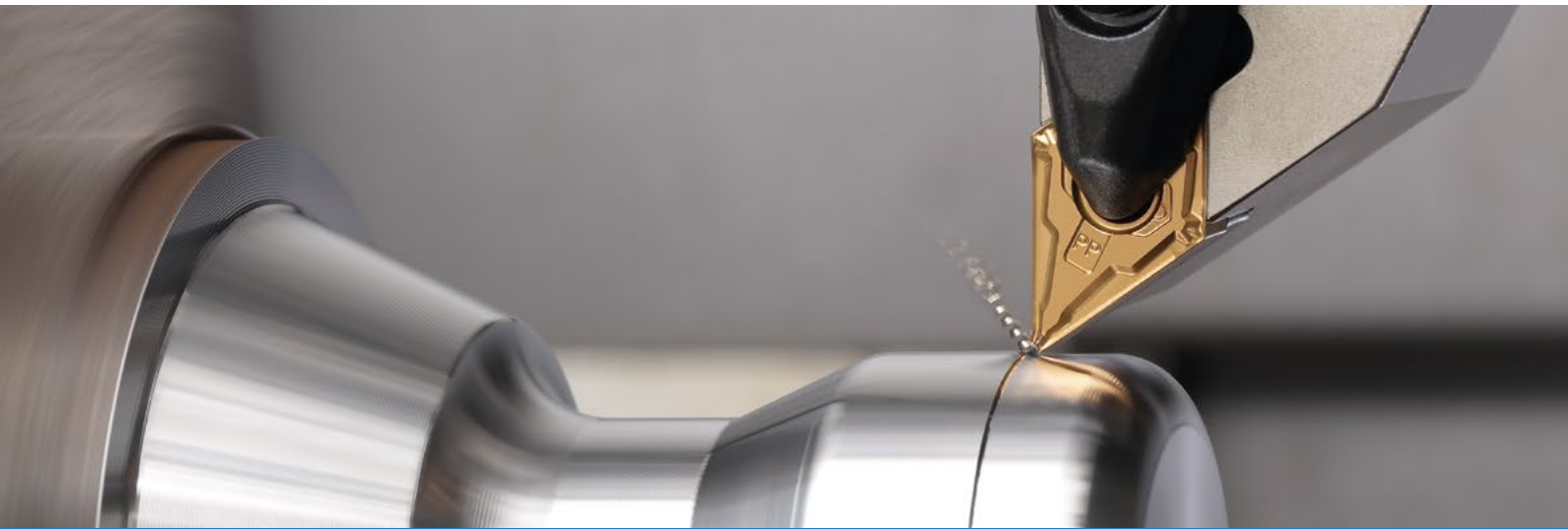


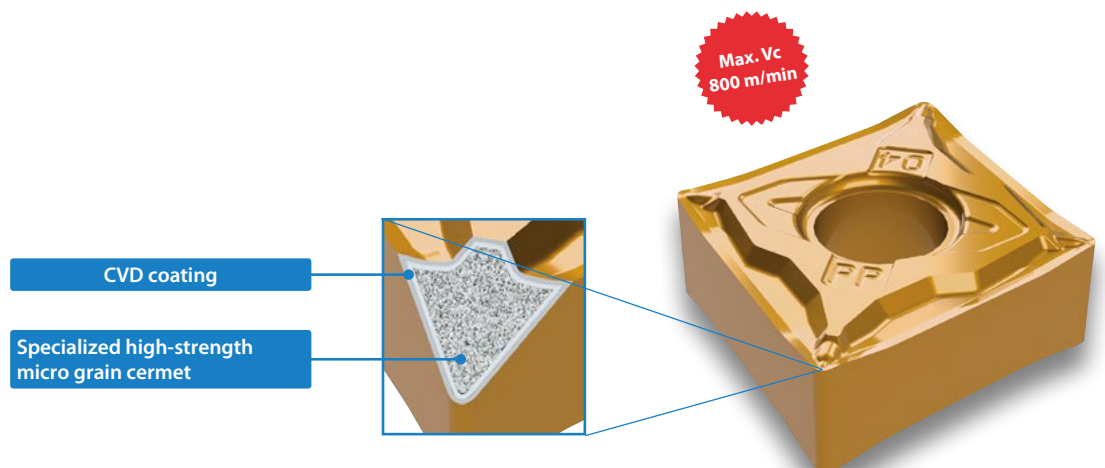
CCX



High speed machining with CVD coated cermet

Newly developed unique cermet base material with thick CVD coating

Excellent wear resistance provides long tool life for low carbon steel, general, steel and cast iron machining



