

COMPANY PROFILE

Zhuzhou Huarui Precision Cutting Tools Co.,Ltd. is a high and new tech enterprise engaged in the production of cemented carbide cutting tools for CNC machinery, the municipal supporting institution of Zhuzhou Carbide Precision Cutting tool Engineering Technology Research Center. Also the production line has been named key project of "Manufacture makes Hunan stronger". In the market, its "Hardstone" Brand products with excellent properties have been widely used in industries of automobiles, aviation & aerospace, rail traffic, heavy equipment, mold manufacture, power equipment, etc. and have been accepted by customers. Therefore they are selling to various overseas markets.

With its good development prospects, the company has won great favor from various investors. The well-known domestic equity investment funds invested a large sum of money for company in 2011, 2015 and 2017, which has speed-ed up the introduction of high-tech manufacturing equipments and quality test instruments. Therefore, the product quality has climbed one storey higher & reached the first- class in Asia.

The company has in its possession a strong technical strength & has forged a top domestic specialized & high-level R & D team of old, middle-aged & young professional personnel. They included experts enjoying special allowance of the state council & introduced outstanding CNC talents. The company has its own R&D Center consisting of material research, products design, mould design & manufacture, cutting experiments & technical application service, etc. ensuring the provision to customers of the best solutions to products & technical service. At present, the company has 22 nationally authorized patents.

The company has its quality control system covering the whole processes with independent intellectual property rights to guarantee the stability and consistency of its products. The company was awarded ISO9001:2000 quality management system certificate, and passed ISO9001:2015 quality standard system certificate in 2014.

The company has experienced sales engineers and technical application engineers, and has set up its product and technical service branched in China's major industrial cities to provide the most professional and efficient service.



HONOR

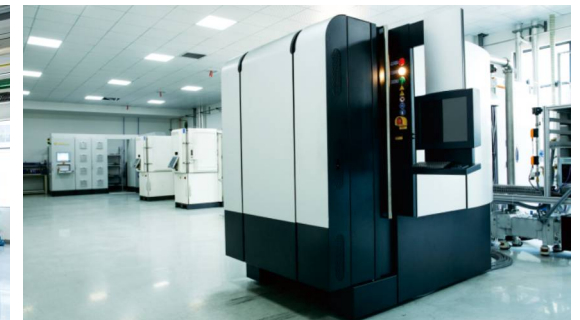
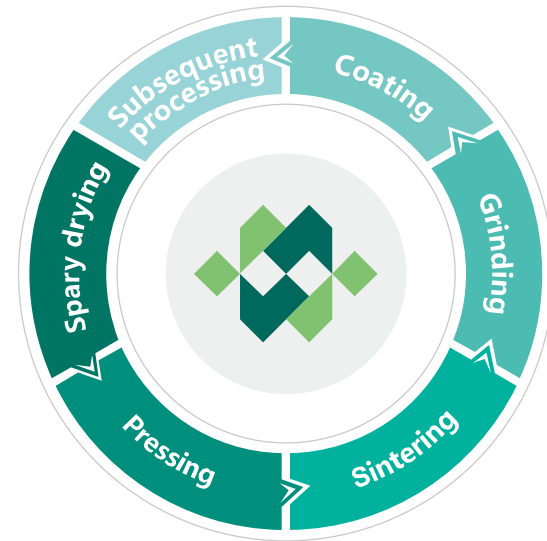


EQUIPMENT

The company has a full set of high-level producing equipment ranging from raw power material preparation, mould manufacture, pressing, pressure sintering, grinding to post processing. We use spray drying tower in mixing process. Its advanced technique ascertains the best performance behavior of material in physical property and formability.

Using powder compacting press with Electro-Servo Motor Direct Drive, the most advanced machine for press shaping in the world, which meet the high requirements on precision, performance and stability. For sintering, we equipped the most advanced devices to meet the quality requirements on chemical and physical performance.

For grinding and machining, we equipped Fully auto CNC periphery insert grinder, CNC two-wheel flat lapping machine etc. to ensure product shape and precision demand. We also use the most advanced PVD/CVD coating machines. The state-of-the-art sub-sequence process devices equipped for better performance.





目录

A

Turning Insert

- ◆ The Explanation Of Chip-breaker... A-02 — 05
- ◆ The Explanation Of Grade A-06 — 07
- ◆ The Explanation Of Specification... A-08 — 09
- ◆ Overview A-10 — 11

A1 Negative Inserts

For Steel

- ◆ Feature A1-02
- ◆ Series A1-03 — 08
- ◆ Application Case A1-09 — 14

For Stainless Steel

- ◆ Feature A1-16
- ◆ Series A1-17 — 21
- ◆ Application Case A1-22

For Cast Iron

- ◆ Series A1-24 — 29
- ◆ Application Case A1-30

A2 Positive Inserts

- ◆ Series A2-02 — 07

A3 For Aluminum

- ◆ Series A3-02 — 07

A4 For Grooving and Parting

- ◆ The Explanation Of Specification... A4-02
- ◆ Feature A4-03
- ◆ Series A4-04 — 05
- ◆ Application Case A4-06

A5 For Threading

- ◆ The Explanation Of Specification... A5-02
- ◆ Feature A5-03 — 04
- ◆ Series A5-05 — 09
- ◆ Application Case A5-10 — 12

B

Milling Insert

- ◆ The Explanation Of Grade B-03 — 04

B1 General Milling Insert

- ◆ The Explanation Of Specification... B1-01 — 02
- ◆ Overview B1-03
- ◆ Feature B1-04
- ◆ Series B1-05 — 19
- ◆ Application Case B1-20 — 25

B2 Heavy Milling Insert

- ◆ The Explanation Of Specification... B2-02 — 03
- ◆ Overview B2-04
- ◆ Series B2-05 — 22
- ◆ Application Case B2-23

C

Drilling Insert

- ◆ Feature C-02
- ◆ Series C-03 — 04
- ◆ Application Case C-05 — 06

D





General Technical Data

- ◆ Relevant Information Of Cemented Carbide... D-02 — 08
- ◆ Relevant Information Of Workpiece D-09 — 16
- ◆ Other Technical Information ... D-17 — 22

The Explanation Of Chip-breaker

● Negative Inserts

Chip-breaker	Shape and features	Using for	Precision	Recommended Parameters
MT 	Double-sided chipbreaker;it is suitable for steel machining and has wide application. 	Steel machining	M	ap: 1.00~ 5.00 fn: 0.20~ 0.5
M 	It is suitable for steel machining and has wide application. 	Steel machining	M	ap: 1.00~ 4.00 fn: 0.20~ 0.5
GF 	It is suitable for Steel finish machining. 	Steel machining	M	ap: 0.15~2.00 fn: 0.08~0.18
GT 	It is universal chipbreaker,used for semi-finishing and roughing,the nose and cutting edge sharp and strong. 	Steel machining	M	ap:1.00~5.0 fn:0.20~0.50
BF 	For finishing of M-type materialdouble-sided chipbreaker, it has sharp edges, which can effectively cut off stainless steel and solve the problem of surface hardening, etc 	Stainless steel machining	M	ap: 0.15~2.00 fn: 0.08~0.18
BM 	For semi-finishing of M-type material,double-sided chipbreaker, it is suitable for stainless steel machining and has wide application. * 	Stainless steel machining	M	ap: 0.50~8.50 fn: 0.10~0.55
BR 	For rough finishing of M-type material double-sided chipbreaker, the chipbreaker has been optimized, it has wide application for light load rough machining of stainless steel. 	Stainless steel machining	M	ap: 1.50~11.00 fn: 0.15~1.00

Chip-breaker	Shape and features	Using for	Precision	Recommended Parameters
Universal 	Recommended chipbreaker type for general machining it is suitable for K-type material. 	Cast iron machining	M	ap: 0.20~8.00 fn: 0.15~0.60
Non 	For cast iron machining the cutting edge is very strong ,it is the first choice for cast iron machining 	Cast iron machining	M	ap: 0.20~12.00 fn: 0.10~1.20

● Positive Inserts With Hole





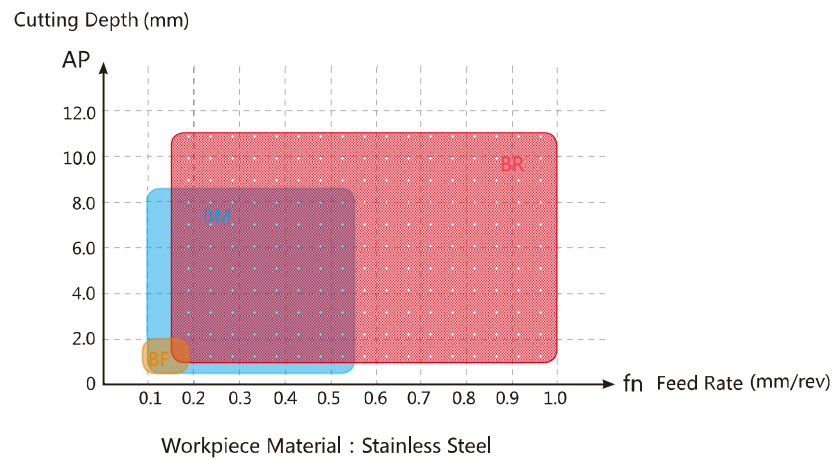
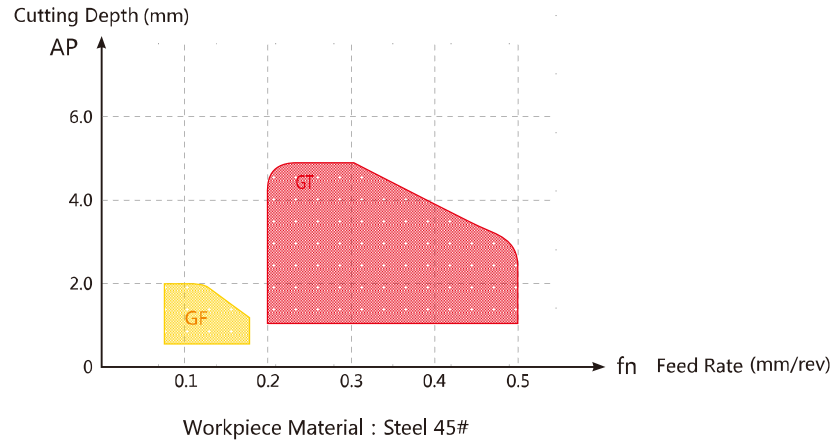
Chip-breaker	Shape and features	Using for	Precision	Recommended Parameters
MP 	For stainless steel The hole processing has better comprehensive performance and strong versatility. 	Stainless steel machining	M	ap: 0.10~ 3.6 fn: 0.03~ 0.4
AK 	Recommended chipbreaker for machining of Al alloy large rake angle and sharpening cutting edge, it can achieve easy and fast cutting. Due to surface polishing treatment, It has good resistance to adhesive performance. * 	Aluminium machining	G	ap: 0.10~ 8.00 fn: 0.10~ 0.50

Diagram Of Turning Inserts Chip-breaker Range

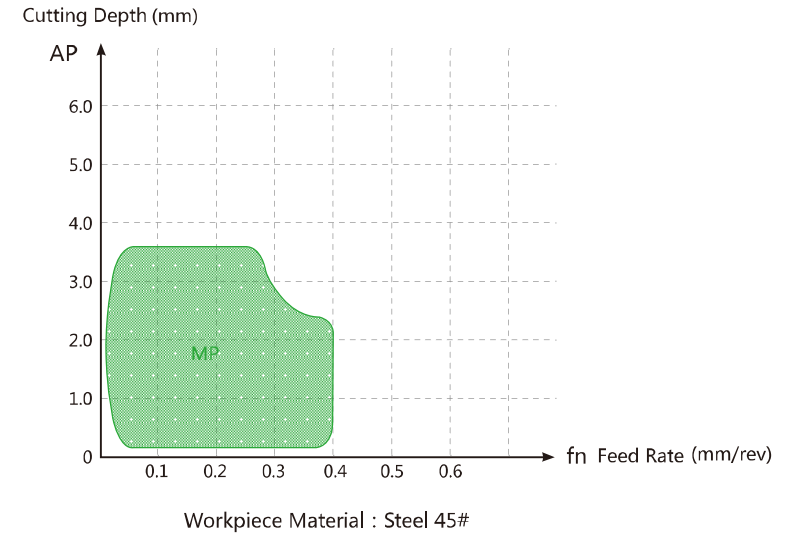
A

Chip-Breaker Range Of Negative Inserts With Hole



Chip-Breaker Range Of Positive Inserts With Hole

A



The Instruction Of Grade

Grade	Coating Structure				Application	ISO	Wear Resistance ←————→ Toughness													
	Coating Way	Coating Color	Pictures	Component			Range	01	05	10	15	20	25	30	35	40	45			
WS8115	CVD	Double Color black-yellow		TiN+MT -TiCN+Al2O3 +TiN	Thick	It is suitable for the stable turning environment and the pursuit of high wear resistance; processing general steel, when the cooling is better, the Vc can reach more than 350m/min.	P10~P20													
WS8125	CVD	Double Color black-yellow		TiN+MT -TiCN+Al2O3 +TiN	Thick	It is firstly grade for general steel turning, from finishing to rough machining, it has strong comprehensive performance from low speed to high speed, and also can be competent for general interrupted turning.	P15~P30													
WS8123	CVD	gold-yellow		TiN+MT -TiCN+Al2O3 +TiN	Thick-	It is suitable for the high speed of parting and grooving turning.	P15~P30													
WS6105	CVD	Black		TiN+MT -TiCN+Al2O3	Thick	It is the most abrasion resistant material grades for turning of Gray iron and Cast iron ; it also can be used for high hardness and high wear resistant steel pieces of dry cutting.	K05~K10													
WS6115	CVD	Black		TiN+MT -TiCN+Al2O3	Thick+	It is the firstly grade for turning of Gray iron and Cast iron, good comprehensive performance, it is also suitable for general intermittent processing, it can be used for lower speed roughing of quenched steel and high strength steel.	K10~K20													
WS5125	PVD	Grey Black		AlTiN	Thin	It is special grade for threading turning which used for steel, stainless steel, cast iron and other materials.	P10~P25 M10~M25 K10~K25													
WS7125	PVD	Grey Black		AlTiN	Thin	It is the firstly grade of stainless steel parting and grooving inserts. It meets the middle and low speed cutting and cutting requirements of steel and cast iron.	P15~P30 M15~M30 K15~K30													
WSK10	Un-Coated	Silver gray				It is suitable for the vehicle and milling of nonferrous metal materials, graphite and cast iron , aluminum, copper and other materials. It can also be used for low speed turning of titanium alloy and high temperature alloy.	K05~K10													

The Explanation Of Specification

Inserts Shape			Chip-breaker and Clamping system				
				N	Without	Without	
				R	Without	Single-Side	
				F	Without	Double-Side	
				A	With	Without	
				M	With	Single-Side	
		Others		G	With	Double-Side	
		Others		X	---	---	Special
U	With	Double-Side					
Code	Hole	Chip-breaker	Section Plane of insert	Code	Hole	Chip-breaker	Section Plane of insert

C N M G

Clearance angle of main cutting edge		Tolerance (mm)			
Code	Clearance angle	Code	Clearance angle		
A		B			
C		D			
E		F			
G		N			
P		O	Others		
Code	Nose height Tolerance (m)	Inscribed circle ϕ IC Tolerance	Thickness Tolerance (s)	◆ (Reference)Details of M-level tolerance (identified by shape) ◆ Nose height tolerance (mm)	
A	±0.005	±0.025	±0.025	Inscribed circle	Regular triangle
F	±0.005	±0.013	±0.025	6.35 ±0.08	±0.08 ±0.08 ±0.08 ±0.11 ±0.16 ---
C	±0.013	±0.025	±0.025	9.525 ±0.08	±0.08 ±0.08 ±0.11 ±0.16 ---
H	±0.013	±0.013	±0.025	12.7 ±0.13	±0.13 ±0.13 ±0.15 ---
E	±0.025	±0.025	±0.025	15.875 ±0.15	±0.15 ±0.15 ±0.18 ---
G	±0.025	±0.025	±0.13	19.05 ±0.15	±0.15 ±0.15 ±0.18 ---
J	±0.005	±0.05±0.13	±0.025	25.4 ---	±0.18 --- ---
K	±0.013	±0.05±0.13	±0.025	◆ Inscribed circle ϕ IC Tolerance	
L	±0.025	±0.05±0.13	±0.025	Inscribed circle	Regular triangle
M	±0.08±0.18	±0.05±0.13	±0.13	6.35 ±0.05	±0.05 ±0.05 ±0.05 ±0.05 ---
N	±0.08±0.18	±0.05±0.13	±0.025	9.525 ±0.05	±0.05 ±0.05 ±0.05 ±0.05 ±0.05
U	±0.13±0.38	±0.08±0.25	±0.13	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

Diameter of IC(mm)	Inserts shape							
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			

Code	Thickness(mm)
12	12.70
10	11.11
19	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

16 06 12 - BM (ISO)
5 4 3 (inch)

Inscribed Circle	
Code	Diameter of 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

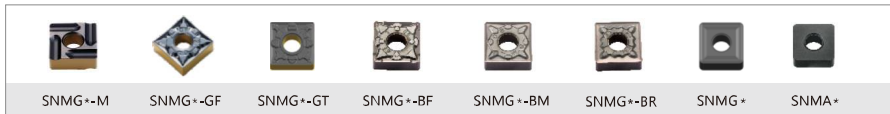
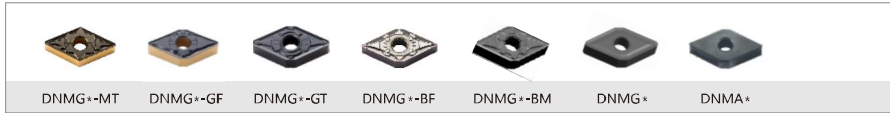
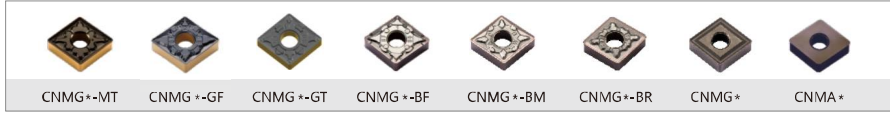
Nose Radius	
Code	Nose Radius (mm)
0	0.2
1	0.4
2	0.8
3	1.2
4	1.6
5	2.0
6	2.4

Nose Radius Code	
代号	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	Others

Chip-Breaker Code		
GT	M	TM
BR	BM	BF
AK	Universal	Non

Overview

● Negative inserts



● Positive Inserts



● Aluminium Inserts



Features of turning inserts machining steel

- ◆ Specific groove design can effectively control chip flow direction, which makes the cutting process brisk and improve the inserts' service life.
- ◆ Small cutting force efficiently reducing the cutting vibration, obtain high quality finished surface.
- ◆ Optimize the combination of substrate and coating, contribute to more stable and reducing the accidental failure of the inserts caused by the peeling of the coating in the machining process.
- ◆ Optimized design of the roughing cutting edge to balance the safety and sharpness, improve the tool performance.

Features of chip-breaker

MT

- ◆ +6° front angle with the rake face, form a large arc smooth transition design, smooth cutting and versatility.

M

- ◆ Light cutting semi-finishing for light cutting with stable processing for medium and low speed applications with poor rigidity.
- ◆ Improved cutting edge safety and reliability in intermittent and rough machining.
- ◆ Good chip evacuation performance and versatility.

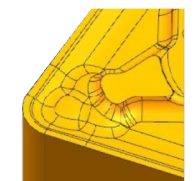
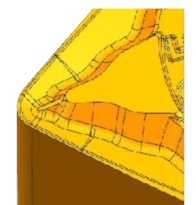
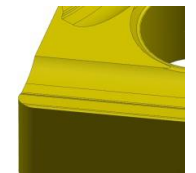
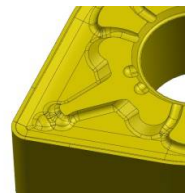
GF

- ◆ Used for finishing and semi-finishing;
- ◆ Large positive rake angle for smaller cutting resistance;
- ◆ Positive cutting edge inclination design effectively controls the flow of chips, good chip evacuation achieved;
- ◆ Coating post-treatment technology improves the wear resistance and makes the surface more gloss.

GT

- ◆ Used for semi-finishing and roughing;
- ◆ The nose and cutting edge sharp and strong;
- ◆ Variable rake angle design combined with spherical chipbreaker, suitable for a wider processing range;
- ◆ Good chip evacuation performance and versatility.

