HARDSTONE
Cutting Tools

ZHUZHOU HUARUI PRECISION CUTTING TOOLS CO., LTD.

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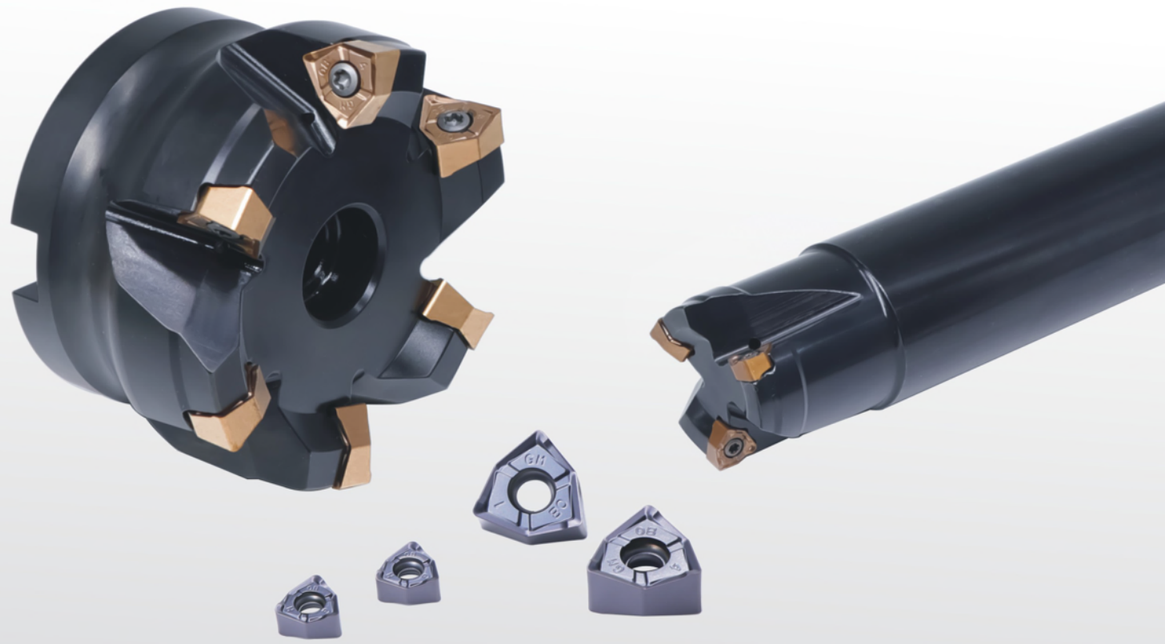
HARDSTONE
Cutting Tools

2021-2022
PRODUCT CATALOGUE



ZHUZHOU HUARUI PRECISION CUTTING TOOLS CO., LTD.

COMPANY PROFILE

Zhuzhou Huarui Precision Cutting tools Co. , Ltd. (Stock Code: 688059) was established in March 2007 with a registered capital of 44, 008, 000 CNY. As an advanced cutting tool manufacturer in China, HUARUI upholding the development strategy of "Independent Research & Development, Continuous Innovation", focus on the R&D, manufacture, sales and application of cemented carbide CNC cutting insert, constantly pursuing the improvement in overall performance and optimization in fabrication technology.

Relying on the multi-year technological accumulation and skilled talents, together with the intergration, assimilation and absorbtion of advanced equipment, HUARUI has formed their own independent core technology in the fields of "Substrate material", "Chip-breaker geometry", "Precision forming" and "Surface coating", and developed "Turning series", "Milling series" and "Drilling series" as the three major product range.

HUARUI is proud of their core product being the domestic leading level for their efficiency, long service life and cutting accuracy, successfully entered the high end markets which long time dominated by Europe, USA, Japan and Korea companies, Especially the milling series, it has formed a significant competitive advantage.

HUARUI has been awarded as the "National High-tech Enterprise", "National Small Giant Enterprise", "Hunan Province Recognized Enterprise Technology Center" and "100 Major Scientific and Technological Innovation Project 2020 Implementation Plan enterprise". Their "HARDSTONE" brand has been selected as the "Customer Satisfaction Brand" in the 4th Cutting Tool User Survey. And the independently developed FM series milling inserts has been awarded the "Golden Edge Awards" and "Ringier Technology Innovation Awards".

HONOR

HARDSTONE
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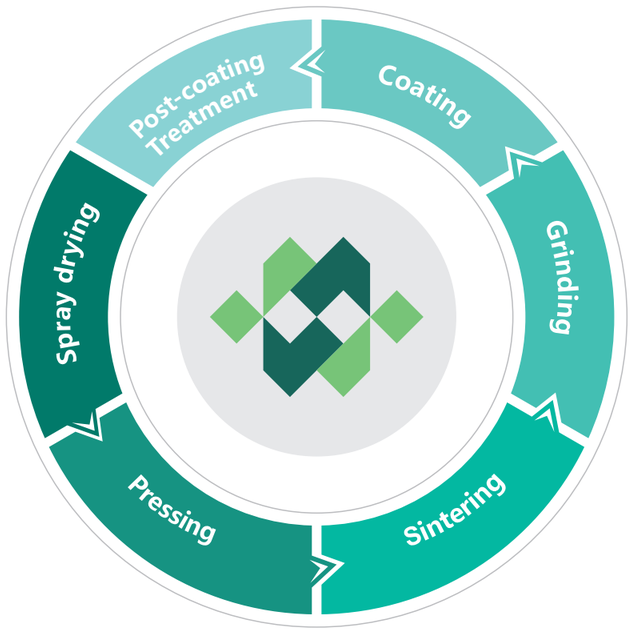
TECHNOLOGY

HUARUI has a full set of process equipments and complete production line for CNC cutting insert manufacturing from powder material preparation, mould making, compression forming, pressure sintering, grinding, coating, post coating treatment to automatic packing.At the meantime, HUARUI adopt the R&D strategy of "Concentrate advantages to breakthrough each single product", focusing on the research and innovation of cemented carbide CNC cutting insert at the areas of substrate materials, chip breaker geometry, precision mould machining and surface coating, continuously improve the machining accuracy, efficiency and extend the service life. After more than ten years scientific research innovation, HUARUI has mastered lots of independent core technologies, possess strong independent R&D and design capabilities, and the overall technical strength has achieved the national advanced level.




Spray drying


Pressing

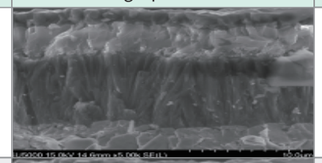
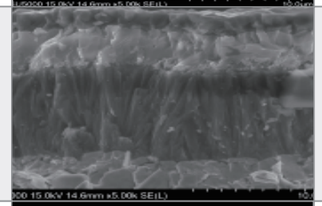
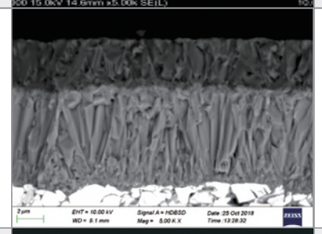
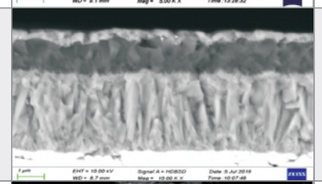
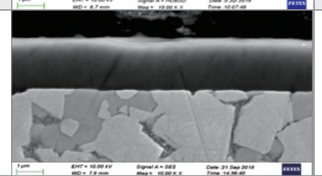
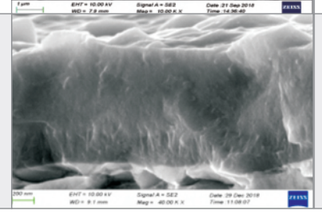

Sintering


Grinding


Coating

CATALOGUE

The introduction of grade

Grade	Coating				Characteristics	Application	ISO	Wear Resistance ⟷ Toughness									
	Type	Color	Metallographic Structure	Composition				01	05	10	15	20	25	30	35	40	45
WS8215	CVD	Double color black-yellow		TiN+MT -TiCN+Al_2O_3 +TiN	The proprietary substrate of gradient alloy structure formed by special sintering process, together with thick TiCN, thick Al_2O_3, and sophisticated coating post treatment, not only makes the coating more beautiful, but also greatly improves the wear resistance. It is very suitable for finishing and semi-finishing of carbon steel and alloy steel.	Suitable for stable turning environment pursuit high wear resistance. For ordinary steel processing with good cooling, the linear velocity can be over 350m/min	P10~P20										
WS8135	CVD	Double color black-yellow		TiN+MT -TiCN+Al_2O_3 +TiN	It has adopted the strengthen binder phase which can effectively inhibit the high temperature plastic deformation of the substrate; The fabrication of high binder phase content functional gradient layer effectively controlled the crack propagation of the coating; Uniform distributed hard phase particles considered both the toughness and wear resistance of the substrate; Coupled with the thickened and advanced CVD coating, it can widely used in various types of steel processing.	It is a most commonly used grade for steel turning, with superior performance for high speed interrupted semi-finishing and finishing.	P15~P35										
WS8133	CVD	Double color black-yellow		TiN+MT -TiCN+Al_2O_3 +TiN	It has adopted the strengthen binder phase which can effectively inhibit the high temperature plastic deformation of the substrate; The fabrication of high binder phase content functional gradient layer effectively controlled the crack propagation of the coating; Uniform distributed hard phase particles considered both the toughness and wear resistance of the substrate; The medium thick TiCN coupled with thin alumina coat, provide superior performance for parting and grooving process of steel material.	It is an upgraded grade with better stability, design for high speed parting off and grooving of general-purpose steel parts.	P15-P35										
WS7120	CVD	Yellow		TiN+MT -TiCN+Al_2O_3 +TiN	It has adopted the substrate with better high temperature hardness which provide good plastic deformation resistance under high speed cutting process; The compound multi-layer coating effectively blocked the longitudinal expansion of the coating cracks during the cutting process; Coupled with the fine coating post-treatment technology, provide a much more better, delicate and smooth coating surface. Suitable for roughing and semi-finishing of various types of stainless steel.	It is suitable for high speed and high efficiency roughing of stainless steel.	M15-M30										
WS7125	PVD	Grey-black		AlTiN	The precise and unique coating formulations, together with innovative high-performance coating processes, provide a delicate, smooth and dropletless coating, which has the advantages of low coefficient of friction, high antioxidant temperature, high nano hardness, etc. This coating can match different edge requirements to ensure optimum comprehensive performance for various chip breaker design.	Preferred grade parting and grooving of stainless steel. It can also meet the requirements of medium and low speed parting and grooving of steel and cast iron.	P15-P30 M15-M30 K15-K30										
WS7225	PVD	Brass-yellow		TiAlSiN	The precise and unique coating formulation with Si+ elements added, together with innovative high-performance coating processes, provide a delicate, smooth and dropletless coating, which has the advantages of low coefficient of friction, high antioxidant temperature, high nano hardness, etc. This coating can match different cutting edge requirements to ensure optimum comprehensive performance for various chip breaker design.	It is a commonly used upgraded grade for stainless steel turning, greatly improved the sticking resistance and wear resistance, it is also suitable for general speed semi-finishing and finishing of mild steel.	M15-M30										

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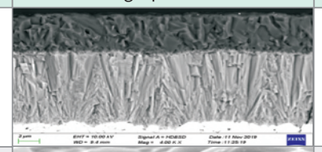
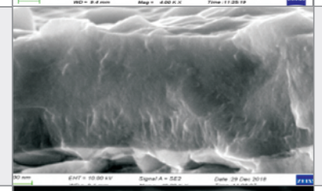
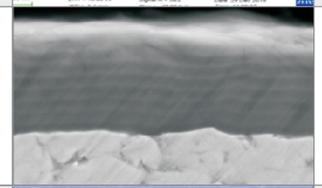
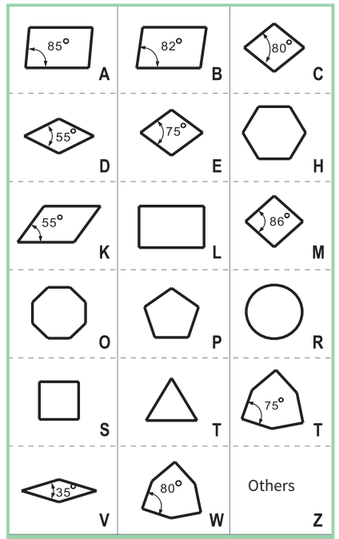
The introduction of grade

Grade	Coating				Characteristics	Application	ISO	Wear Resistance ⟷ Toughness									
	Type	Color	Metallographic Structure	Composition				01	05	10	15	20	25	30	35	40	45
WS6115	CVD	Black		TiN+MT -TiCN+Al_2O_3	The thickened CVD black diamond coating with special coating post-treatment, provide excellent wear resistance and toughness. Combined with the corresponding substrate, it has better universality and widely used in all kinds of cast iron machining.	It is a preferred grade for the turning of gray iron and ductile cast iron, with excellent comprehensive performance, it is also suitable for general interrupted machining, It can be used for low speed roughing of quenched steel and high strength steel.	K10-K20			■	■	■						
WS5225	PVD	bronze		TiAlSiN	The special proportion of ingredients, with rare metals added, actively improves bending strength and heat-cack resistance of the substrate, together with the highest level cutting nose and cutting edge treatment technology, and the latest nano coating containing Si+ elements, greatly ensured the cutting insert with high hardness, wear resistance and sharpness.	It is an exclusive grade for threading of various materials.	P10-P25 M10-M25 K10-K25			■	■	■	■					
WS5231	PVD	purple bronze		AlCrN+ TiSiN	The ultra-fine grainsize substrate material and special ingredient ratio actively improves the bending strength and wear resistance of the substrate, greatly reduced the crack risk of cutting edge. The PVD nano composite multi-layer coating effectively prevent the formation of longitudinal cracks. and the meantime, the small friction coefficient coating surface provide strong sticking resistance.	It is an exclusive grade for the drill machining of various materials.	P20-P35 M20-M35 K20-K35					■	■	■	■				
WSK10	Un-coated	Silver grey		(K10)	Uniform and fine grain substrate material present high bending strength and good wear resistance; The fine treatment of cutting nose and cutting edge greatly ensured the sharpness and provide stable comprehensive performance.	It is used for turning, milling of graphite, cast iron and other non-ferrous metal materials like aluminum, copper, etc. It can also used for low speed turning of titanium alloy and high temperature alloy.	K05-K10			■	■							

Insert identification system

Insert Shape



Chip-breaker and Clamping system

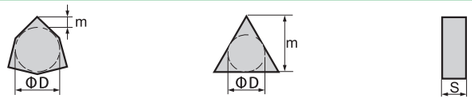
Code	Hole	Chip-breaker	Section Plane	Code	Hole	Chip-breaker	Section Plane
B	With	Without	>65°	N	Without	Without	
H	With	Single-Side	>65°	R	Without	Single-Side	
C	With	Wihout	>65°	F	Without	Double-Side	
J	With	Double-side	>65°	A	With	Without	
W	With	Without	≤65°	M	With	Single-Side	
T	With	Single-Side	≤65°	G	With	Double-Side	
Q	With	Without	≤65°	X	_	---	
U	With	Double-side	≤65°				

C N M G

Clearance angle of main cutting edge

Code	Clearance angle	Code	Clearance angle
A	3°	B	5°
C	7°	D	15°
E	20°	F	25°
G	30°	N	0°
P	11°	O	Others

Tolerance (mm)



Code	Nose height Tolerance(m)	Inscribed circle(ΦD)	Thickness Tolerance(s)
A	±0.005	±0.025	±0.025
F	±0.005	±0.013	±0.025
C	±0.013	±0.025	±0.025
H	±0.013	±0.013	±0.025
E	±0.025	±0.025	±0.025
G	±0.025	±0.025	±0.13
J	±0.005	±0.05-±0.13	±0.025
K	±0.013	±0.05-±0.13	±0.025
L	±0.025	±0.05-±0.13	±0.025
M	±0.08-±0.18	±0.05-±0.13	±0.13
N	±0.08-±0.18	±0.05-±0.13	±0.025
U	±0.13-±0.38	±0.08-±0.25	±0.13

◆ M-level tolerance(Idertifled by shape)

◆ Tolerance of tool tip height (mm)

Inscribed circle	Regular triangle	Square	Rhombus with80°	Rhombus with 55°	Rhombus with 35°	Round
6.35	±0.08	±0.08	±0.08	±0.11	±0.16	---
9.525	±0.08	±0.08	±0.08	±0.11	±0.16	---
12.7	±0.13	±0.13	±0.13	±0.15	---	---
15.875	±0.15	±0.15	±0.15	±0.18	---	---
19.05	±0.15	±0.15	±0.15	±0.18	---	---
25.4	---	±0.18	---	---	---	---