CVD coated cermet for finishing

CCX

Combination of cermet with a CVD coating provides high speed machining for better productivity. Applicable to a wide range of cutting conditions from general to high speed machining. Maintains long tool life in soft steel, general steel and cast iron machining

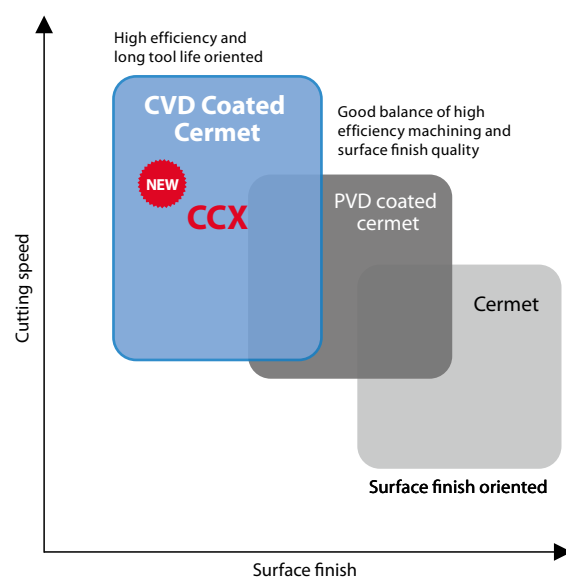
1 Excellent high speed finishing leads to greater productivity

Superior wear resistance with unique cermet grade and thickened CVD coating
Finishing available at a higher speed range

Wide range of cutting speeds from general to high speed provides long tool life in finishing applications



Cermet application map



CCX application examples

Great performance in continuous to light interruption finishing applications

- Cutting with coolant is recommended
- Recommended ap is 1.0 mm or less

Long tool life in high speed machining of soft steel and general steel

Long tool life for cast iron finishing



Vc: 300-600-800 (m/min)



Vc: 200-300-400 (m/min)



Vc: 150-250-300 (m/min)

Recommended cutting conditions

2 Combination of cermet and a CVD coating provides high speed machining for better productivity

Newly developed unique cermet grade with thick CVD coating which is difficult to accomplish using conventional technology

High speed machining and long tool life with superior wear and chipping resistance

Thickened CVD coated cermet

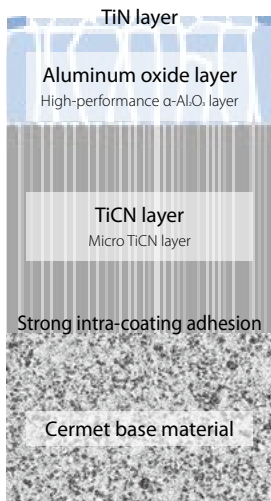
Improved wear resistance with thicker coating than PVD

Al₂O₃ layer provides excellent crater wear resistance

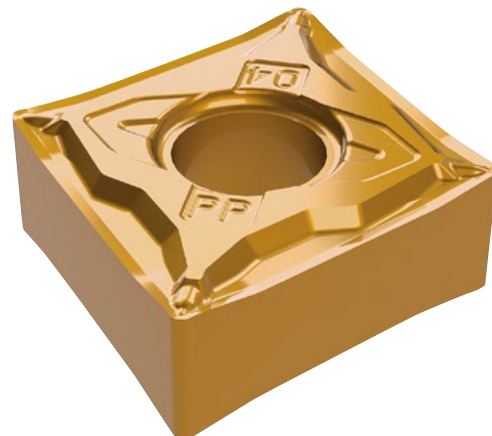
Newly developed unique cermet grade

Specialized high-strength micro grain cermet including a high metal content binder phase

