch)

Order Number	Cutting Area	MP9005	MP9015	MP9025 ^{NEW}	MT9015	IC	S	RE	D1
NEW CNMG321LS	L	●	●			.375	.125	.016	.150
NEW CNMG322LS	L	●	●			.375	.125	.031	.150
NEW CNMG430.5LS	L	●	●		●	.500	.187	.008	.203
CNMG431LS	L	●	●	●	●	.500	.187	.016	.203
CNMG432LS	L	●	●	●	●	.500	.187	.031	.203
NEW CNMG321MS	M	●	●			.375	.125	.016	.150
NEW CNMG322MS	M	●	●			.375	.125	.031	.150
CNMG431MS	M	●	●	●	●	.500	.187	.016	.203
CNMG432MS	M	●	●	●	●	.500	.187	.031	.203
CNMG433MS	M	●	●	●	●	.500	.187	.047	.203
CNMG543MS	M	●	●		●	.625	.250	.047	.250
CNMG544MS	M	●	●		●	.625	.250	.063	.250
CNMG431MA	M		●	●		.500	.187	.016	.203
CNMG432MA	M		●	●		.500	.187	.031	.203
CNMG433MA	M		●	●		.500	.187	.047	.203
CNMG434MA	M		●			.500	.187	.063	.203
NEW CNMG431MJ	M	●	●			.500	.187	.016	.203
NEW CNMG432MJ	M	●	●			.500	.187	.031	.203
NEW CNMG433MJ	M	●	●			.500	.187	.047	.203
NEW CNMG434MJ	M	●	●			.500	.187	.063	.203
CNMG432RS	R		●	●	●	.500	.187	.031	.203
CNMG433RS	R		●	●	●	.500	.187	.047	.203
CNMG434RS	R		●	●	●	.500	.187	.063	.203
CNMG543RS	R		●		●	.625	.250	.047	.250
CNMG544RS	R		●		●	.625	.250	.063	.250
CNMG643RS	R		●		●	.750	.250	.047	.312
CNMG644RS	R		●		●	.750	.250	.063	.312

Negative Inserts (With Hole)

M Class

DNMG



(inch)

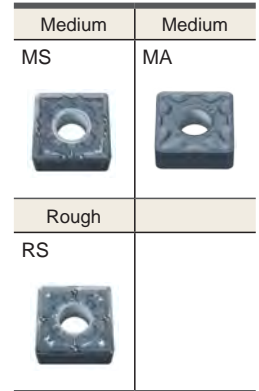
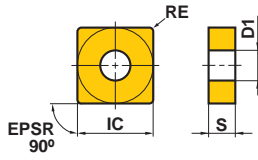
Order Number	Cutting Area	MP9005	MP9015	MP9025 NEW	MT9015	IC	S	RE	D1
NEW DNMG430.5LS	L	●	●	●	●	.500	.187	.008	.203
DNMG431LS	L	●	●	●	●	.500	.187	.016	.203
DNMG432LS	L	●	●	●	●	.500	.187	.031	.203
DNMG441LS	L	●	●	●	●	.500	.250	.016	.203
DNMG442LS	L	●	●	●	●	.500	.250	.031	.203
DNMG431MS	M	●	●	●	●	.500	.187	.016	.203
DNMG432MS	M	●	●	●	●	.500	.187	.031	.203
DNMG433MS	M	●	●	●	●	.500	.187	.047	.203
DNMG441MS	M	●	●	●	●	.500	.250	.016	.203
DNMG442MS	M	●	●	●	●	.500	.250	.031	.203
DNMG443MS	M	●	●	●	●	.500	.250	.047	.203
DNMG431MA	M		●			.500	.187	.016	.203
DNMG432MA	M		●	●		.500	.187	.031	.203
DNMG433MA	M		●	●		.500	.187	.047	.203
DNMG441MA	M		●			.500	.250	.016	.203
DNMG442MA	M		●	●		.500	.250	.031	.203
DNMG443MA	M		●	●		.500	.250	.047	.203
NEW DNMG431MJ	M	●	●			.500	.187	.016	.203
NEW DNMG432MJ	M	●	●			.500	.187	.031	.203
NEW DNMG433MJ	M	●	●			.500	.187	.047	.203
NEW DNMG434MJ	M	●	●			.500	.187	.063	.203
NEW DNMG441MJ	M	●	●			.500	.250	.016	.203
NEW DNMG442MJ	M	●	●			.500	.250	.031	.203
NEW DNMG443MJ	M	●	●			.500	.250	.047	.203
NEW DNMG444MJ	M	●	●			.500	.250	.063	.203
DNMG432RS	R		●	●	●	.500	.187	.031	.203
DNMG433RS	R		●	●	●	.500	.187	.047	.203
DNMG434RS	R		●		●	.500	.187	.063	.203
DNMG442RS	R		●	●	●	.500	.250	.031	.203
DNMG443RS	R		●	●	●	.500	.250	.047	.203
DNMG444RS	R		●		●	.500	.250	.063	.203

9000 Series Grades for Difficult-to-cut Materials

Negative Inserts (With Hole)

M Class

SNMG



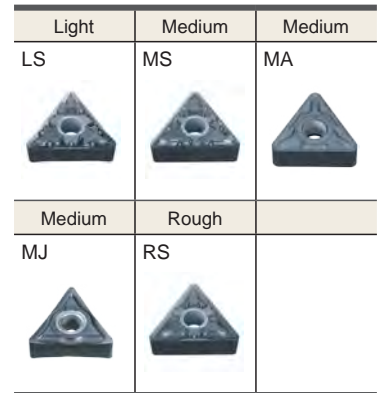
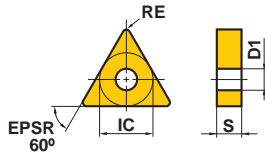
(inch)