◆Inscribed circle(ΦD)Tolerance

Inscribed circle	Regular triangle	Square	Rhombus with80°	Rhombus with 55°	Rhombus with 35°	Round
6.35	±0.05	±0.05	±0.05	±0.05	±0.05	---
9.525	±0.05	±0.05	±0.05	±0.05	±0.05	±0.05
12.7	±0.08	±0.08	±0.08	±0.08	---	±0.08
15.875	±0.10	±0.10	±0.10	±0.10	---	±0.10
19.05	±0.10	±0.10	±0.10	±0.10	---	±0.10
25.4	---	±0.13	---	---	---	±0.13

Length of Cutting Edge

Diameter of IC(mm)	C	D	R	S	T	V	W	K
32.00			32					
31.75			31					
25.40			25	25				
25.00	25	25	25					
20.00			20					
19.05	19		19	19	33			
16.00		19	16					
15.875	16		15	16	27			
12.70	12	15	12	12	22	22	08	
12.00			12					
10.00			10					
9.525	09	11	09	09	16	16	06	16
8.00			08					
6.35	06	07			11	11		
6.00			06					
5.56					09			
5.50			05					
3.97					06			

Insert shape

Insert Thickness

Code	Thickness(mm)
12	12.70
10	11.11
T9	9.72
09	9.52
07	7.94
T6	6.75
06	6.35
T5	5.95
05	5.56
T4	4.96
04	4.76
T3	3.97
03	3.18
T2	2.58
02	2.38
T1	1.98
01	1.59
T0	0.99
00	0.79

12 04 08 - GF (ISO)

4 3 2 (inch)

Inscribed Circle

Code	Diameter 0f IC(mm)
2	6.35
3	9.525
4	12.7
5	15.875
6	19.05
8	25.4

Thickness

Code	Thickness (mm)
2	3.18
3	4.76
4	6.35
5	7.94
6	9.52

Nose Radius

Code	Nose Radius (mm)
0	0.2
1	0.4
2	0.8
3	1.2
4	1.6
5	2.0
6	2.4

Nose Radius Code

Code	Nose Radius (mm)
00	No Radius
02	0.2
04	0.4
08	0.8
12	1.2
16	1.6
20	2.0
24	2.4
32	3.2
X	Ohers
Diameter of Inserts (Meric)	Round Inserts

Chip-Breaker Code

GF	GM	TM
		
BR	**BM**	**BF**
		
AK	**All round**	**Without chipbreaker**
		

Overview

Negative insert

CNMG*-GF CNMG*-GM CNMG*-GR CNMG*-BF CNMG*-BM CNMG*-BR CNMA* CNMG*

DNMG*-GF DNMG*-GM DNMG*-GR DNMG*-BF DNMG*-BM DNMA* DNMG*

SNMG*-GF SNMG*-GM SNMG*-GR SNMG*-GZ SNMG*-CR SNMG*-HAF SNMG*-HSF SNMG*-BF

SNMG*-BM SNMG*-BR SNMA* SNMG*

TNMG*-GF TNMG*-GM TNMG*-GR TNMG*-BF TNMG*-BM TNMG*-BR TNMA* TNMG*

VNMG*-GF VNMG*-GM VNMG*-BF VNMG*-BM VNMA* VNMG*

WNMG*-GF WNMG*-GM WNMG*-GR WNMG*-BF WNMG*-BM WNMG*-BR WNMA* WNMG*

Positive Insert

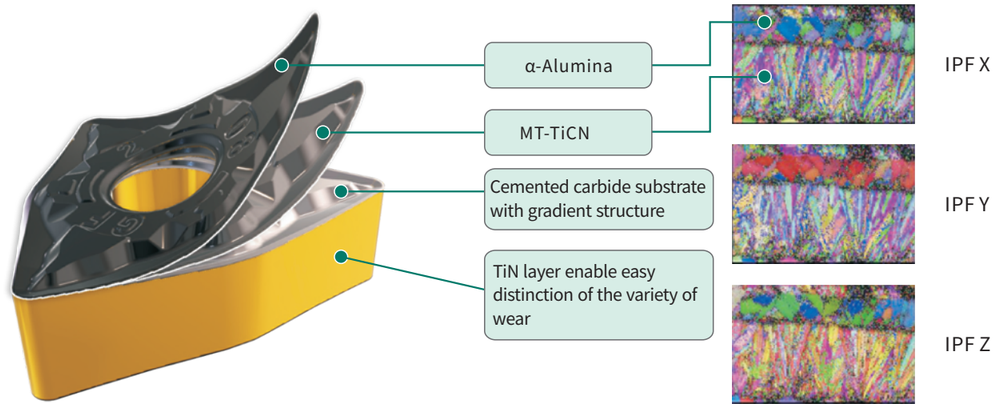
CCMT*-TM DCMT*-TM SCMT*-TM TCMT*-TM VBMT*-TM VCMT*-TM

Aluminium insert

CCGT*-AK DCGT*-AK TCGT*-AK VBGT*-AK VCGT*-AK

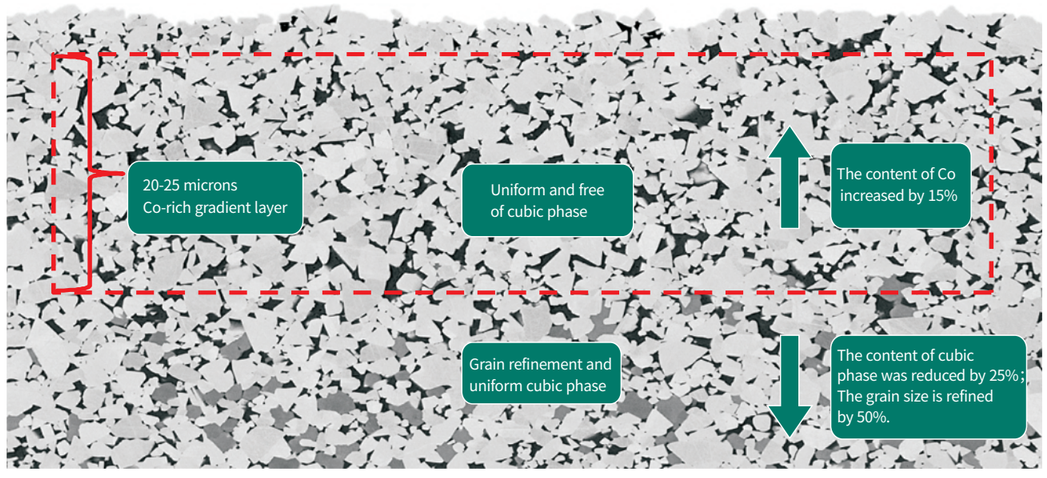
New Grade

WS8215\WS8135



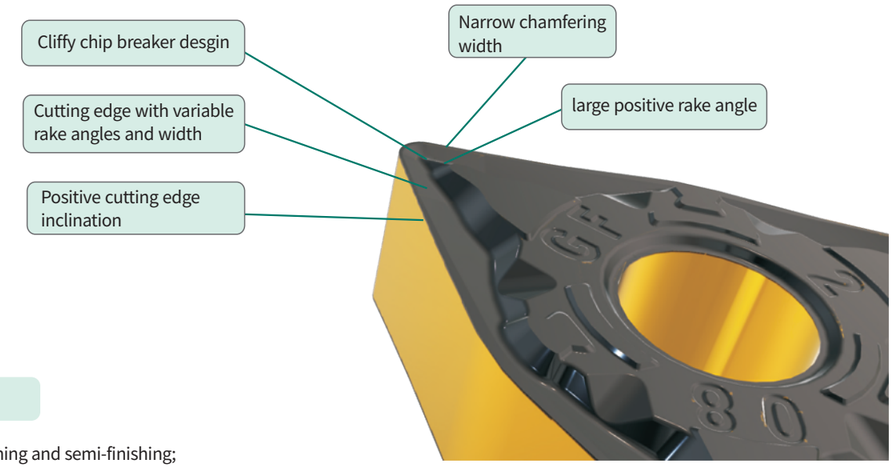
EBSD-inverse pole figure

WS8215\WS8135



Introduction of chip-breaker

Steel machining



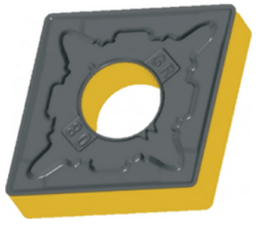
GF

- Used for finishing and semi-finishing;
- Large positive rake angle for smaller cutting resistance
- Positive cutting edge inclination effectively controls the cutting flow direction
- Two-section chip-breaker design ensures good chip breaking performance at small depth of cut.

GM

- Used for semi-finishing and realizes high-efficiency and high-stability machining.
- Specially designed cutting edge perfectly combines sharpness and strength; Curved rake face consists of cutting edge with variable rake angles and width that makes controlling the chipping fow direction valid.
- Good versatility with a wide range of cutting.

GR



- Used for light-load roughing, semi-fnishing.
- The cutting edge of chip-breaker makes controlling the chipping flow direction valid at small depth of cut.
- Specially designed large rake angle with wide land combine sharpness and strength.
- Good chip breaking performance and versatility with economical double-face chipbreaker.

Stainless steel machining

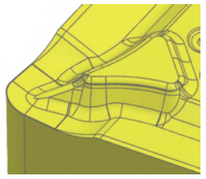
Features

- Specially designed chip-breaker is excellent in roughing , semi-finishing and finishing of stainless steel.
- BF chip-breaker used for finishing, semi-finishing and achieve good surface quality. Specially designed chip-breaker effectively eliminat the phenomena of burr.
- BM chip-breaker used for semi-finishing ,roughing and combine sharpness and strength. It is first choice for machining of stainless steel.
- Effectively cut off stainless steel and avoid adhering and surface hardening, achieving high surface quality.
- Specially designed chip-breaker makes controlling the chipping flow direction valid, which enables it to cut lightly and easily and reduce the occurrence of built-up edges.
- Different designs of cutting edge for roughing, semi-finishing and finishing.
- Inserts for finishing and semi-finishing focus on the sharpness of the cutting edge and inserts for roughing focus on optimal design of cutting edge, which achieves balance between edge security and sharpness and improve the efficiency of the insert.

Features of chip-breaker

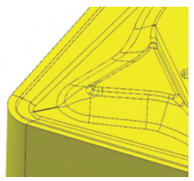
BF

- Used for finishing and semi-finishing.
- Sharp cutting edge, small cutting resistance.
- Good chip breaking performance at small depth of cut.
- Special edge treatment reduce the occurrence of built-up edges.



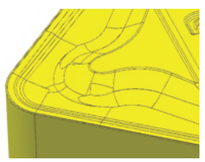
BM

- Used for semi-finishing and roughing
- Cutting edge is designed to combine sharpness and strength with a wide range of cutting.
- Good chip breaking performance, small cutting resistance.



BR

- Sturdy cutting land, used for interruptedmachining and roughing.
- Well-proportioned cutting edge passivation.
- Optimized chipbreaker.
- Large space of chip-breaker is suited to roughing at high feed rate.

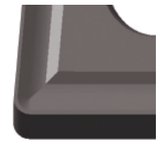


Cast iron machining

Features of chip-breaker

All round

- Double-sided chip-breaker with good versatility for K-type materials.
- Recommended cutting parameters：ap:0.20-8.00 fn:0.15-0.60



Without Chip-breaker

- Brittle and high hardness materials with high cutting edge strength ensure a perfect fit of holder. It is suitable for machining cast iron under unstable working conditions.

Positive chip-breaker

TM

- Used for semi-finishing with good versatility.
- With M-level tolerance, it is suitable for internal and external machining of steel, stainless steel,cast iron, etc.

Parting and grooving

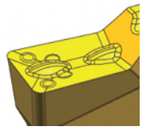
Features

- QCMB can be used for grooving and turning with good versatility.
- Optimized 3D chip-breaker makes controlling the chipping flow direction valid, which reduce the cutting resistance and the vibration in machining.
- The parting and grooving insert combines specially developed cemented carbide substrate and coating that achieves the balance between wear resistance and toughness, also improves the tool life and reliability.

Parting and grooving

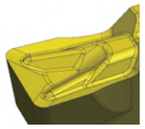
Features of chip-breaker

M



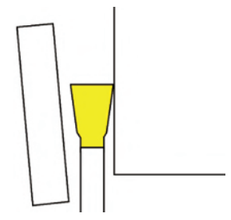
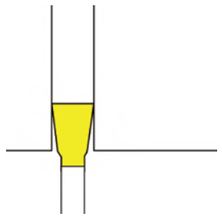
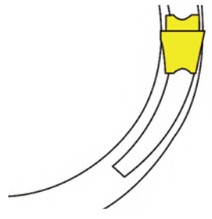
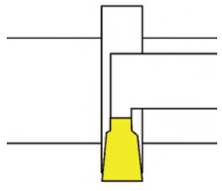
- Used for parting, grooving and turning etc. Enables it to cut lightly and easily, unobstructed chip fow and improve the surface quality.

T



- With specially designed flank, the cutting resistance can reduce by 20% and also reduces the vibration in machining and improve the surface quality.
  Specially designed cutting edge provides excellent chip breaking performance and can be transverse cutting feed.

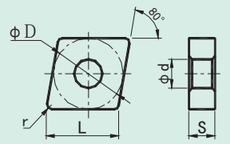
Processing methods

External parting	External grooving
	
Face grooving	Internal grooving
	

Negative Insert

80° CN** With Hole

● Good working condition ◕ Normal working condition ⌗ Bad working condition

Shape	Description						CVD Coating					PVD Coating								un-coated	Cutting Parameters	
							WS8215	WS8135	WS8133	WS6115	WS7120	WS7140	WS5115	WS5120	WS5130	WS5225	WS5231	WS7125	WS7225	WS7130	WSK10	Ap	Fn
		L	IC	S	ød	Re																(mm)	(mm/r)
	CNMG120404-GF	12.9	12.7	4.76	5.16	0.4	●	◕														0.15-2.0	0.08-0.18
	CNMG120408-GF	12.9	12.7	4.76	5.16	0.8	●	◕														0.25-2.0	0.08-0.25
	CNMG120404-GM	12.9	12.7	4.76	5.16	0.4	●	◕														0.6-5.0	0.2-0.25
	CNMG120408-GM	12.9	12.7	4.76	5.16	0.8	●	◕														0.8-5.0	0.2-0.40
	CNMG120412-GM	12.9	12.7	4.76	5.16	1.2	●	◕														1.0-5.0	0.20-0.50
	CNMG160608-GM	16.1	15.875	6.35	6.35	0.8	●	◕														1.5-6.0	0.15-0.40
	CNMG160612-GM	16.1	15.875	6.35	6.35	1.2	●	◕														1.5-6.0	0.20-0.60
	CNMG120408-GR	12.9	12.7	4.76	5.16	0.8		◕														2.0-6.5	0.28-0.50
	CNMG120412-GR	12.9	12.7	4.76	5.16	1.2		◕														2.0-6.5	0.28-0.63
	CNMG190608-GR	19.3	19.05	6.35	7.94	0.8		◕														2.0~8.0	0.30~0.60
	CNMG190612-GR	19.3	19.05	6.35	7.94	1.2		◕														2.0~8.0	0.40~0.80
	CNMG120404-BF	12.9	12.7	4.76	5.16	0.4														●		0.1-2.0	0.08-0.18
	CNMG120408-BF	12.9	12.7	4.76	5.16	0.8														●		0.1-2.0	0.08-0.18
	CNMG120404-BM	12.9	12.7	4.76	5.16	0.4														◕		0.4-5.5	0.10-0.25
	CNMG120408-BM	12.9	12.7	4.76	5.16	0.8														◕		0.5-5.5	0.10-0.40
	CNMG120412-BM	12.9	12.7	4.76	5.16	1.2														◕		0.8-5.5	0.10-0.55
	CNMG120408-BR	12.9	12.7	4.76	5.16	0.8						◕								◕	◕	1.5-6.0	0.25-0.40
	CNMG120412-BR	12.9	12.7	4.76	5.16	1.2						◕								◕	◕	1.5-6.0	0.25-0.55
	CNMG190616-BR	19.3	19.05	6.35	7.94	1.6						◕								◕	◕	3.0-8.0	0.25-0.80