A1

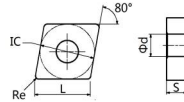


Series

For Steel

A1

80° CN□□With Hole

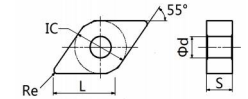


Shape	Description	Specification(mm)					Grade																	
		L	IC	S	Φd	Re	CVD Coating					PVD Coating					pepaco-un							
							WS8123	WS8115	WS8125	WS8135	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130		WS8130	WS7125	WSK10				
	CNMG120404-MT	12.9	12.7	4.76	5.16	0.4	●	●	○															
	CNMG120408-MT	12.9	12.7	4.76	5.16	0.8	●	●	○															
	CNMG120412-MT	12.9	12.7	4.76	5.16	1.2	●	●	○															
	CNMG120404-GF	12.9	12.7	4.76	5.16	0.4	○	●	○															
	CNMG120408-GF	12.9	12.7	4.76	5.16	0.8	○	●	○															
	CNMG120412-GF	12.9	12.7	4.76	5.16	1.2	○	●	○															
	CNMG120404-GT	12.9	12.7	4.76	5.16	0.4	○	●	○															
	CNMG120408-GT	12.9	12.7	4.76	5.16	0.8	○	●	○															
	CNMG120412-GT	12.9	12.7	4.76	5.16	1.2	○	●	○															

Note : ● Standing inventory ○ Make-to-order

For Steel

55° DN□□With Hole



A1

Shape	Description	Specification(mm)					Grade																	
		L	IC	S	Φd	Re	CVD Coating					PVD Coating					pepaco-un							
							WS8123	WS8115	WS8125	WS8135	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130		WS8130	WS7125	WSK10				
	DNMG150404-MT	15.5	12.7	4.76	5.16	0.4	●	●	○															
	DNMG150408-MT	15.5	12.7	4.76	5.16	0.8	●	●	○															
	DNMG150404-GF	15.5	12.7	4.76	5.16	0.4	○	●																
	DNMG150604-GF	15.5	12.7	6.35	5.16	0.4	○	●																
	DNMG150408-GF	15.5	12.7	4.76	5.16	0.8	○	●																
	DNMG150608-GF	15.5	12.7	6.35	5.16	0.8	○	●																
	DNMG150404-GT	15.5	12.7	4.76	5.16	0.4	○	●	○															
	DNMG150604-GT	15.5	12.7	6.35	5.16	0.4	○	●	○															
	DNMG150408-GT	15.5	12.7	4.76	5.16	0.8	○	●	○															
	DNMG150608-GT	15.5	12.7	6.35	5.16	0.8	○	●	○															
	DNMG150412-GT	15.5	12.7	4.76	5.16	1.2	○	●	○															
	DNMG150612-GT	15.5	12.7	6.35	5.16	1.2	○	●	○															

Note : ● Standing inventory ○ Make-to-order

For Steel

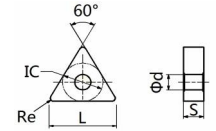
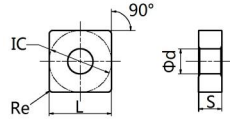
For Steel

A1

A1

90° SN□□With Hole

60° TN□□With Hole



Shape	Description	Specification(mm)					Grade													
		L	IC	S	Φd	Re	CVD Coating					PVD Coating					pepab-un			
							WS8123	WS8115	WS8125	WS8135	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130		WS8130	WS7125	WSK10
	SNMG120408R-M	12.7	12.7	4.76	5.16	0.8	●	●	○											
	SNMG120408L-M	12.7	12.7	4.76	5.16	0.8	●	●	○											
	SNMG120404-GF	12.7	12.7	4.76	5.16	0.4	○	●												
	SNMG120408-GF	12.7	12.7	4.76	5.16	0.8	○	●												
	SNMG120404-GT	12.7	12.7	4.76	5.16	0.4	○	●	○											
	SNMG120408-GT	12.7	12.7	4.76	5.16	0.8	○	●	○											
	SNMG120412-GT	12.7	12.7	4.76	5.16	1.2	○	●	○											

Shape	Description	Specification(mm)					Grade													
		L	IC	S	Φd	Re	CVD Coating					PVD Coating					pepab-un			
							WS8123	WS8115	WS8125	WS8135	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130		WS8130	WS7125	WSK10
	TNMG160404-MT	16.5	9.525	4.76	3.81	0.4	●	●	○											
	TNMG160408-MT	16.5	9.525	4.76	3.81	0.8	●	●	○											
	TNMG160412-MT	16.5	9.525	4.76	3.81	1.2	●	●	○											
	TNMG160404R-M	16.5	9.525	4.76	3.81	0.4	●	●	○											
	TNMG160404L-M	16.5	9.525	4.76	3.81	0.4	●	●	○											
	TNMG160408R-M	16.5	9.525	4.76	3.81	0.8	●	●	○											
	TNMG160408L-M	16.5	9.525	4.76	3.81	0.8	●	●	○											
	TNMG160404-GF	16.5	9.525	4.76	3.81	0.4	○	●												
	TNMG160408-GF	16.5	9.525	4.76	3.81	0.8	○	●												
	TNMG160404-GT	16.5	9.525	4.76	3.81	0.4	○	●	○											
	TNMG160408-GT	16.5	9.525	4.76	3.81	0.8	○	●	○											
	TNMG160412-GT	16.5	9.525	4.76	3.81	1.2	○	●	○											

Note : ● Standing inventory ○ Make-to-order

Note : ● Standing inventory ○ Make-to-order

For Steel

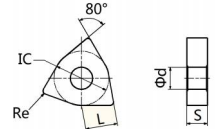
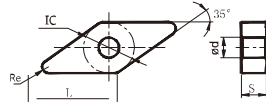
For Steel

A1

A1

35° VN□□With Hole

80° WN□□With Hole



Shape	Description	Specification(mm)					Grade													
		L	IC	S	Φd	Re	CVD Coating					PVD Coating					pepab-un			
							WS8123	WS8115	WS8125	WS8135	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130		WS8130	WS7125	WSK10
	VNMG160404-MT	16.6	9.525	4.76	3.81	0.4	●	●	○											
	VNMG160408-MT	16.6	9.525	4.76	3.81	0.8	●	●	○											
	VNMG160412-MT	16.6	9.525	4.76	3.81	1.2	●	●												
	VNMG160404-GF	16.6	9.525	4.76	3.81	0.4	○	●												
	VNMG160408-GF	16.6	9.525	4.76	3.81	0.8	○	●												
	VNMG160412-GT	16.6	9.525	4.76	3.81	1.2	○	●	○											

Shape	Description	Specification(mm)					Grade													
		L	IC	S	Φd	Re	CVD Coating					PVD Coating					pepab-un			
							WS8123	WS8115	WS8125	WS8135	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130		WS8130	WS7125	WSK10
	WNMG080404-MT	8.7	12.7	4.76	5.16	0.4	●	●	○											
	WNMG080408-MT	8.7	12.7	4.76	5.16	0.8	●	●	○											
	WNMG080412-MT	8.7	12.7	4.76	5.16	1.2	●	●	○											
	WNMG080408R-M	8.7	12.7	4.76	5.16	0.8	●	●	○											
	WNMG080408L-M	8.7	12.7	4.76	5.16	0.8	●	●	○											
	WNMG080404-GF	8.7	12.7	4.76	5.16	0.4	○	●												
	WNMG080408-GF	8.7	12.7	4.76	5.16	0.8	○	●												
	WNMG080404-GT	8.7	12.7	4.76	5.16	0.4	○	●	○											
	WNMG080408-GT	8.7	12.7	4.76	5.16	0.8	○	●	○											
	WNMG080412-GT	8.7	12.7	4.76	5.16	1.2	○	●	○											


Note : ● Standing inventory ○ Make-to-order

Note : ● Standing inventory ○ Make-to-order


Application Case

Automobile Hub unit continuous turning in high speed


A1

	Workpiece	Automobile Hub unit steel 65Mn
	Machining way	Wet continuous/ intermittent semi-finish external turning
	Inserts	WNMG080408-GF WS8115
	Machining parameter	Vc=330m/min, f=0.3mm/r, ap=0.8mm
	Result of cutting	Hardstone : 23~30pcs/cutting edge Brand T:13-21pcs/cutting edge

Automobile Hub unit continuous turning in intermediate speed

	Workpiece	Automobile Hub unit steel 65Mn
	Machining way	Wet continuous/ intermittent semi-finish external turning
	Inserts	WNMG080408-GF WS8125
	Machining parameter	Vc=190m/min, f=0.2mm/r, ap=0.5~0.6mm
	Result of cutting	Hardstone : 63~87pcs/cutting edge Brand T:40-65pcs/cutting edge

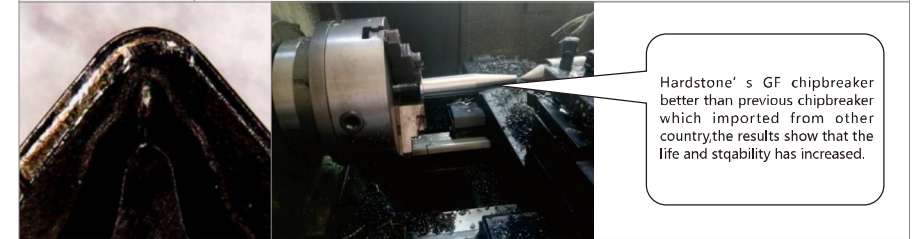
Cage steel continuous turning

	Workpiece	Cage steel 55#
	Machining way	Cage steel continuous semi-finishing and finishing external turning
	Inserts	TNMG160408-GF WS8115
	Machining parameter	Vc=320m/min, f=0.24~0.27mm/r, ap=0.5~1.5mm
	Result of cutting	Hardstone : 130pcs/cutting edge Brand T:120pcs/cutting edge


Hinge pin external and taper roughing turning

A1

Workpiece	42CrMo tempering to HRC38
Machining way	Continuous turning with emulsion for facing A and external turning
Inserts	WNMG080408-GF WS8115/WS8125
Machining parameter	Vc=125m/min, f=0.25mm/r, ap=1.0~2.5mm
Result of cutting	Hardstone : 134+pcs/cutting edge Brand L:76pcs/cutting edge




End facing of hinge pin roughing turning


	Workpiece	42CrMo tempering to HRC38
	Machining way	Turning with emulsion for facing turning
	Inserts	WNMG080408-GT WS8115
	Machining parameter	Vc=175m/min, f=0.2~0.25mm/r, ap=1.5~1.8mm
	Result of cutting	Hardstone : 152+pcs/cutting edge Brand O:70pcs/cutting edge

A1

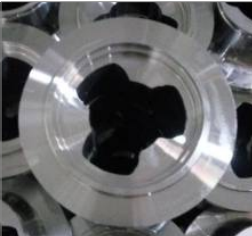
Bearing pedestal intermittent turning

	Workpiece	Automobile Hub bearing pedestal steel 65Mn
	Machining way	Wet continuous/ intermittent semi-finishing external turning
	Inserts	WNMG080408-GT WS8125
	Machining parameter	$V_c=230\text{m/min}$, $f=0.22\text{mm/r}$, $a_p=0.8\text{mm}$
	Result of cutting	Hardstone : 55~65pcs/cutting edge Brand T:50~60pcs/cutting edge

Bearing pedestal intermittent turning


	Workpiece	Automobile Hub bearing pedestal steel 55#
	Machining way	Wet continuous/ intermittent semi-finishing and finishing external turning
	Inserts	WNMG080408-GT WS8125
	Machining parameter	$V_c=259\text{m/min}$, $f=0.18\sim0.275\text{mm/r}$, $a_p=0.5\sim1\text{mm}$
	Result of cutting	Hardstone : 78pcs/cutting edge Brand D:40-50pcs/cutting edge

End facing of housing continuous roughing turning


	Workpiece	steel 55#
	Machining way	Wet intermittent turning
	Inserts	WNMG080408-GT WS8125
	Machining parameter	$V_c=209\text{m/min}$, $f=0.25\text{mm/r}$, $a_p=1.8\text{mm}$
	Result of cutting	Hardstone : 100~130pcs/cutting edge Brand T:110~140pcs/cutting edge

A1


Automobile Hub unit intermittent / continuous turning

	Workpiece	Automobile Hub unit steel 55#
	Machining way	Wet continuous/ intermittent semi-finish external turning
	Inserts	WNMG080408-MT WS8125
	Machining parameter	$V_c=220\sim300\text{m/min}$, $f=0.15\sim0.28\text{mm/r}$, $a_p=0.8\text{mm}$
	Result of cutting	Hardstone : 80~100pcs/cutting edge Brand T:70-90pcs/cutting edge

Flange intermittent / continuous turning in high speed


	Workpiece	Flange steel 55#
	Machining way	Wet journal shaft continuous/ intermittent finishing turning
	Inserts	VNMG160408-MT WS8115
	Machining parameter	$V_c=230\sim510\text{m/min}$, $f=0.167\text{mm/r}$, $a_p=0.45\text{mm}$
	Result of cutting	Hardstone : 20~21pcs/cutting edge Brand T:15-16pcs/cutting edge

Automobile Hub unit hole intermittent / continuous turning


	Workpiece	Automobile Hub unit steel 65Mn
	Machining way	Wet intermittent semi-finishing turning
	Inserts	VNMG160408-MT WS8115
	Machining parameter	$V_c=300\text{m/min}$, $f=0.24\text{mm/r}$, $a_p=0.5\text{mm}$
	Result of cutting	Hardstone : 160~180pcs/cutting edge Brand T:160~180pcs/cutting edge

Housing intermittent roughing turning


A1

	Workpiece	Steel Cf53
	Machining way	Wet journal shaft intermittent finishing turning
	Inserts	CNMG120408-MT WS8125
	Machining parameter	Vc=220m/min , f=0.2mm/r , ap=1.5mm
	Result of cutting	Hardstone : 40~50pcs/cutting edge Brand T:30~40pcs/cutting edge

Housing intermittent / continuous roughing turning


	Workpiece	Cf53
	Machining way	Wet continuous/ intermittent semi-finish external turning
	Inserts	DNMG150408-MT WS8125
	Machining parameter	Vc=286m/min , f=0.33mm/r , ap=0.2mm
	Result of cutting	Hardstone : 46~63pcs/cutting edge Brand T:40~50pcs/cutting edge

Bearing turning


	Workpiece	Bearing Gcr15
	Machining way	Wet rough turning with facing B and external turning
	Inserts	WNMG080408-MT WS8125
	Machining parameter	Vc=260m/min , f=0.32mm/r , ap=2mm
	Result of cutting	Hardstone : 130~150pcs/cutting edge Brand T:130~150pcs/cutting edge

Bearing turning


A1

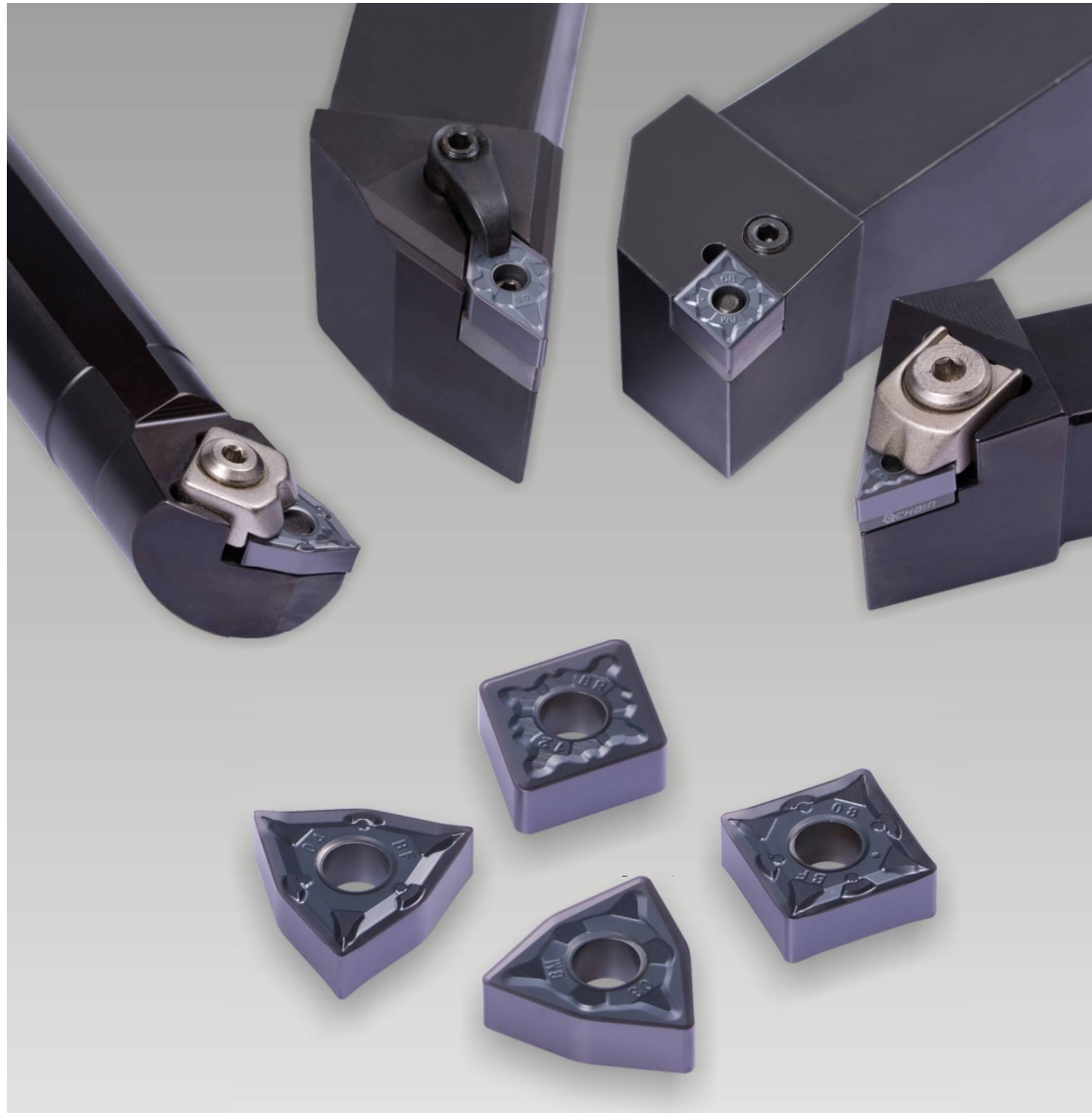
	Workpiece	Bearing Gcr15
	Machining way	Wet rough turning with facing A and chamfer turning
	Inserts	WNMG080408-MT WS8125
	Machining parameter	Vc=369m/min , f=0.31mm/r , ap=1mm
	Result of cutting	Hardstone : 65~72pcs/cutting edge Brand T:60~70pcs/cutting edge

Piston rod roughing turning

	Workpiece	27SiMn
	Machining way	Dry roughing turning
	Inserts	TNMG160408R-M WS8125
	Machining parameter	Vc=100m/min , f=0.4mm/r , ap=2.5mm
	Result of cutting	Hardstone : 50~60pcs/cutting edge Brand Z : its fail when machining cause vibration is too large.

Spherical shells hole turning

	Workpiece	Steel 45#
	Machining way	Wet continuous semi-finishing turning
	Inserts	CCMT09T308-TM WS8115
	Machining parameter	Vc=238m/min , f=0.14~0.26mm/r , ap=1mm
	Result of cutting	Hardstone : 882~908pcs/cutting edge Brand T:600~850pcs/cutting edge



Features of turning inserts machining stainless steel

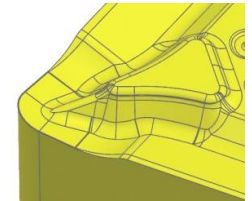
- The special design chipbreaker has excellent performance of stainless steel for rough machining, semi-finishing machining and finishing machining.
- BF-chipbreaker inserts are used for semi-finishing machining and finishing good surface. The specific chipbreaker solved the burr phenomenon on the parts surface.
- BM-chipbreaker inserts are the first choice for stainless steel common machining, the cutting tools with both sharpness and hardness, which suitable use to semi-finishing and rough turning.
- Well-solved the difficulty of the stainless steel hard chip breaking, sticking, surface hardening etc, thus obtain the high quality surface.
- Special chipbreaker can control the chipping direction, thus raises the production efficiency and reduce the built-up edge occur.
- There are different cutting edge designs for rough machining, semi-finishing machining and finishing machining. The inserts for finishing and semi-finishing are emphasize the sharpness of cutting edge. To optimize the cutting edge for rough machining inserts, well balanced the safety and sharpness, improved service efficiency of tool.