Order Number	Cutting Area	MP9005	MP9015	MP9025 NEW	MT9015	IC	S	RE	D1
SNMG431MS	M	●	●		●	.500	.187	.016	.203
SNMG432MS	M	●	●	●	●	.500	.187	.031	.203
SNMG433MS	M	●	●	●	●	.500	.187	.047	.203
SNMG543MS	M	●	●		●	.625	.250	.047	.250
SNMG544MS	M	●	●		●	.625	.250	.063	.250
NEW SNMG643MS	M	●	●			.750	.250	.047	.312
SNMG431MA	M		●			.500	.187	.016	.203
SNMG432MA	M		●			.500	.187	.031	.203
SNMG433MA	M		●			.500	.187	.047	.203
SNMG434MA	M		●			.500	.187	.063	.203
SNMG432RS	R		●	●	●	.500	.187	.031	.203
SNMG433RS	R		●	●	●	.500	.187	.047	.203
SNMG434RS	R		●		●	.500	.187	.063	.203
SNMG544RS	R		●		●	.625	.250	.063	.250
NEW SNMG643RS	R		●			.750	.250	.047	.312
SNMG644RS	R		●		●	.750	.250	.063	.312

Negative Inserts (With Hole)

M Class

TNMG



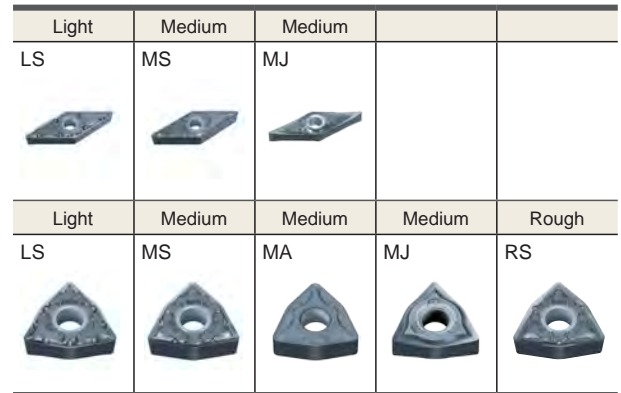
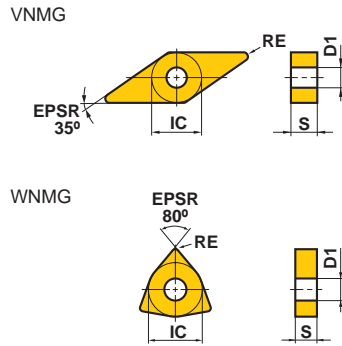
(inch)

Order Number	Cutting Area	MP9005	MP9015	MP9025 NEW	MT9015	IC	S	RE	D1
NEW TNMG330.5LS	L	●	●	●	●	.375	.187	.008	.150
TNMG331LS	L	●	●	●	●	.375	.187	.016	.150
TNMG332LS	L	●	●	●	●	.375	.187	.031	.150
TNMG331MS	M	●	●	●	●	.375	.187	.016	.150
TNMG332MS	M	●	●	●	●	.375	.187	.031	.150
TNMG333MS	M	●	●	●	●	.375	.187	.047	.150
TNMG432MS	M	●	●		●	.500	.187	.031	.203
TNMG433MS	M	●	●		●	.500	.187	.047	.203
TNMG331MA	M		●	●		.375	.187	.016	.150
TNMG332MA	M		●	●		.375	.187	.031	.150
TNMG333MA	M		●			.375	.187	.047	.150
TNMG432MA	M		●			.500	.187	.031	.203
TNMG433MA	M		●			.500	.187	.047	.203
TNMG434MA	M		●			.500	.187	.063	.203
TNMG544MA	M		●			.625	.250	.063	.250
TNMG666MA	M		●			.750	.375	.094	.312
NEW TNMG331MJ	M	●	●			.375	.187	.016	.150
NEW TNMG332MJ	M	●	●			.375	.187	.031	.150
NEW TNMG333MJ	M	●	●			.375	.187	.047	.150
TNMG332RS	R		●	●	●	.375	.187	.031	.150
TNMG333RS	R		●	●	●	.375	.187	.047	.150
TNMG432RS	R		●		●	.500	.187	.031	.203
TNMG433RS	R		●		●	.500	.187	.047	.203

9000 Series Grades for Difficult-to-cut Materials

Negative Inserts (With Hole)

M Class

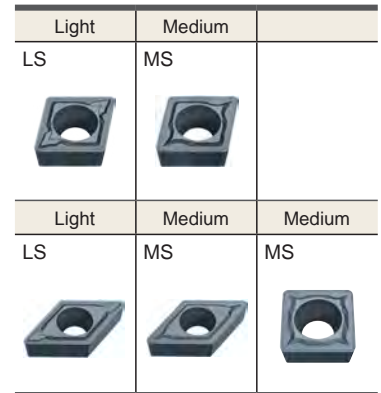
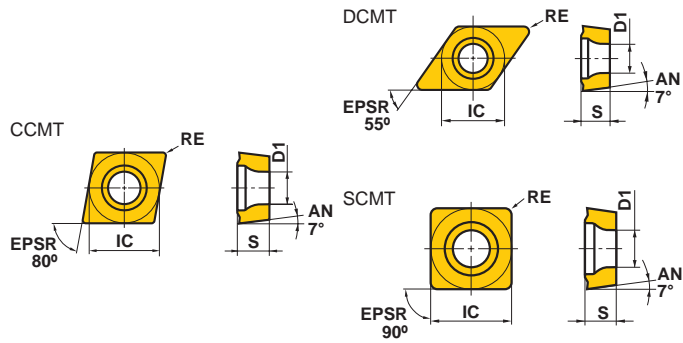


(inch)

Order Number	Cutting Area	MP9005	MP9015	MP9025 NEW	MT9015	IC	S	RE	D1
NEW VNMG330.5LS	L	●	●	●	●	.375	.187	.008	.150
VNMG331LS	L	●	●	●	●	.375	.187	.016	.150
VNMG332LS	L	●	●	●	●	.375	.187	.031	.150
VNMG331MS	M	●	●	●	●	.375	.187	.016	.150
VNMG332MS	M	●	●	●	●	.375	.187	.031	.150
NEW VNMG331MJ	M	●	●			.375	.187	.016	.150
NEW VNMG332MJ	M	●	●			.375	.187	.031	.150
NEW VNMG333MJ	M	●	●			.375	.187	.047	.150
NEW WNMG430.5LS	L	●	●		●	.500	.187	.008	.203
WNMG431LS	L	●	●	●	●	.500	.187	.016	.203
WNMG432LS	L	●	●	●	●	.500	.187	.031	.203
WNMG431MS	M	●	●	●	●	.500	.187	.016	.203
WNMG432MS	M	●	●	●	●	.500	.187	.031	.203
WNMG433MS	M	●	●	●	●	.500	.187	.047	.203
WNMG431MA	M		●			.500	.187	.016	.203
WNMG432MA	M		●			.500	.187	.031	.203
WNMG433MA	M		●			.500	.187	.047	.203
WNMG434MA	M		●			.500	.187	.063	.203
NEW WNMG432MJ	M	●	●			.500	.187	.031	.203
NEW WNMG433MJ	M	●	●			.500	.187	.047	.203
NEW WNMG434MJ	M	●	●			.500	.187	.063	.203
WNMG432RS	R		●	●	●	.500	.187	.031	.203
WNMG433RS	R		●	●	●	.500	.187	.047	.203
WNMG434RS	R		●		●	.500	.187	.063	.203
WNMG543RS	R		●		●	.625	.250	.047	.250