Negative Insert

80° CN** With Hole

● Good working condition ◕ Normal working condition ⌗ Bad working condition

Shape	Description	ϕD / r / L / ϕd / S					CVD Coating						PVD Coating										un-coated	Cutting Parameters	
							WS8215	WS8135	WS8133	WS6115	WS7120	WS7140	WS5115	WS5120	WS5130	WS5225	WS5231	WS7125	WS7225	WS7130	WSK10	Ap	Fn
		L	IC	S	ød	Re																(mm)	(mm/r)
	CNMA120404	12.9	12.7	4.76	5.16	0.4				◕												1.0-4.5	0.15-0.25
	CNMA120408	12.9	12.7	4.76	5.16	0.8				◕												1.0-4.5	0.15-0.40
	CNMA120412	12.9	12.7	4.76	5.16	1.2				◕												1.0-4.5	0.15-0.55
	CNMA120416	12.9	12.7	4.76	5.16	1.6				◕												1.0-4.5	0.15-0.60
	CNMA160608	16.1	15.875	6.35	6.35	0.8				◕												2.0-6.0	0.15-0.40
	CNMA160612	16.1	15.875	6.35	6.35	1.2				◕												2.0-6.0	0.15-0.55
	CNMA160616	16.1	15.875	6.35	6.35	1.6				◕												2.0-6.0	0.15-0.70
	CNMA190612	19.3	19.05	6.35	7.94	1.2				◕												3.0-8.0	0.15-0.55
	CNMA190616	19.3	19.05	6.35	7.94	1.6				◕												3.0-8.0	0.15-0.80
	CNMG120404	12.9	12.7	4.76	5.16	0.4				◕												1.0-4.5	0.15-0.25
	CNMG120408	12.9	12.7	4.76	5.16	0.8				◕												1.0-4.5	0.15-0.40
	CNMG120412	12.9	12.7	4.76	5.16	1.2				◕												1.0-4.5	0.15-0.55
	CNMG120416	12.9	12.7	4.76	5.16	1.6				◕												1.0-4.5	0.15-0.60
	CNMG160608	16.1	15.875	6.35	6.35	0.8				◕												2.0-6.0	0.15-0.40
	CNMG160612	16.1	15.875	6.35	6.35	1.2				◕												2.0-6.0	0.15-0.55
	CNMG160616	16.1	15.875	6.35	6.35	1.6				◕												2.0-6.0	0.15-0.70
	CNMG190612	19.3	19.05	6.35	7.94	1.2				◕												3.0-8.0	0.15-0.55
	CNMG190616	19.3	19.05	6.35	7.94	1.6				◕												3.0-8.0	0.15-0.80

Negative Insert

55° DN** With Hole

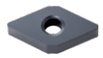
● Good working condition ◕ Normal working condition ⌗ Bad working condition

Shape	Description	ϕD / r / L / ϕd / S					CVD Coating						PVD Coating										un-coated	Cutting Parameters	
							WS8215	WS8135	WS8133	WS6115	WS7120	WS7140	WS5115	WS5120	WS5130	WS5225	WS5231	WS7125	WS7225	WS7130	WSK10	Ap	Fn
		L	IC	S	ød	Re																(mm)	(mm/r)
	DNMG150404-GF	15.5	12.7	4.76	5.16	0.4	●	◕														0.15-2.0	0.08-0.18
	DNMG150408-GF	15.5	12.7	4.76	5.16	0.8	●	◕														0.25-2.0	0.08-0.25
	DNMG150604-GF	15.5	12.7	6.35	5.16	0.4	●	◕														0.15-2.0	0.08-0.18
	DNMG150608-GF	15.5	12.7	6.35	5.16	0.8	●	◕														0.25-2.0	0.08-0.25
	DNMG150404-GM	15.5	12.7	4.76	5.16	0.4	●	◕														0.6-4.0	0.20-0.25
	DNMG150408-GM	15.5	12.7	4.76	5.16	0.8	●	◕														0.8-4.0	0.20-0.40
	DNMG150412-GM	15.5	12.7	4.76	5.16	1.2	●	◕														1.0-4.0	0.20-0.50
	DNMG150604-GM	15.5	12.7	6.35	5.16	0.4	●	◕														0.6-4.0	0.20-0.25
	DNMG150608-GM	15.5	12.7	6.35	5.16	0.8	●	◕														0.8-4.0	0.20-0.40
	DNMG150612-GM	15.5	12.7	6.35	5.16	1.2	●	◕														1.0-4.0	0.20-0.50
	DNMG150608-GR	15.5	12.7	6.35	5.16	0.8		◕														2.0-6.5	0.28-0.50
	DNMG150612-GR	15.5	12.7	6.35	5.16	1.2		◕														2.0-6.5	0.28-0.63
	DNMG150404-BF	15.5	12.7	4.76	5.16	0.4															●	0.1-2.0	0.08-0.18
	DNMG150408-BF	15.5	12.7	4.76	5.16	0.8															●	0.1-2.0	0.08-0.18
	DNMG150404-BM	15.5	12.7	4.76	5.16	0.4															◕	0.4-4.5	0.10-0.25
	DNMG150408-BM	15.5	12.7	4.76	5.16	0.8															◕	0.5-4.5	0.10-0.40
	DNMG150412-BM	15.5	12.7	4.76	5.16	1.2															◕	0.8-4.5	0.10-0.55
	DNMG150604-BM	15.5	12.7	6.35	5.16	0.4															◕	0.4-4.5	0.10-0.25
	DNMG150608-BM	15.5	12.7	6.35	5.16	0.8															◕	0.5-4.5	0.10-0.40
	DNMG150612-BM	15.5	12.7	6.35	5.16	1.2															◕	0.8-4.5	0.10-0.55

Negative Insert

55° DN** With Hole

● Good working condition ◕ Normal working condition ⌗ Bad working condition

Shape	Description	ΦD	r	L	S	Φd	CVD Coating						PVD Coating										un-coated	Cutting Parameters	
							WS8215	WS8135	WS8133	WS6115	WS7120	WS7140	WS5115	WS5120	WS5130	WS5225	WS5231	WS7125	WS7225	WS7130	WSK10	Ap	Fn
		L	IC	S	ød	Re																(mm)	(mm/r)
	DNMA150404	15.5	12.7	4.76	5.16	0.4				◕												1.0-4.5	0.15-0.25
	DNMA150408	15.5	12.7	4.76	5.16	0.8				◕												1.0-4.5	0.15-0.40
	DNMA150412	15.5	12.7	4.76	5.16	1.2				◕												1.0-4.5	0.15-0.55
	DNMA150604	15.5	12.7	6.35	5.16	0.4				◕												1.0-4.5	0.15-0.25
	DNMA150608	15.5	12.7	6.35	5.16	0.8				◕												1.0-4.5	0.15-0.40
	DNMA150612	15.5	12.7	6.35	5.16	1.2				◕												1.0-4.5	0.15-0.55

Negative Insert

90° SN** With Hole

● Good working condition ◕ Normal working condition ⌗ Bad working condition

Shape	Description	ΦD	r	L	S	Φd	CVD Coating						PVD Coating										un-coated	Cutting Parameters	
							WS8215	WS8135	WS8133	WS6115	WS7120	WS7140	WS5115	WS5120	WS5130	WS5225	WS5231	WS7125	WS7225	WS7130	WSK10	Ap	Fn
		L	IC	S	ød	Re																(mm)	(mm/r)
	SNMG120404-GF	12.7	12.7	4.76	5.16	0.4	●	◕														0.15-2.0	0.08-0.18
	SNMG120408-GF	12.7	12.7	4.76	5.16	0.8	●	◕														0.25-2.0	0.08-0.25
	SNMG120404-GM	12.7	12.7	4.76	5.16	0.4	●	◕														0.4-5.5	0.10-0.25
	SNMG120408-GM	12.7	12.7	4.76	5.16	0.8	●	◕														0.5-5.5	0.10-0.40
	SNMG120412-GM	12.7	12.7	4.76	5.16	1.2	●	◕														0.8-5.5	0.10-0.55
	SNMG120412-GR	12.7	12.7	4.76	5.16	1.2		◕														2.0-6.5	0.28-0.50
	SNMG120408-GR	12.7	12.7	4.76	5.16	0.8		◕														2.0-6.5	0.28-0.63
	SNMG190608-GR	19.05	19.05	6.35	7.94	0.8		◕														2.0~8.0	0.30~0.60
	SNMG190612-GR	19.05	19.05	6.35	7.94	1.2		◕														2.0~8.0	0.40~0.80
	SNMG190616-GR	19.05	19.05	6.35	7.94	1.6		◕														2.0~8.0	0.50~1.00
	SNMM190612-GZ	19.05	19.05	6.35	7.94	1.2	●	◕														3.0~10.0	0.50~0.80
	SNMM190624-GZ	19.05	19.05	6.35	7.94	2.4	●	◕														3.0~10.0	0.50~1.20
	SNMM250724-CR	25.4	25.4	7.94	9.12	2.4	●	◕														5.0~15.0	0.60~1.40
	SNMM250924-CR	25.4	25.4	9.52	9.12	2.4	●	◕														5.0~15.0	0.60~1.40
	SNMG120404-HAF	12.7	12.7	4.76	5.16	0.4												◕							
	SNMG120404-HSF	12.7	12.7	4.76	5.16	0.4												◕							
	SNMG120404-BF	12.7	12.7	4.76	5.16	0.4													●			0.1-2.0	0.08-0.18
	SNMG120408-BF	12.7	12.7	4.76	5.16	0.8													●			0.1-2.0	0.08-0.18
	SNMG120404-BM	12.7	12.7	4.76	5.16	0.4													◕			0.4-5.5	0.10-0.25
	SNMG120408-BM	12.7	12.7	4.76	5.16	0.8													◕			0.5-5.5	0.10-0.40
	SNMG120412-BM	12.7	12.7	4.76	5.16	1.2													◕			0.8-5.5	0.10-0.55
	SNMG120408-BR	12.7	12.7	4.76	5.16	0.8												◕				1.5-6.0	0.25-0.40
	SNMG120412-BR	12.7	12.7	4.76	5.16	1.2												◕				1.5-6.0	0.25-0.55

Negative Insert

90° SN** With Hole

● Good working condition ◕ Normal working condition ⌗ Bad working condition

Shape	Description	ΦD / Φd / r / L / S					CVD Coating						PVD Coating										un-coated	Cutting Parameters	
							WS8215	WS8135	WS8133	WS6115	WS7120	WS7140	WS5115	WS5120	WS5130	WS5225	WS5231	WS7125	WS7225	WS7130	WSK10	Ap	Fn
		L	IC	S	ød	Re																(mm)	(mm/r)
	SNMA120404	12.7	12.7	4.76	5.16	0.4				◕												1.0-4.5	0.15-0.25
	SNMA120408	12.7	12.7	4.76	5.16	0.8				◕												1.0-4.5	0.15-0.40
	SNMA120412	12.7	12.7	4.76	5.16	1.2				◕												1.0-4.5	0.15-0.55
	SNMA150608	15.875	15.875	6.35	6.35	0.8				◕												2.0-6.0	0.15-0.40
	SNMA150612	15.875	15.875	6.35	6.35	1.2				◕												2.0-6.0	0.15-0.55
	SNMA150616	15.875	15.875	6.35	6.35	1.6				◕												2.0-6.0	0.15-0.70
	SNMA190612	19.05	19.05	6.35	7.94	1.2				◕												3.0-8.0	0.15-0.55
	SNMA190616	19.05	19.05	6.35	7.94	1.6				◕												3.0-8.0	0.15-0.80
	SNMG120404	12.7	12.7	4.76	5.16	0.4				◕												1.0-4.5	0.15-0.25
	SNMG120408	12.7	12.7	4.76	5.16	0.8				◕												1.0-4.5	0.15-0.40
	SNMG120412	12.7	12.7	4.76	5.16	1.2				◕												1.0-4.5	0.15-0.55
	SNMG150608	15.875	15.875	6.35	6.35	0.8				◕												2.0-6.0	0.15-0.40
	SNMG150612	15.875	15.875	6.35	6.35	1.2				◕												2.0-6.0	0.15-0.55
	SNMG150616	15.875	15.875	6.35	6.35	1.6				◕												2.0-6.0	0.15-0.70
	SNMG190612	19.05	19.05	6.35	7.94	1.2				◕												3.0-8.0	0.15-0.55
	SNMG190616	19.05	19.05	6.35	7.94	1.6				◕												3.0-8.0	0.15-0.80

Negative Insert

60° TN** With Hole

● Good working condition ◕ Normal working condition ⌗ Bad working condition

Shape	Description	ΦD / Φd / r / L / S					CVD Coating						PVD Coating										un-coated	Cutting Parameters	
							WS8215	WS8135	WS8133	WS6115	WS7120	WS7140	WS5115	WS5120	WS5130	WS5225	WS5231	WS7125	WS7225	WS7130	WSK10	Ap	Fn
		L	IC	S	ød	Re																(mm)	(mm/r)
	TNMG160404-GF	16.5	9.525	4.76	3.81	0.4	●	◕														0.15-2.0	0.08-0.18
	TNMG160408-GF	16.5	9.525	4.76	3.81	0.8	●	◕														0.25-2.0	0.08-0.25
	TNMG160404-GM	16.5	9.525	4.76	3.81	0.4	●	◕														0.4-4.5	0.10-0.25
	TNMG160408-GM	16.5	9.525	4.76	3.81	0.8	●	◕														0.5-4.5	0.10-0.40
	TNMG160412-GM	16.5	9.525	4.76	3.81	1.2	●	◕														0.8-4.5	0.10-0.55
	TNMG220412-GM	22	12.7	4.76	5.16	1.2	●	◕														2.0-6.5	0.28-0.50
	TNMG160408-GR	16.5	9.525	4.76	3.81	0.8		◕														2.0-6.5	0.28-0.50
	TNMG160412-GR	16.5	9.525	4.76	3.81	1.2		◕														2.0-6.5	0.28-0.63
	TNMG160404-BF	16.5	9.525	4.76	3.81	0.4														●		0.1-2.0	0.08-0.18
	TNMG160408-BF	16.5	9.525	4.76	3.81	0.8														●		0.1-2.0	0.08-0.18
	TNMG160404-BM	16.5	9.525	4.76	3.81	0.4														◕		0.4-4.5	0.10-0.25
	TNMG160408-BM	16.5	9.525	4.76	3.81	0.8														◕		0.5-4.5	0.10-0.40
	TNMG160412-BM	16.5	9.525	4.76	3.81	1.2														◕		0.8-4.5	0.10-0.55
	TNMG160408-BR	16.5	9.525	4.76	3.81	0.8				◕										◕	◕	1.5-5.0	0.25-0.40
	TNMG160412-BR	16.5	9.525	4.76	3.81	1.2				◕										◕	◕	1.5-5.0	0.25-0.55
	TNMA160404	16.5	9.525	4.76	3.81	0.4			◕													1.0-4.5	0.15-0.25
	TNMA160408	16.5	9.525	4.76	3.81	0.8			◕													1.0-4.5	0.15-0.40
	TNMA160412	16.5	9.525	4.76	3.81	1.2			◕													1.0-4.5	0.15-0.55
	TNMA220408	22	12.7	4.76	5.16	0.8			◕													2.0-6.0	0.15-0.40
	TNMA220412	22	12.7	4.76	5.16	1.2			◕													2.0-6.0	0.15-0.55
	TNMA220416	22	12.7	4.76	5.16	1.6			◕													2.0-6.0	0.15-0.70

Negative Insert

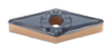
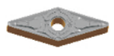
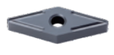
60° TN** With Hole

● Good working condition ◕ Normal working condition ⌗ Bad working condition

Shape	Description	L	IC	S	ød	Re	CVD Coating						PVD Coating									un-coated	Cutting Parameters	
							WS8215	WS8135	WS8133	WS6115	WS7120	WS7140	WS5115	WS5120	WS5130	WS5225	WS5231	WS7125	WS7225	WS7130	WSK10	Ap (mm)	Fn (mm/r)
	TNMG160404	16.5	9.525	4.76	3.81	0.4				◕												1.0-4.5	0.15-0.25
	TNMG160408	16.5	9.525	4.76	3.81	0.8				◕												1.0-4.5	0.15-0.40
	TNMG160412	16.5	9.525	4.76	3.81	1.2				◕												1.0-4.5	0.15-0.55
	TNMG220408	22	12.7	4.76	5.16	0.8				◕												2.0-6.0	0.15-0.40
	TNMG220412	22	12.7	4.76	5.16	1.2				◕												2.0-6.0	0.15-0.55
	TNMG220416	22	12.7	4.76	5.16	1.6				◕												2.0-6.0	0.15-0.70

35° VN** With Hole

● Good working condition ◕ Normal working condition ⌗ Bad working condition

Shape	Description	L	IC	S	ød	Re	CVD Coating						PVD Coating									un-coated	Cutting Parameters	
							WS8215	WS8135	WS8133	WS6115	WS7120	WS7140	WS5115	WS5120	WS5130	WS5225	WS5231	WS7125	WS7225	WS7130	WSK10	Ap (mm)	Fn (mm/r)
	VNMG160404-GF	16.6	9.525	4.76	3.81	0.4	●	◕														0.15-2.0	0.08-0.18
	VNMG160408-GF	16.6	9.525	4.76	3.81	0.8	●	◕														0.25-2.0	0.08-0.25
	VNMG160404-GM	16.6	9.525	4.76	3.81	0.4	●	◕														0.4-4.0	0.10-0.25
	VNMG160408-GM	16.6	9.525	4.76	3.81	0.8	●	◕														0.5-4.0	0.10-0.40
	VNMG160412-GM	16.6	9.525	4.76	3.81	1.2	●	◕														0.8-4.0	0.10-0.55
	VNMG160404-BF	16.6	9.525	4.76	3.81	0.4													●			0.1-2.0	0.08-0.18
	VNMG160408-BF	16.6	9.525	4.76	3.81	0.8													●			0.1-2.0	0.08-0.18
	VNMG160404-BM	16.6	9.525	4.76	3.81	0.4													◕			0.4-4.5	0.10-0.25
	VNMG160408-BM	16.6	9.525	4.76	3.81	0.8													◕			0.5-4.5	0.10-0.40
	VNMG160412-BM	16.6	9.525	4.76	3.81	1.2													◕			0.8-4.5	0.10-0.55
	VNMA160404	16.6	9.525	4.76	3.81	0.4				◕												1.0-4.5	0.15-0.25
	VNMA160408	16.6	9.525	4.76	3.81	0.8				◕												1.0-4.5	0.15-0.40
	VNMG160404	16.6	9.525	4.76	3.81	0.4				◕												1.0-4.5	0.15-0.25
	VNMG160408	16.6	9.525	4.76	3.81	0.8				◕												1.0-4.5	0.15-0.40