A1

Features of chip-breaker

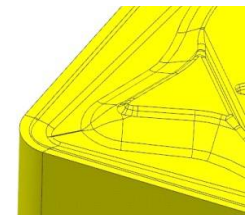
BF

- Chipbreaker for finishing machining and semi-finishing machining.
- The sharp cutting edge with smaller cutting resistance.
- It has good chipping processing power even machining small cutting depth.
- The special treatment for the cutting edge can reduce the production of built-up edge.



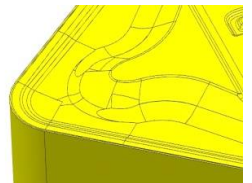
BM

- Chipbreaker for semi-finishing machining and rough machining.
- The combination of sharpness and hardness for cutting edge, which can achieved wider range of machining.
- Good chipping removal performance with lower cutting resistance.



BR

- Improved chip breaking lug boss.
- Well-proportioned cutting edge passivation
- The solid cutting edge is suitable for rough and intermittent turning.
- The large space for chipping can easy handle rough and high feed rates machining.

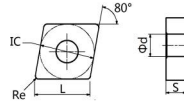


Series

For Stainless Steel

A1

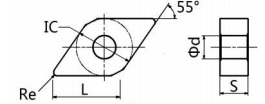
80° CN□□With Hole



Shape	Description	Specification(mm)					Grade														
		L	IC	S	Φd	Re	CVD Coating					PVD Coating					papijcc-un				
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK10		
	CNMG120404-BF	12.9	12.7	4.76	5.16	0.4															•
	CNMG120408-BF	12.9	12.7	4.76	5.16	0.8															•
	CNMG120404-BM	12.9	12.7	4.76	5.16	0.4															•
	CNMG120408-BM	12.9	12.7	4.76	5.16	0.8															•
	CNMG120412-BM	12.9	12.7	4.76	5.16	1.2															•
	CNMG120408-BR	12.9	12.7	4.76	5.16	0.8															•
	CNMG120412-BR	12.9	12.7	4.76	5.16	1.2															•
	CNMG190616-BR	19.3	19.05	6.35	7.94	1.6															•

For Stainless Steel

55° DN□□With Hole



A1

Shape	Description	Specification(mm)					Grade															
		L	IC	S	Φd	Re	CVD Coating					PVD Coating					papijcc-un					
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK10			
	DNMG150404-BF	15.5	12.7	4.76	5.16	0.4																•
	DNMG150408-BF	15.5	12.7	4.76	5.16	0.8																•
	DNMG150404-BM	15.5	12.7	4.76	5.16	0.4																•
	DNMG150408-BM	15.5	12.7	4.76	5.16	0.8																•
	DNMG150412-BM	15.5	12.7	4.76	5.16	1.2																•
	DNMG150604-BM	15.5	12.7	6.35	5.16	0.4																•
	DNMG150608-BM	15.5	12.7	6.35	5.16	0.8																•
	DNMG150612-BM	15.5	12.7	6.35	5.16	1.2																•

For Stainless Steel

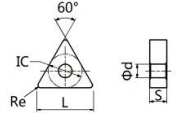
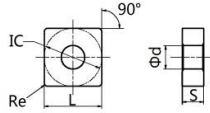
For Stainless Steel

A1

A1

90° SN□□With Hole

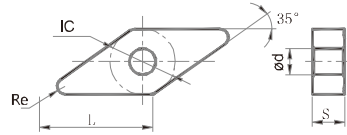
60° TN□□With Hole



Shape	Description	Specification(mm)					Grade															
		L	IC	S	Φd	Re	CVD Coating					PVD Coating					pepa-co-un					
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK10			
	SNMG120404-BF	12.7	12.7	4.76	5.16	0.4															•	
	SNMG120408-BF	12.7	12.7	4.76	5.16	0.8																•
	SNMG120404-BM	12.7	12.7	4.76	5.16	0.4																•
	SNMG120408-BM	12.7	12.7	4.76	5.16	0.8																•
	SNMG120412-BM	12.7	12.7	4.76	5.16	1.2																•
	SNMG120408-BR	12.7	12.7	4.76	5.16	0.8																•
	SNMG120412-BR	12.7	12.7	4.76	5.16	1.2																•

Shape	Description	Specification(mm)					Grade																
		L	IC	S	Φd	Re	CVD Coating					PVD Coating					pepa-co-un						
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK10				
	TNMG160404-BF	16.5	9.525	4.76	3.81	0.4																•	
	TNMG160408-BF	16.5	9.525	4.76	3.81	0.8																	•
	TNMG160404-BM	16.5	9.525	4.76	3.81	0.4																	•
	TNMG160408-BM	16.5	9.525	4.76	3.81	0.8																	•
	TNMG160412-BM	16.5	9.525	4.76	3.81	1.2																	•
	TNMG160408-BR	16.5	9.525	4.76	3.81	0.8																	•

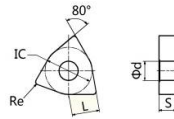
For Stainless Steel



35° VN□□With Hole

A1

Shape	Description	Specification(mm)					Grade															
		L	IC	S	Φd	Re	CVD Coating					PVD Coating					para-co-un					
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK10			
	VNMG160404-BF	16.6	9.525	4.76	3.81	0.4															●	
	VNMG160408-BF	16.6	9.525	4.76	3.81	0.8																●
	VNMG160404-BM	16.6	9.525	4.76	3.81	0.4																●
	VNMG160408-BM	16.6	9.525	4.76	3.81	0.8																●
	VNMG160412-BM	16.6	9.525	4.76	3.81	1.2																●

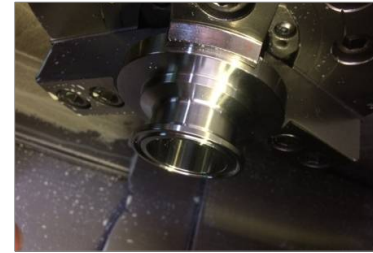


80° WN□□With Hole

Shape	Description	Specification(mm)					Grade																
		L	IC	S	Φd	Re	CVD Coating					PVD Coating					para-co-un						
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK10				
	WNMG080404-BF	8.7	12.7	4.76	5.16	0.4																●	
	WNMG080408-BF	8.7	12.7	4.76	5.16	0.8																	●
	WNMG06T312-BM	6.6	9.525	3.97	3.81	1.2																	●
	WNMG060412-BM	6.6	9.525	4.76	3.81	1.2																	●
	WNMG080404-BM	8.7	12.7	4.76	5.16	0.4																	●
	WNMG080408-BM	8.7	12.7	4.76	5.16	0.8																	●
	WNMG080412-BM	8.7	12.7	4.76	5.16	1.2																	●
	WNMG080408-BR	8.7	12.7	4.76	5.16	0.8																	●

Application Case

Flange finishing turning



Workpiece	Stainless steel SUS304
Machining way	Continuous external finishing turning
Inserts	WNMG080408-BF WS7125
Machining parameter	Vc=220m/min , f=0.14mm/r , ap=0.1mm (Ra≤0.8)
Result of cutting	Surface roughness: lower than Ra1.6 Hardstone, 242 pieces / cutting edge Brand C: 212 pieces /cutting edge

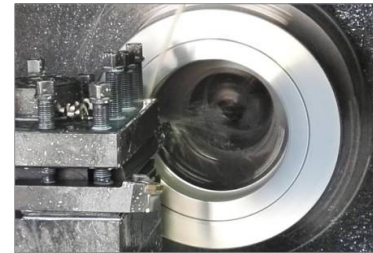
A1

Flange finishing turning



Workpiece	Stainless steel SUS304
Machining way	Continuous external finishing turning
Inserts	WNMG080408-BF WS7125
Machining parameter	Vc=210m/min , f=0.1mm/r , ap=0.1mm (Ra≤0.8)
Result of cutting	Surface roughness: lower than Ra1.6 Hardstone, 740 pieces / cutting edge Brand Z: 450 pieces /cutting edge

Flange roughing turning

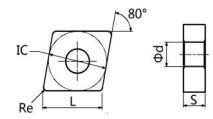




Workpiece	Stainless steel SUS201
Machining way	The continuous turning for end face and excircle
Inserts	WNMG080408-BM WS7125
Machining parameter	Vc=273m/min , f=0.3mm/r , ap=1.0mm
Result of cutting	Hardstone:37~42pcs/cutting edge Brand M:38~42pcs/cutting edge

Series

For cast iron

80° CN□□With Hole



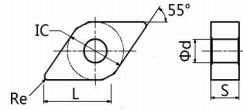
Shape	Description	Specification(mm)					Grade												
		L	IC	S	φd	Re	CVD Coating			PVD Coating						perforated			
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130		WS6130	WS7125	WSK10
	CNMG120404	12.9	12.7	4.76	5.16	0.4				•									
	CNMG120408	12.9	12.7	4.76	5.16	0.8				•									
	CNMG120412	12.9	12.7	4.76	5.16	1.2				•									
	CNMG120416	12.9	12.7	4.76	5.16	1.6				•									
	CNMG160608	16.1	15.875	6.35	6.35	0.8				•									
	CNMG160612	16.1	15.875	6.35	6.35	1.2				•									
	CNMG160616	16.1	15.875	6.35	6.35	1.6				•									
	CNMG190612	19.3	19.05	6.35	7.94	1.2				•									
CNMG190616	19.3	19.05	6.35	7.94	1.6				•										
	CNMA120404	12.9	12.7	4.76	5.16	0.4				•									
	CNMA120408	12.9	12.7	4.76	5.16	0.8				•									
	CNMA120412	12.9	12.7	4.76	5.16	1.2				•									
	CNMA160608	16.1	15.875	6.35	6.35	0.8				•									
	CNMA160612	16.1	15.875	6.35	6.35	1.2				•									
	CNMA160616	16.1	15.875	6.35	6.35	1.6				•									
	CNMA190612	19.3	19.05	6.35	7.94	1.2				•									
	CNMA190616	19.3	19.05	6.35	7.94	1.6				•									

Note : • Standing inventory

A1

For cast iron

55° DN□□With Hole



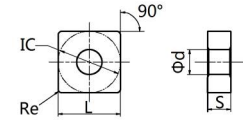
A1

Shape	Description	Specification(mm)					Grade																		
		L	IC	S	φd	Re	CVD Coating					PVD Coating					piece-un								
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK10						
	DNMG150404	15.5	12.7	4.76	5.16	0.4				•															
	DNMG150408	15.5	12.7	4.76	5.16	0.8				•															
	DNMG150412	15.5	12.7	4.76	5.16	1.2				•															
	DNMG150604	15.5	12.7	6.35	5.16	0.4				•															
	DNMG150608	15.5	12.7	6.35	5.16	0.8				•															
	DNMG150612	15.5	12.7	6.35	5.16	1.2				•															
	DNMA150404	15.5	12.7	4.76	5.16	0.4				•															
	DNMA150408	15.5	12.7	4.76	5.16	0.8				•															
	DNMA150412	15.5	12.7	4.76	5.16	1.2				•															
	DNMA150604	15.5	12.7	6.35	5.16	0.4				•															

Note : • Standing inventory

For cast iron

90° SN□□With Hole



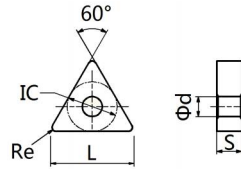
A1

Shape	Description	Specification(mm)					Grade																			
		L	IC	S	φd	Re	CVD Coating					PVD Coating					piece-un									
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK10							
	SNMG120404	12.7	12.7	4.76	5.16	0.4				•																
	SNMG120408	12.7	12.7	4.76	5.16	0.8				•																
	SNMG120412	12.7	12.7	4.76	5.16	1.2				•																
	SNMG150608	15.875	15.875	6.35	6.35	0.8				•																
	SNMG150612	15.875	15.875	6.35	6.35	1.2				•																
	SNMG150616	15.875	15.875	6.35	6.35	1.6				•																
	SNMA190612	19.05	19.05	6.35	7.94	1.2				•																
	SNMA190616	19.05	19.05	6.35	7.94	1.6				•																
	SNMA120404	12.7	12.7	4.76	5.16	0.4				•																
	SNMA120408	12.7	12.7	4.76	5.16	0.8				•																
	SNMA120412	12.7	12.7	4.76	5.16	1.2				•																
	SNMA150608	15.875	15.875	6.35	6.35	0.8				•																

Note : • Standing inventory

For cast iron

60° TN□□With Hole



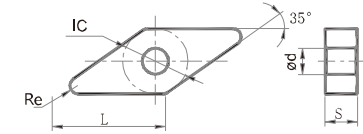
A1

Shape	Description	Specification(mm)					Grade												
		L	IC	S	φd	Re	CVD Coating					PVD Coating					piece/un		
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK10
	TNMG160404	16.5	9.525	4.76	3.81	0.4				●									
	TNMG160408	16.5	9.525	4.76	3.81	0.8				●									
	TNMG160412	16.5	9.525	4.76	3.81	1.2				●									
	TNMG220412	22.0	12.7	4.76	5.16	1.2				●									
	TNMG220416	22.0	12.7	4.76	5.16	1.6				●									
	TNMA160404	16.5	9.525	4.76	3.81	0.4				●									
	TNMA160408	16.5	9.525	4.76	3.81	0.8				●									
	TNMA160412	16.5	9.525	4.76	3.81	1.2				●									
	TNMA220408	22.0	12.7	4.76	5.16	0.8				●									
	TNMA220412	22.0	12.7	4.76	5.16	1.2				●									

Note : ● Standing inventory

For cast iron

35° VN□□With Hole



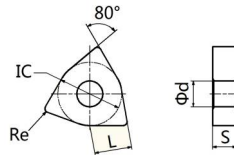
A1

Shape	Description	Specification(mm)					Grade												
		L	IC	S	φd	Re	CVD Coating					PVD Coating					piece/un		
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK10
	VNMG160404	16.6	9.525	4.76	3.81	0.4				●									
	VNMG160408	16.6	9.525	4.76	3.81	0.8				●									
	VNMA160404	16.6	9.525	4.76	3.81	0.4				●									
	VNMA160408	16.6	9.525	4.76	3.81	0.8				●									

Note : ● Standing inventory

For cast iron

80° WN□□With Hole



A1

Shape	Description	Specification(mm)					Grade												
		L	IC	S	Φd	Re	CVD Coating					PVD Coating					piece-in		
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK10
	WNMG080404	8.7	12.7	4.76	5.16	0.4				•									
	WNMG080408	8.7	12.7	4.76	5.16	0.8				•									
	WNMG080412	8.7	12.7	4.76	5.16	1.2				•									
	WNMA080404	8.7	12.7	4.76	5.16	0.4				•									
	WNMA080408	8.7	12.7	4.76	5.16	0.8				•									
	WNMA080412	8.7	12.7	4.76	5.16	1.2				•									

Note : • Standing inventory



Application Case

Air cylinder



Workpiece	HT250
Machining way	External and end face rough turning
Inserts	WNMG080412 WS6115
Machining parameter	Vc=415m/min, f=0.15mm/r, ap=0.4mm
Result of cutting	Hardstone : 60~70 pieces/cutting edge Brand M : 60~70 pieces/cutting edge

A1

Flange



Workpiece	D138 Flange HT250
Machining way	Dry continuous/intermittent rough turning external and end face
Inserts	WNMG080408 WS6115
Machining parameter	Vc=563m/min, f=0.25mm/r, ap=1mm
Result of cutting	Hardstone : 70~80pieces/cutting edge Brand M : 70~80 pieces/cutting edge

Crankshaft



Workpiece	Crankshaft Qt550
Machining way	Continuous rough turning
Inserts	WNMG080408 WS6115
Machining parameter	Vc=190m/min, f=0.4mm/r, ap=1mm
Result of cutting	Hardstone : 96~102 pieces/cutting edge Brand A : 99~102 pieces/cutting edge

External and facing lathe machining for belt pulley

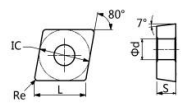


Workpiece	Ht200
Machining way	continuous cutting external and face with dry-type
Inserts	CNMG12408 WS6115
Machining parameter	Vc=438m/min, f=0.3mm/r, ap=1.2mm
Result of cutting	Hardstone : 130~140 pieces/cutting edge Brand A:130~140pieces/cutting edge



Series

80° CC□□With Hole



Shape	Description	Specification(mm)					Grade											
		L	IC	S	Φd	Re	CVD Coating				PVD Coating					un-coated		
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130		WS8130	WS7125
	CCMT060204-MP	6.4	6.35	2.38	2.8	0.4		●										●
	CCMT09T302-MP	9.7	9.525	3.97	4.4	0.2		●										●
	CCMT09T304-MP	9.7	9.525	3.97	4.4	0.4		●										●
	CCMT09T308-MP	9.7	9.525	3.97	4.4	0.8		●										●
	CCMT120404-MP	12.9	12.7	4.76	5.56	0.4		●										●
	CCMT120408-MP	12.9	12.7	4.76	5.56	0.8		●										●
	CCMT060204-TM	6.4	6.35	2.38	2.8	0.4		●										●
	CCMT060208-TM	6.4	6.35	2.38	2.8	0.8		●										●
	CCMT09T304-TM	9.7	9.525	3.97	4.4	0.4		●										●
	CCMT09T308-TM	9.7	9.525	3.97	4.4	0.8		●										●
	CCMT120404-TM	12.9	12.7	4.76	5.56	0.4		●										●
	CCMT120408-TM	12.9	12.7	4.76	5.56	0.8		●										●
	CCMT120412-TM	12.9	12.7	4.76	5.56	1.2		●										●

A2

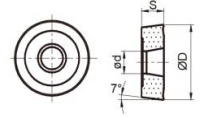
55° DC□□With Hole



Shape	Description	Specification(mm)					Grade																
		L	IC	S	Φd	Re	CVD Coating					PVD Coating					page□□-un						
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK110				
	DCMT070204-MP	7.8	6.35	2.38	2.8	0.4				●													
	DCMT11T304-MP	11.6	9.525	3.97	4.4	0.4				●													
	DCMT11T308-MP	11.6	9.525	3.97	4.4	0.8				●													
	DCMT070204-TM	7.8	6.35	2.38	2.8	0.4				●													
	DCMT070208-TM	7.8	6.35	2.38	2.8	0.8				●													
	DCMT11T304-TM	11.6	9.525	3.97	4.4	0.4				●													
	DCMT11T308-TM	11.6	9.525	3.97	4.4	0.8				●													
	DCMT11T312-TM	11.6	9.525	3.97	4.4	1.2				●													

Note : ● Standing inventory ○ Make-to-order

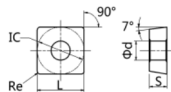
RC□□With Hole



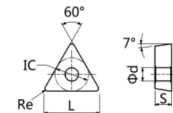
Shape	Description	Specification(mm)					Grade																
		L	IC	S	Φd	ΦD	CVD Coating					PVD Coating					page□□-un						
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK110				
	RCMX1003MO				3.18	3.6	10	○	●														
	RCMX1204MO				4.76	4.4	12	○	●														
	RCMX1606MO				6.35	5.5	16	●	○														
	RCMX2006MO				6.35	6.5	20	●	○														
	RCMX2507MO				7.94	7.2	25	●	○														
	RCMX3209MO				9.525	9.5	32	●	○														

Note : ● Standing inventory ○ Make-to-order



90° SC□□With Hole



60° TC□□With Hole





A2

Shape	Description	Specification(mm)					Grade														
		L	IC	S	φd	Re	CVD Coating					PVD Coating					Un-coated				
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK10		
	SCMT09T304-MP	9.525	9.525	3.97	4.4	0.4			●												●
	SCMT09T308-MP	9.525	9.525	3.97	4.4	0.8			●												●
	SCMT09T304-TM	9.525	9.525	3.97	4.4	0.4			●												
	SCMT09T308-TM	9.525	9.525	3.97	4.4	0.8			●												
	SCMT120404-TM	12.7	12.7	4.76	5.56	0.4			●												
	SCMT120408-TM	12.7	12.7	4.76	5.56	0.8			●												
	SCMT120412-TM	12.7	12.7	4.76	5.56	1.2			●												