7° Positive Inserts (With Hole)

M Class



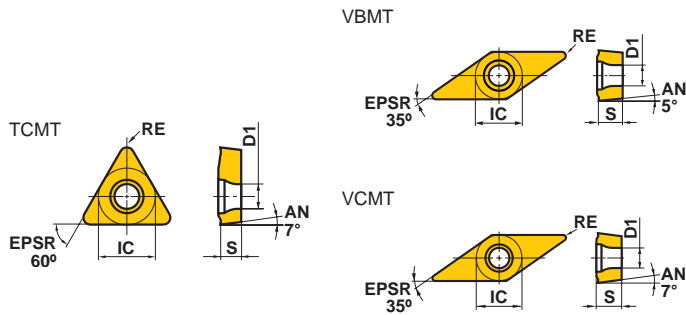
(mm)

Order Number	Cutting Area	MP9005	MP9015	MT9005	IC	S	RE	D1
CCMT21.50.5LS	L	●	●	●	.250	.094	.008	.110
CCMT21.51LS	L	●	●	●	.250	.094	.016	.110
CCMT32.50.5LS	L	●	●	●	.375	.156	.008	.173
CCMT32.51LS	L	●	●	●	.375	.156	.016	.173
CCMT32.52LS	L	●	●	●	.375	.156	.031	.173
NEW CCMT21.50.5MS	M	●	●	●	.250	.094	.008	.110
NEW CCMT21.51MS	M	●	●	●	.250	.094	.016	.110
NEW CCMT21.52MS	M	●	●	●	.250	.094	.031	.110
NEW CCMT32.50.5MS	M	●	●	●	.375	.156	.008	.173
CCMT32.51MS	M	●	●	●	.375	.156	.016	.173
CCMT32.52MS	M	●	●	●	.375	.156	.031	.173
NEW CCMT431MS	M	●	●	●	.500	.187	.016	.217
NEW CCMT432MS	M	●	●	●	.500	.187	.031	.217
NEW CCMT433MS	M	●	●	●	.500	.187	.047	.217
DCMT21.50.5LS	L	●	●	●	.250	.094	.008	.110
DCMT21.51LS	L	●	●	●	.250	.094	.016	.110
DCMT32.50.5LS	L	●	●	●	.375	.156	.008	.173
DCMT32.51LS	L	●	●	●	.375	.156	.016	.173
DCMT32.52LS	L	●	●	●	.375	.156	.031	.173
DCMT21.51MS	M	●	●	●	.250	.094	.016	.110
DCMT21.52MS	M	●	●	●	.250	.094	.031	.110
DCMT32.51MS	M	●	●	●	.375	.156	.016	.173
DCMT32.52MS	M	●	●	●	.375	.156	.031	.173
NEW DCMT32.53MS	M	●	●	●	.375	.156	.047	.173
NEW SCMT32.51MS	M	●	●	●	.375	.156	.016	.173
NEW SCMT32.52MS	M	●	●	●	.375	.156	.031	.173
NEW SCMT431MS	M	●	●	●	.500	.187	.016	.217
NEW SCMT432MS	M	●	●	●	.500	.187	.031	.217
NEW SCMT433MS	M	●	●	●	.500	.187	.047	.217

9000 Series Grades for Difficult-to-cut Materials

5° and 7° Positive Inserts (With Hole)

M Class

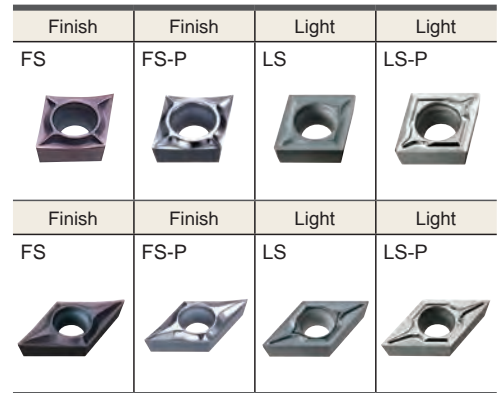
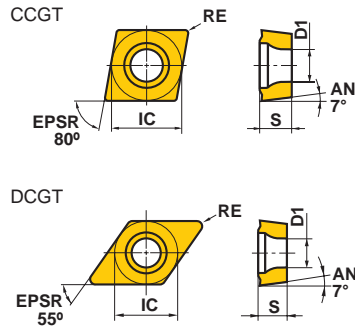


(mm)

Order Number	Cutting Area	MP9005	MP9015	MT9005	IC	S	RE	D1
NEW TCMT1.81.50.5LS	L	●	●	●	.219	.094	.008	.098
NEW TCMT21.50.5LS	L	●	●	●	.250	.094	.008	.110
NEW TCMT1.81.51MS	M	●	●	●	.219	.094	.016	.098
NEW TCMT1.81.52MS	M	●	●	●	.219	.094	.031	.098
NEW TCMT21.51MS	M	●	●		.250	.094	.016	.110
NEW TCMT21.52MS	M	●	●		.250	.094	.031	.110
NEW TCMT32.51MS	M	●	●	●	.375	.156	.016	.173
NEW TCMT32.52MS	M	●	●	●	.375	.156	.031	.173
NEW TCMT32.53MS	M	●	●	●	.375	.156	.047	.173
NEW VBMT220.5LS	L	●	●	●	.250	.125	.008	.115
NEW VBMT221LS	L	●	●	●	.250	.125	.016	.115
NEW VBMT222LS	L	●	●	●	.250	.125	.031	.115
VBMT331LS	L	●	●	●	.375	.187	.016	.173
VBMT332LS	L	●	●	●	.375	.187	.031	.173
NEW VBMT330.5MS	M	●	●	●	.375	.187	.008	.173
VBMT331MS	M	●	●	●	.375	.187	.016	.173
VBMT332MS	M	●	●	●	.375	.187	.031	.173
NEW VBMT333MS	M	●	●	●	.375	.187	.047	.173
VCMT220.5LS	L	●	●	●	.250	.125	.008	.110
VCMT221LS	L	●	●	●	.250	.125	.016	.110
VCMT331LS	L	●	●	●	.375	.187	.016	.173
VCMT332LS	L	●	●	●	.375	.187	.031	.173
NEW VCMT220.5MS	M	●	●		.250	.125	.008	.110
NEW VCMT221MS	M	●	●	●	.250	.125	.016	.110
NEW VCMT222MS	M	●	●	●	.250	.125	.031	.110
VCMT331MS	M	●	●	●	.375	.187	.016	.173
VCMT332MS	M	●	●	●	.375	.187	.031	.173