Negative Insert

80° WN** With Hole

● Good working condition ◕ Normal working condition ⌗ Bad working condition

Shape	Description	L	IC	S	ød	Re	CVD Coating						PVD Coating									un-coated	Cutting Parameters	
							WS8215	WS8135	WS8133	WS6115	WS7120	WS7140	WS5115	WS5120	WS5130	WS5225	WS5231	WS7125	WS7225	WS7130	WSK10	Ap (mm)	Fn (mm/r)
	WNMG080404-GF	8.7	12.7	4.76	5.16	0.4	●	◕														0.15-2.0	0.08-0.18
	WNMG080408-GF	8.7	12.7	4.76	5.16	0.8	●	◕														0.25-2.0	0.08-0.25
	WNMG080404-GM	8.7	12.7	4.76	5.16	0.4	●	◕														0.4-5.5	0.10-0.25
	WNMG080408-GM	8.7	12.7	4.76	5.16	0.8	●	◕														0.5-5.5	0.10-0.40
	WNMG080412-GM	8.7	12.7	4.76	5.16	1.2	●	◕														0.8-5.5	0.10-0.55
	WNMG080408-GR	8.7	12.7	4.76	5.16	0.8		◕														2.0-6.5	0.28-0.50
	WNMG080412-GR	8.7	12.7	4.76	5.16	1.2		◕														2.0-6.5	0.28-0.63
	WNMG080404-BF	8.7	12.7	4.76	5.16	0.4														●		0.1-2.0	0.08-0.18
	WNMG080408-BF	8.7	12.7	4.76	5.16	0.8														●		0.1-2.0	0.08-0.18
	WNMG06T312-BM	6.6	9.525	3.97	3.81	0.8														◕		0.8-3.0	0.10-0.55
	WNMG060412-BM	6.6	9.525	4.76	3.81	0.8														◕		0.8-3.0	0.10-0.55
	WNMG080404-BM	8.7	12.7	4.76	5.16	0.4														◕		0.4-5.5	0.10-0.25
	WNMG080408-BM	8.7	12.7	4.76	5.16	0.8														◕		0.5-5.5	0.10-0.40
	WNMG080412-BM	8.7	12.7	4.76	5.16	1.2														◕		0.8-5.5	0.10-0.55
	WNMG080408-BR	8.7	12.7	4.76	5.16	0.8														◕	◕	1.5-6.0	0.25-0.40
	WNMG080412-BR	8.7	12.7	4.76	5.16	1.2														◕	◕	1.5-6.0	0.25-0.55
	WNMA060404	6.6	9.525	4.76	3.81	0.4			◕													0.5-3.0	0.15-0.25
	WNMA060408	6.6	9.525	4.76	3.81	0.8			◕													0.5-3.0	0.15-0.40
	WNMA080404	8.7	12.7	4.76	5.16	0.4			◕													1.0-4.5	0.15-0.25
	WNMA080408	8.7	12.7	4.76	5.16	0.8			◕													1.0-4.5	0.15-0.40
	WNMA080412	8.7	12.7	4.76	5.16	1.2			◕													1.0-4.5	0.15-0.55
	WNMA080416	8.7	12.7	4.76	5.16	1.6			◕													1.0-4.5	0.15-0.60

Negative Insert

80° WN** With Hole

● Good working condition ◕ Normal working condition ⌗ Bad working condition

Shape	Description	L	IC	S	ød	Re	CVD Coating						PVD Coating									un-coated	Cutting Parameters	
							WS8215	WS8135	WS8133	WS6115	WS7120	WS7140	WS5115	WS5120	WS5130	WS5225	WS5231	WS7125	WS7225	WS7130	WSK10	Ap (mm)	Fn (mm/r)
	WNMG060404	6.6	9.525	4.76	3.81	0.4				◕												0.5-3	0.15-0.40
	WNMG060408	6.6	9.525	4.76	3.81	0.8				◕												1.0-4.5	0.15-0.25
	WNMG080404	8.7	12.7	4.76	5.16	0.4				◕												1.0-4.5	0.15-0.40
	WNMG080408	8.7	12.7	4.76	5.16	0.8				◕												1.0-4.5	0.15-0.55
	WNMG080412	8.7	12.7	4.76	5.16	1.2				◕												1.0-4.5	0.15-0.60

Positive Insert

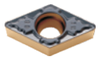
80° CC** With Hole

● Good working condition ◕ Normal working condition ⌗ Bad working condition

Shape	Description	L	IC	S	ød	Re	CVD Coating						PVD Coating									un-coated	Cutting Parameters	
							WS8215	WS8135	WS8133	WS6115	WS7120	WS7140	WS5115	WS5120	WS5130	WS5225	WS5231	WS7125	WS7225	WS7130	WSK10	Ap (mm)	Fn (mm/r)
	CCMT060204-TM	6.4	6.35	2.38	2.8	0.4	●	◕		◕								◕	◕			0.2-2.0	0.06-0.20
	CCMT060208-TM	6.4	6.35	2.38	2.8	0.8	●	◕		◕								◕	◕			0.2-2.0	0.08-0.30
	CCMT09T304-TM	9.7	9.525	3.97	4.4	0.4	●	◕		◕								◕	◕			0.3-3.0	0.08-0.25
	CCMT09T308-TM	9.7	9.525	3.97	4.4	0.8	●	◕		◕								◕	◕			0.3-3.0	0.10-0.30
	CCMT120404-TM	12.9	12.7	4.76	5.56	0.4	●	◕		◕								◕	◕			0.3-3.5	0.10-0.25
	CCMT120408-TM	12.9	12.7	4.76	5.56	0.8	●	◕		◕								◕	◕			0.3-3.5	0.20-0.40
	CCMT120412-TM	12.9	12.7	4.76	5.56	1.2	●	◕		◕								◕	◕			0.3-3.5	0.20-0.50
	CCGT060202-AK	6.4	6.35	2.38	2.8	0.2															●	0.05-3.0	0.01-0.12
	CCGT060204-AK	6.4	6.35	2.38	2.8	0.4															●	0.1-3.0	0.02-0.20
	CCGT09T302-AK	9.7	9.525	3.97	4.4	0.2															●	0.1-5.0	0.02-0.15
	CCGT09T304-AK	9.7	9.525	3.97	4.4	0.4															●	0.1-5.0	0.02-0.25
	CCGT120404-AK	12.9	12.7	4.76	5.56	0.4															●	0.1-5.0	0.02-0.40
	CCGT120408-AK	12.9	12.7	4.76	5.56	0.8															●	0.1-5.0	0.02-0.60

55° DC** With Hole

● Good working condition ◕ Normal working condition ⌗ Bad working condition

Shape	Description	L	IC	S	ød	Re	CVD Coating						PVD Coating									un-coated	Cutting Parameters	
							WS8215	WS8135	WS8133	WS6115	WS7120	WS7140	WS5115	WS5120	WS5130	WS5225	WS5231	WS7125	WS7225	WS7130	WSK10	Ap (mm)	Fn (mm/r)
	DCMT070204-TM	7.8	6.35	2.38	2.8	0.4	●	◕		◕								◕	◕			0.2-2.0	0.06-0.20
	DCMT070208-TM	7.8	6.35	2.38	2.8	0.8	●	◕		◕								◕	◕			0.2-2.0	0.08-0.30
	DCMT11T304-TM	11.6	9.525	3.97	4.4	0.4	●	◕		◕								◕	◕			0.3-3.0	0.08-0.25
	DCMT11T308-TM	11.6	9.525	3.97	4.4	0.8	●	◕		◕								◕	◕			0.3-3.0	0.10-0.30
	DCMT11T312-TM	11.6	9.525	3.97	4.4	1.2	●	◕		◕								◕	◕			0.3-3.0	0.10-0.40
	DCGT070202-AK	7.8	6.35	2.38	2.8	0.2															●	0.05-3.0	0.01-0.12
	DCGT070204-AK	7.8	6.35	2.38	2.8	0.4															●	0.1-3.0	0.02-0.20
	DCGT11T302-AK	11.6	9.525	3.97	4.4	0.2															●	0.05-4.0	0.02-0.20
	DCGT11T304-AK	11.6	9.525	3.97	4.4	0.4															●	0.1-4.0	0.02-0.25

Positive Insert

90° SC** With Hole

● Good working condition ◕ Normal working condition ⌗ Bad working condition

Shape	Description	L	IC	S	ød	Re	CVD Coating						PVD Coating									un-coated	Cutting Parameters	
							WS8215	WS8135	WS8133	WS6115	WS7120	WS7140	WS5115	WS5120	WS5130	WS5225	WS5231	WS7125	WS7225	WS7130	WSK10	Ap (mm)	Fn (mm/r)
	SCMT09T304-TM	9.525	9.525	3.97	4.4	0.4	●	◕		◕								◕	◕			0.3-3.0	0.08-0.25
	SCMT09T308-TM	9.525	9.525	3.97	4.4	0.8	●	◕		◕								◕	◕			0.3-3.0	0.10-0.30
	SCMT120404-TM	12.7	12.7	4.76	5.56	0.4	●	◕		◕								◕	◕			0.3-3.5	0.10-0.25
	SCMT120408-TM	12.7	12.7	4.76	5.56	0.8	●	◕		◕								◕	◕			0.3-3.5	0.20-0.40
	SCMT120412-TM	12.7	12.7	4.76	5.56	1.2	●	◕		◕								◕	◕			0.3-3.5	0.20-0.50

60° TC** With Hole

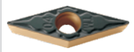
● Good working condition ◕ Normal working condition ⌗ Bad working condition

Shape	Description	L	IC	S	ød	Re	CVD Coating						PVD Coating									un-coated	Cutting Parameters	
							WS8215	WS8135	WS8133	WS6115	WS7120	WS7140	WS5115	WS5120	WS5130	WS5225	WS5231	WS7125	WS7225	WS7130	WSK10	Ap (mm)	Fn (mm/r)
	TCMT110204-TM	11.0	6.35	2.38	2.8	0.4	●	◕		◕								◕	◕			0.3-3.0	0.08-0.25
	TCMT110208-TM	11.0	6.35	2.38	2.8	0.8	●	◕		◕								◕	◕			0.3-3.0	0.10-0.30
	TCMT16T304-TM	16.5	9.525	3.97	4.4	0.4	●	◕		◕								◕	◕			0.3-3.0	0.08-0.25
	TCMT16T308-TM	16.5	9.525	3.97	4.4	0.8	●	◕		◕								◕	◕			0.3-3.0	0.10-0.30
	TCMT16T312-TM	16.5	9.525	3.97	4.4	1.2	●	◕		◕								◕	◕			0.3-3.0	0.10-0.40
	TCGT090204-AK	9.7	5.56	2.38	2.8	0.4															●	0.05-3.0	0.01-0.12
	TCGT110204-AK	11.0	6.35	2.38	2.8	0.4															●	0.1-4.0	0.03-0.20
	TCGT16T304-AK	16.5	9.525	3.97	4.4	0.4															●	0.1-5.0	0.02-0.25

Positive Insert

35° VB&VC** With Hole

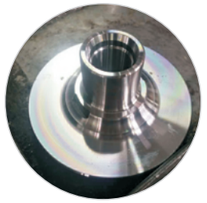
● Good working condition ◕ Normal working condition ⌗ Bad working condition

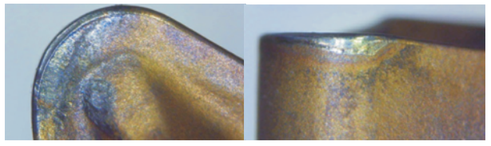
Shape	Description	L	IC	S	ød	Re	a	CVD Coating						PVD Coating									un-coated	Cutting Parameters	
								WS8215	WS8135	WS8133	WS6115	WS7120	WS7140	WS5115	WS5120	WS5130	WS5225	WS5231	WS7125	WS7225	WS7130	WSK10	Ap (mm)	Fn (mm/r)
	VBMT110304-TM	11.0	6.35	3.18	2.8	0.4	5.0	●	◕		◕								◕	◕			0.2-2.0	0.06-0.20
	VBMT110308-TM	11.0	6.35	3.18	2.8	0.8	5.0	●	◕		◕								◕	◕			0.2-2.0	0.08-0.30
	VBMT160404-TM	16.5	9.525	4.76	4.4	0.4	5.0	●	◕		◕								◕	◕			0.3-3.0	0.08-0.25
	VBMT160408-TM	16.5	9.525	4.76	4.4	0.8	5.0	●	◕		◕								◕	◕			0.3-3.0	0.10-0.30
	VBMT160412-TM	16.5	9.525	4.76	4.4	1.2	5.0	●	◕		◕								◕	◕			0.3-3.0	0.10-0.40
	VCMT110304-TM	11.0	6.35	3.18	2.8	0.4	7.0	●	◕		◕								◕	◕			0.2-2.0	0.06-0.20
	VCMT110308-TM	11.0	6.35	3.18	2.8	0.8	7.0	●	◕		◕								◕	◕			0.2-2.0	0.08-0.30
	VCMT160404-TM	16.5	9.525	4.76	4.4	0.4	7.0	●	◕		◕								◕	◕			0.3-3.0	0.08-0.25
	VCMT160408-TM	16.5	9.525	4.76	4.4	0.8	7.0	●	◕		◕								◕	◕			0.3-3.0	0.10-0.30
	VCMT160412-TM	16.5	9.525	4.76	4.4	1.2	7.0	●	◕		◕								◕	◕			0.3-3.0	0.10-0.40
	VBGT160402-AK	16.5	9.525	4.76	4.4	0.2	5.0															●	0.05-4.0	0.03-0.15
	VBGT160404-AK	16.5	9.525	4.76	4.4	0.4	5.0															●	0.1-5.0	0.03-0.25
	VBGT160408-AK	16.5	9.525	4.76	4.4	0.8	5.0															●	0.1-5.0	0.03-0.50
	VCGT110302-AK	11.0	6.35	3.18	2.8	0.2	7.0															●	0.05-3.0	0.01-0.12
	VCGT110304-AK	11.0	6.35	3.18	2.8	0.4	7.0															●	0.05-3.0	0.02-0.15
	VCGT160402-AK	16.5	9.525	4.76	4.4	0.2	7.0															●	0.05-4.0	0.03-0.15
	VCGT160404-AK	16.5	9.525	4.76	4.4	0.4	7.0															●	0.1-5.0	0.03-0.25
	VCGT160408-AK	16.5	9.525	4.76	4.4	0.8	7.0															●	0.1-5.0	0.03-0.50

Cases

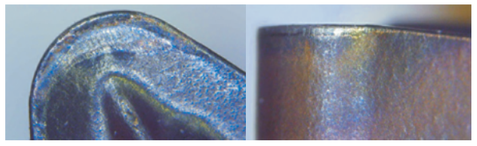
Continuous finish turning - Flange

- **Workpiece** Flange 40Cr
- **Machining Methods** Wet-type continuous finish turning of external & end face
- **Insert** DNMG150408-GF WS8215
- **Cutting Conditions** Vc=338.5m/min，f=0.14~0.32mm/r，ap=0.2mm
- **Result of cutting** Compare with Brand A after 200 pcs/cutting edge,
  WS8215 shows better surface qualitly and abrasion resistance.





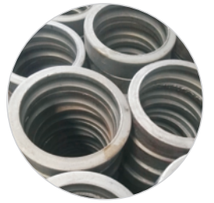
Brand A



HARDSTONE

Continuous turning - Bearing

- **Workpiece** Bearing GCr15
- **Machining Methods** Wet-type continuous internal roughing and semi-finishing
- **Insert** VNMG160408-GM WS8215
- **Cutting Conditions** Vc=200m/min，f=0.30mm/r，ap=0.30~1.0mm



GM type chip-breaker, with smooth chip evacation and safty cutting edge for continuous roughing, and sharp edge for finishing

Cutting life	
Hardstone	138pcs/edge
Brand A	130~140pcs/edge

High speed continuous turning - Automobile Hub Unit

- **Workpiece** Automobile Hub unit steel 65Mn
- **Machining Methods** Wet-type continuous finish turning of external & end face
- **Insert** WNMG080408-GF WS8215
- **Cutting Conditions** Vc=330m/min，f=0.3mm/r，ap=0.8mm

WS8215 with GF chip-breaker provide excellent chip breaking effect, high surface quality and good wear resistance for high speed continuous turning of steel.