Note : ● Standing inventory

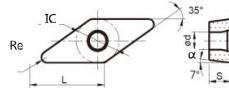
A2

Shape	Description	Specification(mm)					Grade															
		L	IC	S	φd	Re	CVD Coating					PVD Coating					Un-coated					
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK10			
	TCMT16T304-MP	16.5	9.525	3.97	4.4	0.4			●													●
	TCMT16T308-MP	16.5	9.525	3.97	4.4	0.8			●													●
	TCMT110204-TM	11	6.35	2.38	2.8	0.4			●													
	TCMT110208-TM	11	6.35	2.38	2.8	0.8			●													
	TCMT16T304-TM	16.5	9.525	4.76	4.4	0.4			●													
	TCMT16T308-TM	16.5	9.525	4.76	4.4	0.8			●													
	TCMT16T312-TM	16.5	9.525	4.76	4.4	1.2			●													

Note : ● Standing inventory

A Positive Inserts

60° V□□□With Hole



A2

Shape	Description	Specification(mm)						Grade												
		L	IC	S	Φd	Re	α	CVD Coating					PVD Coating					piece/pc-un		
								WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK10
	VBMT110304-TM	11.1	6.35	3.18	2.8	0.4	5				●									
	VBMT110308-TM	11.1	6.35	3.18	2.8	0.8	5				●									
	VBMT160404-TM	16.6	9.525	4.76	3.81	0.4	5				●									
	VBMT160408-TM	16.6	9.525	4.76	3.81	0.8	5				●									
	VBMT160412-TM	16.6	9.525	4.76	3.81	1.2	5				●									
	VCMT110304-TM	11.1	6.35	3.18	2.8	0.4	7				●									
	VCMT110308-TM	11.1	6.35	3.18	2.8	0.8	7				●									
	VCMT160404-TM	16.6	9.525	4.76	3.81	0.4	7				●									
	VCMT160408-TM	16.6	9.525	4.76	3.81	0.8	7				●									
	VCMT160412-TM	16.6	9.525	4.76	3.81	1.2	7				●									

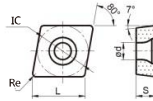
Note : ● Standing inventory



Series

For Aluminum

80° CC□□With Hole



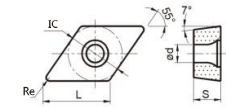
Shape	Description	Specification(mm)					Grade															
		L	IC	S	Φd	Re	CVD Coating					PVD Coating					un-coated					
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK10			
	CCGT060202-AK	6.4	6.35	2.38	2.80	0.2															●	
	CCGT060204-AK	6.4	6.35	2.38	2.80	0.4																●
	CCGT09T304-AK	9.7	9.525	3.97	4.40	0.4																●
	CCGT09T308-AK	9.7	9.525	3.97	4.40	0.8																●
	CCGT120404-AK	12.9	12.7	4.76	5.56	0.4																●
	CCGT120408-AK	12.9	12.7	4.76	5.56	0.8																●

Note : ● Standing inventory

A3

For Aluminum

55° DC□□With Hole



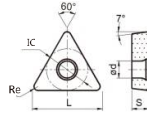
Shape	Description	Specification(mm)					Grade																
		L	IC	S	Φd	Re	CVD Coating					PVD Coating					un-coated						
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK10				
	DCGT070202-AK	7.8	6.35	2.38	2.80	0.2																●	
	DCGT070204-AK	7.8	6.35	2.38	2.80	0.4																	●
	DCGT11T302-AK	11.6	9.525	3.97	4.40	0.2																	●
	DCGT11T304-AK	11.6	9.525	3.97	4.40	0.4																	●

Note : ● Standing inventory

A3

For Aluminum

60° TC□□With Hole



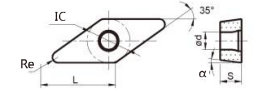
Shape	Description	Specification(mm)					Grade																				
		L	IC	S	φd	Re	CVD Coating					PVD Coating					un-coated										
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK10								
	TCGT090204-AK	9.7	5.56	2.38	2.80	0.4																				●	
	TCGT110204-AK	11.0	6.35	2.38	2.80	0.4																					●
	TCGT16T304-AK	16.5	9.525	3.97	4.40	0.4																					●

Note : ● Standing inventory

A3

For Aluminum

35° VC□□With Hole



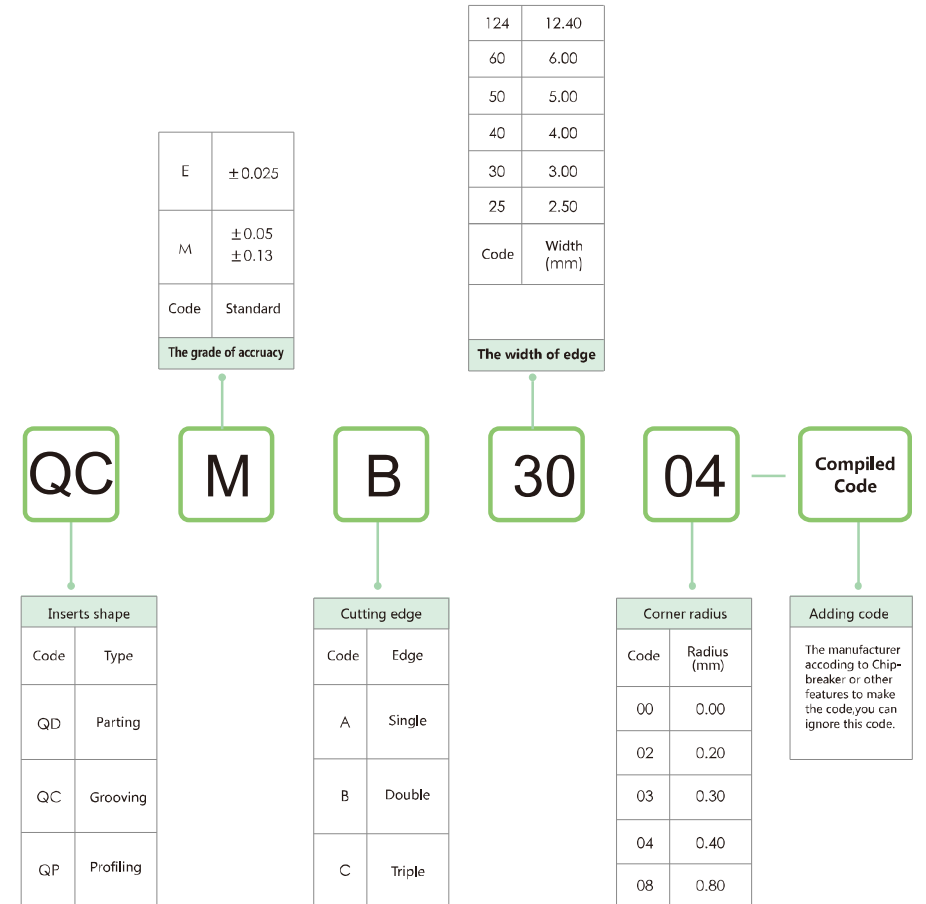
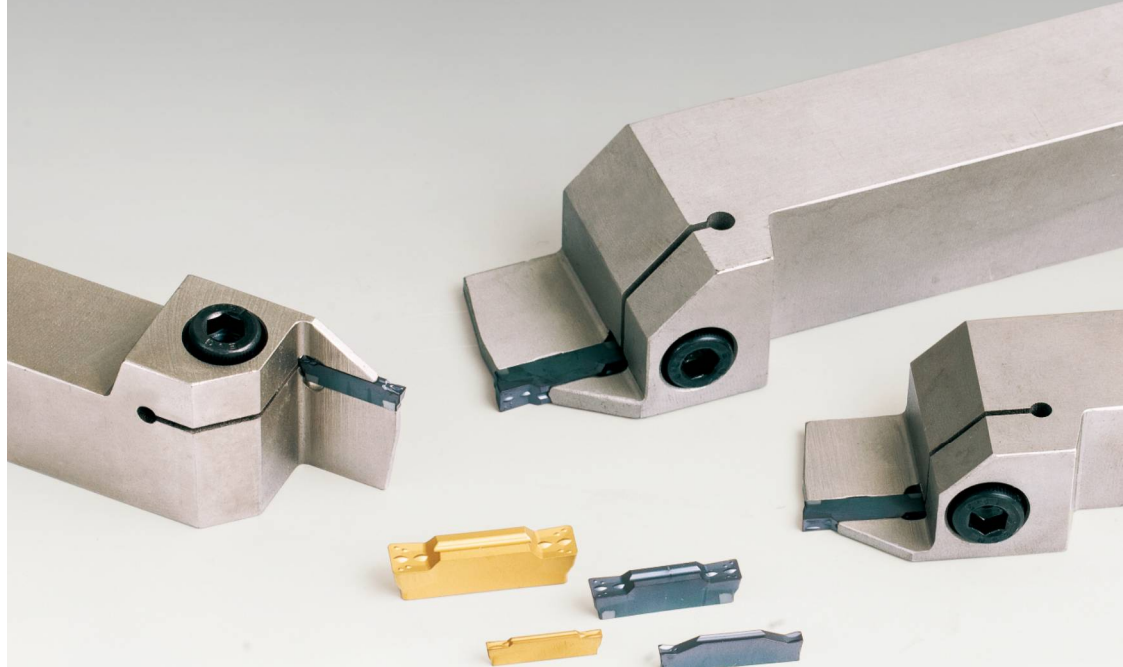
Shape	Description	Specification(mm)							Grade																		
		L	IC	S	φd	Re	α	CVD Coating					PVD Coating					un-coated									
								WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK10							
	VCGT110302-AK	11.0	6.35	3.18	2.80	0.2	7																				●
	VCGT110304-AK	11.0	6.35	3.18	2.80	0.4	7																				●
	VCGT160402-AK	16.5	9.525	4.76	4.40	0.2	7																				●
	VCGT160404-AK	16.5	9.525	4.76	4.40	0.4	7																				●
	VCGT160408-AK	16.5	9.525	4.76	4.40	0.8	7																				●
	VBGT160402-AK	16.5	9.525	4.76	4.40	0.2	5																				●
	VBGT160404-AK	16.5	9.525	4.76	4.40	0.4	5																				●
	VBGT160408-AK	16.5	9.525	4.76	4.40	0.8	5																				●

Note : ● Standing inventory

A3



The Explanation of Grooving and Parting



Features of grooving inserts

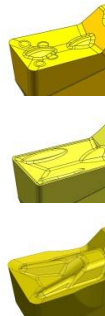
- A type of general machining cutting insert with multifunction which can be used for grooving and turning.
- Improved 3D chipbreaker achieved effective control of grooving. Maximum decrease the cutting resistance and machining vibration.
- High toughness cutting edge reduce the chipping possibility of cutting nose at unstable machining conditions. Suitable for interrupted cut and vibration machining.
- The combination of wear-resistance and toughness that improved the service life and machining reliability.

Features of chip-breaker

Chip-breaker M: Satisfied cutting, grooving, turning and other processing needs, the cutting process becomes light, chip more smooth, to achieve the ideal processing surface quality.

Chip-breaker G: mainly used for cutting applications. Special chip-breaker design makes cutting narrow and improves cutting flow control.

Chip-breaker T: The special back face structure reduces the cutting resistance by 20% , reducing noise and shakes, improving the quality of face. The special cutting edge design makes the chip breaking effect better , it can machining by transverse section.



Processing method

Cylindrical cutter machining	Cylindrical grooving machining
Face grooving machining	Internal grooving machining


Series



For Grooving and Parting

Shape	Description	Specification(mm)					Grade													
		L	S	T	Re	a	CVD Coating				PVD Coating				paipao-Jr					
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131		WS7130	WS8130	WS7125	WSK10	
	QCMB2002-M	16	2.0	3.50	0.2	8°	●												●	
	QCMB2502-M	18.5	2.5	3.90	0.2	8°	●												●	
	QCMB3004-M	21	3.0	4.76	0.4	8°	●												●	
	QCMB4004-M	21	4.0	4.76	0.4	8°	●												●	
	QCMB5008-M	26	5.0	5.80	0.8	8°	●												●	
	QCMB15015-G	16	1.5	3.50	0.15	8.5°	●												●	
	QCMB2002-G	16	2.0	3.5	0.2	7.5°	●												●	
	QCMB2502-G	18.5	2.5	3.85	0.2	8.5°	●												●	
	QCMB3003-G	21	3.0	4.8	0.3	7.5°	●												●	
	QCMB2002-T	16	2.0	3.55	0.2	7.5°	●												●	
	QCMB3004-T	21	3.0	4.86	0.4	7.5°	●												●	
	QCMB4004-T	21	4.0	4.86	0.4	7.5°	●												●	
	QCMB2002	16	2.0	3.55	0.2	7.5°													●	
	QCMB3004	21	3.0	4.86	0.4	7.5°													●	
	QCMB4004	21	4.0	4.86	0.4	7.5°													●	
	QCMB5008	26	5.0	5.80	0.8	7.5°													●	



Shape	Description	Specification(mm)					Grade										
		L	S	T	Re	a	CVD Coating					PVD Coating					perico-Jr
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130	
		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	QPMB2010-M	16	2.0	3.5	1.0	7°	●										●
	QPMB3015-M	21	3.0	4.8	1.5	7°	●										●
	QPMB4020-M	21	4.0	4.8	2.0	7°	●										●
	QPMB5025-M	26	5.0	5.8	2.5	7°	●										●

A4



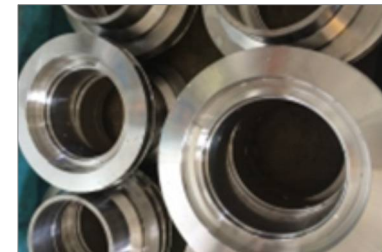
Application Case

Grooving seal groove end face



Workpiece	stainless steel SUS304
Machining way	Continuous turning end face
Inserts	QCMB3004-T WS7125
Machining parameter	Vc=130m/min , f=0.05mm/r
Result of cutting	Hardstone: 1300 pieces/cutting edge Brand C : 1100 pieces/cutting edge

Grooving flange end face



Workpiece	Stainless steel SUS304
Machining way	Continuous turning end face
Inserts	QCMB4004-M WS7125
Machining parameter	Vc=147.2m/min , f=0.04mm/r
Result of cutting	Hardstone: 352 pieces/cutting edge Brand M : 218 pieces/cutting edge

A4

Grooving end turning



Workpiece	Casting stainless steel
Machining way	Continuous grooving, external turning
Inserts	QCMB3004-M WS7125
Machining parameter	Vc=120m/min , f=0.1mm/r
Result of cutting	Hardstone : 11 pieces/cutting edge Brand C : 10 pieces/cutting edge

Threading Inserts



22	φ 12.70
16	φ 9.525
Code	Diameter of IC
Insert size(Inch)	

16

L	Left
R	Right
Code	Direction
Cutting direction	

E

R

150

ISO

A5

Cutting types	
Code	Types
E	External threading inserts
I	Internal threading inserts

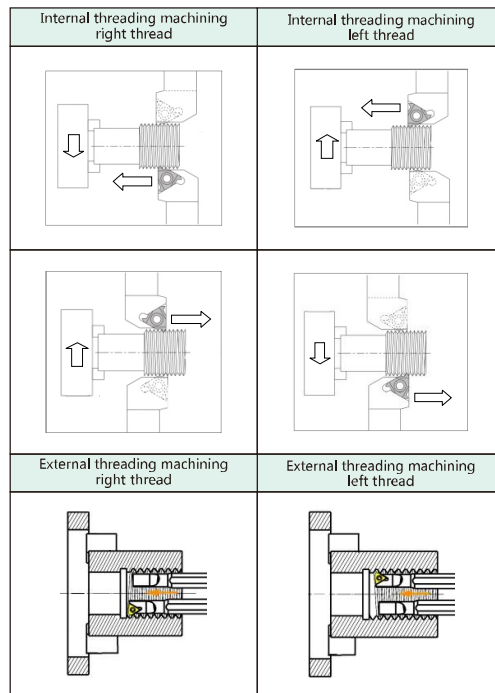
Thread pitch		
Full profile		
mm	TPI	
0.35-9.0	72-2	
V profile		
	mm	TPI
A	0.5-1.5	48-16
AG	0.5-3.0	48-8
G	1.75-3.0	14-8
N	3.5-5.0	7-5
Q	5.5-6.0	41/2-4

Profile	
Code	Types
ISO	ISO metric 60°thread
UN	Unified thread
W	Whitworth thread
BSPT	British standard taper piper thread
NPT	American standard taper piper thread

Features of threading inserts

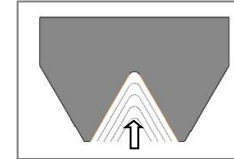
- Pressed by high precision mould which ensure the high accuracy of tooth profiles and excellent quality of cutting edge.
- Strict measurement control which narrow the size difference between inserts and keep the consistency.
- Special process technique for cutting edge makes small circular nose treatment more professional and reasonable.
- The insert with chip breaker improves the capacity of iron processing, possessing the excellent processing stability.
- WSS125, the specially developed for threading inserts, ensuring effectively resistance of plastic deformation and abrasion in machining.

Processing mode of thread cutting inserts



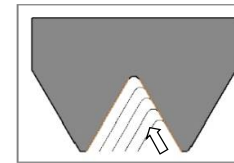
Feed mode of thread cutting inserts

Radial in-feed



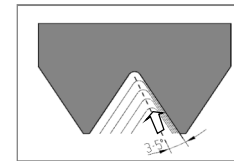
- Radial machining, the most common way of machining.
- The cutting edge is relative sharp with good toughness material, suitable for fine pitch thread cutting and meet the small cut deep machining requirement.
- Due to different workpiece being processed, the V-type chip is difficult to control in machining.
- The longer the interface of cutting chips on left and right side, the heavier the cutting load produced. Thus more easier cause the vibration.

Flank in-feed



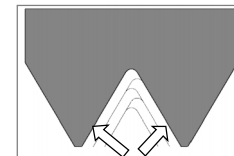
- With more cutting depth, the cutting edge bear less pressure. Thus provide a stable working condition, recommended for coarse pitch thread cutting.
- Flank in-feed is conducive to chip discharging.
- The right side cutting edge is easy to wear, so it is easier to discharge in the same direction.

Improved flank in-feed



- The improved method of flank in-feed from the side along the cutting tooth.
- The consistency chip removal direction provides an easy way for discharging.
- Reduce the abrasion of right side flank, recommended for double-edged thread machining.
- The right side cutting edge also involved in a certain cutting depth, completely eradicate the phenomenon of zero cutting depth. More stable in cutting machining.

Alternation flank in-feed



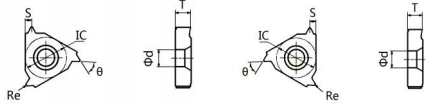
- Alternation use of cutting edge which well distribute the wear for left and right side' s flank, extending the tool' s life.
- Chips are flowing from both of right and left, good chips removal.
- Recommended for coarse pitch thread cutting.