High wear and fracture resistance



CCX image

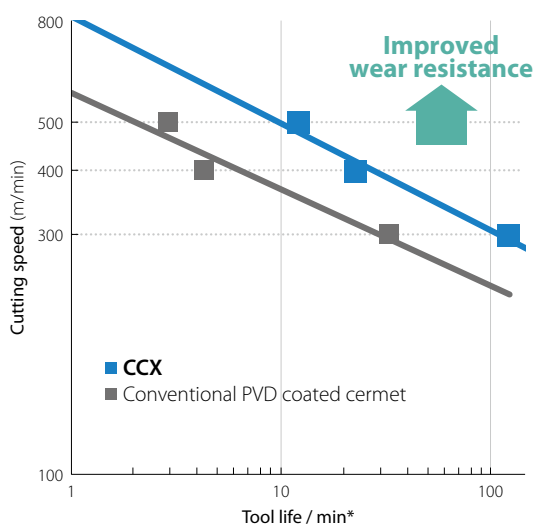


Wear resistance

Shows greater strength and wear resistance in a wide range of cutting speeds from general to high speed machining

V-T diagram (Internal evaluation)

* Tool life criterion (min): Edge wear amount 0.1 mm (Logarithmic chart)



Cutting conditions : Vc = 300/400/500 m/min, ap = 0.5 mm, f = 0.2 mm/rev, wet CNMG120408 type Workpiece : 34CrMo4

Cutting edge (Vc = 500 m/min : After machining 12.4 min)

CCX



Conventional PVD coated cermet A

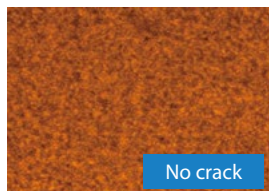


Chipping resistance

Great chipping resistance with specialized high-strength micro grain substrate and the compressive residual stress of a CVD coating layer

Surface condition after the CVD coating (Internal evaluation)

CCX



No crack

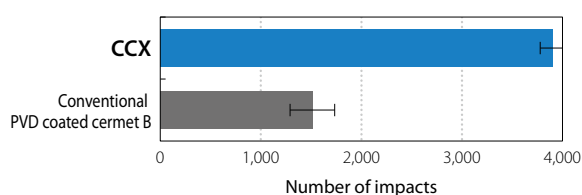
CVD coated carbide



Cracks

Strong compressive residual stress prevents cracks from occurring

Chipping resistance comparison (Internal evaluation)



Cutting conditions: Vc = 300 m/min, ap = 0.5 mm, f = 0.3 mm/rev, n = 3, wet CNMG120408 type, workpiece : C45 (with 4 slots)

3

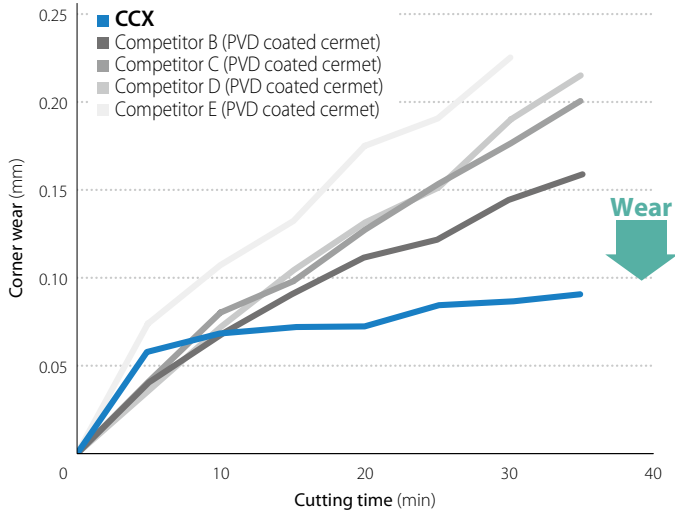
Superior wear resistance to PVD coated cermets

Alloy Steel - 34CrMo4

High speed comparison: $V_c = 400$ m/min

CCX provided better tool life than competitor's PVD cermets by greatly reducing the amount of wear