7° Positive Inserts (With Hole)

G Class



(inch)

Order Number	Cutting Area	MP9005	MP9015	MT9005	IC	S	RE	D1
CCGT21.50.2MFS	F	●	●		.250	.094	.003	.110
CCGT21.50.5MFS	F	●	●		.250	.094	.007	.110
CCGT32.50.2MFS	F	●	●		.375	.156	.003	.173
CCGT32.50.5MFS	F	●	●		.375	.156	.007	.173
CCGT32.51MFS	F	●	●		.375	.156	.015	.173
CCGT21.50.2MFS-P	F			●	.250	.094	.003	.110
CCGT21.50.5MFS-P	F			●	.250	.094	.007	.110
CCGT32.50.2MFS-P	F			●	.375	.156	.003	.173
CCGT32.50.5MFS-P	F			●	.375	.156	.007	.173
CCGT32.51MFS-P	F			●	.375	.156	.015	.173
CCGT21.50.2MLS	L	●	●		.250	.094	.003	.110
CCGT21.50.5MLS	L	●	●		.250	.094	.007	.110
CCGT32.50.2MLS	L	●	●		.375	.156	.003	.173
CCGT32.50.5MLS	L	●	●		.375	.156	.007	.173
CCGT32.51MLS	L	●	●		.375	.156	.015	.173
CCGT21.50.2MLS-P	L			●	.250	.094	.003	.110
CCGT21.50.5MLS-P	L			●	.250	.094	.007	.110
CCGT32.50.2MLS-P	L			●	.375	.156	.003	.173
CCGT32.50.5MLS-P	L			●	.375	.156	.007	.173
CCGT32.51MLS-P	L			●	.375	.156	.015	.173
DCGT21.50.2MFS	F	●	●		.250	.094	.003	.110
DCGT21.50.5MFS	F	●	●		.250	.094	.007	.110
DCGT32.50.2MFS	F	●	●		.375	.156	.003	.173
DCGT32.50.5MFS	F	●	●		.375	.156	.007	.173
DCGT21.50.2MFS-P	F			●	.250	.094	.003	.110
DCGT21.50.5MFS-P	F			●	.250	.094	.007	.110
DCGT32.50.2MFS-P	F			●	.375	.156	.003	.173
DCGT32.50.5MFS-P	F			●	.375	.156	.007	.173
DCGT21.50.2MLS	L	●	●		.250	.094	.003	.110
DCGT21.50.5MLS	L	●	●		.250	.094	.007	.110
DCGT21.51MLS	L	●	●		.250	.094	.015	.110
DCGT32.50.2MLS	L	●	●		.375	.156	.003	.173
DCGT32.50.5MLS	L	●	●		.375	.156	.007	.173
DCGT32.51MLS	L	●	●		.375	.156	.015	.173
DCGT21.50.2MLS-P	L			●	.250	.094	.003	.110
DCGT21.50.5MLS-P	L			●	.250	.094	.007	.110
DCGT21.51MLS-P	L			●	.250	.094	.015	.110
DCGT32.50.2MLS-P	L			●	.375	.156	.003	.173
DCGT32.50.5MLS-P	L			●	.375	.156	.007	.173
DCGT32.51MLS-P	L			●	.375	.156	.015	.173

9000 Series Grades for Difficult-to-cut Materials

7° Positive Inserts (With Hole)

G Class

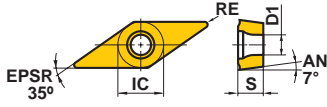
Light
LS



Light
LS-P



VCGT



(inch)

Order Number	Cutting Area	MP9005	MP9015	MT9005	IC	S	RE	D1
VCGT220.2MLS	L	●	●		.250	.125	.003	.110
VCGT220.5MLS	L	●	●		.250	.125	.007	.110
VCGT221MLS	L	●	●		.250	.125	.015	.110
VCGT2.520.2MLS	L	●	●		.313	.125	.003	.134
VCGT2.520.5MLS	L	●	●		.313	.125	.007	.134
VCGT2.521MLS	L	●	●		.313	.125	.015	.134
VCGT220.2MLS-P	L			●	.250	.125	.003	.110
VCGT220.5MLS-P	L			●	.250	.125	.007	.110
VCGT221MLS-P	L			●	.250	.125	.015	.110
VCGT2.520.2MLS-P	L			●	.313	.125	.003	.134
VCGT2.520.5MLS-P	L			●	.313	.125	.007	.134
VCGT2.521MLS-P	L			●	.313	.125	.015	.134

Recommended Cutting Conditions

Negative Inserts

(inch)