Series

For threading



55° Whitworth thread



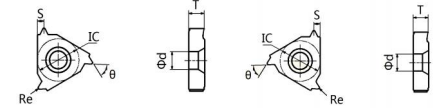
Shape	Description	Thread pitch	Specification(mm)						Grade																						
			IC	S	T	Re	Φd	θ	CVD Coating					PVD Coating					un-peeled												
									WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK10										
	16ER11W	11	9.525	1.5	3.52	0.3	4	55																							
	16ER14W	14	9.525	1.2	3.52	0.23	4	55																							
	16ER19W	19	9.525	1.0	3.52	0.17	4	55																							
	16IR11W	11	9.525	1.5	3.52	0.3	4	55																							
	16IR14W	14	9.525	1.2	3.52	0.23	4	55																							
	16IR19W	19	9.525	1.0	3.52	0.17	4	55																							

A5

For threading



60° ISO metric thread



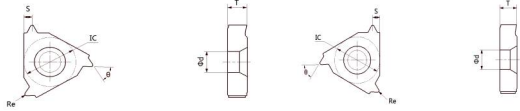
Shape	Description	Thread pitch	Specification(mm)						Grade																						
			IC	S	T	Re	Φd	θ	CVD Coating					PVD Coating					un-peeled												
									WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK10										
	16ER150ISO	1.5	9.525	1.0	3.52	0.2	4	60																							
	16ER200ISO	2.0	9.525	1.3	3.52	0.26	4	60																							
	16ER250ISO	2.5	9.525	1.5	3.52	0.33	4	60																							
	16ER300ISO	3.0	9.525	1.6	3.52	0.44	4	60																							
	16IR150ISO	1.5	9.525	1.0	3.52	0.1	4	60																							
	16IR200ISO	2.0	9.525	1.3	3.52	0.13	4	60																							
	16IR250ISO	2.5	9.525	1.5	3.52	0.17	4	60																							
	16IR300ISO	3.0	9.525	1.5	3.52	0.22	4	60																							

A5

Series

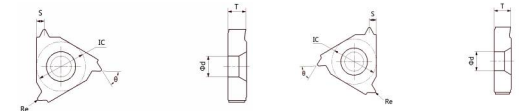


General pitch thread



Shape	Description	Thread pitch	Specification(mm)						Grade															
			IC	S	T	Re	Φd	θ	CVD Coating					PVD Coating					perforo-un					
									WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK10			
	16ERAG55	0.5-3.0	9.525	1.7	3.52	0.06	4	55																
	16ERAG60	0.5-3.0	9.525	1.7	3.52	0.07	4	60																
	16IRAG55	0.5-3.0	9.525	1.7	3.52	0.06	4	55																
	16IRAG60	0.5-3.0	9.525	1.7	3.52	0.076	4	60																

British standard taper piper thread



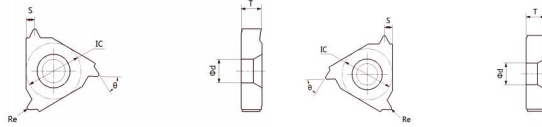
Shape	Description	Thread pitch	Specification(mm)						Grade															
			IC	S	T	Re	Φd	θ	CVD Coating					PVD Coating					perforo-un					
									WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK10			
	16ER11BSPT	11	9.525	1.5	3.52	0.32	4	55																
	16ER14BSPT	14	9.525	1.2	3.52	0.23	4	55																
	16ER19BSPT	19	9.525	0.9	3.52	0.19	4	55																
	16IR11BSPT	11	9.525	1.5	3.52	0.32	4	55																
	16IR14BSPT	14	9.525	1.2	3.52	0.23	4	55																
	16IR19BSPT	19	9.525	0.9	3.52	0.19	4	55																

A5

A5



American standard taper pipe thread



Shape	Description	Thread pitch	Specification(mm)						Grade																
			IC	S	T	Re	Ød	θ	CVD Coating				PVD Coating				perfect-cut								
									WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131		WS7130	WS8130	WS7125	WSK10				
	16ER115NPT	11.5	9.525	1.5	3.52	0.08	4	60																	•
	16ER14NPT	14	9.525	1.2	3.52	0.07	4	60																	•
	16ER18NPT	18	9.525	1	3.52	0.06	4	60																	•
	16IR115NPT	11.5	9.525	1.5	3.52	0.08	4	60																	•
	16IR14NPT	14	9.525	1.2	3.52	0.07	4	60																	•
	16IR18NPT	18	9.525	1	3.52	0.06	4	60																	•

A5

Application cases

Valve rod internal thread turning


	Workpiece	Stainless steel SUS 304
	Machining way	Internal thread turning M20
	Inserts	16IR14W WS5125
	Machining parameter	Vc=75m/min, 走刀次数=12次
	Result of cutting	Hardstone : 460 pieces/cutting edge Brand Z : 390 pieces/cutting edge

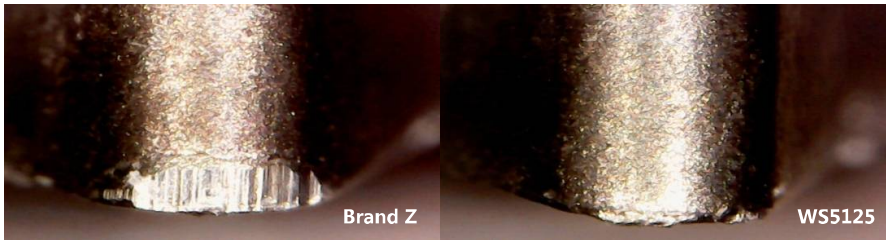
Valve body internal thread turning

	Workpiece	Stainless steel 201
	Machining way	Internal thread turning M56
	Inserts	16IR11W WS5125
	Machining parameter	Vc=120m/min, 走刀次数=16次
	Result of cutting	Hardstone : 120 pieces/cutting edge Brand Z : 96 pieces/cutting edge

A5

Pipe joint internal thread turning

	Workpiece	Stainless steel SUS201
	Machining way	Internal thread turning
	Inserts	16JR11W WS5125
	Machining parameter	Vc=93.3m/min, Cutting times: 17 times
	Result of cutting	Comparison result of cutting 50 pcs parts: Hardstone: slight wear Brand Z: severe wear



Application Case Comparison No.1

Workpiece material : Stainless steel 201 Cutter bar :

SNR2525K16

Inserts type : 16JR11W

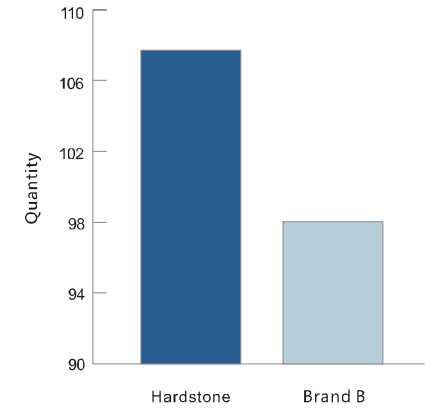
Cutting parameters

n = 600r/min , cutting times:16 times, Vc=103m/min

Result of cutting

Hardstone A continuous machining 108 pieces , normal wear

Brand B continuous machining 98 pieces , slight chipping.



Valve deck internal thread turning

A5

Workpiece	Stainless steel 201
Machining way	Internal thread turning M45
Inserts	16JR11W WS5125
Machining parameter	Vc=98.9m/min , cutting times:16 times,
Result of cutting	Comparison result of cutting 70 pcs parts: Hardstone : slight wear Brand Z: severe wear



Application Case Comparison No.2

Workpiece material : Stainless steel 304 Cutter bar :

SNR2020K16

Inserts type : 16JR14W

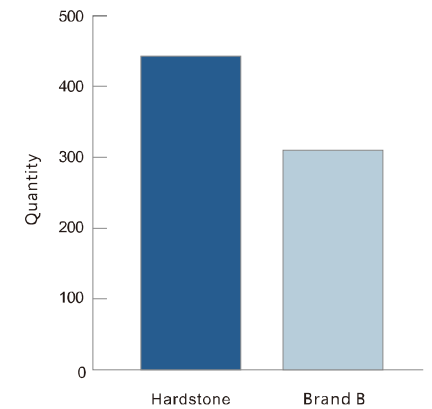
Cutting parameters

n = 900r/min , cutting times:11 times, Vc=85m/min

Result of cutting

Hardstone A continuous machining 440 pieces , normal wear

Brand B continuous machining 310 pieces , severe wear



A5



B

Milling Insert

- ◆ The Explanation Of Grade..... B-03 — 04

B1 General Milling Insert

- ◆ The Explanation Of Specification... B1-01 — 02
- ◆ Overview B1-03
- ◆ Feature B1-04
- ◆ Series B1-05 — 19
- ◆ Application Case..... B1-20 — 25
































B2 Heavy Milling Insert

- ◆ The Explanation Of Specification... B2-02 — 03
- ◆ Overview B2-04
- ◆ Series B2-05 — 22
- ◆ Application Case..... B2-23










The Explanation Of Grade

Grade	Coating Structure			Application	ISO	Wear Resistance ←—————→ Toughness															
	Coating Way	Coating Color	Pictures			Component	Range	01	05	10	15	20	25	30	35	40	45				
WS5130	PVD	Gray Black		AlTiN	Thin	It is suitable for the general milling of steel, stainless steel, cast iron and other materials, especially in the range of steel HRC30-50.	P20~P35 M20~M35 K20~K35														
WS7130	PVD	Gray		AlCrN	Thin	It is the firstly grade of stainless steel for milling. With different chipbreaker types, it can meet the requirements of roughing and finishing milling of all kinds of stainless steel and titanium alloys, and has good stability and safety.	P35~P45 M35~M45														
WS7140	CVD	gold-yellow		TiN+MT-TiCN+Al2O3+TiN	Thick-	It is a medium and low speed of heavy milling for stainless steel and steel.	P35~P45 M35~M45														
WS8130	PVD	Gray Black		AlTiN	Thin	It is a general machining for heavy milling of steel.	P25~P35 M25~M35														
WS5131	PVD	gold-yellow		AlTiN+TiN	Thin																









The Explanation Of Specification



 A	 B	 C	B	With	Without		N	Without	Without	
 D	 E	 H	H	With	Single-Side		R	Without	Single-Side	
 K	 L	 M	C	With	Without		F	Without	Double-Side	
 O	 P	 R	J	With	Double-Side		A	With	Without	
 S	 T	 T	W	With	Without		M	With	Single-Side	
 V	 W	Others	T	With	Single-Side		G	With	Double-Side	
			Q	With	Without		X	---	---	Special
			U	With	Double-Side					
Inserts Shape			Chip-breaker and Clamping system							
Code	Hole	Chip-breaker	Section	Plane of insert	Code	Hole	Chip-breaker	Section	Plane of insert	

A P M T



Clearance angle of main cutting edge				Tolerance (mm)			
Code	Clearance angle	Code	Clearance angle				
A		B					
C		D					
E		F					
G		N					
P		O	Others				





Code	Nose height Tolerance (m)	Inscribed circle of I.C. Tolerance	Thickness Tolerance (s)	◆ (Reference)Details of M-level tolerance(Identified by shape) ◆ Nose height tolerance(mm)						
				Inscribed circle	Regular triangle	Square	Rhombus with 80°	Rhombus with 55°	Rhombus with 35°	Round
A	±0.005	±0.025	±0.025	6.35	±0.08	±0.08	±0.08	±0.11	±0.16	---
F	±0.005	±0.013	±0.025	9.525	±0.08	±0.08	±0.08	±0.11	±0.16	---
C	±0.013	±0.025	±0.025	12.7	±0.13	±0.13	±0.13	±0.15	---	---
H	±0.013	±0.013	±0.025	15.875	±0.15	±0.15	±0.15	±0.18	---	---
E	±0.025	±0.025	±0.025	19.05	±0.15	±0.15	±0.15	±0.18	---	---
G	±0.025	±0.025	±0.13	25.4	---	±0.18	---	---	---	---
J	±0.005	±0.05±0.13	±0.025	◆ Inscribed circle ø I.C. Tolerance						
K	±0.013	±0.05±0.13	±0.025	Inscribed circle	Regular triangle	Square	Rhombus with 80°	Rhombus with 55°	Rhombus with 35°	Round
L	±0.025	±0.05±0.13	±0.025	6.35	±0.05	±0.05	±0.05	±0.05	±0.05	---
M	±0.08±0.18	±0.05±0.13	±0.13	9.525	±0.05	±0.05	±0.05	±0.05	±0.05	±0.05
N	±0.08±0.18	±0.05±0.13	±0.025	12.7	±0.08	±0.08	±0.08	±0.08	---	±0.08
U	±0.13±0.38	±0.08±0.25	±0.13	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

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			16	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	19	16	16	06	16				
8.00			08									
6.35	06	07	06			11	11					
6.00			06									
5.56			05			09						
5.50			05									
3.97						06						
Diameter of IC(mm)	Inserts shape											
												
Length of Cutting Edge												

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
Code	Thickness(mm)
	
Inserts Thickness	

16 05 PD E R - FM

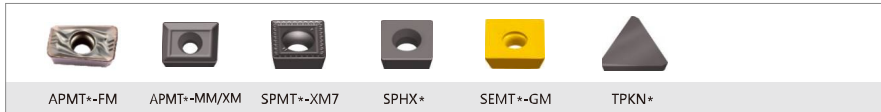
Wiper	
	
A 45°	A 3°
D 60°	B 5°
E 75°	C 7°
F 85°	D 15°
P 90°	E 20°
Z Others	F 25°
	G 30°
	N 0°
	P 11°
	Z 其它

Chamfering			
			
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	Q
	4-25°	4-0.30	
	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

● Inserts for square shoulder milling



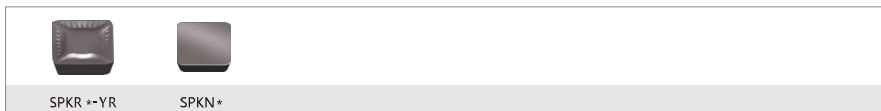
● Inserts for face milling 45°



● Inserts for profile milling



● Inserts for face milling 75°



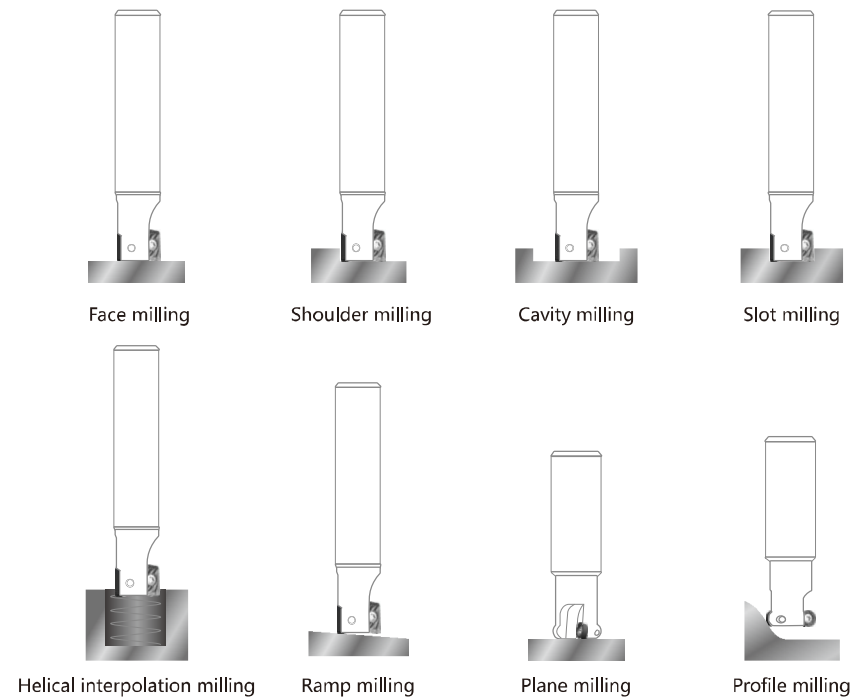
● Inserts for high feed milling



Milling inserts' Features

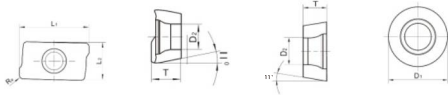
- Design with double clearance angle and special treatment on its cutting edge and tool nose. High dimensional accuracy, fine and smooth surface.
- Using fine cemented carbide substrate with unique process and excellent coating, which achieved the combination of hardness, toughness and higher red hardness.
- According to the different hardness of mould workpiece, evaluate the service life of cutting tools accurately. In this way, automatic and unmanned processing is realized and raises the production efficiency.
- Suitable for processing of face milling, shoulder milling, cavity milling, ramp machining, profile milling, etc.
- Well solved the difficulty of tools selection and replacement, thus reducing tools inventory costs.
- Versatility, good stability, long service life, high cost-effective, machining, profile milling, etc.

Schematic diagram of cutting processes



Series

For mould milling

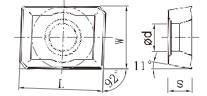


Shape	Description	Specification(mm)						Grade														
		L1	L2	Re	D2	T	D1	CVD Coating					PVD Coating					paleo-un				
								WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK10		
	APMT1135PDER-FM	11.3	6.25	0.8	2.8	3.5																
	APMT1604PDER-FM	17.25	9.22	0.8	4.4	4.76																
	APMT1605PDER-FM	17.42	9.33	0.8	4.5	5.22																
	RCKT10T3MO-FM				4.4	3.97	10															
	RCKT1204MO-FM				4.4	4.76	12															
	RCKT1606MO-FM				5.5	6.35	16															
	RCKT2006MO-FM				6.55	6.35	20															
	RDMW10T3MO-FM				4.5	3.97	10															
	RDMW1204MO-FM				5.5	4.76	12															
	RDMW1605MO-FM				5.5	5.56	16															
	RPMT08T2M0-FM				3.5	2.78	8															
	RPMT10T3MO-FM				4.5	3.97	10															
	RPMT1003MO-FM				4.5	3.18	10															
	RPMT1204MO-FM				4.5	4.76	12															
	RPMW1003MO-FM				4.5	3.18	10															

B1

Insert for helical milling with end tooth

AP□□ Serie

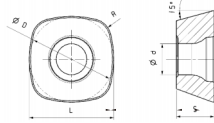




Shape	Description	Specification(mm)				Grade																	
		L	W	S	Φd	CVD Coating					PVD Coating					paleo-un							
						WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131	WS7130	WS8130		WS7125	WSK10					
	APMT150412-MM	16.33	12.7	4.76	5.4																		
	APMT150412-XM7	16.33	12.7	4.76	5.4																		
	APHX1504	16.33	12.7	4.76	5.4																		

B1

Series

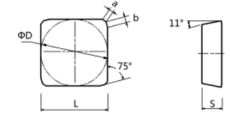
Insert for roughing feed
SD□□ Serie




Shape	Description	Specification(mm)					Grade															
		L	ΦD	S	Φd	R	CVD Coating					PVD Coating					un-coated					
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131	WS7130	WS8130		WS7125	WSK10			
	SDMW1205ZTN	12.7	12.7	5.56	4.6	3						•										
	SDMW1505ZTN	15.875	15.875	5.56	5.5	0.8						•										
	SDMT1205ZTN-FM	12.7	12.7	5.56	4.6	3						•										
	SDMT1505ZTN-FM	15.875	15.875	5.56	5.5	0.8						•										

B1

SP□□ Serie

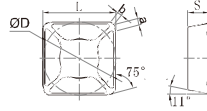


Shape	Description	Specification(mm)						Grade														
		L	ΦD	S	a	b	CVD Coating					PVD Coating					un-coated					
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131	WS7130	WS8130		WS7125	WSK10			
	SPKN1504EDFR	15.875	15.875	4.76	1.4	1.0						•										
	SPKN1504EDFL	15.875	15.875	4.76	1.4	1.0						•										
	SPKN1504EDS32R	15.875	15.875	4.76	R1.6	1.2						•										
	SPKN1504EDS32L	15.875	15.875	4.76	1.2	R1.6						•										

B1

B General Milling Insert

SP□□ Serie

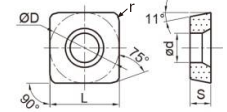


Shape	Description	Specification(mm)					Grade												
		L	ΦD	S	a	b	CVD Coating					PVD Coating					un-coated		
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131	WS7130	WS8130		WS7125	WSK10
	SPKR1504EDR-YR	15.875	15.875	4.76	1.0	1.4						•							
	SPKR1504EDL-YR	15.875	15.875	4.76	1.0	1.4						•							

B1

General Milling Insert B

Insert for helical milling with peripheral tooth
SP□□ Serie

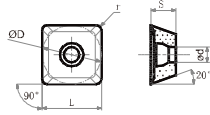


Shape	Description	Specification(mm)					Grade												
		L	ΦD	S	Φd	r	CVD Coating					PVD Coating					un-coated		
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131	WS7130	WS8130		WS7125	WSK10
	SPMT120408-MM	12.7	12.7	4.76	5.5	0.8						•							
	SPMT120408-XM7	12.7	12.7	4.76	5.5	0.8						•							
	SPHX120408	12.7	12.7	4.76	5.5	0.8						•							

B1

B General Milling Insert

SE□□ Serie



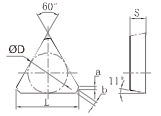
Shape	Description	Specification(mm)					Grade																			
		L	ΦD	S	Φd	r	CVD Coating					PVD Coating					un-coated									
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5123	WS5130	WS7125	WS5131	WS7130		WS8130	WS7125	WSK10						
	SEEN1203AZS30N	12.7	12.7	3.18	1.5																					
	SEEN1504AFT31N	15.875	15.875	4.76	2.35																					
	SEMT1204AFTN-FM	12.7	12.7	4.76	5.5	0.8																				
	SEMT13T3AGTN-FM	13.4	13.4	3.97	4.1	1.5																				
	SEMT09T3PER-GM	9.525	9.525	4.0	3.4	0.8																				
	SEMT1203PER-GM	13.3	13.3	4.05	4.1	0.8																				