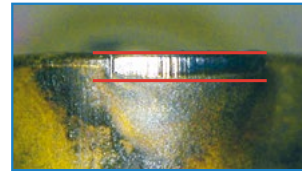
Wear resistance comparison (Internal evaluation)



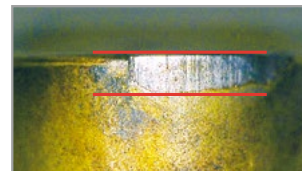
Cutting conditions: $V_c = 400$ m/min, $a_p = 0.3$ mm, $f = 0.12$ mm/rev, Wet, CNMG120408 type, external turning

Cutting edge (After machining 35 min)

CCX



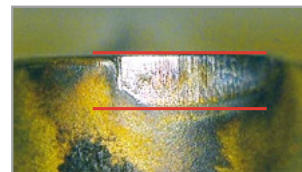
Competitor B (PVD coated cermet)



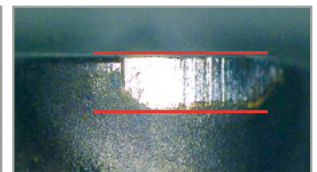
Competitor C (PVD coated cermet)



Competitor D (PVD coated cermet)



Competitor E (PVD coated cermet)

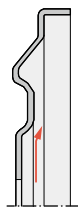


* Picture shows 30 min after machining due to a large amount of wear

Case studies

Cover QStE360TM

$V_c = 540$ m/min
 $a_p = 0.4$ mm
 $f = 0.25$ mm/rev
 Wet
 TNMG160408PQ CCX



Tool life

CCX
 CVD coated cermet

210 pcs/edge (Stable)



Competitor F
 CVD coated carbide

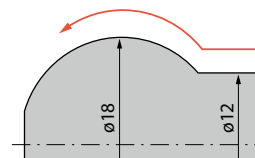
200 pcs/edge (Unstable)

Shortened cutting time with 1.3x faster cutting speed
 Stable machining of 210 pcs per edge with improved tool life

User evaluation

Pin C50 etc.

$V_c = 125\text{--}180$ m/min
 $a_p \sim 1.0$ mm
 $f = 0.18$ mm/rev
 Wet
 VNMG160408VF CCX



Tool life

CCX
 CVD coated cermet

1,200 pcs/edge (Stable)



Conventional C
 PVD coated cermet

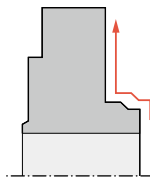
500 pcs/edge (Unstable)

Increased the number of parts produced by 2.4 times than the conventional PVD cermet
 Stable part production

User evaluation

Hubs C45

$V_c = 290$ m/min
 $a_p = 0.15$ mm
 $f = 0.27$ mm/rev
 Wet
 VNMG160404PQ CCX



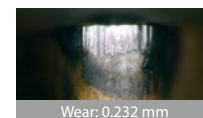
Cutting edge (After machining 320 pcs)

CCX
 CVD coated cermet



Wear: 0.106 mm

Conventional D
 PVD coated cermet
















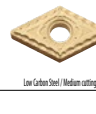








Wear: 0.232 mm

Reduced amount of wear by about 50% of conventional PVD cermet in the same conditions

User evaluation














Inserts (Negative)