Cutting life	
Hardstone	23~30pcs/edge
Brand A	13~21pcs/edge

Continuous turning - Flange

- **Workpiece** 65Mn
- **Machining Methods** Wet-type continuous rough turning of external & end face
- **Insert** WNMG080412-GM WS8135
- **Cutting Conditions** Vc=260m/min，f=0.32mm/r，ap=1.0mm

WS8135 with GM chip-breaker, not only applicable for interrupted medium speed roughing, but also with strong versatility.

Cutting life	
Hardstone	100pcs/edge
Brand A	80pcs/edge

Cases

Strong interrupted turning - Flange

- **Workpiece** Flange steel 45#
- **Machining Methods** Wet-tpye rough & finish turning of heavy interrupted end face
- **Insert** WNMG080408-GM WS8135
- **Cutting Conditions** Vc=180~358m/min，f=0.275mm/r，ap=1.3/3mm

WS8135 matching GM chip-breaker has a strong adaptability to constant speed and variable speed rough turning and fine turning of strongly discontinuous parts.

Cutting life	
Hardstone	33pcs/edge
Brand A	15~25pcs/edge

Interrupted turning- Flange

- **Workpiece** Quenched and tempered steel 55#
- **Machining Methods** Wet-tpye finish turning of continuous external and interrupted end face
- **Insert** WNMG080408-GM WS8135
- **Cutting Conditions** Vc=285.7m/min，f=0.27mm/r，ap=0.6mm

WS8135 with GM chip-breaker, provide high performance and strong stability for medium and high speed semi-finish turning of workpiece with both continuous and interrupted machining requirements.

Cutting life	
Hardstone	74pcs/edge
Brand A	60~70pcs/edge

Interrupted turning - Bearing Block

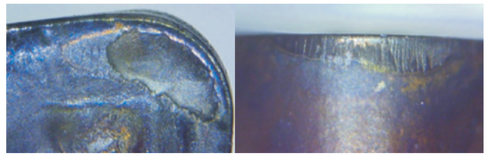
- **Workpiece** Quenched and tempered steel 55#
- **Machining Methods** Wet-tpye finish turning of continuous external and interrupted end face
- **Insert** WNMG080408-GM WS8135
- **Cutting Conditions** Vc=282.6m/min，f=0.225mm/r，ap=0.5mm

WS8135 with GM chip-breaker, provide high performance and strong stability for medium and high speed semi-finish turning of workpiece with both continuous and interrupted machining requirements.

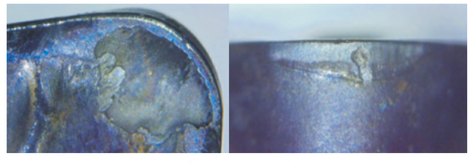
Cutting life	
Hardstone	70pcs/edge
Brand A	37~48pcs/edge

Interrupted & continuous turning - Housing

- **Workpiece** Quenched and tempered steel 55#
- **Machining Methods** Wet-tpye finish turning of continuous external and interrupted end face
- **Insert** WNMG080408-GM WS8135
- **Cutting Conditions** Vc=285.7m/min f=0.27mm/r，ap=0.6mm
- **Result of cutting** Compare with Brand A after testing 21 pcs/cutting edge, all samples shows minor abrasion in rake/flank face, and are of the same life span.



GM



Competitor A

Cases

Interrupted / continuous roughing turning - Housing

- **Workpiece** CF53
- **Machining Methods** Wet-tpye semi-finish turning of continuous & interrupted external
- **Insert** DNMG150408-GM WS8135
- **Cutting Conditions** Vc=354m/min, f=0.345mm/r, ap=0.5mm

WS8135 with GM chip-breaker, provide strong versatility for ultra-high speed finish turning of workpiece with both continuous and interrupted machining requirements.

Cutting life	
Hardstone	48pcs/edge
Brand A	40~50pcs/edge

Interrupted and continuous rough turning - Housing

- **Workpiece** CF53
- **Machining Methods** Wet-tpye finish turning of interrupted shaft journal and continuous small shaft
- **Insert** DNMG150408-GM WS8135
- **Cutting Conditions** Vc=369m/min, f=0.3mm/r, ap=0.5mm

WS8135 with GM chip-breaker, provide strong applicability for ultra-high speed finish turning of workpiece with both continuous and interrupted machining requirements.

Cutting life	
Hardstone	108pcs/edge
Brand A	100pcs/edge

Interrupted and continuous rough turning - Housing

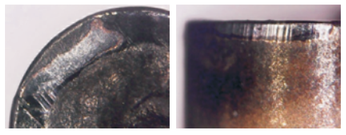
- **Workpiece** CF53
- **Machining Methods** Wet-tpye rough turning of interrupted shaft journal and continuous small shaft
- **Insert** WNMG080412-GR WS8135
- **Cutting Conditions** Vc=351m/min，f=0.45mm/r，ap=2.0mm

WS8135 with GR chip-breaker, provide superior advantages for ultra-high speed, large cutting depth, high feeding rate rough turning of workpiece with both continuous and interrupted machining requirements.

Cutting life	
Hardstone	15pcs/edge
Brand A	9~10pcs/edge

Continuous rough turning - Slender shaft

- **Workpiece** 45#
- **Machining Methods** Wet-type rough turning of continuous external
- **Insert** DNMG150408-GM WS8135
- **Cutting Conditions** Vc=354m/min，f=0.26mm/r，ap=0.25mm



WS8135 with GR chip-breaker, provide very good chip evacuation, excellent surface finish and long lifespan for shaft type workpiece.

Cutting life	
Hardstone	104~110pcs/edge
Brand A	100pcs/edge

Cases

Finish turning - Flange

- **Workpiece** Stainless steel SUS304
- **Machining Methods** Wet-type finish turning of continuous external & end face
- **Insert** VNMG160408-BF WS7225
- **Cutting Conditions** Vc=171~180m/min，f=0.08mm/r，ap=0.10mm(Ra≤0.8))

BF chip-breaker, with sharp edge, landless design, big and wide rake angle, provide small chip deformation and small cutting vibration, suitable for finish machining enviroment with high surface quality requirement only.WS7225 is preferable for the machining of viscous materials.

Cutting life	
Hardstone	160~180pcs/edge
Brand A	120pcs/edge

Rough Tuirning - Compressor Cylinder

- **Workpiece** Stainless steel SUS304
- **Machining Methods** Wet-type semi-finish turning of continuous conical surface & end face
- **Insert** WNMG080408-BM WS7225
- **Cutting Conditions** Vc=150~243m/min，f=0.2mm/r，ap=0.8mm

BM chip-breaker, with sharp cutting edge and large rake angle, provide small chip deformation and small built up edge, together with the high anti-adhesion property new grade, significantly improved the lifespan.

Cutting life	
Hardstone	125pcs/edge
Brand A	73pcs/edge

Finish turning - Flange

- **Workpiece** Stainless steel SUS304
- **Machining Methods** Finish turning of continuous external & end face
- **Insert** WNMG080408-BF WS7225
- **Cutting Conditions** Vc=259m/min，f=0.10mm/r，ap=0.10mm（Ra≤0.8）

BF chip-breaker, with sharp edge, landless design, big and wide rake angle, provide small chip deformation and small cutting vibration, suitable for finish machining enviroment with high surface quality requirement only.WS7225 is preferable for high speed machining of viscous materials.

Cutting life	
Hardstone	47~48pcs/edge
Brand A	36~55pcs/edge

Rough turning

- **Workpiece** HT250
- **Machining Methods** Rough turning of external and end face
- **Insert** WNMG080412 WS6115
- **Cutting Conditions** Vc=415m/min，f=0.15mm/r，ap=0.4mm

For sub high speed turning of cast iron workpiece, it's lifespan and stability reached the imported top brand level

Cutting life	
Hardstone	60~70pcs/edge
Brand A	60~70pcs/edge

Cases

Continuous and interrupted rough turning - Compressor Flange

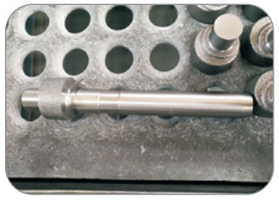
- **Workpiece** Flange
- **Machining Methods** Dry-type rough turning of continuous external and interrupted end face
- **Insert** WNMG080408 WS6115
- **Cutting Conditions** Vc=563m/min，f=0.25mm/r，ap=1mm

For high speed turning of slight interrupted cast iron workpiece,it's lifespan and stability reached the imported top brand level.

Cutting life	
Hardstone	70~80pcs/edge
Brand A	70~80pcs/edge

Continuous rough turning - Compressor Crankshaft

- **Workpiece** Crankshaft QT550
- **Machining Methods** Continuous rough turning
- **Insert** WNMG080408 WS6115
- **Cutting Conditions** Vc=190m/min，f=0.4mm/r，ap=1mm

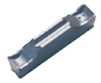


For medium and low speed turning of cast iron workpiece,it's lifespan and stability much more better than domestic brands.

Cutting life	
Hardstone	170~176pcs/edge
Brand A	120~140pcs/edge

Parting and Grooving

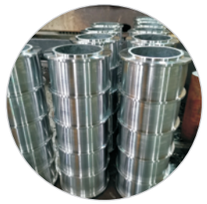
● Good working condition ◕ Normal working condition ⌗ Bad working condition

Shape	Description	L	W	S	R	CVD Coating: WS8215	WS8135	WS8133	WS6115	WS7120	WS7140	PVD Coating: WS5115	WS5120	WS5130	WS5225	WS5231	WS7125	WS7225	WS7130	un-coated: WSK10	Cutting Parameters: Ap (mm)	Fn (mm/r)
	QCMB2002-T	16	2	3.55	0.2			◕	●								◕				~14.0	0.05-0.12
	QCMB2502-T	18.5	2.5	4.5	0.2			◕	●								◕				~16.0	0.05-0.15
	QCMB3004-T	21	3	4.86	0.4			◕	●								◕				~18.0	0.07-0.15
	QCMB4004-T	21	4	4.86	0.4			◕	●								◕				~18.0	0.07-0.18
	QCMB5008-T	26	5	5.8	0.8			◕	●								◕				~23.0	0.10-0.18
	QPMB2010-M	16	2	3.5	1			◕	●								◕				~14.0	0.05-0.12
	QPMB3015-M	21	3	4.8	1.5			◕	●								◕				~18.0	0.07-0.12
	QPMB4020-M	21	4	4.8	2			◕	●								◕				~23.0	0.07-0.15
	QPMB5025-M	26	5	5.8	2.5			◕	●								◕				~23.0	0.08-0.15
	QPMB6030-M	26	6	5.9	3			◕	●								◕				~23.0	0.08-0.15
	TDC20	20	2	3.9	0.2												◕				~22.0	0.05-0.18
	TDC30	20	3	4.2	0.2												◕				~22.0	0.07-0.25
	TDC40	20	4	4.2	0.3												◕				~22.0	0.08-0.30
	TDC50	25	5	5	0.3												◕				~25.0	0.09-0.35

Cases

Parting and Grooving

- **Workpiece** Steel 45#
- **Machining way** Continuous external grooving
- **Inserts** QCMB3004-T WS7125
- **Cutting Conditions** Vc=82m/min，f=0.2mm/r

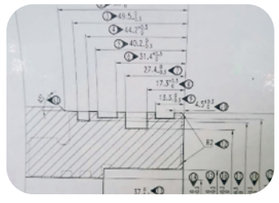


T type chip breaker, provide smooth cutting and excellent chip evacuation performance.

Cutting life	
Hardstone	60~70pcs/edge
Brand A	60pcs/edge

Grooving

- **Workpiece** piston 45#
- **Machining way** Wet-type continuous grooving
- **Inserts** QCMB4004-T WS8133
- **Cutting Conditions** Vc=325m/min，f=0.12mm/r



T type chip-breaker, smooth and light cutting, effectively reduceed the vibration. special designed groove cutter grade WS8133, provide good vibration resistance,excellent wear resistance and stability.

Cutting life	
Hardstone	55~60pcs/edge
Brand A	25~30pcs/edge

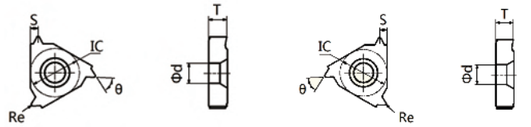
Grooving

- **Workpiece** Qt600
- **Machining way** Wet-type continuous/interrupted grooving
- **Inserts** QCMB5008-T WS8133
- **Cutting Conditions** Vc=150m/min，f=0.12~0.18mm/r

T type chip breaker, smooth and light cutting, effectively reduceed the vibration.special designed grade WS8133 provide good vibration resistance, excellent wear resistance and stability.

Cutting life	
Hardstone	130~140pcs/edge
Brand A	100~120pcs/edge

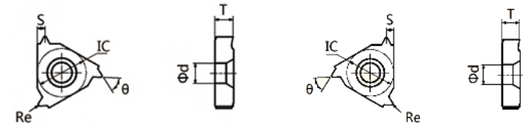
60° ISO metric thread



● Good working condition ◕ Normal working condition ⌗ Bad working condition

Shape	Description	Thread pitch	Specification (mm)						Grade
			IC	S	T	Re	ød	θ	WS5225
	16ER100ISO	1.00	9.53	0.70	3.52	0.13	4.00	60°	◕
	16ER125ISO	1.25	9.53	0.90	3.52	0.16	4.00	60°	◕
	16ER150ISO	1.50	9.53	1.00	3.52	0.10	4.00	60°	◕
	16ER175ISO	1.75	9.53	1.20	3.52	0.22	4.00	60°	◕
	16ER200ISO	2.00	9.53	1.30	3.52	0.26	4.00	60°	◕
	16ER250ISO	2.50	9.53	1.50	3.52	0.33	4.00	60°	◕
	16ER300ISO	3.00	9.53	1.60	3.52	0.44	4.00	60°	◕
	11IR100ISO	1.00	6.35	0.70	3.05	0.06	3.20	60°	◕
	11IR125ISO	1.25	6.35	0.90	3.05	0.08	3.20	60°	◕
	11IR150ISO	1.50	6.35	1.00	3.05	0.10	3.20	60°	◕
	11IR250ISO	2.50	6.35	1.50	3.05	0.08	3.20	60°	◕
	16IR100ISO	1.00	9.53	0.70	3.52	0.06	4.00	60°	◕
	16IR125ISO	1.25	9.53	0.90	3.52	0.08	4.00	60°	◕
	16IR150ISO	1.50	9.53	1.00	3.52	0.10	4.00	60°	◕
	16IR175ISO	1.75	9.53	1.20	3.52	0.11	4.00	60°	◕
	16IR200ISO	2.00	9.53	1.30	3.52	0.13	4.00	60°	◕
	16IR250ISO	2.50	9.53	1.50	3.52	0.17	4.00	60°	◕
	16IR300ISO	3.00	9.53	1.50	3.52	0.22	4.00	60°	◕

55° Whitworth thread



● Good working condition ◕ Normal working condition ⌗ Bad working condition

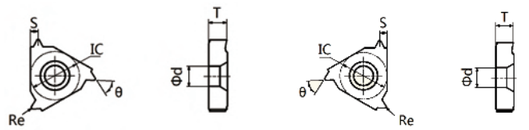
Shape	Description	Thread pitch	Specification (mm)						Grade
			IC	S	T	Re	ød	θ	WS5225
	16ER11W	11.00	9.53	1.50	3.52	0.30	4.00	55°	◕
	16ER14W	14.00	9.53	1.20	3.52	0.23	4.00	55°	◕
	16ER19W	19.00	9.53	1.00	3.52	0.17	4.00	55°	◕
	16IR11W	11.00	9.53	1.50	3.52	0.30	4.00	55°	◕
	16IR12W	12.00	9.53	1.40	3.52	0.30	4.00	55°	◕
	16IR14W	14.00	9.53	1.20	3.52	0.23	4.00	55°	◕
	16IR19W	19.00	9.53	1.00	3.52	0.17	4.00	55°	◕

General pitch thread

● Good working condition ◕ Normal working condition ⌗ Bad working condition

Shape	Description	Thread pitch	Specification (mm)						Grade
			IC	S	T	Re	ød	θ	WS5225
	16ERAG55	0.5-3.0	9.53	1.70	3.52	0.06	4.00	55°	◕
	16ERA55	0.5-1.5	9.53	0.90	3.52	0.05	4.00	55°	◕
	16ERG55	1.75-3.0	9.53	1.70	3.52	0.23	4.00	55°	◕
	16ERAG60	0.5-3.0	9.53	1.70	3.52	0.07	4.00	60°	◕
	16ERA60	0.5-1.5	9.53	0.90	3.52	0.06	4.00	60°	◕
	16ERG60	1.75-3.0	9.53	1.70	3.52	0.18	4.00	60°	◕
	16IRAG55	0.5-3.0	9.53	1.70	3.52	0.06	4.00	55°	◕
	16IRA55	0.5-1.5	9.53	0.90	3.52	0.05	4.00	55°	◕
	16IRG55	1.75-3.0	9.53	1.70	3.52	0.21	4.00	55°	◕
	16IRAG60	0.5-3.0	9.53	1.70	3.52	0.08	4.00	60°	◕
	16IRA60	0.5-1.5	9.53	0.90	3.52	0.05	4.00	60°	◕
	16IRG60	1.75-3.0	9.53	1.70	3.52	0.10	4.00	60°	◕