B1

General Milling Insert



TP□□ Serie

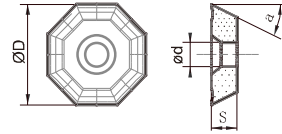


Shape	Description	Specification(mm)					Grade																			
		L	ΦD	S	a	b	CVD Coating					PVD Coating					un-coated									
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131	WS7130	WS8130		WS7125	WSK10							
	TPKN1603PDQ21R	16.5	9.525	3.18	1.2	R0.8																				
	TPKN1603PDQ21L	16.5	9.525	3.18	1.2	R0.8																				
	TPKN2204PDQ32R	22.0	12.7	4.76	1.4	R0.8																				
	TPKN2204PDQ32L	22.0	12.7	4.76	1.4	R0.8																				

B1

B General Milling Insert

O□□□ Serie

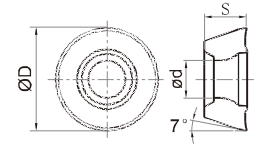


Shape	Description	Specification(mm)				Grade																
		ΦD	Φd	S	α	CVD Coating					PVD Coating					un-coated						
						WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131	WS7130	WS8130		WS7125	WSK10				
	OFKR0704-XM	17.94		4.76	26°																	
	ODMW040408ADS23	12.8	4.8	4.76	15°																	
	ODKT0605ADN	15.875	5.5	5.56	15°																	

B1

General Milling Insert B

RC□□ Serie

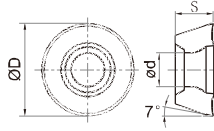



Shape	Description	Specification(mm)			Grade																
		ΦD	S	Φd	CVD Coating					PVD Coating					un-coated						
					WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131	WS7130	WS8130		WS7125	WSK10				
	RCKT10T3MO-XM	10.0	3.97	4.4																	
	RCKT1204MO-XM	12.0	4.76	4.0																	
	RCKT2006MO-XM	20.0	6.35	6.55																	
	RCKT1606MOT23-SG	16.0	6.35	5.56																	

B1

B General Milling Insert

RP□□ Serie

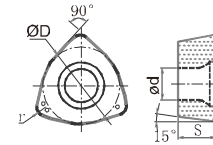



Shape	Description	Specification(mm)			Grade														
		ΦD	S	Φd	CVD Coating					PVD Coating					un-coated				
					WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131	WS7130	WS8130		WS7125	WSK10		
	RPHX10T3MO-D57	10.0	3.97	4.4															
	RPHT1204MO-D57	12.0	4.76	4.4															

B1

General Milling Insert B

WD□□ Serie

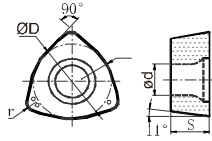



Shape	Description	Specification(mm)				Grade													
		ΦD	S	Φd	r	CVD Coating					PVD Coating					un-coated			
						WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131	WS7130	WS8130		WS7125	WSK10	
	WDMW080520ZTR	13.0	5.5	5.0	2.0														
	WDMT080520ZTR-GM	13.0	5.5	5.0	2.0														

B1

B General Milling Insert

WP□□ Serise



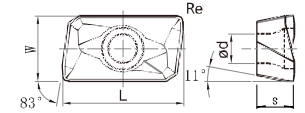
Shape	Description	Specification(mm)				Grade											
		ΦD	S	Φd	r	CVD Coating					PVD Coating					un-coated	
						WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131	WS7130	WS8130		WS7125
	WPMT080615ZSR	12.85	6.35	5.5	1.5						•						




B1

General Milling Insert B

Milling inserts for Aluminium

AP□□With Hole

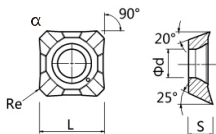


Shape	Description	Specification(mm)					Grade										
		L	W	S	Φd	Re	CVD Coating					PVD Coating					un-coated
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130	
	APGT1135PDFR-G2	11.25	6.20	3.50	2.80	0.8											•
	APGT1604PDFR-G2	17.25	9.25	4.76	4.40	0.8											•
	APKT1604PDFR-MA	16.17	9.525	4.76	4.40	0.2											•
	APKT1604PDFR-MA3	17	9.525	5	4.40	0.8											•

B1

Milling inserts for Aluminium

90° SE□□ With Hole



Shape	Description	Specification(mm)					Grade													
		L	IC	S	Phi d	alpha	CVD Coating					PVD Coating					para-to-un			
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK10	
	SEHT1204AFFN-X83	12.70	12.70	4.76	5.56	1.6														●

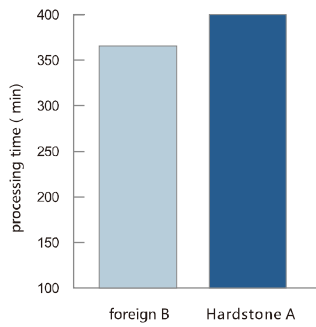
B1

Brief introduction of main workpiece materials

- C45W commonly known as 45 # steel, Hong Kong named it ace steel. Hardness is range from HB170 to HB220. Has widely application, and the price is relatively cheap.
- Germany's 40CrMnMo7 is used as pre-hardened plastic mould steel, hardness range from HRC28 to HRC40. Its advantage is higher hardness than medium carbon steel and more stable on deformation.
- US grade P20 belongs to plastic mould steel, Called 3Cr2Mo in China. This grade steel has uniform hardness range from HRC30 to HRC42, with good polishing and light etching performance, which suitable for large and medium-sized precision moulds matching with large die-set. This steel has good machine ability and widely used in plastic moulds.
- Pre-hardened plastic mould steel NAK80, delivery hardness from HRC37 to HRC43. Has a good polish and carve ability, good discharge performance, and commonly used in mirror polishing mould.
- 4Cr5MoSiV1, American-standard is H13. Before the heat treatment, hardness range from HRC15 to HRC 20, has excellent high-temperature strength, wear resistance, toughness and other comprehensive mechanical properties. Good harden ability, small thermal deformation, and easy for processing, which is suitable for larger size, complex shape mould. Widely used in aluminum, zinc die-casting mould applications.
- The varieties of 7185, 738H, 745H, Nak5, etc. have just accounted for about 15% to 20% in mould applications. The processing of these kinds is more difficult to machining than 45 # steel which mainly for the mould core and cavity.

Application Case Comparison No.1

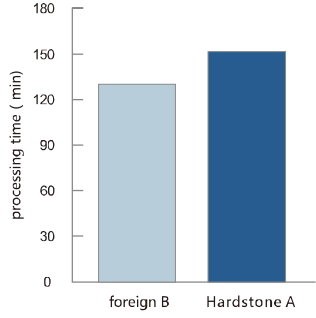
Workpiece material : steel 45#
 Material hardness : HB200 Holder : phi63x6t
 Inserts type : APMT1605PDER-FM
 Cutting parameters
 S=800rpm f=4800mmpm ap=0.5mm ae=45mm
 Result of cutting
 Hardstone A processing for 400mins, normal wear without breakage. Foreign B processing for 370mins, slight chipping.



B1

Application Case Comparison No.2

Workpiece material : P20
 Material hardness : HRC30
 Holder : phi20x2t
 Inserts type : APMT1135PDER-FM
 Cutting parameters
 S=2200rpm F=2500mmpm ap=0.27mm
 Result of cutting
 Hardstone A processing for 150mins, normal wear on flank and rake surface. Foreign B processing for 130mins, cutting edge slight chipping.



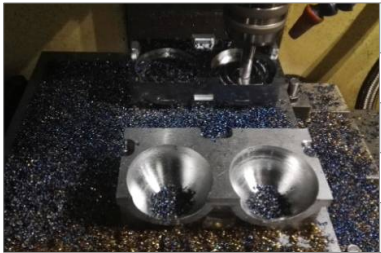
Application Cases

45# steel cavity milling



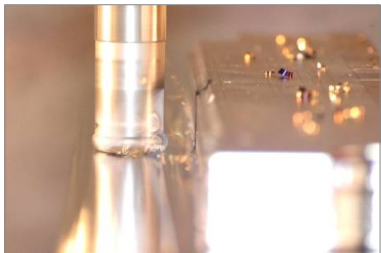
Workpiece	Steel 45#
Machining way	D50-Z4-L125 overhang BT40 dry rough cavity milling
Inserts	RPMT1003MO-FM WS5130
Machining parameter	Vc=180m/min , fz=0.8mm/z , ap=0.4mm ae=32mm
Result of cutting	Hardstone : 240min/cutting edge,normal wear. Foreign brand M : 210min/cutting edge,slight chipping.

718H rough milling



Workpiece	Plastic bulbs female mould pre-hardened steel 718H (HRC38~42)
Machining way	D17-Z2-L65 overhang BT40 dry rough milling ball socket
Inserts	APMT1135PDER-FM WS5130
Machining parameter	Vc=160m/min , fz=0.8mm/z , ap=0.25mm ae=10mm
Result of cutting	Hardstone : 91min/cutting edge,normal wear , Foreign brand D : 80min/cutting edge,normal wear.

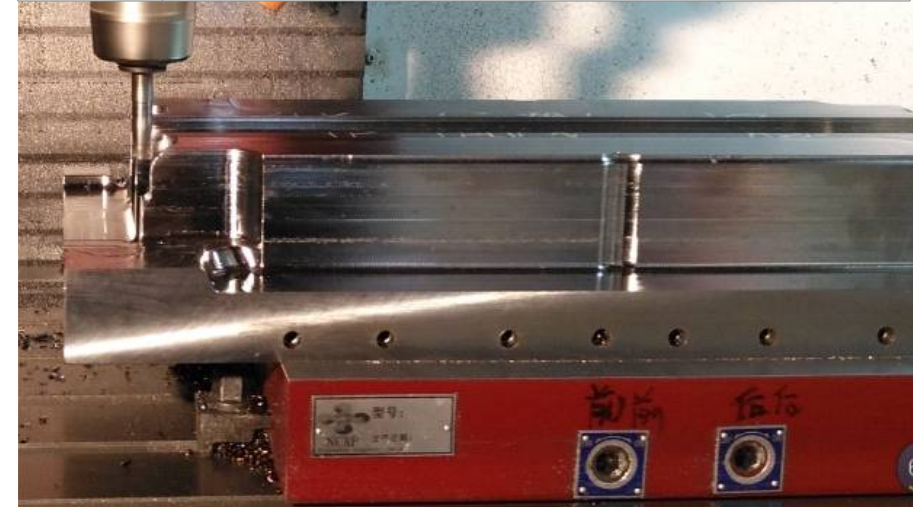
738H Rough Milling



Workpiece	738H rough milling
Machining way	D35-Z3-L80 overhang BT40 rough milling
Inserts	RPMT1003MO-FM WS5130
Machining parameter	Vc=165m/min , fz=0.67mm/z , ap=0.3mm ae=22mm
Result of cutting	Handstone : 164 min/cutting edge, normal wear Brand D : 95 min/cutting edge, normal wear

738H clean-up machining

Workpiece	pre-hardened steel 718H (HRC38~42)
Machining way	D16-Z2-L65 overhang BT40 dry clean-up machining
Inserts	APMT1135PDER-FM WS5130
Machining parameter	Vc=150m/min , fz=0.4mm/z , ap=0.25mm ae=10mm
Result of cutting	Hardstone : 240+min/cutting edge with normal wear.



NAK80 Rough Milling



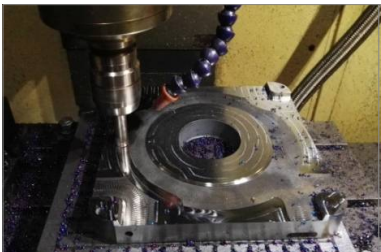
Workpiece	High polished pre-hardened steel NAK80 (HRC38~42)
Machining way	D16-Z2-L60 overhang BT40 dry rough face milling
Inserts	APMT1135PDER-FM WS5130
Machining parameter	Vc=125m/min , fz=0.4mm/z , ap=0.25mm ae=12mm
Result of cutting	Hardstone : 46min/cutting edge,normal wear , Foreign brand D : 38min/cutting edge,normal wear.

H13 Aluminium Extrusion Mould



Workpiece	Aluminium Extrusion Mould H13
Machining way	D16-Z2-L104 overhang BT40 dry rough milling hole
Inserts	APMT1135PDER-FM WS5130
Machining parameter	Vc=177m/min , fz=0.55mm/z , ap=0.28mm ae=16mm
Result of cutting	Hardstone : 50min/cutting edge,normal wear, Foreign brand D : 48min/cutting edge,normal wear.

H13 Hardened Steel Die-casting Mould



Workpiece	Die-casting Mould H13 Hardened Steel (HRC48~51)
Machining way	D21-Z2-L60 overhang BT40 dry rough face milling
Inserts	APMT1135PDER-FM WS5130
Machining parameter	Vc=148m/min , fz=0.44mm/z , ap=0.2mm ae=13mm
Result of cutting	Hardstone : 17min/cutting edge,abrasion and chipping , Foreignbrand D : 11min/cutting edge,heavily worn.

S136 Corrosion-resistant Mould Steel Rough Milling

Workpiece	S136 corrosion-resistant mould steel
Machining way	D17-Z2-L70 overhang BT40 dry rough face milling
Inserts	APMT1135PDER-FM WS5130
Machining parameter	Vc=160m/min , fz=0.6mm/z , ap=0.25mm ae=10mm
Result of cutting	Hardstone : 287min/cutting edge,normal wear.



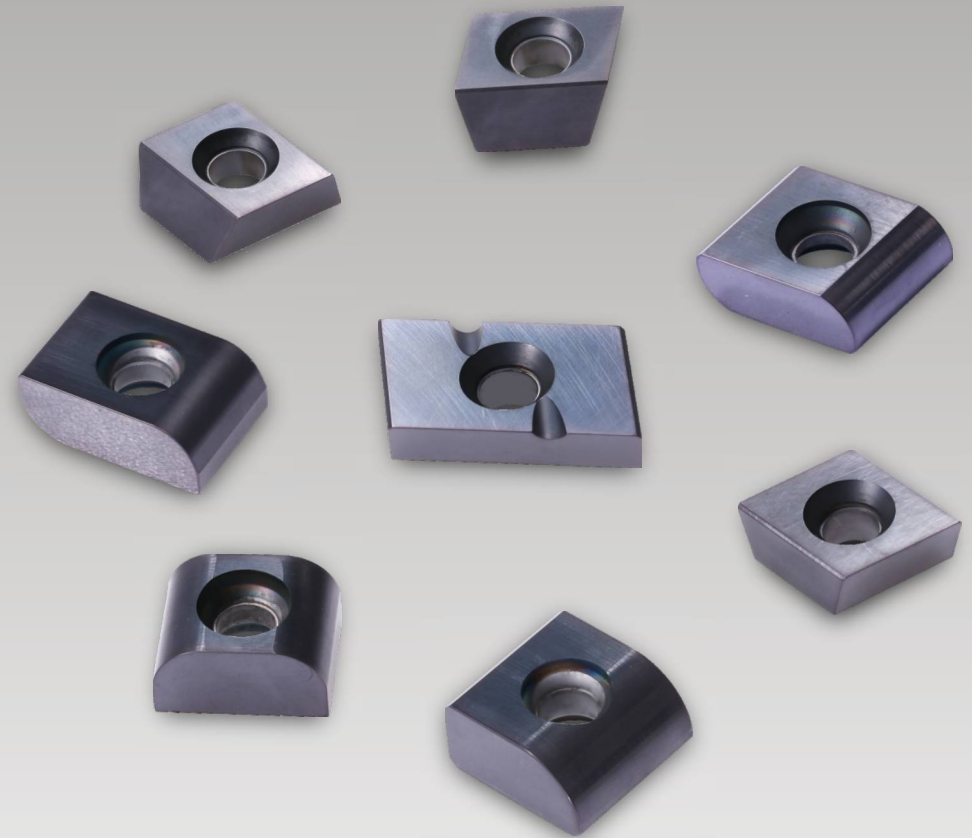
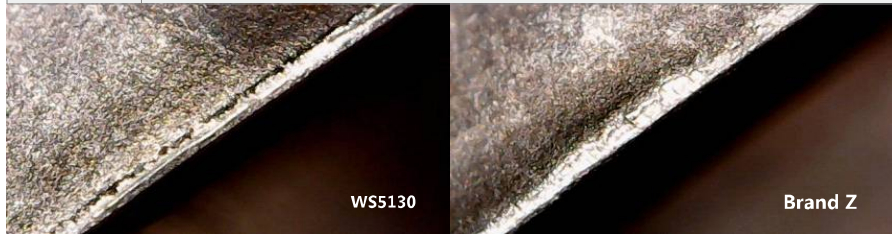
B General Milling Insert

S136 Hardened Steel Rough Milling

Workpiece	S136 Hardened Steel Mould (HRC48)	
Machining way	D17-Z2-L65 Overhang BT40 dry Rough Milling	
Inserts	APMT1135PDER-FM WS5130	
Machining parameter	Vc=128m/min , fz=0.38mm/z , ap=0.2mm ae=0.5~10mm	
Result of cutting	Hradstone : 74Min/Cutting Edge,normal Wear.	

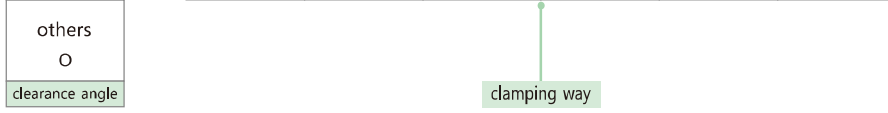
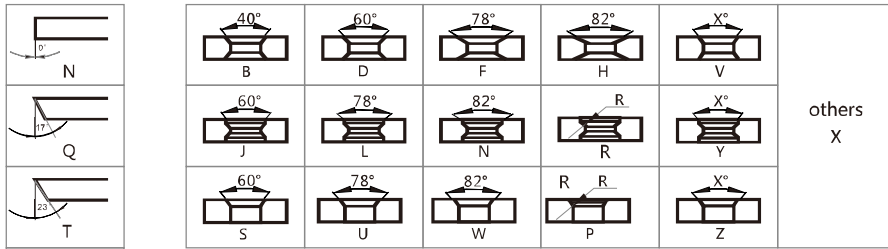
Cr12 Punch Mould Hole-Milling

Workpiece	Cr12 Punch Mould
Machining way	D30-Z2-L75 Overhang BT40 Dry Rough Hole-Milling
Inserts	RPMT1003MO-FM WS5130
Machining parameter	Vc=170m/min , fz=0.89mm/z , ap=0.3mm
Result of cutting	Comparison under 58min/cutting edge,WS5130 slight chipping , While foreign brand D heavily worn



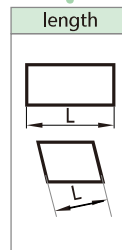
B1

The Explanation Of Specification

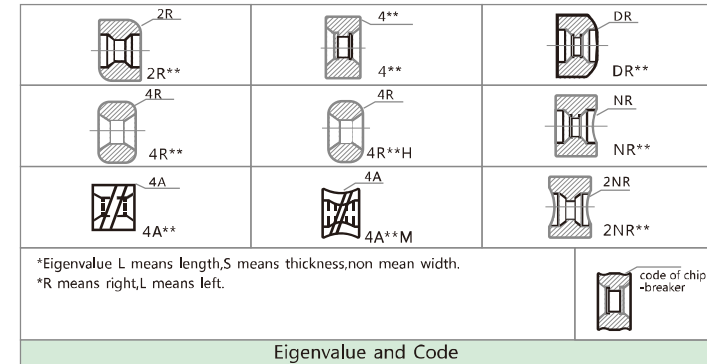


shape
C
F
G
L
S
X
others Z

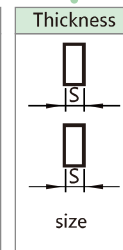
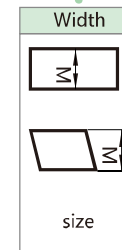
Precision
C Grade : ± 0.013 ± 0.025
E Grade : ± 0.025
R Grade : Workblank



The code of Length,Width,Thickness												
Code	03	03A	04	05	05A	05B	06	06A	06B	06C	06D	06E
Size	3.80	3.97	4.76	5.00	5.95	5.80	6.35	6.00	6.94	6.84	6.55	6.70
Code	07	07A	07B	07C	07D	07E	07F	07G	08	08A	09	09A
Size	7.94	7.04	7.15	7.24	7.35	7.60	7.50	7.82	8.50	8.00	9.52	
Code	09B	10	11	11A	11B	11C	12	12A	12B	12C	13	13A
Size	9.43	10.00	11.50	11.11	11.90	11.00	12.70	12.00	12.40	12.80	13.50	13.00
Code	13B	13C	14	14A	14B	14C	15	15A	15B	15C	15D	15E
Size	13.85	13.75	14.29	14.20	14.50	14.05	15.87	15.00	15.10	15.28	15.50	15.78
Code	15F	15G	16	16A	16B	16C	17	17A	18	18A	18B	19
Size	15.68	15.40	16.30	16.00	16.50	16.78	17.50	17.00	18.47	18.00	18.35	19.05
Code	20	22	22A	23	25	26	28					
Size	20.00	22.80	20.00	23.99	25.00	26.50	28.57					