Shape	Description	Dimensions (mm)				CVD coated cermet	
		I.C.	Thickness	Hole diameter	Corner R(RE)	CCX	
 Finishing	CNMG 120402PP	12.70	4.76	5.16	0.2	●	
	120404PP				0.4	●	
	120408PP				0.8	●	
	120412PP				1.2	●	
 Finishing-Medium	CNMG 120404PQ	12.70	4.76	5.16	0.4	●	
	120408PQ				0.8	●	
	120412PQ				1.2	●	
 Finishing-Medium	CNMG 090404HQ	9.525	4.76	3.81	0.4	●	
	090408HQ				0.8	●	
	CNMG 120404HQ	12.70	4.76	5.16	0.4	●	
	120408HQ				0.8	●	
	120412HQ				1.2	●	
 Finishing / Small ap	CNMG 120404XF	12.70	4.76	5.16	0.4	●	
	120408XF				0.8	●	
 Low Carbon Steel / Finishing	CNMG 120404XP	12.70	4.76	5.16	0.4	●	
	120408XP				0.8	●	
 Low Carbon Steel / Medium cutting	CNMG 120404XQ	12.70	4.76	5.16	0.4	●	
	120408XQ				0.8	●	
 for Cast Iron	CNMG 120404	12.70	4.76	5.16	0.4	●	
	120408				0.8	●	
	120412				1.2	●	
 for Cast Iron (Without Chipbreaker)	CNMA 120404	12.70	4.76	5.16	0.4	●	
	120408				0.8	●	
 Finishing	DNMG 150402PP	12.70	4.76	5.16	0.2	●	
	150404PP				0.4	●	
	150408PP				0.8	●	
	150412PP				1.2	●	
	DNMG 150602PP	12.70	6.35	5.16	0.2	●	
	150604PP				0.4	●	
	150608PP				0.8	●	
	150612PP				1.2	●	
 Finishing-Medium	DNMG 150404PQ	12.70	4.76	5.16	0.4	●	
	150408PQ				0.8	●	
	150412PQ				1.2	●	
	DNMG 150604PQ	12.70	6.35	5.16	0.4	●	
	150608PQ				0.8	●	
	150612PQ				1.2	●	

Shape	Description	Dimensions (mm)				CVD coated cermet	
		I.C.	Thickness	Hole diameter	Corner R(RE)	CCX	
 Finishing-Medium	DNMG 110402HQ	9.525	4.76	3.81	0.2	●	
	110404HQ				0.4	●	
	DNMG 150404HQ	12.70	4.76	5.16	0.4	●	
	150408HQ				0.8	●	
	150412HQ				1.2	●	
	DNMG 150604HQ	150608HQ	12.70	6.35	5.16	0.4	●
150612HQ		0.8				●	
150612HQ		1.2				●	
 Finishing / Small ap	DNMG 150404XF	12.70	4.76	5.16	0.4	●	
	150408XF				0.8	●	
 Low Carbon Steel / Finishing	DNMG 150404XP	12.70	4.76	5.16	0.4	●	
	150408XP				0.8	●	
DNMG 150604XP	150608XP	12.70	6.35	5.16	0.4	●	
	150608XP				0.8	●	
	150608XP				0.8	●	
 Low Carbon Steel / Medium cutting	DNMG 150404XQ	12.70	4.76	5.16	0.4	●	
	150408XQ				0.8	●	
 for Cast Iron	DNMG 150408	12.70	4.76	5.16	0.8	●	
	150408				0.8	●	
 for Cast Iron (Without Chipbreaker)	DNMA 150408	12.70	4.76	5.16	0.8	●	
	150408				0.8	●	
 Finishing-Medium	SNMG 120404PQ	12.70	4.76	5.16	0.4	●	
	120408PQ				0.8	●	
 Finishing-Medium	SNMG 120404HQ	12.70	4.76	5.16	0.4	●	
	120408HQ				0.8	●	
	120412HQ				1.2	●	
 Low Carbon Steel / Finishing	SNMG 120408XP	12.70	4.76	5.16	0.8	●	
	120408XP				0.8	●	
 Low Carbon Steel / Medium cutting	SNMG 120408XQ	12.70	4.76	5.16	0.8	●	
	120408XQ				0.8	●	
 Low Carbon Steel / Roughing	SNMG 120408XS	12.70	4.76	5.16	0.8	●	
	120408XS				0.8	●	
 for Cast Iron	SNMG 120408	12.70	4.76	5.16	0.8	●	
	120408				0.8	●	





● : Available

Inserts (Negative)