Workpiece Material	Cutting Conditions	Cutting Area	Chip Breaker	Grade	Cutting Speed vc (SFM)	Feed f (IPR)	Depth of Cut ap	
M Precipitation Hardening Stainless Steels (AISI 630)	Stable Cutting	Light Cutting	LS	MP9005	410 – 575	.004 – .010	.008 – .031	
		Medium Cutting	MS	MP9005	375 – 525	.004 – .010	.020 – .157	
		Rough Cutting	RS	MP9015	345 – 490	.008 – .014	.039 – .157	
	General Cutting	Light Cutting	LS	MP9015	395 – 540	.004 – .010	.008 – .031	
		Medium Cutting	MS	MP9015	360 – 490	.004 – .010	.020 – .157	
		Rough Cutting	RS	MP9015	330 – 460	.008 – .014	.039 – .157	
	Unstable Cutting	Light Cutting	LS	MP9025	260 – 310	.004 – .010	.008 – .031	
		Medium Cutting	MS	MP9025	245 – 295	.006 – .020	.020 – .157	
		Rough Cutting	RS	MP9025	230 – 280	.008 – .014	.039 – .157	
S Titanium Alloys (Ti-6Al-4V)	Stable Cutting	Light Cutting	LS	MT9015	130 – 280	.004 – .010	.008 – .031	
		Medium Cutting	MS	MT9015	130 – 260	.004 – .010	.020 – .157	
		Rough Cutting	RS	MT9015	115 – 245	.008 – .014	.039 – .157	
	General Cutting	Light Cutting	LS	MT9015	130 – 280	.004 – .010	.008 – .031	
		Medium Cutting	MS	MT9015	130 – 260	.004 – .010	.020 – .157	
		Rough Cutting	RS	MT9015	115 – 245	.008 – .014	.039 – .157	
	Ni Based Heat Resistant Alloys (Inconel718, Hastelloy, Waspaloy) Co Based Heat Resistant Alloys (Tribaloy, Stellite)	Stable Cutting	Light Cutting	LS	MP9005	100 – 360	.004 – .010	.008 – .031
			Medium Cutting	MS	MP9005	100 – 330	.004 – .010	.020 – .157
			Rough Cutting	RS	MP9015	65 – 245	.008 – .014	.039 – .157
General Cutting		Light Cutting	LS	MP9015	80 – 280	.004 – .010	.008 – .031	
		Medium Cutting	MS	MP9015	80 – 260	.004 – .010	.020 – .157	
		Rough Cutting	RS	MP9015	65 – 245	.008 – .014	.039 – .157	
Unstable Cutting		Light Cutting	LS	MP9025	65 – 100	.004 – .010	.008 – .031	
		Medium Cutting	MS	MP9025	65 – 100	.004 – .010	.020 – .157	
		Rough Cutting	RS	MP9025	50 – 80	.008 – .014	.039 – .157	

Note 1) When cutting conditions are unstable, please refer to page 3 for recommended chip breaker and grade.

Note 2) Verify the recommended conditions for each boring bar as cutting conditions for internal machining will vary depending on the length of overhang.

Note 3) MC7015, MC7025 and MP7035 grade are also recommended for precipitation hardening stainless steels.

9000 Series Grades for Difficult-to-cut Materials

Recommended Cutting Conditions

Positive Inserts

(inch)

Workpiece Material	Cutting Conditions	Cutting Area	Chip Breaker	Grade	Cutting Speed vc (SFM)	Feed f (IPR)	Depth of Cut ap	
M Precipitation Hardening Stainless Steels (AISI 630)	Stable Cutting	Light Cutting	LS	MP9015	345 – 460	.002 – .008	.008 – .039	
		Medium Cutting	MS	MP9015	280 – 395	.003 – .010	.012 – .079	
	General Cutting	Light Cutting	LS	MP9015	345 – 460	.002 – .008	.008 – .039	
		Medium Cutting	MS	MP9015	280 – 395	.003 – .010	.012 – .079	
S	Stable Cutting	Finish and Light	LS	MT9005	130 – 260	.002 – .008	.008 – .039	
		Medium Cutting	MS	MT9005	115 – 210	.003 – .010	.012 – .079	
	General Cutting	Finish and Light	LS	MT9005	130 – 260	.002 – .008	.008 – .039	
		Medium Cutting	MS	MT9005	115 – 210	.003 – .010	.012 – .079	
	Unstable Cutting	Finish and Light	LS	MT9005	130 – 260	.002 – .008	.008 – .039	
		Medium Cutting	MS	MT9005	115 – 210	.003 – .010	.012 – .079	
	Ni Based Heat Resistant Alloys (Inconel718, Hastelloy, WSPALLOY)	Stable Cutting	Finish and Light	LS	MP9005	80 – 310	.002 – .008	.008 – .039
			Medium Cutting	MS	MP9005	65 – 260	.003 – .010	.012 – .079
		General Cutting	Finish and Light	LS	MP9015	65 – 245	.002 – .008	.008 – .039
			Medium Cutting	MS	MP9015	65 – 195	.003 – .010	.012 – .079
Unstable Cutting		Finish and Light	LS	MP9015	65 – 245	.002 – .008	.008 – .039	
		Medium Cutting	MS	MP9015	65 – 195	.003 – .010	.012 – .079	

Recommended Cutting Conditions

Precision Positive Inserts

(inch)

Workpiece Material	Cutting Conditions	Chip Breaker	Grade	Cutting Speed vc (SFM)	Feed f (IPR)	Depth of Cut ap	
M Precipitation Hardening Stainless Steels (AISI 630)	Stable Cutting	FS	MP9005	130 – 260	.002 – .004	.008 – .055	
		LS	MP9005	130 – 260	.002 – .006	.012 – .079	
	General Cutting	FS	MP9015	130 – 260	.002 – .004	.008 – .055	
		LS	MP9015	130 – 260	.002 – .006	.012 – .079	
	Unstable Cutting	LS	MP9015	100 – 195	.002 – .004	.012 – .039	
	S Titanium Alloys (Ti-6Al-4V)	Stable Cutting	FS-P	MT9005	130 – 260	.002 – .005	.008 – .055
LS-P			MT9005	130 – 260	.002 – .008	.012 – .118	
General Cutting		FS-P	MT9005	130 – 260	.002 – .005	.008 – .055	
		LS-P	MT9005	130 – 260	.002 – .005	.012 – .079	
Unstable Cutting		FS-P	MT9005	100 – 195	.002 – .004	.008 – .055	
Cobalt Chromium Alloys (Co-Cr-Mo Alloys)		Stable Cutting	FS	MP9005	130 – 260	.002 – .004	.008 – .055
			LS	MP9005	130 – 260	.002 – .006	.012 – .079
		General Cutting	FS	MP9015	130 – 260	.002 – .004	.008 – .055
			LS	MP9015	130 – 260	.002 – .006	.012 – .079
		Unstable Cutting	LS	MP9015	100 – 195	.002 – .004	.012 – .039
		Ni Based Heat Resistant Alloys (Inconel718, Hastelloy, WASTALLOY)	Stable Cutting	FS	MP9005	80 – 310	.002 – .005
LS				MP9005	80 – 310	.002 – .005	.012 – .079
General Cutting	FS		MP9015	65 – 245	.002 – .005	.008 – .055	
	LS		MP9015	65 – 245	.002 – .005	.012 – .079	
Unstable Cutting	FS		MP9015	65 – 245	.002 – .005	.008 – .055	

For Effective Use of Large Corner Radius

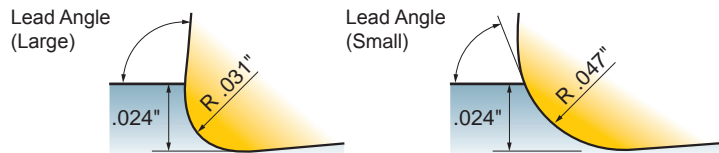
By setting the depth of cut smaller than the corner radius value, notching during cutting of heat resistant alloys can be greatly reduced.