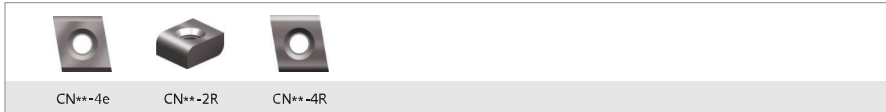
Eigenvalue and Code



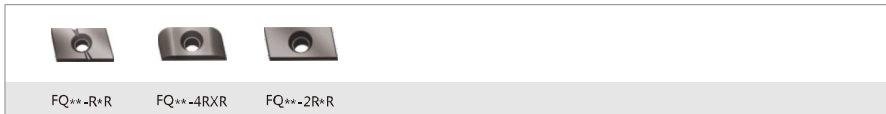
Chamfering of edge	
0-5°	0-0.100
1-10°	1-0.151
2-15°	2-0.202
3-20°	3-0.253
4-25°	4-0.304
5-30°	5-0.355
Non	6-0.406
	7-0.457

Overview

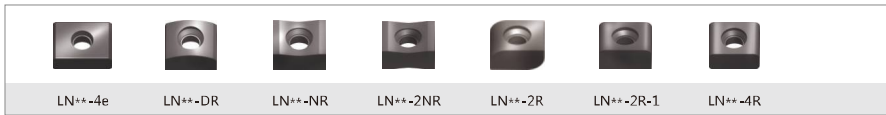
● C ***-Serie



● F ***-Serie



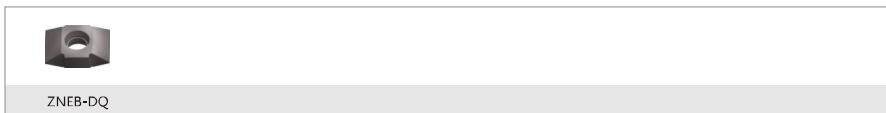
● LN ***-Serie



● SN ***-Serie

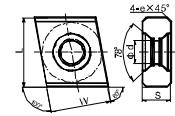


● ZN ***-Serie



Series

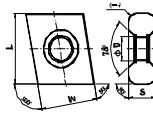
CN□□ Serie




Shape	Description	Specification(mm)					Grade													
		L	W	S	Φd	Eigenvalue	CVD Coating				PVD Coating				un-coated					
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131		WS7130	WS8130	WS7125	WSK10	
	CNEF121206-405	12.7	12.7	6.35	5.4	4-0.5X45														
	CNEF121206-408	12.7	12.7	6.35	5.4	4-0.8x45														
	CNEL161406-408	16.3	14.29	6.35	5.4	4-0.8x45														
	CNEF161406-2R30	16.3	14.29	6.35	5.4	2-R3.0														
	CNEL161406-2R50	16.30	14.29	6.35	5.4	2-R5.3														

B Heavy Milling Insert

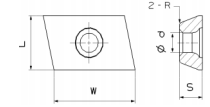
CN□□ Serie






Shape	Description	Specification(mm)					Grade												
		L	W	S	ϕd	Eigenvalue	CVD Coating					PVD Coating					un-peel-off		
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131	WS7130	WS8130		WS7125	WSK10
	CNEF161406-4R10	16.3	14.29	6.35	5.4	4-R1.0													●
	CNEF161406-4R15	16.3	14.29	6.35	5.4	4-R1.5													●
	CNEF161406-4R30	16.3	14.29	6.35	5.4	4-R3.0													●

Heavy Milling Insert B

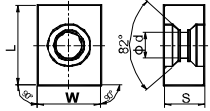
FQ□□ Serie



Shape	Description	Specification(mm)					Grade												
		L	W	S	ϕd	Eigenvalue	CVD Coating					PVD Coating					un-peel-off		
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131	WS7130	WS8130		WS7125	WSK10
	FQEW221406-R04R	14.29	22.8	6.35	5.4	2-R0.4													●
	FQES190906-203R	9.525	19.05	6.35	4.4														●
	FQES190906-2R30R	9.525	19.05	6.35	4.4	2-R3.0													●
	FQES190906-2R34R	9.525	19.05	6.35	4.4	2-R3.4													●
	FQES190906-2R40R	9.525	19.05	6.35	4.4	2-R4.0													●
	FQES190906-2R45R	9.525	19.05	6.35	4.4	2-R4.5													●
	FQES190906-2R50R	9.525	19.05	6.35	4.4	2-R5.0													●
	FQES190906-4RXR	9.525	19.05	6.35	4.4	2-R4.7													●

B Heavy Milling Insert

LN□□ Serie

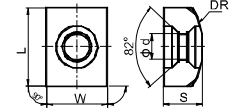


Shape	Description	Specification(mm)					Grade																			
		L	W	S	ϕd	Eigenvalue	CVD Coating					PVD Coating					un-coated									
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131	WS7130	WS8130		WS7125	WSK10							
	LNEN151207-400	15.875	7.94	7.94	5.5	4-0.0x00																				
	LNEN151207-408	15.875	7.94	7.94	5.5	4-0.8x45																				
	LNED150906-408	15.875	6.35	6.35	4.4	4-0.8x45																				
	LNEF191206-405	19.05	6.35	6.35	5.4	4-0.8x45																				
	LNEL191207-400	19.05	7.94	7.94	5.4	4-0.0x00																				
	LNEL191406-400	19.05	6.35	6.35	5.4	4-0.0x00																				
	LNEL191406-408	19.05	6.35	6.35	5.4	4-0.8x45																				

B2

B Heavy Milling Insert

LN□□ Serie

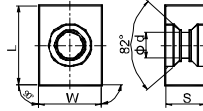


Shape	Description	Specification(mm)					Grade																				
		L	W	S	ϕd	Eigenvalue	CVD Coating					PVD Coating					un-coated										
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131	WS7130	WS8130		WS7125	WSK10								
	LNEN151207-DR100	15.875	12.7	7.94	5.4	DR10																					
	LNEN151207-DR115	15.875	12.7	7.94	5.4	DR11.5																					
	LNEN151207-DR130	15.875	12.7	7.94	5.4	DR13																					
	LNEN151207-DR145	15.875	12.7	7.94	5.4	DR14.5																					
	LNEN151207-DR152	15.875	12.7	7.94	5.4	DR15.2																					
	LNEN151207-DR160	15.875	12.7	7.94	5.4	DR16																					
	LNEN151207-DR190	15.875	12.7	7.94	5.4	DR19																					
	LNEN151207-DR200	15.875	12.7	7.94	5.4	DR20																					
	LNEN151207-DR250	15.875	12.7	7.94	5.4	DR25																					
	LNEN151207-DR400	15.875	12.7	7.94	5.4	DR40																					
	LNEN151207-DR800	15.875	12.7	7.94	5.4	DR80																					

B2

B Heavy Milling Insert

LN□□ Serie



Shape	Description	Specification(mm)					Grade																
		L	W	S	Φd	Eigenvalue	CVD Coating					PVD Coating					un-coated						
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131	WS7130	WS8130		WS7125	WSK10				
	LNEN151207-NR100	15.875	12.7	7.94	5.4	NR 10																	
	LNEN151207-NR130	15.875	12.7	7.94	5.4	NR 13																	
	LNEN151207-NR140	15.875	12.7	7.94	5.4	NR 14																	
	LNEN151207-NR150	15.875	12.7	7.94	5.4	NR 15																	
	LNEN151207-NR190	15.875	12.7	7.94	5.4	NR 19																	
	LNEN151207-NR200	15.875	12.7	7.94	5.4	NR 20																	
	LNEN151207-NR800	15.875	12.7	7.94	5.4	NR80																	
	LNEN151207-NR3000	15.875	12.7	7.94	5.4	NR300																	

B2

Heavy Milling Insert B

LN□□ Serie

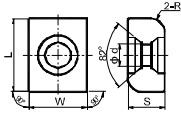


Shape	Description	Specification(mm)					Grade																
		L	W	S	Φd	Eigenvalue	CVD Coating					PVD Coating					un-coated						
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131	WS7130	WS8130		WS7125	WSK10				
	LNEN151207-2NR100	15.875	12.7	7.94	5.4	2NR10																	
	LNEN151207-2NR130	15.875	12.7	7.94	5.4	2NR13																	
	LNEN151207-2NR140	15.875	12.7	7.94	5.4	2NR14																	
	LNEN151207-2NR190	15.875	12.7	7.94	5.4	2NR19																	

B2

B Heavy Milling Insert

LN□□ Serie

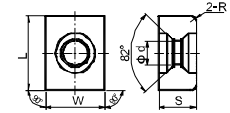


Shape	Description	Specification(mm)					Grade												
		L	W	S	ϕd	Eigenvalue	CVD Coating				PVD Coating				un- paletti- in				
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131		WS7130	WS8130	WS7125	WSK10
	LNEN151207-2R20	15.875	12.7	7.94	5.4	2-R2													
	LNEN151207-2R30	15.875	12.7	7.94	5.4	2-R3													
	LNEN151207-2R40	15.875	12.7	7.94	5.4	2-R 4													
	LNEN151207-2R45	15.875	12.7	7.94	5.4	2-R4.5													
	LNEN151207-2R50	15.875	12.7	7.94	5.4	2-R 5													
	LNEN151207-2R55	15.875	12.7	7.94	5.4	2-R 5.5													
	LNED191406-2R30	19.05	14.29	6.35	5.4	2-R3-14													
	LNED191406-2R35	19.05	14.29	6.35	5.4	2-R 3.5													
	LNED191406-2R55	19.05	14.29	6.35	5.4	2-R 5.6													
LNED191407-2R60	19.05	14.29	7.94	5.4	2-R6-22														

B2

Heavy Milling Insert B

LN□□ Serie

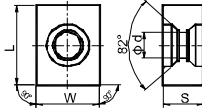


Shape	Description	Specification(mm)					Grade												
		L	W	S	ϕd	Eigenvalue	CVD Coating				PVD Coating				un- paletti- in				
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131		WS7130	WS8130	WS7125	WSK10
	LNEN151207-2R20-1	15.875	12.7	7.94	5.5	2-R2-1													
	LNEN151207-2R80-1	15.875	12.7	7.94	5.4	2-R8-1													
	LNEN151207-2R50-1	15.875	12.7	7.94	5.4	2-R5-1													

B2

B Heavy Milling Insert

LN□□ Serie

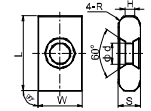


Shape	Description	Specification(mm)					Grade																
		L	W	S	Φd	Eigenvalue	CVD Coating					PVD Coating					un-coat						
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131	WS7130	WS8130		WS7125	WSK10				
	LNEN151207-4R10	15.875	12.7	7.94	5.5	4-R1																	
	LNEN151207-4R20	15.875	12.7	7.94	5.5	4-R 2																	
	LNEN151207-4R30	15.875	12.7	7.94	5.5	4-R 3																	
	LNEN191406-4R24	19.05	14.29	6.35	5.4	4-R2.4																	
	LNEN191406-4R12	19.05	14.29	6.35	5.4	4-R1.2																	
	LNEN191406-4R20	19.05	14.29	6.35	5.4	4-R 2																	

B2

Heavy Milling Insert B

LN□□ Serie

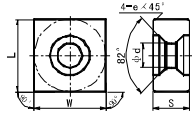


Shape	Description	Specification(mm)					Grade																
		L	W	S	Φd	Eigenvalue	CVD Coating					PVD Coating					un-coat						
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131	WS7130	WS8130		WS7125	WSK10				
	LNEN151206-4R40	15.875	12.7	6.35	5.4	4-R4H																	
	LNEN151207-4R40	15.875	12.7	7.94	5.4	4-R4H																	
	LNEN151207-4R50	15.875	12.7	7.94	5.4	4-R5H																	
	LNEN151206-4R50	15.875	12.7	6.35	5.4	4-R 5H																	
	LNEN151206-4R55	15.875	12.7	6.35	5.4	4-R 5.5H																	
	LNEN151206-4R65	15.875	12.7	6.35	5.4	4-R6.5H																	
	LNEN151206-4R50	15.875	12.7	6.35	5.4	4-R 5H																	
	LNEN151206-4R30	15.875	12.7	6.35	5.4	4-R3.2H																	
	LNEN151207-4R40	15.875	12.7	7.94	5.4	4-R 4H																	

B2

B Heavy Milling Insert

SN□□ Serie

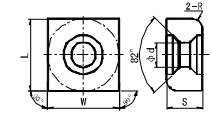


Shape	Description	Specification(mm)					Grade											
		L	W	S	Φd	Eigenvalue	CVD Coating					PVD Coating					un-coated	
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131	WS7130	WS8130		WS7125
	SNED121206-408	12.7	12.7	6.35	5.5	4-0.8x45												
	SNEN151507-400	15.875	15.88	7.94	5.4	4-0.0x00											•	
	SNEN151507-408	15.875	15.88	7.94	5.4	4-0.8x45											•	

B2

Heavy Milling Insert B

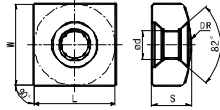
SN□□ Serie



Shape	Description	Specification(mm)					Grade											
		L	W	S	Φd	Eigenvalue	CVD Coating					PVD Coating					un-coated	
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131	WS7130	WS8130		WS7125
	SNEN151507-2R20	15.875	15.88	7.94	5.4	2-R2.0-23											•	
	SNEN151507-2R30	15.875	15.88	7.94	5.4	2-R3.2											•	
	SNEN151507-2R40	15.875	15.88	7.94	5.4	2-R4.0-24											•	
	SNEN151507-2R50	15.875	15.88	7.94	5.4	2-R5.0-24											•	
	SNEN151507-2R60	15.875	15.88	7.94	5.4	2-R6.3-30											•	
	SNEN151507-2R115	15.875	15.88	7.94	5.4	2-R11.5-51											•	

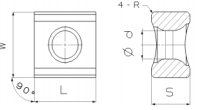
B2

SN□□ Serise



Shape	Description	Specification(mm)					Grade																	
		L	W	S	ϕd	Eigenvalue	CVD Coating					PVD Coating					un-coated							
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131	WS7130	WS8130		WS7125	WSK10					
	SNEN151507-DR130	15.875	15.88	7.94	5.4	DR13-50																		
	SNEN151507-DR235	15.875	15.88	7.82	5.4	DR-23.5																		
	SNEN121206-DR170	12.7	12.7	6.35	4.4	DR-40																		

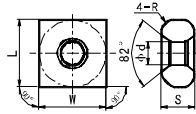
SN□□ Serise




Shape	Description	Specification(mm)					Grade																		
		L	W	S	ϕd	Eigenvalue	CVD Coating					PVD Coating					un-coated								
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131	WS7130	WS8130		WS7125	WSK10						
	SNER121207-2NR80	12.7	12.7	7.94	5.4	2NR8.0																			

B Heavy Milling Insert

SN□□ Serie

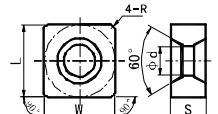



Shape	Description	Specification(mm)					Grade																		
		L	W	S	Φd	Eigenvalue	CVD Coating					PVD Coating					un-coated								
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131	WS7130	WS8130		WS7125	WSK10						
	SNER121206-4R25	12.7	12.7	6.35	5.5	4-R2																			
	SNER151507-4R20	15.875	15.88	7.94	5.4	4-R2-23																			

B2

Heavy Milling Insert B

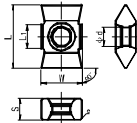
SN□□ Serie



Shape	Description	Specification(mm)					Grade																			
		L	W	S	Φd	Eigenvalue	CVD Coating					PVD Coating					un-coated									
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131	WS7130	WS8130		WS7125	WSK10							
	SNEY090904-S4R04	9.525	9.525	4.76	4.4	4-R0.4																				
	SNED121206-S4R08	12.7	12.7	6.35	5.5	4-R0.8																				

B2

ZN□□ Serie



Shape	Description	Specification(mm)					Grade																	
		L	W	S	Φd	Eigenvalue	CVD Coating					PVD Coating					papeco-un							
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS7125	WS5131	WS7130	WS8130		WS7125	WSK110					
	ZNEB1912B06A-DQ	19.05	12.40	6.0	5.4	DQ																		

B2

Application Case

Cylinder stator



Workpiece	Turbine cylinder 15Cr1MoV
Machining way	Face and side milling with dry
Inserts	CNEF161406-408(CNE454) WS8130
Machining parameter	Vc=120m/min, f=0.2mm/z, ap=20mm, ae=140mm
Result of cutting	Hardstone:160min/cutting edge Brand i:150-180min/cutting edge

Crankshaft milling



Workpiece	42CrMo
Machining way	Rough milling for shaft
Inserts	XNER11C10A0A/XNER14E0904/XNER14E10A06A WS8130
Machining parameter	Vc=202m/min, fz=0.12mm/z, ap=1.5~2.5mm
Result of cutting	Hardstone:1100pcs/cutting edge Brand K:1000pcs/cutting edge

Switch rail



Workpiece	U75V
Machining way	Rough milling for wing rail
Inserts	LNEN151207-400(N18-1) WS8130
Machining parameter	Vc=180m/min, fz=0.2mm/z, ae=20mm, ap=50mm
Result of cutting	Hardstone:15m/cutting edge Brand Z:10m/cutting edge

External gear



Workpiece	50Mn
Machining way	Rough milling for gear with dry
Inserts	LNEN191405-2R35M23-16 WS8130
Machining parameter	Vc=113m/min, fz=0.12mm/z, ap=12mm
Result of cutting	Hardstone:460m/set Brand S:300m/set

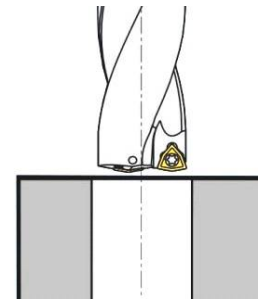
B2



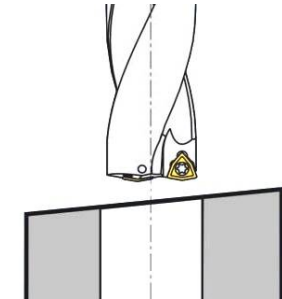
Features of the inserts

- Using the same types of inserts at the center and in the surrounding of drilling inserts, which is more easier for inserts replacement.
- With sharp cutting edge, reducing the vibration of machining process , which is beneficial to the insert surface with low roughness
- Optimized chipbreaker structure improve the cutting performance and chipping control, contributing to easy and fast cutting.
- The combination of specific substrate and coating, well balanced the different wear patterns of center inserts and surrounding inserts.