Shape <small>Handed Insert shows Right-hand</small>	Description	Dimensions (mm)				CVD coated cermet	
		I.C.	Thickness	Hole diameter	Corner R(RE)	CCX	
 <small>Finishing</small>	TNMG 160402PP	9.525	4.76	3.81	0.2	●	
	160404PP				0.4	●	
	160408PP				0.8	●	
	160412PP				1.2	●	
 <small>Finishing-Medium</small>	TNMG 160404PQ	9.525	4.76	3.81	0.4	●	
	160408PQ				0.8	●	
	160412PQ				1.2	●	
 <small>Finishing-Medium</small>	TNMG 110404HQ	6.35	4.76	2.26	0.4	●	
	110408HQ				0.8	●	
	TNMG 160404HQ	9.525	4.76	3.81	0.4	●	
	160408HQ				0.8	●	
	160412HQ				1.2	●	
 <small>Finishing / Small ap</small>	TNMG 160404XF	9.525	4.76	3.81	0.4	●	
	160408XF				0.8	●	
 <small>Low Carbon Steel / Finishing</small>	TNMG 160404XP	9.525	4.76	3.81	0.4	●	
	160408XP				0.8	●	
 <small>Low Carbon Steel / Medium cutting</small>	TNMG 160404XQ	9.525	4.76	3.81	0.4	●	
	160408XQ				0.8	●	
 <small>for Cast Iron</small>	TNMG 160404	9.525	4.76	3.81	0.4	●	
	160408				0.8	●	
 <small>for Cast Iron (Without Chipbreaker)</small>	TNMA 160404	9.525	4.76	3.81	0.4	●	
	160408				0.8	●	
 <small>Finishing</small>	VNMG 160402PP	9.525	4.76	3.81	0.2	●	
	160404PP				0.4	●	
	160408PP				0.8	●	
	160412PP				1.2	●	
 <small>Finishing-Medium</small>	VNMG 160404 R/L-VC	9.525	4.76	3.81	0.4	●	
	160408 R/L-VC				0.8	●	
	160412 R/L-VC				1.2	●	
 <small>Finishing-Medium</small>	VNMG 160404PQ	9.525	4.76	3.81	0.4	●	
	160408PQ				0.8	●	
	160412PQ				1.2	●	
 <small>Finishing-Medium</small>	VNMG 160404HQ	9.525	4.76	3.81	0.4	●	
	160408HQ				0.8	●	
	160412HQ				1.2	●	
 <small>Finishing-Medium</small>	VNMG 160404VF	9.525	4.76	3.81	0.4	●	
	160408VF				0.8	●	



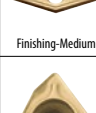

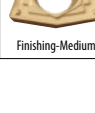
Shape	Description	Dimensions (mm)				CVD coated cermet	
		I.C.	Thickness	Hole diameter	Corner R(RE)	CCX	
 <small>for Cast Iron</small>	VNMG 160408	9.525	4.76	3.81	0.8	●	
 <small>Finishing</small>	WNMG 080402PP	12.70	4.76	5.16	0.2	●	
	080404PP				0.4	●	
	080408PP				0.8	●	
	080412PP				1.2	●	
 <small>Finishing-Medium</small>	WNMG 080404PQ	12.70	4.76	5.16	0.4	●	
	080408PQ				0.8	●	
 <small>Finishing-Medium</small>	WNMG 060404HQ	9.525	4.76	3.81	0.4	●	
	060408HQ				0.8	●	
	WNMG 080404HQ	12.70	4.76	5.16	0.4	●	
	080408HQ				0.8	●	
	080412HQ				1.2	●	
 <small>Low Carbon Steel / Finishing</small>	WNMG 080404XP	12.70	4.76	5.16	0.4	●	
	080408XP				0.8	●	
 <small>Low Carbon Steel / Medium cutting</small>	WNMG 080404XQ	12.70	4.76	5.16	0.4	●	
	080408XQ				0.8	●	
 <small>for Cast Iron</small>	WNMG 080408	12.70	4.76	5.16	0.8	●	
 <small>for Cast Iron (Without Chipbreaker)</small>	WNMA 080408	12.70	4.76	5.16	0.8	●	