Corner Radius > 1.5 x Depth of Cut

Depth of cut: .024 inch. Corner radius over .035 inch is recommended.

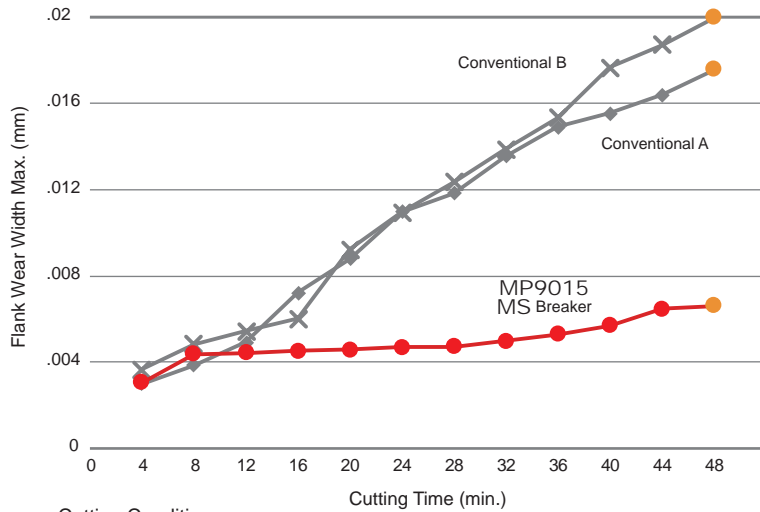
Point

A smaller lead angle is the key to reduced notching.



Cutting Performance

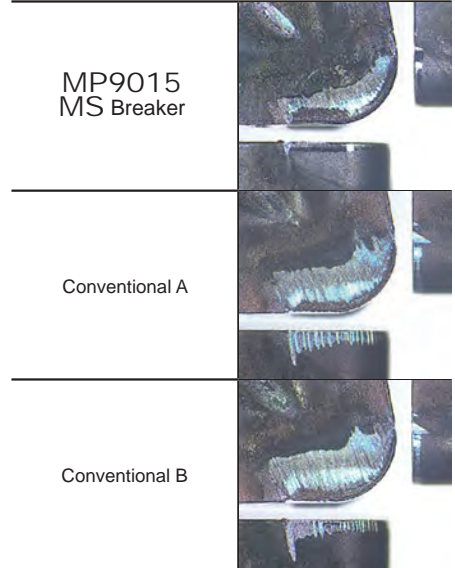
Comparison in Continuous Machining of AISI 630



<Cutting Conditions>

Workpiece Material : AISI 630
 Inserts : CNMG432
 Machining Methods : External Continuous Cutting
 Cutting Speed : vc=395 SFM
 Feed per Rev. : f=.008 IPR
 Depth of Cut : ap=.059 inch
 Cutting Mode : Wet Cutting

Cutting Time : 48min (Wear Photo)



Achieved 2X tool life when machining Inconel718 during continuous machining.

MP9005+LS Conventional A (S10) Conventional B (S10) Conventional C (S10)



Wear - .0094 inch Wear - .0087 inch Wear - .0091 inch Wear - .0098 inch
 Cutting Time 66 min Cutting Time 22 min Cutting Time 36 min Cutting Time 16 min

<Cutting Conditions>

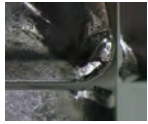
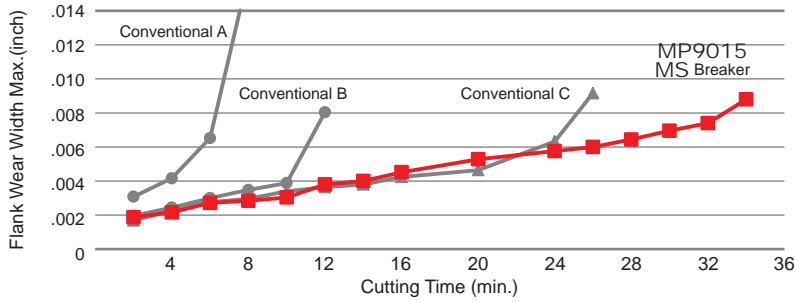
Workpiece Material : Inconel718
 Inserts : CNMG432
 Cutting Speed : vc=165 SFM
 Feed per Rev. : f=.006 IPR
 Depth of Cut : ap=.020 inch
 Cutting Mode : Wet Cutting

Comparison of Wear Resistance by Workpiece Material

Workpiece Materials and Cutting Conditions	Chip Breaker	Conventional A	Conventional B
Workpiece Material : Co-Cr-Mo Alloy Inserts : DCGT32.51MLS Grade : MP9005 Cutting Speed : vc=130 SFM Feed per Rev. : f=.002 IPR Depth of Cut : ap=.008 inch Cutting Mode : Wet Cutting (Water-soluble) Machine : Swiss Style Lathes Cutting Time : 12 min.			
Workpiece Material : Inconel718 Inserts : DCGT32.51MLS Grade : MP9015 Cutting Speed : vc=195 SFM Feed per Rev. : f=.002 IPR Depth of Cut : ap=.020 inch Cutting Mode : Wet Cutting (Water-soluble) Machine : Swiss Style Lathes Cutting Time : 20 min.			
Workpiece Material : Ti-6Al-4V ELI Inserts : DCGT32.51MLS-P Grade : MT9005 Cutting Speed : vc=260 SFM Feed per Rev. : f=.002 IPR Depth of Cut : ap=.118 inch Cutting Mode : Wet Cutting (Water-insoluble) Machine : Automatic Lathes			
	35 Pieces (Non-coat)	35 Pieces (PVD)	15 Pieces (PVD)