British standard taper pipe thread



● Good working condition ◕ Normal working condition ⌗ Bad working condition

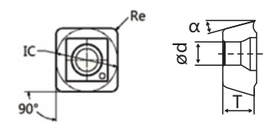
Shape	Description	Thread pitch	Specificiation（mm）						Grade
			IC	S	T	Re	ød	θ	WS5225
	16ER11BSPT	11.00	9.53	1.50	3.52	0.32	4.00	55°	◕
	16ER14BSPT	14.00	9.53	1.20	3.52	0.23	4.00	55°	◕
	16ER19BSPT	19.00	9.53	0.90	3.52	0.19	4.00	55°	◕
	16IR11BSPT	11.00	9.53	1.50	3.52	0.32	4.00	55°	◕
	16IR14BSPT	14.00	9.53	1.20	3.52	0.23	4.00	55°	◕
	16IR19BSPT	19.00	9.53	0.90	3.52	0.19	4.00	55°	◕

American standard taper pipe thread

● Good working condition ◕ Normal working condition ⌗ Bad working condition

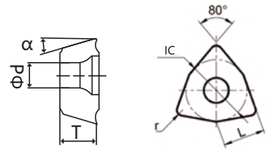
Shape	Description	Thread pitch	Specificiation（mm）						Grade
			IC	S	T	Re	ød	θ	WS5225
	16ER14NPT	14.00	9.53	1.20	3.52	0.07	4.00	60°	◕
	16ER115NPT	11.50	9.53	1.50	3.52	0.08	4.00	60°	◕
	16ER18NPT	18.00	9.53	1.00	3.52	0.06	4.00	60°	◕
	16IR14NPT	14.00	9.53	1.20	3.52	0.07	4.00	60°	◕
	16IR115NPT	11.50	9.53	1.50	3.52	0.08	4.00	60°	◕
	16IR18NPT	18.00	9.53	1.00	3.52	0.06	4.00	60°	◕

Drilling



● Good working condition ◕ Normal working condition ⌗ Bad working condition

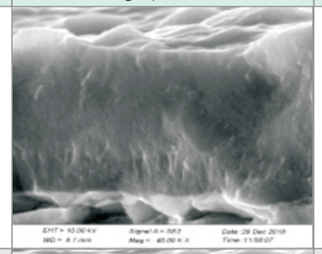
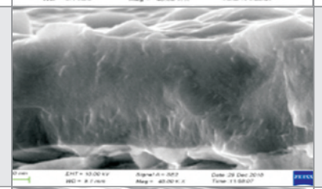
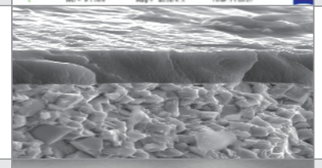
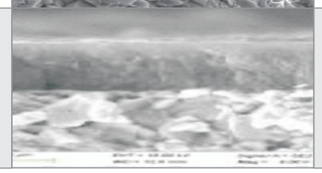
Shape	Description	Specificiation（mm）					CVD Coating						PVD Coating							un-coated	Cutting Parameters	
		IC	T	r	ød	α	WS8215	WS8135	WS8133	WS6115	WS7120	WS7140	WS5115	WS5120	WS5130	WS5225	WS5231	WS7125	WS7225	WS7130	WSK10	Ap (mm)	Fn (mm/r)
	SPMG050204DG	11.5	4.3	0.8	4.5	16.5°											◕						0.04-0.15
	SPMG060204DG	9.8	4.3	0.8	4.05	17.5°											◕						0.04-0.16
	SPMG07T308DG	7.94	3.97	0.8	2.85	15.5°											◕						0.04-0.20
	SPMG090408DG	6	2.38	0.4	2.61	14°											◕						0.06-0.25
	SPMG110408DG	5	2.38	0.4	2.25	14°											◕						0.06-0.28



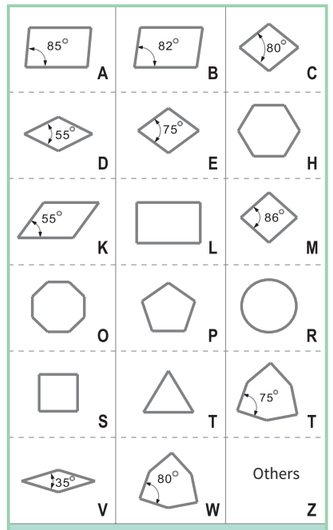
● Good working condition ◕ Normal working condition ⌗ Bad working condition

Shape	Description	Specificiation（mm）					CVD Coating						PVD Coating							un-coated	Cutting Parameters	
		IC	T	r	ød	α	WS8215	WS8135	WS8133	WS6115	WS7120	WS7140	WS5115	WS5120	WS5130	WS5225	WS5231	WS7125	WS7225	WS7130	WSK10	Ap (mm)	Fn (mm/r)
	WCMX030204	5.56	2.38	0.8	2.8	7											◕						0.04-0.15
	WCMX030208	5.56	2.38	0.8	2.8	7											◕						0.04-0.15
	WCMX040204	6.35	2.38	0.8	3	7											◕						0.04-0.16
	WCMX040208	6.35	2.38	0.8	3	7											◕						0.04-0.16
	WCMX050308	7.94	3.18	0.8	3.4	7											◕						0.04-0.20
	WCMX06T308	9.525	3.97	0.8	3.8	7											◕						0.06-0.25
	WCMX080412	12.7	4.76	1.2	4.4	7											◕						0.06-0.28

The introduction of Grade

Grade	Coating				Coating strucuture	Application	ISO	Wear Resistance ⟷ Toughnes									
	Type	Color	Metallographic Structure	Composition				01	05	10	15	20	25	30	35	40	45
WS5115	PVD	Purple Bronze		TiAlN+CrAlN +TiSiN	Evenly distributed sub-micro level WC crystal grain with high strength and reasonable adjusted alloy composition, enhanced the solution of binder phase, which ensured the high toughness of the substrate; It has a multi-layer composite coating, TiAlN bottom layer increases the binding force with substrate, AlCrN functional layer provide superior high temperature performance, TiSiN surface layer reduces frictional coefficient to workpiece; The coating match the elastic modulus with the substrate and firmly integrated.	Extremely suitable for the milling of hardended steel, expecially for steel with hardness range HRC45-HRC62, which excellent in performance.	P15-P30 M15-M30 K15-K30				■	■	■	■				
WS5120	PVD	Purple Bronze		TiAlN+CrAlN +TiSiN	Special substrate with better wear resistance and toughness, suitable for high hardness material milling, Matching with latest diversified nano coating to provide better high temperature hardness, excellent in performance for high hardness material processing, It's comprehensive performance can be in the leading level for hard matreial milling applications.	It is used for general milling of steel, stainless steel, cast ion and other materials, expecially for steel with hardness range HRC30-HRC50, which excellent in performance.	P20-P30 M20-M30 K20-K30					■	■	■	■			
WS5130	PVD	Gray		AlTiN	Newly developed substrate, dedicated for die milling cutter, it's ultra fine particles and special ratio greatly improves the wear resistance and toughness of the substrate, and reduces the risk of edge collapse. Match up latest nano coating, it's comprehensive performance can be top No.1 in segmented application field.	It is used for general milling of steel, stainless steel, cast ion and other materials, expecially for steel with hardness range HRC30-HRC50, which excellent in performance.	P20-P35 M20-M35 K20-K35					■	■	■	■	■		
WS7130	PVD	Gray		AlTiN	Specially used for machining of difficult-to-cut meterials, with high hardness, high temperature resistance and oxidation resistance.The proprietary coating can still maintain high hardness when temperature reach 1100°C, and protect the cutter substrate from oxidation. Can be used for high speed cutting.	Preferred grade for stainless steel milling, match with different grooves, it can meet rough/finish milling requirement of all kinds of stainless steel and titanium alloy material, with good stablility and safty property.	P35-P45 M34-M45								■	■	■	

Insert Identification System



Insert Shape

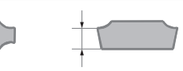
Code	Hole	Chip-breaker	Section Plane	Code	Hole	Chip-breaker	Section Plane
B	With	Without	>65°	N	Without	Without	
H	With	Single-Side	>65°	R	Without	Single-Side	
C	With	Wihout	>65°	F	Without	Double-Side	
J	With	Double-side	>65°	A	With	Without	
W	With	Without	≤65°	M	With	Single-Side	
T	With	Single-Side	≤65°	G	With	Double-Side	
Q	With	Without	≤65°	X	—	---	Special
U	With	Double-side	≤65°				

Chip-breaker and Clamping system

32.00			32					
31.75			31					
25.40			25	25				
25.00	25	25	25					
20.00			20					
19.05	19		19	19	33			
16.00		19	16					
15.875	16		15	16	27			
12.70	12	15	12		22	22	08	
12.00			12					
10.00			10					
9.525	09	11	09	19	16	16	06	16
8.00			08					
6.35	06	07			11	11		
6.00			06					
5.56					09			
5.50			05					
3.97					06			
Diameter of IC(mm)	C	D	R	S	T	V	W	K
	Insert Shape							

Length of Cutting Edge

Code	Thickness(mm)
12	12.70
10	11.11
T9	9.72
09	9.52
07	7.94
T6	6.75
06	6.35
T5	5.95
05	5.56
T4	4.96
04	4.76
T3	3.97
03	3.18
T2	2.58
02	2.38
T1	1.98
01	1.59
T0	0.99
00	0.79



Insert Thickness

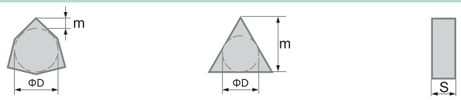
A P M T

16 05 PD E R - HM

Clearance angle of main cutting edge

Code	Clearance angle	Code	Clearance angle
A	3°	B	5°
C	7°	D	15°
E	20°	F	25°
G	30°	N	0°
P	11°	O	Others

Tolerance (mm)



Code	Nose height Tolerance(m)	Inscribed circle(ΦD)	Thickness Tolerance(s)
A	±0.005	±0.025	±0.025
F	±0.005	±0.013	±0.025
C	±0.013	±0.025	±0.025
H	±0.013	±0.013	±0.025
E	±0.025	±0.025	±0.025
G	±0.025	±0.025	±0.13
J	±0.005	±0.05-±0.13	±0.025
K	±0.013	±0.05-±0.13	±0.025
L	±0.025	±0.05-±0.13	±0.025
M	±0.08-±0.18	±0.05-±0.13	±0.13
N	±0.08-±0.18	±0.05-±0.13	±0.025
U	±0.13-±0.38	±0.08-±0.25	±0.13

◆M-level tolerance(Idertifled by shape)

◆Tolerance of tool tip height (mm)

Inscribed circle	Regular triangle	Square	Rhombus with80°	Rhombus with 55°	Rhombus with 35°	Round
6.35	±0.08	±0.08	±0.08	±0.11	±0.16	---
9.525	±0.08	±0.08	±0.08	±0.11	±0.16	---
12.7	±0.13	±0.13	±0.13	±0.15	---	---
15.875	±0.15	±0.15	±0.15	±0.18	---	---
19.05	±0.15	±0.15	±0.15	±0.18	---	---
25.4	---	±0.18	---	---	---	---

◆Inscribed circle(ΦD)Tolerance

Inscribed circle	Regular triangle	Square	Rhombus with80°	Rhombus with 55°	Rhombus with 35°	Round
6.35	±0.05	±0.05	±0.05	±0.05	±0.05	---
9.525	±0.05	±0.05	±0.05	±0.05	±0.05	±0.05
12.7	±0.08	±0.08	±0.08	±0.08	---	±0.08
15.875	±0.10	±0.10	±0.10	±0.10	---	±0.10
19.05	±0.10	±0.10	±0.10	±0.10	---	±0.10
25.4	---	±0.13	---	---	---	±0.13

Wiper

A	45°	A	3°
D	60°	B	5°
E	75°	C	7°
F	85°	D	15°
P	90°	E	20°
Z	others	F	25°
		G	30°
		N	0°
		P	11°
		Z	Others

Chamfer

	a	b	
F	0-5°	0-0.10	K(or no mark)
E	1-10°	1-0.15	P
T	2-15°	2-0.20	W
S	3-20°	3-0.25	
	4-25°	4-0.30	Q
	5-30°	5-0.35	
	1-10°	6-0.40	
	1-10°	7-0.45	

Chip-breaker Code

Cutting Direction

Code	Direction
R	Right
L	Left
N	Double side

Overview

- Square shoulder milling

AOKT11*-VM | AOKT16*-VM | APMT11*-HM | APMT16*-HM | APKT*-MA

- Profile milling

RCKT*-FM | RDMW*-FM | RDMW* | RPKT*-MS | RPMW* | RPMT*-HM

- Helical end milling

APHX1504 | APMT*-MM | SPMT* | SPHX*

- Face milling

SEHT*-X83

- Economical square shoulder milling

ZNMU*-GM/GL

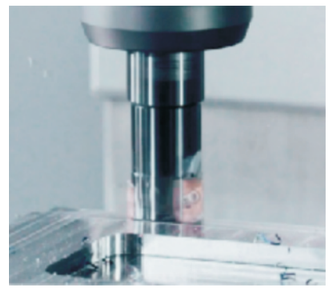
High Precision Square Shoulder Milling Insert S/CSM190

New

- Long service life
- High cutting efficiency
- High surface finish quality
- High vertical sidewall accuracy

Features

90 degree shoulder square milling in the true sense

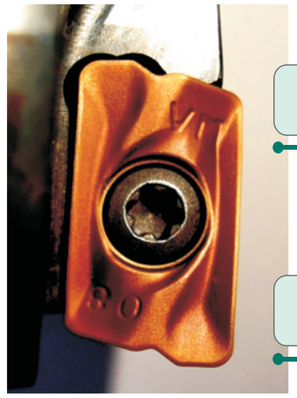


Excellent sidewall surface finish, runout＜0.005mm
(depth: 20mm, ϕ16X2 edges,)

Features A

The unique inserts design of 3D chipbreker and cutting edge structure to reduce cutting vibration.

The small cutting wedge angle enables the tool to smoothly cut into the workpiece, and under the control of the inserts edge structure, it can especially achieve high-precision sidewall surface quality. At the same time, with the help of the anti-vibration cutter body, the cutting vibration can be better reduced.



Positive axial rake angle

Optimal cutting edge shape

Features B

Latest independently-developed three PVD coating types for your choice, covering various materials and hardness range.

Machined material hardness
Under HRC30
<WS5130>

Machined material hardness
HRC30~HRC40
<WS5120>

Machined material hardness
HRC40~HRC50
<WS5115>

Suitable for general purpose machining of steel, stainless steel and cast iron workpiece, as well as high hardness materials like SKD61, hardened steel, etc.

Features C

Special pre- and post-coating technology and micro edge processing technologies. Fine and smooth surface, uniform cutting edge, greatly increased the cutting stability.

Features D

Apart from the high strength steel body, a new combination of exchangable tool head and cemented carbide holderhas been adopted, which enriched the tool style and enhanced the vibration resistance of sidewall machining.

Highly Recommended

Ensure sidewall accuracy
Precision edge control

Effective torque transfer
High precision thread connection

Resist cutting vibration
Cemented carbide holder

Cutting performance

Sidewall precision comparison

	HARDSTONE	Brand M	Brand S
NO.1 (ap=2mm)	0.002mm	0.002mm	0.002mm
NO.2 (ap=4mm)	0.004mm	0.007mm	0.005mm

HARDSTONE sample`s average precsion runout ＜0.005mm,better than other brand samples.