● : Available

Shape Handed Insert shows Right-hand	Description	Dimensions (mm)					CVD coated cermet	
		I.C.	Thickness	Hole diameter	Corner R(RE)	Relief angle		CCX
 Finishing	CCMT 060202PP	6.35	2.38	2.8	0.2	7°	●	
	060204PP				0.4		●	
	CCMT 09T302PP	9.525	3.97	4.4	0.2	7°	●	
	09T304PP				0.4		●	
	09T308PP				0.8		●	
 Finishing-Medium	CCMT 060202GK	6.35	2.38	2.8	0.2	7°	●	
	060204GK				0.4		●	
	CCMT 09T302GK	9.525	3.97	4.4	0.2	7°	●	
	09T304GK				0.4		●	
	CCMT 120404GK	12.70	4.76	5.5	0.4	7°	●	
120408GK	0.8				●			
 Finishing-Medium	CCMT 060202HQ	6.35	2.38	2.8	0.2	7°	●	
	060204HQ				0.4		●	
	CCMT 09T302HQ	9.525	3.97	4.4	0.2	7°	●	
	09T304HQ				0.4		●	
	09T308HQ				0.8		●	
 Medium cutting	CCMT 09T308	9.525	3.97	4.4	0.8	7°	●	
 Finishing	CPMT 080202PP	7.94	2.38	3.3	0.2	11°	●	
	080204PP				0.4		●	
	CPMT 090302PP	9.525	3.18	4.4	0.2	11°	●	
	090304PP				0.4		●	
	090308PP				0.8		●	
 Finishing-Medium	CPMH 080204HQ	7.94	2.38	3.5	0.4	11°	●	
	080208HQ				0.8		●	
	CPMH 090304HQ	9.525	3.18	4.5	0.4	11°	●	
	090308HQ				0.8		●	
	 Medium cutting				CPMH 080204		7.94	2.38
080208		0.8	●					
CPMH 090304		9.525	3.18	4.5	0.4	11°	●	
090308					0.8		●	
 Low carbon steel / Finishing					CPMT 080204XP		7.94	2.38
	090304XP	0.4	●					
	CPMT 090308XP	9.525	3.18	4.4	0.4	11°	●	
	090308XP				0.8		●	
	 Low carbon steel / Medium cutting				CPMT 090304XQ		9.525	3.18
090308XQ		0.8	●					
 Finishing		DCMT 070202PP	6.35	2.38	2.8	0.2	7°	●
		070204PP				0.4		●
		DCMT 11T302PP	9.525	3.97	4.4	0.2	7°	●
	11T304PP	0.4				●		
	11T308PP	0.8				●		
 Finishing-Medium	DCMT 070202GK	6.35	2.38	2.8	0.2	7°	●	
	070204GK				0.4		●	
	DCMT 070208GK	9.525	3.97	4.4	0.8	7°	●	
	11T302GK				0.2		●	
	11T304GK				0.4		●	
11T308GK	0.8	●						
 Finishing-Medium	DCMT 070202HQ	6.35	2.38	2.8	0.2	7°	●	
	070204HQ				0.4		●	
	070208HQ				0.8		●	
	DCMT 11T302HQ	9.525	3.97	4.4	0.2	7°	●	
	11T304HQ				0.4		●	
	11T308HQ				0.8		●	
	 Medium cutting	DCMT 11T308	9.525	3.97	4.4	0.8	7°	●
	 Low carbon steel / Finishing	DCMT 070204XP	6.35	2.38	2.8	0.4	7°	●
		11T302XP				0.2		●
		DCMT 11T304XP	9.525	3.97	4.4	0.4	7°	●
		11T308XP				0.8		●
		 Low carbon steel / Medium cutting	DCMT 11T304XQ	9.525	3.97	4.4	0.4	7°
11T308XQ	0.8		●					
 Without chipbreaker	SPMN 120312		12.7	3.18	-	1.2	11°	●
 Finishing	TBMT 060102DP		3.97	1.59	2.3	0.2	5°	●
	060104DP					0.4		●
	 Finishing-Medium	TCMT 090202HQ	5.56	2.38	2.5	0.2	7°	●
		090204HQ				0.4		●
		TCMT 110202HQ	6.35	2.38	2.8	0.2	7°	●
110204HQ		0.4				●		
110208HQ		0.8				●		
TCMT 16T304HQ	9.525	3.97	4.4	0.4	7°	●		
16T308HQ				0.8		●		
16T312HQ				1.2		●		
 Finishing	TPMT 090202PP	5.56	2.38	2.8	0.2	11°	●	
	090204PP				0.4		●	
	TPMT 110302PP	6.35	3.18	3.3	0.2	11°	●	
	110304PP				0.4		●	
	110308PP				0.8		●	
 Finishing-Medium	TPMT 090202HQ	5.56	2.38	2.8	0.2	11°	●	
	090204HQ				0.4		●	
	TPMT 110302HQ	6.35	3.18	3.3	0.2	11°	●	
	110304HQ				0.4		●	
	110308HQ				0.8		●	
TPMT 160302HQ	9.525	3.18	4.4	0.2	11°	●		
160304HQ				0.4		●		
160308HQ				0.8		●		
 Low carbon steel / Finishing	TPMT 110304XP	6.35	3.18	3.3	0.4	11°	●	
	110308XP				0.8		●	
	TPMT 160304XP	9.525	3.18	4.4	0.4	11°	●	
	160308XP				0.8		●	