Cutting Performance

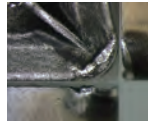
Inconel718, vc=195SFM Continuous Machining



Conventional A
8 min



Conventional B
12 min



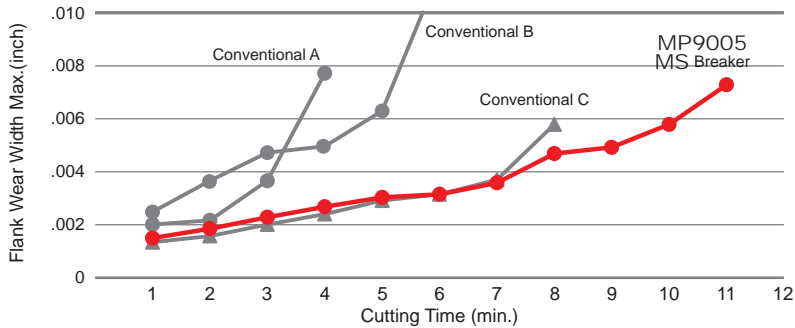
Conventional C
26 min



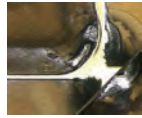
MP9015
MS Breaker, 34 min

**Increased
28%
Tool Life**

Inconel718, vc=330SFM Continuous Machining



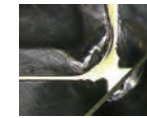
Conventional A
4 min



Conventional B
6 min



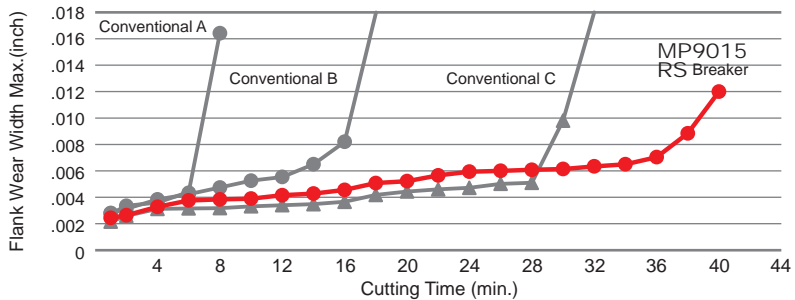
Conventional C
8 min



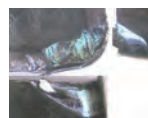
MP9005
MS Breaker, 11 min

**Increased
37%
Tool Life**

Inconel718, ap=.079 inch Continuous Machining



Conventional A
8 min



Conventional B
18 min



Conventional C
32 min



MP9015
RS Breaker, 40 min

**Increased
33%
Tool Life**

WASPALLOY Continuous Machining

MP9015 with RS breaker was smallest damage.



Conventional A



Conventional B



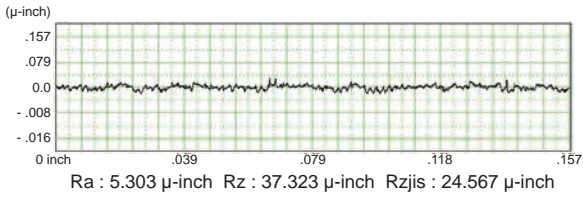
MP9015
RS Breaker

**Increased
33%
Tool Life**

<Cutting Conditions>
 Workpiece Material : WASPALLOY
 Inserts : CNMG432
 Cutting Speed : vc=95 SFM
 Feed per Rev. : f=.009 IPR
 Depth of Cut : ap=.157 inch
 Cutting Time : 7 min
 Cutting Mode : Wet Cutting

Cutting Performance

Titanium Alloy, Comparison of Surface Finish (Depth of Cut: .01 inch)

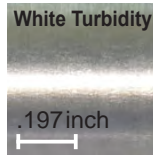
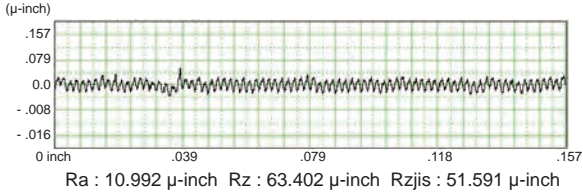


MT9015
LS Breaker



<Cutting Conditions>

Workpiece Material : Ti-6Al-6V(325HB)
 Inserts : CNMG432 $\odot\odot$
 Cutting Speed : $vc=230$ SFM
 Feed per Rev. : $f=.002$ IPR
 Depth of Cut : $ap=.01$ inch
 Cutting Mode : Wet Cutting



Conventional

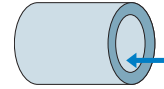
MP9015 with LS breaker was smallest damage.



Conventional



MP9015 LS Breaker



<Cutting Conditions>

Workpiece Material : Heat Resistant Cast Steel
 Inserts : DCMT32.51 $\odot\odot$
 Cutting Speed : $vc=330$ SFM
 Feed per Rev. : $f=.004$ IPR
 Depth of Cut : $ap=.010$ inch
 Cutting Mode : Wet Cutting

Chip Control when Back Turning

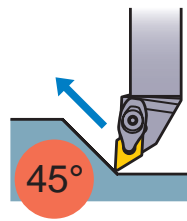
Non-tangling of chips when back turning Inconel718.