Workpiece materials:steel 45 #(28HRC)
▪Cutting parameters:
Vc=280m/min,fz=0.15mm/z,
ap=20mm,ae=1mm
▪Tool type:
AOKT113508PEER-VM,WS5130,
tooth ϕ16x2, overhang depth:40mm

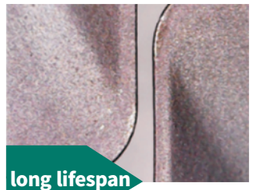
Plane precision comparison

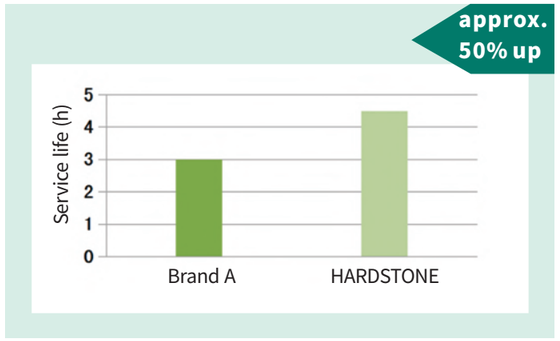
	HARDSTONE	Brand M	Brand S
Vertical toolpath	Ra=0.31μm	Ra=0.37μm	Ra=0.38μm
Parallel toolpath	Ra=0.26μm	Ra=0.32μm	Ra=0.37μm

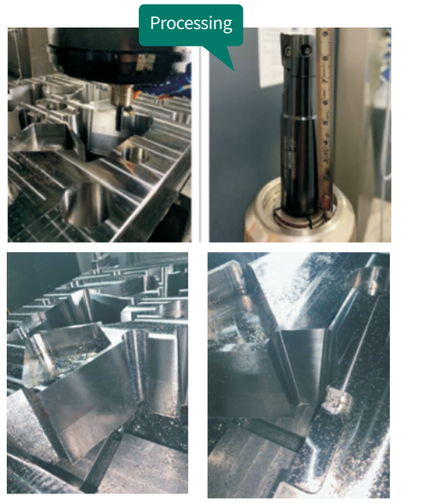
For the vertical precision and parallel toolpath precision,HARDSTONE products are much higher than other samples.

Workpiece materials:steel 45 #(28HRC)
▪Cutting parameters:
Vc=280m/min,fz=0.15mm/z,
ap=20mm,ae=1mm
▪Tool type:
AOKT113508PEER-VM,WS5130,
tooth ϕ16x2, overhang depth:40mm

Service life comparison







Workpiece material: 718H (35HRC)

Test location: Mould center, Xiamen City

Workpiece: large-scale mould base cavity

Cutting parameters:

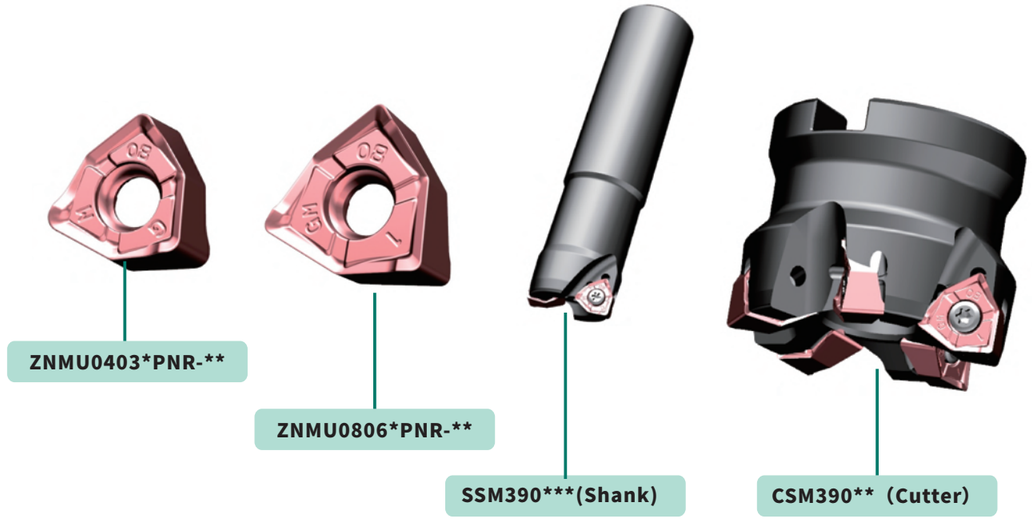
Vc=326m/min,fz=0.5mm/z,ap=0.2

5mm,ae=0.1mm

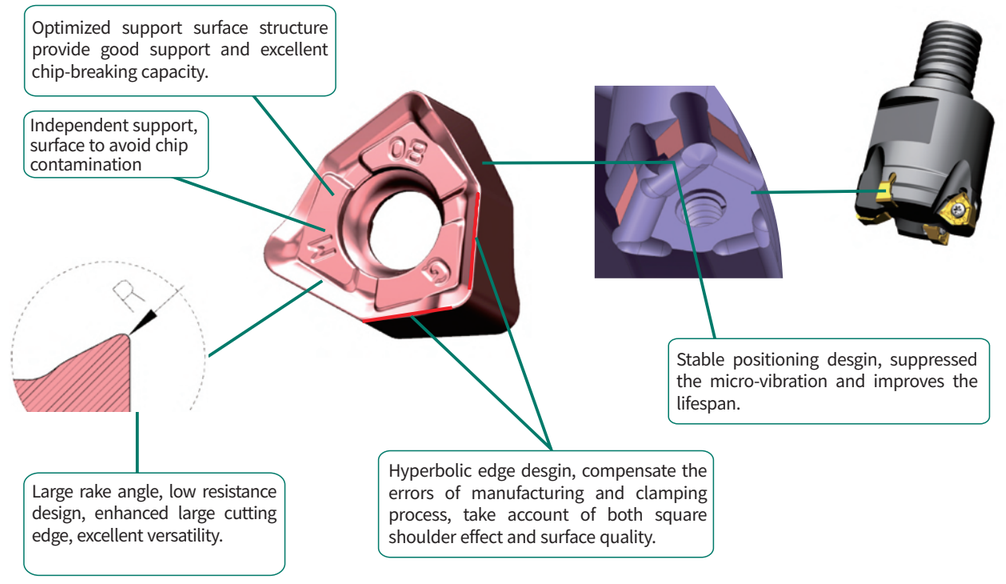
Tool: AOKT160408PEER-VM,WS5130,

Toolφ26x2, Overhang depth: 80mm

New generation economic square shoulder milling insert S/CSM390



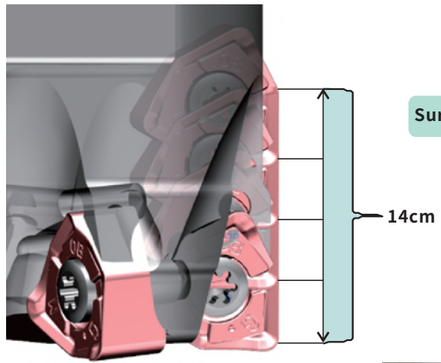
Features



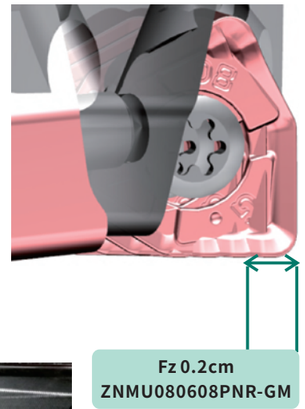
New generation economic square shoulder milling insert S/CSM390

Cutting effect

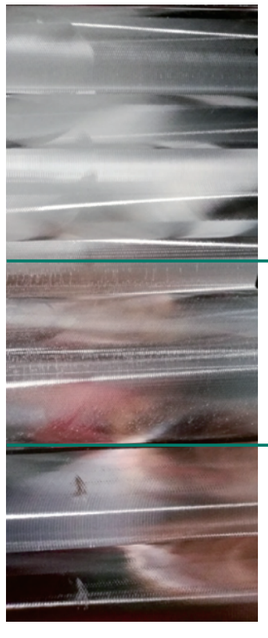
Sidewall



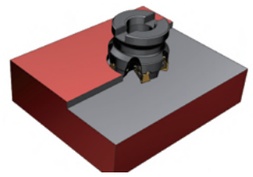
Surface Quality



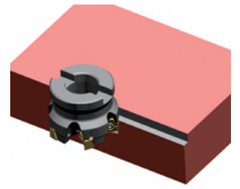
Perpendicularity: 0.014mm



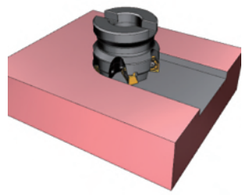
Application and parameters



Face milling



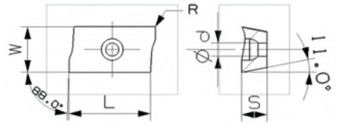
Square shoulder milling



Slot milling

ISO	Material	Grade	Recommended cutting parameters	
			VC(m/min)	FZ(mm/z)
P	Mild steel	WS5130 WS5120	120~250	0.08~0.3
	Carbon steel alloy steel		120~200	0.08~0.3
	Pre hardened steel		120~200	0.08~0.3
M	Martensitic stainless steel		120~180	0.08~0.3
	Austenitic stainless steel		120~160	0.08~0.3
K	Grey cast iron		100~220	0.08~0.3
	Nodular cast iron		100~180	0.08~0.3
S	Heat resistant alloy		50~100	0.08~0.3

Square shoulder milling



● Good working condition ◕ Normal working condition ⌗ Bad working condition

Shape	Description	L	W	S	ϕd	R	CVD Coating						PVD Coating							un-coated	Cutting Parameters	
							WS8215	WS8135	WS8133	WS6115	WS7120	WS7140	WS5115	WS5120	WS5130	WS5225	WS5231	WS7125	WS7225	WS7130	WSK10	Ap (mm)	Fn (mm/r)
	AOKT113504PEER-VM	11.75	6.42	3.50	2.80	0.40							●	◕	◕							0.1~3.0	0.10-0.40
	AOKT113508PEER-VM	11.75	6.42	3.50	2.80	0.80							●	◕	◕							0.1~3.0	0.10-0.60
	AOKT113516PEER-VM	11.75	6.42	3.50	2.80	1.60							●	◕	◕							0.1~3.0	0.10-1.00
	AOKT160408PEER-VM	17.65	9.64	4.76	4.40	0.80							●	◕	◕							0.1~5.0	0.10-0.60
	AOKT160412PEER-VM	17.65	9.64	4.76	4.40	1.20							●	◕	◕							0.1~5.0	0.10-1.00
	APMT1135PDER-HM	11.25	6.20	3.50	2.80	0.80							●	◕	◕							0.1~3.0	0.10-0.80
	APMT1605PDER-HM	17.25	9.25	4.76	4.40	0.80							●	◕	◕							0.1~5.0	0.10-1.00
	APMT160520PDER-HM	17.25	9.25	4.76	4.40	2.00							●	◕	◕							0.1~5.0	0.10-1.20
	APMT150412-MM	16.33	12.70	4.76	5.40	1.20								◕	◕							~16.33	0.05-0.15
	APHX1504	16.33	12.70	4.76	5.40	0.40								◕	◕							~16.33	0.05-0.15
	APGT1135PDFR-G2	11.25	6.20	3.50	2.80	0.80															●	0.1~3.0	0.10-0.15
	APGT1604PDFR-G2	17.25	9.33	5.20	4.40	0.80															●	0.1~5.0	0.10-0.20
	APKT1604PDFR-MA	16.17	9.53	4.76	4.40	0.20															●	0.1~5.0	0.05-0.15
	APKT1604PDFR-MA3	16.17	9.53	4.76	4.40	0.80															●	0.1~5.0	0.10-0.20

Profile milling

● Good working condition ◕ Normal working condition ⌗ Bad working condition

Shape	Description	L1	α	D1	D2	T	CVD Coating						PVD Coating							un-coated	Cutting Parameters	
							WS8215	WS8135	WS8133	WS6115	WS7120	WS7140	WS5115	WS5120	WS5130	WS5225	WS5231	WS7125	WS7225	WS7130	WSK10	Ap (mm)	Fn (mm/r)
	RCKT10T3MO-FM		7°	10.00	4.40	3.97							●	◕	◕							0.1~2.0	0.20-0.80
	RCKT1204MO-FM		7°	12.00	4.40	4.76							●	◕	◕							0.2~3.0	0.25-1.00
	RCKT1606MO-FM		7°	16.00	5.50	6.35							●	◕	◕							0.5~4.0	0.30-1.20
	RCKT1606MO-MS		7°	16.00	5.50	6.35						⌗								⌗		0.5~4.0	0.30-1.20
	RCKT2006MO-FM		7°	20.00	6.55	6.35							●	◕	◕							0.5~6.0	0.40-1.20
	RDMW1003MO-FM		15°	10.00	4.40	3.18									◕							0.1~0.5	0.20-0.80
	RDMW12T3MO-FM		15°	12.00	4.40	3.97									◕							0.2~1.0	0.30-1.00
	RDMW10T3MO		15°	10.00	4.50	3.97							●	◕	◕							0.1~0.5	0.30-1.00
	RDMW1204MO		15°	12.00	4.40	3.97							●	◕	◕							0.2~1.0	0.30-1.00
	RDMW1605MO		15°	16.00	5.50	5.56							●	◕	◕							0.5~2.0	0.50-1.50
	RPKT10T3MO-MS		11°	10.00	4.50	3.97						⌗								⌗		0.1~2.0	0.20-0.80
	RPKT1204MO-MS		11°	12.00	4.00	4.76						⌗								⌗		0.2~3.0	0.25-1.00
	RPMW1003MO		11°	10.00	4.50	3.18							●	◕	◕							0.1~0.5	0.20-0.80
	RPMT1204MO-HM		11°	12.00	5.50	4.76							●	◕	◕							0.2~2.0	0.30-0.80

Helical end milling

● Good working condition ◕ Normal working condition ⌗ Bad working condition

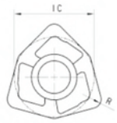
Shape	Description	L	ϕD	S	ϕd	R	CVD Coating						PVD Coating							un-coated	Cutting Parameters	
							WS8215	WS8135	WS8133	WS6115	WS7120	WS7140	WS5115	WS5120	WS5130	WS5225	WS5231	WS7125	WS7225	WS7130	WSK10	Ap (mm)	Fn (mm/r)
	SPHX120408T21	12.70	12.70	4.76	5.50	0.80								◕	◕							~11.5	0.05-0.15
	SPMT120408-MM	12.70	12.70	4.76	5.50	0.80								◕	◕							~11.5	0.05-0.15

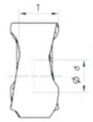
Face milling

● Good working condition ◕ Normal working condition ⌗ Bad working condition

Shape	Description	L	φD	S	φd	WS8215	WS8135	WS8133	WS6115	WS7120	WS7140	WS5115	WS5120	WS5130	WS5225	WS5231	WS7125	WS7225	WS7130	WSK10	Ap (mm)	Fn (mm/r)
	SEHT1204AFFN-X83	12.70	12.70	4.76	5.50															◕	~4.0	0.03~0.30

Economical square shoulder milling





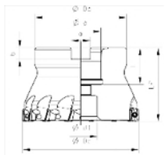
● Good working condition ◕ Normal working condition ⌗ Bad working condition

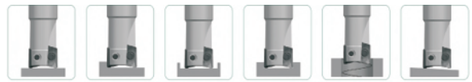
Shape	Description	IC	Apmax	R	φd	T	WS8215	WS8135	WS8133	WS6115	WS7120	WS7140	WS5115	WS5120	WS5130	WS5225	WS5231	WS7125	WS7225	WS7130	WSK10	Ap (mm)	Fn (mm/r)
	ZNMU040308PNR-GM	7	4.2	0.8	2.8	3.65								◕	◕							~4.2	0.05~0.30
	ZNMU080608PNR-GM	12	7.2	0.8	4.6	6.35								◕	◕							~7.3	0.06~0.35
	ZNMU080608PNR-GL	12	7.2	0.8	4.6	6.35								◕	◕							~7.3	0.05~0.30

Milling Tools

Cutter

High strength tool body





Type	Stock	Number of teeth	Basic dimensions φDc	Lf	φDb	φd	φd1	a	b	l	Applicable inserts	Spare parts Screw	Spare parts Wrench
													
CSM190-040A1605-AO11	●	5	40	40	33	16	14	8.4	5.6	18	AOKT1135** PEER-VM	M2.5X5.5	T-8
CSM190-050A2206-AO11	●	6	50	40	47	22	18.2	10.4	6.3	22			
CSM190-063A2207-AO11	●	7	63	40	47	22	18.2	10.4	6.3	22			
CSM190-050A2204-AO16	●	4	50	40	47	22	18.2	10.4	6.3	22	AOKT1604** PEER-VM	M4.0X10	T-15
CSM190-063A2205-AO16	●	5	63	40	47	22	18.2	10.4	6.3	22			
CSM190-080A2706-AO16	●	6	80	50	52	27	18.2	12.4	7	24			

Milling Tools

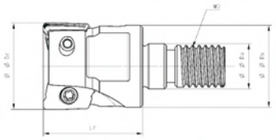
Shank

High strength tool body

Type	Stock	Number of teeth	Basic dimensions				Applicable inserts	Spare parts	
			ϕDc	l2	L	ϕDs		Screw	Wrench
SSM190-016G1602(L)-AO11	•	2	16	40	130(160)	16	AOKT1135** PEER-VM	M2.5X5.5	T-8
SSM190-017G1602(L)-AO11	•	2	17	40	160(200)	16			
SSM190-020G2002(L)-AO11	•	2	20	40	130(160)	20			
SSM190-021G2002(L)-AO11	•	2	21	50	160(200)	20			
SSM190-025G2503(L)-AO11	•	3	25	50	120(160)	25			
SSM190-025G2502(L)-AO16	•	2	25	50	160(200)	25	AOKT1604** PEER-VM	M4.0X10	T-15
SSM190-026G2502(L)-AO16	•	2	26	50	160(200)	25			
SSM190-032G3202(L)-AO16	•	2	32	80	160(200)	32			