● : Available

Shape	Description	Dimensions (mm)					CVD coated cermet	
		I.C.	Thickness	Hole diameter	Corner R(RE)	Relief angle		
 Low carbon steel / Medium cutting	TPMT 110304XQ	6.35	3.18	3.3	0.4	11°	●	
	110308XQ				0.8		●	
	TPMT 160304XQ	9.525	3.18	4.4	0.4	11°	●	
	160308XQ				0.8		●	
 Finishing	VBMT 110302PP	6.35	3.18	2.8	0.2	5°	●	
	110304PP				0.4		●	
	110308PP				0.8		●	
	VBMT 160404PP	9.525	4.76	4.4	0.4	5°	●	
	160408PP				0.8		●	
	160412PP				1.2		●	
 Finishing	VBMT 110302VF	6.35	3.18	2.8	0.2	5°	●	
	110304VF				0.4		●	
	110308VF				0.8		●	
	VBMT 160402VF	9.525	4.76	4.4	0.2	5°	●	
	160404VF				0.4		●	
	160408VF				0.8		●	
	160412VF				1.2		●	
	 Finishing-Medium	VBMT 110304HQ	6.35	3.18	2.8	0.4	5°	●
		110308HQ				0.8		●
VBMT 160404HQ		9.525	4.76	4.4	0.4	5°	●	
160408HQ					0.8		●	
160412HQ					1.2		●	

Shape	Description	Dimensions (mm)					CVD coated cermet
		I.C.	Thickness	Hole diameter	Corner R(RE)	Relief angle	
 Finishing	VCMT 080202PP	4.76	2.38	2.3	0.2	7°	●
	080204PP				0.4		●
	VCMT 160404PP	9.525	4.76	4.4	0.4	7°	●
	160408PP				0.8		●
 Finishing	VCMT 080202VF	4.76	2.38	2.3	0.2	7°	●
	080204VF				0.4		●
 Finishing-Medium	VCMT 080202HQ	4.76	2.38	2.3	0.2	7°	●
	080204HQ				0.4		●
 Finishing	WBMT 060102 ^{R/L} -DP	3.97	1.59	2.3	0.2	5°	●
	060104 ^{R/L} -DP				0.4		●
	WBMT 080202 ^{R/L} -DP	4.76	2.38	2.3	0.2	5°	●
	080204 ^{R/L} -DP				0.4		●
	080204 ^{R/L} -DP				0.4		●
	 Finishing-Medium	WPMT 110202HQ	6.35	2.38	2.8	0.2	11°
110204HQ		0.4				●	
WPMT 160304HQ		9.525	3.18	4.4	0.4	11°	●
160308HQ	0.8				●		

● : Available

Recommended cutting conditions

Workpiece	Vc: m/min
	Min. - Recommendation - Max.
Low carbon steel	300 ~ 600 ~ 800
Carbon steel	200 ~ 300 ~ 450
Alloy steel	200 ~ 300 ~ 400
Gray cast iron	300 ~ 350 ~ 400
Nodular cast iron	150 ~ 250 ~ 300

- Machining with coolant is recommended. Dry machining is not recommended.
- Great for soft steel materials during low to high speed finishing (continuous~light interruption)
- Not recommended for Roughing (scale removal) and heavy interrupted machining (ap should be ≤ 1 mm)