MS Breaker
New Design



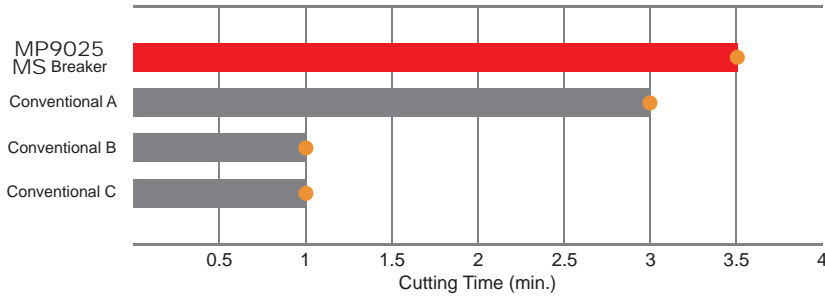
Conventional



<Cutting Conditions>

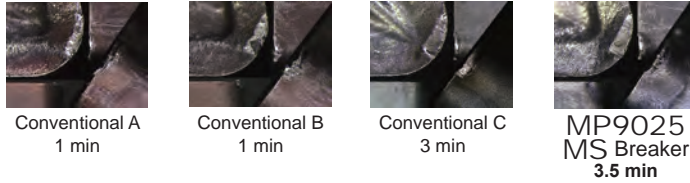
Workpiece Material : Inconel718
 Inserts : DNMG432 $\odot\odot$
 Cutting Speed : $vc=130$ SFM
 Feed per Rev. : $f=.008$ IPR
 Depth of Cut : $ap=.0039$ inch
 Cutting Mode : Wet Cutting

Inconel718, vc=100 SFM Interrupted Machining



<Cutting Conditions>

Workpiece Material : Inconel718
 Inserts : CNMG43200
 Cutting Speed : vc=100 SFM
 Feed per Rev. : f=.004 IPR
 Depth of Cut : ap=.01 inch
 Cutting Mode : Wet Cutting



**Increased
16 %
Tool Life**

Application Examples

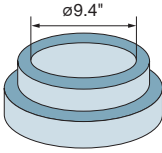
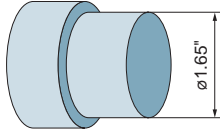
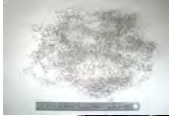



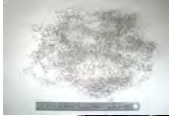







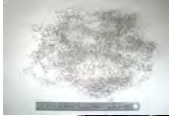





Inserts (Grade)		DCGT32.51MLS (MP9015)	DCGT32.50.5MLS (MP9015)
Workpiece Material		AISI 430 (Forgings)	AISI 630 (17-4PH)
Cutting Conditions	Cutting Speed vc (SFM)	260	195
	Feed per Rev. f (IPR)	.0031	.0016
	Depth of Cut ap (inch)	.012	.012
Cutting Mode		Wet Cutting (Water-insoluble Coolants)	Wet Cutting (Water-insoluble Coolants)
Machine		Swiss Style Lathes	Swiss Style Lathes
Results		Compared to conventional product with inconsistent tool life, whose unstable chip evacuation can cause entanglement of chips in workpiece materials, the LS breaker provided stable chip evacuation allowing machining to be performed up to machining constants. It also exhibited excellent wear conditions after turning.	Even when machining at 1.5X the existing conditions of conventional product, there were no variations in turning surface dimensions. The amount of wear was also extremely small, resulting in longer tool life and cost reduction.

Inserts (Grade)		DCGT32.50.5MFS-P (MT9005)	DCGT21.50.2MFS (MP9015)
Workpiece Material		Ti-6Al-4V ELI	AISI 304
Cutting Conditions	Cutting Speed vc (SFM)	210	260
	Feed per Rev. f (IPR)	.0024	.0020
	Depth of Cut ap (inch)	.030	.012
Cutting Mode		Wet Cutting (Water-insoluble Coolants)	Wet Cutting (Water-insoluble Coolants)
Machine		Swiss Style Lathes	Swiss Style Lathes
Results		Compared to conventional PVD coated product, the cemented carbide MT 9005 (uncoated) provided exceptional machined surface roughness even at 2X the number of cuts. The extremely small amount of wear and stable dimensional precision allowed further machining extension.	Compared to conventional product, the amount of wear was small and chip evacuation was excellent, making it possible to perform machining at 1.5X the existing conditions.

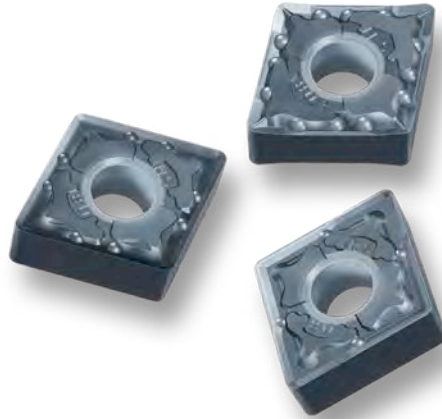
The above application examples are customer's applications, so it can be different from the recommended conditions.

9000 Series Grades for Difficult-to-cut Materials

Application Examples

Inserts (Grade)	DNMG432MS (MP9005)	CNMG432RS (MP9015)										
Workpiece	Inconel718 (Ni Based Heat Resistant Alloy)  45HRC Aging Treatment	HAYNES Alloy 25 (Co Based Heat Resistant Alloy) 										
Component	Disk - Aerospace Component	Cover Plate - Aerospace Component										
Application	Internal Turning	External Turning										
Cutting Conditions	Cutting Speed v_c (SFM)	195										
	Feed per Rev. f (IPR)	.006										
	Depth of Cut $a_p \times a_e$.010 x .591										
Cutting Mode	Wet Cutting	Wet Cutting										
Results	<table border="0"> <tr> <td>Conventional (S10)</td> <td>MP9005+MS</td> </tr> <tr> <td></td> <td></td> </tr> <tr> <td></td> <td></td> </tr> </table> <p>MP9005 - Stable machining and less wear with long tool life without chip tangling.</p>	Conventional (S10)	MP9005+MS					<table border="0"> <tr> <td>Conventional (S10)</td> <td>MP9015+RS</td> </tr> <tr> <td></td> <td></td> </tr> </table> <p>Both conventional and MP9015 display notch wear but the conventional grade wear was greater and exposed the substrate.</p>	Conventional (S10)	MP9015+RS		
Conventional (S10)	MP9005+MS											
												
												
Conventional (S10)	MP9015+RS											
												

The above application examples are customer's applications, so it can be different from the recommended conditions.



9000 Series Grades for Difficult-to-cut Materials

MP9005/MP9015/MP9025 MT9005/MT9015

For your safety

●Don't touch breakers and chips without gloves. ●Please machine within recommended application range, and exchange expired tools with new parts in advance. ●Please use safety cover and wear safety glasses. ●When using compounded cutting oils, please take fire prevention. ●When attaching inserts or spare parts, please use the attached wrench or driver. ●When using tools in revolution machining, please make a trial run to check run-out, vibration, abnormal sounds etc.

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(Tool specifications subject to change without notice.)

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