Modular cutting head

High strength tool body

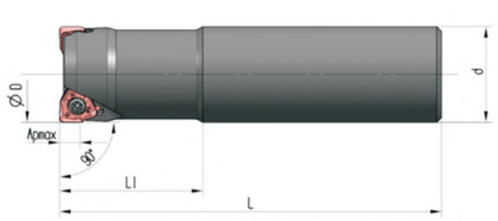


Type	Stock	Number of teeth	Basic dimensions					Applicable inserts	Spare parts	
			ϕDc	Lf	ϕDa	ϕDb	MD		Screw	Wrench
KH-1702-AOKT11-M08	•	2	17	25	8.5	15	M8	AOKT1135** PEER-VM	M2.5X5.5	T-8
KH-2102-AOKT11-M10	•	2	21	30	10.5	19	M10			
KH-2603-AOKT11-M12	•	3	26	35	12.5	24	M12			
KH-3304-AOKT11-M16	•	4	33	40	17	30	M16			

Milling Tools

Shank

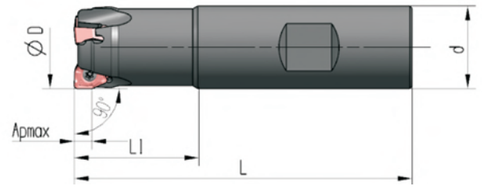
High strength tool body



Type	Stock	Number of teeth	D	d	L	L1	Apmax	Applicable inserts	inner-cooling		
SSM390-020G2002L-ZN04	•	2	20	20	150	30	4.2	ZNMU0403**	•	M2.5X6.5	T-8
SSM390-020G2003L-ZN04		3	20	20	150	30	4.2		•		
SSM390-021G2002L-ZN04	•	2	21	20	150	30	4.2		•		
SSM390-021G2003L-ZN04		3	21	20	150	30	4.2		•		
SSM390-025G2502L-ZN04	•	2	25	25	170	30	4.2		•		
SSM390-025G2503L-ZN04	•	3	25	25	170	30	4.2		•		
SSM390-025G2504L-ZN04		4	25	25	170	30	4.2		•		
SSM390-025G2505L-ZN04		5	25	25	170	30	4.2		•		
SSM390-026G2502L-ZN04	•	2	26	25	170	30	4.2		•		
SSM390-026G2503L-ZN04		3	26	25	170	30	4.2		•		
SSM390-032G3202L-ZN04	•	2	32	32	200	30	4.2		•		
SSM390-032G3203L-ZN04	•	3	32	32	200	30	4.2		•		
SSM390-032G3204L-ZN04		4	32	32	200	30	4.2		•		
SSM390-032G3205L-ZN04		5	32	32	200	30	4.2		•		
SSM390-032G3206L-ZN04		6	32	32	200	30	4.2		•		
SSM390-035G3202L-ZN04	•	2	35	32	200	30	4.2		•		
SSM390-035G3203L-ZN04	•	3	35	32	200	30	4.2		•		
SSM390-040G3204L-ZN04		4	40	32	200	30	4.2		•		
SSM390-040G3205L-ZN04		5	40	32	200	30	4.2		•		
SSM390-040G3206L-ZN04		6	40	32	200	30	4.2		•		

Shank

High strength tool

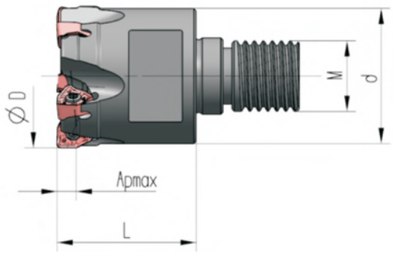


Type	Stock	Number of teeth	Basic dimensions D	d	L	L1	Apmax	Applicable inserts	inner-cooling	Spare parts Screw	Wrench
SSM390-020X2002-ZN04		2	20	20	90	30	4.2	ZNMU0403**	•	M2.5X6.5	T-8
SSM390-020X2003-ZN04		3	20	20	90	30	4.2		•		
SSM390-025X2502-ZN04		2	25	25	100	30	4.2		•		
SSM390-025X2503-ZN04		3	25	25	100	30	4.2		•		
SSM390-025X2504-ZN04		4	25	25	100	30	4.2		•		
SSM390-025X2505-ZN04		5	25	25	100	30	4.2		•		
SSM390-032X3202-ZN04		2	32	32	110	30	4.2		•		
SSM390-032X3203-ZN04		3	32	32	110	30	4.2		•		
SSM390-032X3204-ZN04		4	32	32	110	30	4.2		•		
SSM390-032X3205-ZN04		5	32	32	110	30	4.2		•		
SSM390-032X3206-ZN04		6	32	32	110	30	4.2		•		

Milling Tools

Modular cutting head

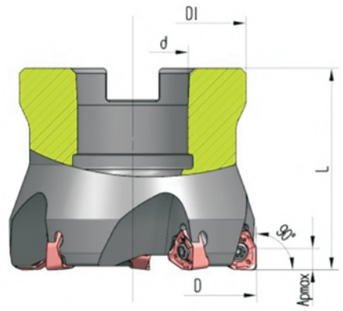
High strength tool body



Type	Stock	Number of teeth	Basic dimensions				Apmax	Applicable inserts	inner-cooling	Spare parts	
			D	d	L	M				Screw	Wrench
KH-2002-ZN04-M10		2	20	18	30	10	4.2	ZNMU0403**	•	M2.5X6.5	T-8
KH-2003-ZN04-M10		3	20	18	30	10	4.2		•		
KH-2502-ZN04-M12		2	25	23	30	12	4.2		•		
KH-2503-ZN04-M12		3	25	23	30	12	4.2		•		
KH-2504-ZN04-M12		4	25	23	30	12	4.2		•		
KH-2505-ZN04-M12		5	25	23	30	12	4.2		•		
KH-3202-ZN04-M16		2	32	30	40	16	4.2		•		
KH-3203-ZN04-M16		3	32	30	40	16	4.2		•		
KH-3204-ZN04-M16		4	32	30	40	16	4.2		•		
KH-3205-ZN04-M16		5	32	30	40	16	4.2		•		
KH-3206-ZN04-M16		6	32	30	40	16	4.2		•		

Cutter

High strength tool body

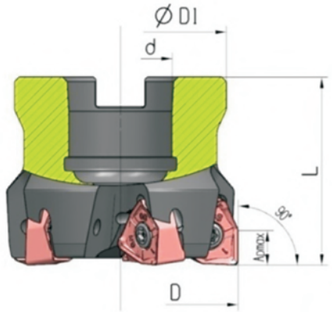


Type	Stock	Number of teeth	Basic dimensions				Apmax	Applicable inserts	inner-cooling	Spare parts	
			D	d	D1	L				Screw	Wrench
CSM390-040A1605-ZN04		5	40	16	35	40	4.2	ZNMU0403**	•	M2.5X6.5	T-8
CSM390-040A1607-ZN04		7	40	16	35	40	4.2		•		
CSM390-050A2206-ZN04		6	50	22	45	40	4.2		•		
CSM390-050A2208-ZN04		8	50	22	45	40	4.2		•		
CSM390-063A2207-ZN04		7	63	22	50	40	4.2		•		
CSM390-063A2210-ZN04		9	63	22	50	40	4.2		•		

Milling Tools

Cutter

High strength tool body

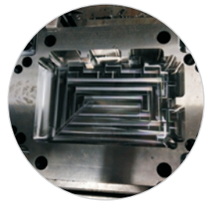


Type	Stock	Number of teeth	Basic dimensions				Apmax	Applicable inserts	inner-cooling	Spare parts	
			D	d	D1	L				Screw	Wrench
CSM390-040A1604-ZN08		4	40	16	35	40	7.3		•		
CSM390-050A2204-ZN08	•	4	50	22	45	40	7.3		•		
CSM390-050A2205-ZN08		5	50	22	45	40	7.3		•		
CSM390-063A2205-ZN08	•	5	63	22	50	40	7.3		•		
CSM390-063A2206-ZN08		6	63	22	50	40	7.3		•		
CSM390-080A2706-ZN08	•	6	80	27	60	50	7.3		•		
CSM390-080A2707-ZN08		7	80	27	60	50	7.3		•		
CSM390-080A2709-ZN08		9	80	27	60	50	7.3		•		
CSM390-100B3207-ZN08	•	7	100	32	80	50	7.3				
CSM390-100B3208-ZN08		8	100	32	80	50	7.3	ZNMU0806**		M4X10	T-15
CSM390-100B3211-ZN08		11	100	32	80	50	7.3				
CSM390-125B4008-ZN08	•	8	125	40	100	63	7.3				
CSM390-125B4011-ZN08		11	125	40	100	63	7.3				
CSM390-125B4014-ZN08		14	125	40	100	63	7.3				
CSM390-160C4010-ZN08		10	160	40	115	63	7.3				
CSM390-160C4012-ZN08		12	160	40	115	63	7.3				
CSM390-160C4016-ZN08		16	160	40	115	63	7.3				
CSM390-200C6012-ZN08		12	200	60	150	63	7.3				
CSM390-200C6016-ZN08		16	200	60	150	63	7.3				

Cases

Milling

- **Workpiece** Mould base, 45# steel
- **Machining Methods** Finish milling of mould sidewall (aire cooling)
- **Insert** AOKT113508PEER-VM WS5115
- **Tool** SSM190-025G2503-AO11
- **Cutting parameters** Vc=220m/min，ap=2mm，ae=0.2mm，fz=0.3mm/z
- **Cutting performance** Process quality, dimention precision and lifespan close to top brand.



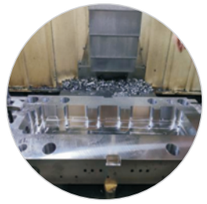
AOKT's cutting vibration is very small, significantly improved the sidewall machined trace, surface quality and surface accuracy. It's surface quality, dimension accuracy and wear resistance have reached the import level.

Finish milling - Mould Sidewall

- **Workpiece** Die materialP20
- **Machining Methods** Finish milling of mould sidewall
- **Insert** AOKT113508PEER-VM
- **Tool** KH-2603-AOKT11-M12
- **Cutting parameters** Vc=259m/min，ap=1mm，ae=0.12mm，fz=0.25mm/z
- **Cutting performance** Surface roughness Ra:0.63、perpendicularity ＜ 0.01，satisfy customers' requirement!

Cases

Finish milling - Mould Sidewall

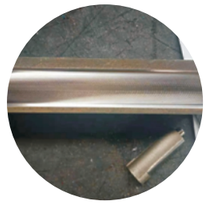


- **Workpiece** Mold frame 45# steel
- **Machining Methods** Finish milling of mould sidewall
- **Insert** AOKT113508PEER-VM
- **Tool** Dc:SSM190-025G2503(L)-AO11
- **Cutting parameters** Vc=220m/min，ap=1.5mm，ae=0.25mm，fz=0.36mm/z
- **Cutting performance** perpendicularity ＜ 0.012，satisfy customers' requirement.Successfully replace imported products!

Side milling - Cylinder block

- **Workpiece** Cylinder block HT250
- **Machining Methods** Side milling of cylinder block
- **Insert** AOKT113508PEER-VM
- **Tool** KH-2603-AOKT11-M12
- **Cutting parameters** Vc=285m/min, ap=0.8mm, ae=0.15mm, fz=0.1mm/z
- **Cutting performance** perpendicularity ＜ 0.008， Successfully replace imported products!

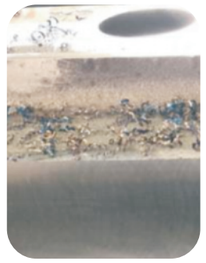
Side milling - Cylinder block



- **Workpiece** Cr15 Quenching(HRC48) Air cooling
- **Machining way** Groove milling
- **Insert** AOKT113508PEER-VM WS5115
- **Tool** SSM190-020G2002-AO11
- **Cutting parameters** Vc=138m/min，ap=0.12mm，ae=5mm，fz=0.25mm/z
- **Cutting performance** Comparing with cermet insert from BRAND A,the surface quality (burr-free sidewall) and life are comparable.

HARDSTONE AOKT tool provide high dimentional presicion, sharp edge, light and smooth cutting, excellent surface quality.

Roughing - Cast iron



- **Workpiece** Dry cut casting steel
- **Machining Methods** Rough milling of cast steel
- **Insert** ZNMU080608PNR-GM/WS5120
- **Tool** CSM390-200C6012-ZN08
- **Cutting parameters** N=300/min ， ap=2~5㎜， F=700㎜/min
- **Cutting life** HARDSTONE: 3 hrs, Brand A: 2.5 hrs
- **Cutting performance** Good surface quality , long cutting life, high cost performance

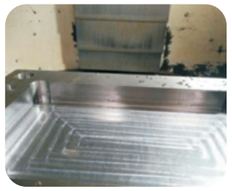
Mounting surface - Milling plate spring

- **Workpiece** Dry cutting 40CrMo HB285-333 Back of plate spring
- **Machining Methods** Mounting surface of Milling plate spring
- **Insert** SSM390-063A2205-ZN08
- **Tool** ZNMU080608PNR-GM/WS5120
- **Cutting parameters** N=720/min，ap=1.5~3㎜，F=540㎜/min
- **Cutting life** HARDSTONE：27pieces，Brand A:12pieces
- **Cutting performance** Good surface quality , long cutting life, high cost performance

Cases

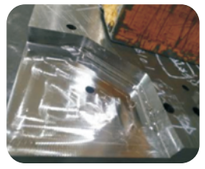
Clean-up machining - Frame

- **Workpiece** Frame 45# steel
- **Machining Methods** Clean-up machining of mould frame
- **Insert** ZNMU040308PNR-GM/WS5130
- **Tool** SSM390-021G2002L-ZN04
- **Cutting parameters** N=2750/min， ap=0.3mm ae=0.5~21mm，F=2500mm/min
- **Original insert** APMT1135
- **Original cutting parameters** N=2750/min ， F=2500mm/min，ap=0.3mm，ae=0.5~21mm
- **Cutting life** HARDSTONE:3hours(3pieces)，Brand A:2hours(2pieces)
- **Cutting performance** Light cutting , cutting efficiency increased by 3 times, long lifespan, good surface quality, remarkable economic benefit.



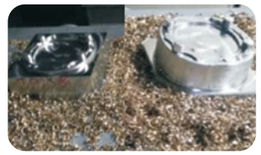
Roughing - Internal Mould Insert

- **Workpiece** XF136BDHH
- **Machining Methods** Roughing of internal mold insert,dry cutting
- **Insert** ZNMU040308PNR-GM/WS5115
- **Tool** SSM390-021G2002L-ZN04
- **Cutting parameters** Vc=132m/min，N=2000/min，ap=0.4mm，ae=15mm，fz=3000mm/r
- **Original insert** APMT1135
- **Original cutting parameters** Vc=132m/min，N=2000/min ， F=2000mm/r，ap=0.25mm ， ae=15mm
- **Cutting life** HARDSTONE: 40 mins, No obvious wear; Brand A: 30 mins, Cutting edge burst crack
- **Cutting performance** Light cutting, cutting efficiency increased to 240%, good surface quality, long lifespan.



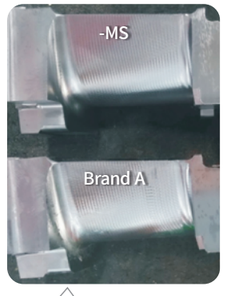
Forming - Front mold insert

- **Workpiece** JY136ADHH
- **Machining Methods** Contour machining of front mold insert Drying cutting
- **Insert** ZNMU040308PNR-GM/WS5115
- **Tool** SSM390-021G2002L-ZN04
- **Cutting parameters** Vc=132m/min，N=2000/min ，ap=0.4mm ， ae=15mm， F=3000mm/min
- **Original insert** APMT1135
- **Original cutting parameters** Vc=132m/min,N=2000/min ,F=2000mm/min,ap=0.4mm,ae=15mm
- **Cutting life** HARDSTONE:37mins；Brand A:10mins+
- **Cutting performance** Light cutting, cutting efficiency increased to 168%, good surface quality, lifespan increased 3.7 times.



Finish milling - Stainless Steel Blade

- **Workpiece** Blade, 2Cr11Mo1VNbN
- **Machining Methods** Finish milling of stainless steel blade (air cooling)
- **Insert** RPKT10T3MO-MS WS7130
- **Cutting parameters** Vc=235.5m/min，ap=0.8mm，e=2mm，fz=0.42~0.74mm/r
- **Cutting performance** Performance comparison after two pieces machining for both HARDSTONE and Brand A



HARDSTONE quality and dimension precision are much better than Brand A

HARDSTONE
Cutting Tools

Hardstone Efficient Cutting tools