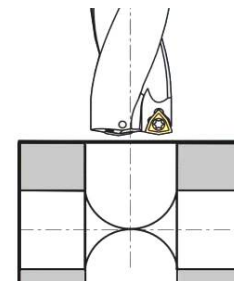
Drilling function schematic diagram



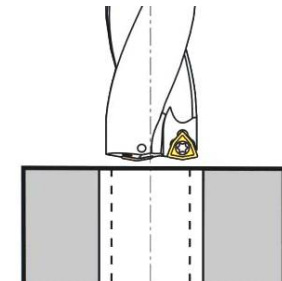
1. Drilling



2. Drilling on inclined surface



3. Cross-hole drilling

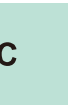


4. Expand drilling



Drilling Insert

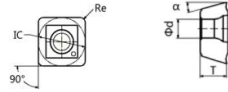
- ◆ Feature C-02
- ◆ Series C-03 — 04
- ◆ Application Case C-05 — 06



Series

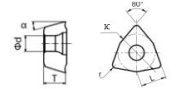
For U Drill

90° SP□□ With Hole



Shape	Description	Specification(mm)					Grade																
		IC	T	Re	Φd	α	CVD Coating					PVD Coating					un-coated						
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK10				
	SPMG050204DG	5.0	2.38	0.4	2.25	14.0											•						
	SPMG060204DG	6.0	2.38	0.4	2.61	14.0											•						
	SPMG07T308DG	7.94	3.97	0.8	2.85	15.5											•						
	SPMG090408DG	9.8	4.3	0.8	4.05	17.5											•						
	SPMG110408DG	11.5	4.8	0.8	4.5	16.5											•						


80° WC□□ With Hole




Shape	Description	Specification(mm)					Grade																
		IC	T	Re	Φd	α	CVD Coating					PVD Coating					un-coated						
							WS8123	WS8115	WS8125	WS6115	WS7140	WS5130	WS5125	WS5131	WS7130	WS8130		WS7125	WSK10				
	WCMX030204	5.56	2.38	0.4	2.25	7°											•						
	WCMX030208	5.56	2.38	0.8	2.55	7°											•						
	WCMX040204	6.35	2.38	0.4	2.8	7°											•						
	WCMX040208	6.35	2.38	0.8	2.8	7°											•						
	WCMX050308	7.94	3.18	0.8	3.2	7°											•						
	WCMX06T308	9.525	3.97	0.8	3.7	7°											•						
	WCMX080412	12.7	4.76	1.2	4.25	7°											•						

Application cases


Condensing plate drilling

	Workpiece	Stainless steel 304
	Machining way	Inter-cooled drilling D23.5
	Inserts	SPMG07T308DG WS5131
	Machining parameter	$V_c=140\text{m/min}$, $f_n=0.10\text{mm/z}$
	Result of cutting	Hardstone : 3.0 M/cutting edge Brand A : 2.5~3.0 M/ cutting edge


Bevel Gear Drilling

	Workpiece	Forge 20CrMnTi
	Machining way	Drilling with Coolant D58
	Inserts	WCMX080412 WS5131
	Machining parameter	$V_c=143.9\text{m/min}$, $f=0.089\text{mm/r}$
	Result of cutting	Hardstone : 180hole/cutting edge Brand S:150hole/cutting edge

Flange end face drilling

	Workpiece	Stainless steel SUS 304
	Machining way	Deep hole D14.5 25 depth
	Inserts	SPMG050204 WS5131
	Machining parameter	$V_c=159.4\text{m/min}$, $f=0.034\text{mm/r}$ ($\leq Ra1.6$)
	Result of cutting	Hardstone : 240 hole/cutting edge Brand D : 200 hole/ cutting edge

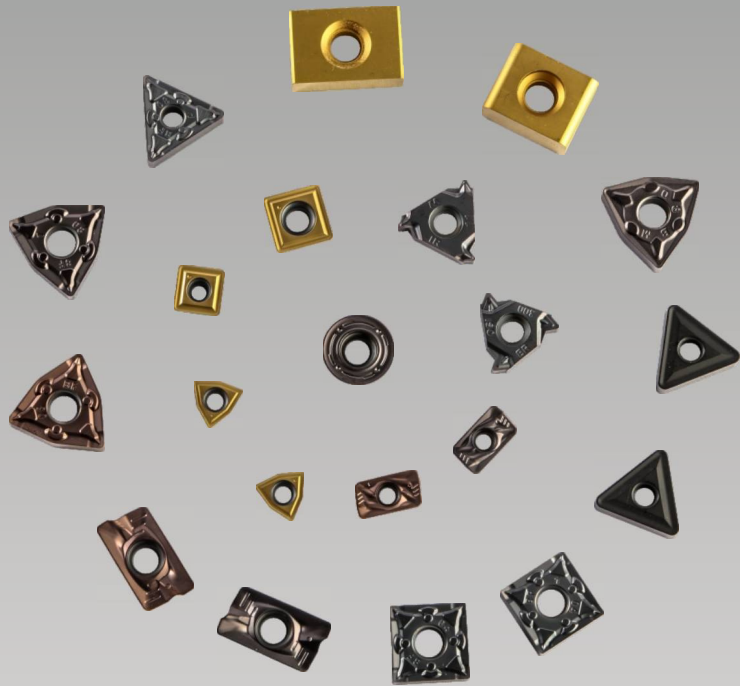
Coupling Drilling

	Workpiece	40Cr
	Machining way	External coolant double-headed drill D54
	Inserts	WCMX080412 WS5131
	Machining parameter	$V_c=76.3\text{m/min}$, $f=0.133\text{mm/r}$
	Result of cutting	Hardstone : 60hole/cutting edge Brand T:50hole/cutting edge



General Technical Data

- ◆ Relevant Information Of Cemented Carbide ··· D-02 — 08
- ◆ Relevant Information Of Workpiece ····· D-09 — 16
- ◆ Other Technical Information ····· D-17 — 22



General Technical Data



Cemented Carbide Products Safety Standard

1. Safety responsibilities

Before using our products, please provide necessary safety training for operators, and carefully read the 'NOTE' and 'CAUTION' contents on the product package. We are not liable for any responsibility caused by not complying with the request for operation.

2. Features of cemented carbide materials

Cemented carbide cutting tools are mainly composed of W, C, Co, N, Ti, Si, Al, O, etc elements and their chemical compound, and come into shape after sintering and a series of subsequent machining. Cemented carbide tool has good chemical stability, high strength and very good wear resistance. It is the ideal tool to cut most metals and high-strength nonmetals.

3. Cautions for safely using cemented carbide tools







- 1) Cemented carbide cutting tools are hard and frangible material, liable to brittle rupture and breakage due to larger force or partial stress, cutting tools have sharp edge.
- 2) In the cutting process, it is unavoidable to generate chips and brittle discs, etc. Please make sure necessary labor protection articles are prepared before machining.
- 3) Most cemented carbide is mainly composed of W and Co with high density. In the process of transport and storage, it should be treated as great heavy object and be handled with care.
- 4) Cemented carbide tools should be stored in dry environment, away from corrosive atmosphere.
- 5) Cemented carbide and steel have different thermal expansion coefficients. To avoid breakage caused by concentrated stress, welding should be conducted under suitable temperature.
- 6) For longer life of machine tool and cutting tools, Coolant is needed in the cutting process, please select correct coolant to prolong machine and tool life.
- 7) If cracks are generated in the machining process, please stop using the tool.
- 8) Long use of cemented carbide tool will lead to cutting edge passivation and lower strength. Please make sure it is reground by professionals.
- 9) Please collect the broken tools and chips properly to avoid injury to other people.









Cautions for safety using cutting tools

Danger	Protective measure
During rotary cutting, clothes, gloves, etc. are easily to get winged in the machine at high speed, thus cause casualties.	The operator should not wear gloves during rotary cutting.
	Please put your long hair in the working cap.
	Please pay attention that the clothes should not contact the operational parts of machine.
Improper use of tools may cause tool breakage and expulsion from machine, causing injuries.	Please read catalogue and safety standard before operating.
	Please wear safeguard glasses and protective clothes.
Direct contact with the sharp cutting edges may cause injuries.	Please use labor protection articles such as gloves when assembling or disassembling cutting tools on machine.
In the cutting process, hot chips may cause scald and scratch on operator.	Please use tools such as pliers to clear away the chips in time.
	Please wear safeguard glasses, protective gloves and clothes.
Burr on workpiece are very sharp and likely to cause injuries.	Do not touch the burrs on the workpiece with bare hand.
	Please wear protective gloves and clothes.
Machining workpiece held infirmly will cause tool breakage and spatter of workpiece.	Make sure the workpiece is clamped firmly.
	Please wear safeguard glasses, protective gloves and clothes.
If inserts or spare parts are not clamped properly, they may become loose and fly off, causing risk of injuries.	Make sure the inserts and spare parts are clamped firmly before machining.
During cutting at high speed, the chips flying off rapidly may cause injuries.	Safeguard articles such as protective cover, screen, etc. should be used.
	Please wear safeguard glasses, protective clothes and gloves.
Inserts or spare parts may fly off due to inertial centrifugal force at high cutting speed.	Use the tools within recommended cutting conditions.
	Please wear safeguard glasses and protective clothes.
Milling cutters have sharp cutting edges and direct contact with them may cause injuries.	For your safety, please wear protective gloves if you need to touch inserts.
Rapid increase of cutting resistance due to excessive abrasion and severe impact may lead to breakage of tool and spatter of chips, thus cause injuries to operator.	Change the tool with excessive abrasion without delay. Please wear safeguard glasses and protective clothes.
In cutting process, sparks and hot chips may cause fire and explosion hazard.	Clear away the inflammable and explosive materials in the cutting area.
	Please make sure the fire extinguishers are ready for use.
At high speed, the machine will vibrate severely because of poor balance of holder, causing tool breakage.	Check whether the machine is loose or has any abnormal noise before cutting.
	Please wear safeguard glasses and protective clothes.
If Inserts and tool are clamped too tightly with screw and clamp, they face the risk of breakage and spatter.	Please do not clamp tools too tightly with bushing.
Off-center or poor balance of tools in rotating machining will cause vibration, breakage and splash of tool, thus will cause injuries.	Please use the tools within the range of recommended rotating speed.
	Check and adjust machine balance periodically.
Using the extremely small drill is likely to cause tool breakage and spatter, and it would be hard to take out the broken part.	Reduce tool vibration and conduct machining at suitable speed.
	Please wear safeguard glasses, protective clothes and gloves.
Machine and tools may be damaged if they are used beside the range of specified purposes, thus may cause other risks	Please use them strictly according to instructions and specified purposes.
Note: We are not responsible for any accidents caused by private modified tools without our permission.	

Metric and Inch Comparison Table of Inserts

C type negative angle	ISO	Inch	Chipbreaker	W type negative angle	ISO	Inch	Chipbreaker				
	090304	321	BF BM BR MT M (All round) (Without chipbreaker)		06T304	3(2.5)1	BF BM BR MT M (All round) (Without chipbreaker)				
	090308	322			06T308	3(2.5)2					
	120404	431			06T312	3(2.5)3					
	120408	432			060404	331					
	120412	433			060408	332					
	120416	434			060412	333					
	160608	542			080404	431					
	160612	543			080408	432					
	160616	544			080412	433					
	190608	642									
	190612	643									
	190616	644									
	190624	646									
	250724	856									
250732	858										
250924	866										
250932	868										
D type negative angle	ISO	Inch	Chipbreaker	T type negative angle	ISO	Inch	Chipbreaker				
	110404	331	BF BM BR MT M (All round) (Without chipbreaker)		110304	221	BF BM BR MT M (All round) (Without chipbreaker)				
	110408	332			110308	222					
	110412	333			160404	331					
	150404	431			160408	332					
	150408	432			160412	333					
	150412	433			220404	431					
	150604	441			220408	432					
	150608	442			220412	433					
	150612	443			220416	434					
	150616	444			270608	542					
	190608	542			270612	543					
	190612	543			270616	544					
	V type negative angle	ISO			Inch	Chipbreaker		S type negative angle	ISO	Inch	Chipbreaker
		160404			331	(All round) (Without chipbreaker)			090304	321	BF BM BR MT M (All round) (Without chipbreaker)
160408		332	090308	322							
160412		333	090312	323							
			120404	431							
			120408	432							
			120412	433							
R type negative angle	ISO	Inch	Chipbreaker	120416	434	BF BM BR MT M (All round) (Without chipbreaker)					
				160608	542						
				160612	543						
				160616	544						
				190412	633						
				190424	636						
				190612	643						
				190616	644						
				250724	856						
				250732	858						
ISO	Inch	Chipbreaker	250924	866							
			250932	868							

Metric and Inch Comparison Table of Inserts

C type positive angle	ISO	Inch	Chipbreaker	D type positive angle	ISO	Inch	Chipbreaker
	060202	2(1.5)0	MP AK (Without chipbreaker)		070202	2(1.5)0	MP AK (Without chipbreaker)
	060204	2(1.5)1			070204	2(1.5)1	
	060208	2(1.5)2			070208	2(1.5)2	
	09T302	3(2.5)0			11T302	3(2.5)0	
	09T304	3(2.5)1			11T304	3(2.5)1	
	09T308	3(2.5)2			11T308	3(2.5)2	
	120404	431			11T312	3(2.5)3	
	120408	432					
	120412	433					
T type positive angle	ISO	Inch	Chipbreaker	S type positive angle	ISO	Inch	Chipbreaker
	06T102	1.2(1.2)0	MP AK (Without chipbreaker)		060204	2(1.5)1	MP AK (Without chipbreaker)
	06T104	1.2(1.2)1			09T302	3(2.5)0	
	06T108	1.2(1.2)2			09T304	3(2.5)1	
	090202	1.8(1.5)0			09T308	3(2.5)2	
	090204	1.8(1.5)1			120404	431	
	090208	1.8(1.5)2			120408	432	
	110202	2(1.5)0			120412	433	
	110204	2(1.5)1			150404	531	
	110208	2(1.5)2			150408	532	
	110302	220			150412	533	
	110304	221			190408	632	
	110308	222			190412	633	
	16T302	3(2.5)0			190416	634	
	16T304	3(2.5)1					
	16T308	3(2.5)2					
	16T312	3(2.5)3					
	160400	330					
	220408	432					
	220412	433					
	220416	434					
270408	532						
270412	533						
330612	643						
330616	644						
V type positive angle	ISO	Inch	Chipbreaker	V type positive angle	ISO	Inch	Chipbreaker
			AK (Without chipbreaker)		110202	2(1.5)0	AK (Without chipbreaker)
					110204	2(1.5)1	
					110208	2(1.5)2	
					110302	220	
					110304	221	
					110308	222	
					160402	330	
					160404	331	
					160408	332	
					160412	333	

Cemented Carbide Rockwell hardness and Vickers hardness comparison table

Vickers hardness (Hv3)	Rockwell hardness (HRA)	Vickers hardness (Hv3)	Rockwell hardness (HRA)
894	85.0	1450	90.1
942	85.5	1500	90.5
1004	86.0	1560	91.0
1076	86.5	1600	91.5
1140	87.0	1650	91.7
1150	87.6	1680	92.0
1200	88.1	1700	92.3
1250	88.5	1750	92.5
1330	89.0	1800	93.0
1370	89.5	1850	93.1
1400	89.9	1900	93.5
1430	90.0	1925	94.0

Grades Comparison Table

ISO	Hitachi Tool	Kyocera	Tungaloy	Sumitomo	TaeguTec	Mitsubishi Material	Korloy	Dijet	Seco Tool	Cera-tizit	Inger-soll	Walter	Iscar	Kennametal	Sandvik	Hardstone	ISO
P10	YBC152	CA5515	T9115	AC810P AC700G	T18115	UF6010	NC3010 NC3220	JC110V	TP1500	CTCP115 CTCK110 CTC3110	TT7310	WPP10 WPP105	IC9150 IC9015	KC9110 KCP10	GC4015	WS8115	P10
P20	YBC352	CA5525	T9025 T9125	AC2000 AC820P	TT8125	UF6020	NC3020 NC3120 NC3220	JC215V	TP2000	CTCP115 CTCP125 CTC1425	TT8115 TT8125 IN5015	WPP20 WPP205 WKP25	IC9250 IC9025	KC9125 KC9225	GC4025 GC4225	WS8125	P20
P40	YBC351	CA5535	T9035 T9135 T3130	AC830P AC630M	TT5100 TT8135	UF6035 UH6400 US735	NC3030 NC5330	JC325V JC450V	TP3000	CTC1135 CTCP125 CTC2135	TT7100 IN6530	WAK30 WKP35 WKP35S	IC635	KC9140 KC9240	GC4035 GC4235	W8135	P40
M30	YBM351	CA5535	T6030	AC630M	TT5100	F7030	NCM325 NCM335	JC215V JC325V	TM4000	CTC2135 CTC1435 CTC5235	TT5100 TT7100 T19235		IC9350	KCM35 KC9240 KC9245	GC2040	WS8122	M30
K10	YBD052	CA4505 CA4010	T5105	AC410K	UC5105			JC105V	TK1000			WPP01	IC9150 IC9080	KCK05	GC3205 GC3210	WS6105	K10
K20	YBD152	CA4515 CA4010 CA4115	T5115	AC410K AC420K AC700G	UC5115		N805K NNCM310	JC110V JC215V	TK2000	CTC3110 CTC1425 CTC3215 SR216	TT1300 TT7310	WAK10 WAK10S	IC9150 IC9015 IC4010	KCK15 KCK20 KC9315	GC3215	WS6115	K20
K30	YBD252		T5125		UF6110		N315K NCM320	JC215		CTCP125 CTCP115		WPP20 WAK30		GC3220 GC3020		WS7140	K30

Note: Document of grade comparison is based on different manufacture catalogue and public documents data collection and collation. Compiled not solicit opinions from the manufacturers, please understanding.

Grades Comparison Table

ISO	Hardstone	Sandvik	Kennametal	Iscar	Walter	Ingersoll	Cera-tizit	Seco Tool	Dijet	Korloy	Mitsubishi Material	TaeguTec Sumitomo	Tungaloy	Kyocera	Hitachi Tool	ZCCCT
P30	WS8130	GC1025 GC1030	KC5025 KC5525 KC725M	IC508 IC950 IC900	WSM30	TT7220 TT9020 TT9030 IN1040 IN1540 IN2540	CTP125 CTP1235 CTP1625	CP500 MP3000 F30M	JC5015 JC8015	PC3500	VP15TF VP20RT	TT9080 TT9030	AH725 AH120 AH130 AH140 GH130 AH730	PR660 PR1230	J54060 JX1045 PTH30E HC844 CY250 CY25 IP3000	YBG202 YBG205
M20	WS5125	GC1025 GC1030	KC5025 KC715M KC5525	IC354 IC808 IC908	WSM20 WSM21 WXM15	TT9020 TT9030	CTP120 CTP1125 CTP1625	TS2500 CP200 CP500 F25M	JC5015 JC5030 JC5040	PC210	VP15TF VP20MF VP20RT	TT9030 TT5030	AH725 AH120 GH350 AH350 GH110	PR730 PR660 PR1025 PR1225	CY150 CY150 JX1015 IP1005	YBG202 YBG205
M30	WS7125 WS5123	GC1030 GC1040 GC2030	KC5025 KC5040 KC725M	IC300 IC928 IC1008	WSM30 WSM35 WSM36	TT8020 IN1515 IN1530 IN2005 IN2030	CTP1125 CTP2440 CTP1625	CP500 F30M F40M	JC5015 JC5030 JC5040	PC9030 PC9530	VP15TF VP20MF VP20RT	TT9030TT 9080	AH120 AH725 AH130 AH140 GH130 AH730	PR660	JX1045 HC844 CY250 CY25 IP1005	YBG202 YBG205
M40	WS5130 WS5131	GC1040 GC2035	KC735M	IC228 IC328 IC928	WSP45 WSM35 WSM36	TT8020 IN2030	CM45 CTP2440 CTP2235	F40M	JC5015 JC5118 JC8050	PC3545	VP30RT	TT8020			JX1060 GF30	YBG302 YBG402

Grades Comparison Table

ISO	Hardstone	Sandvik	Kennametal	Iscar	Walter	Ingersoll	Cera-tizit	Seco Tool	Dijet	Korloy	Mitsubishi Material	TaeguTec Sumitomo	Tungaloy	Kyocera	Hitachi Tool	ZCCCT
K10	WS9105	GC1210	KC5010 KC5510 KC510M	IC900 IC910	WHH15 WXM15	IN2004	CTP6215	CP200	JC5003 JC5015	PC505F PC8510	VP10RT		GH110 AH110		CY9020 CY100H CY10H	YBG102 YBG105
K20	WS9115	GC1020 GC1220	KC5025 KC520M KU25T	IC3088 IC508 IC350	WSM35 WKK25 WSM15	IN1030 IN1515 IN2010 IN2015 IN2510 IN2515 IN2505	CTP2120 CTP3220 CM45 CTP6215	CP200 CP250	JC5015	PC215K PC5300	VP10RT VP15TF VP20RT	TT6030 ACK300	AH120	PR1210 PR905	CY150 CY15 PTH13S	YBG202
K30	WS7130		KC5025 IC630 KU25T	IC350 IC1008	WSM35 WKK25	IN1530 IN2015 IN2015 IN2150	CM45	CP500	JC5015	PC220	VP15TF VP20RT		GH130		JX1045 PTH40H CY250 CY250	YBG302

Note: Document of grade comparison is based on different manufacture catalogue and public documents data collection and collation. Compiled not solicit opinions from the manufacturers, please understanding.

type material cross comparison table

type material cross comparison table

ISO	China GB	USA AISI/ SAE	Germany		Great Britain		Sweden SS	France AFNOR	Italy UNI	Japan JIS
			W.-nr	DIN	BS	En				
P	Structural steel									
	15	1015	1.0401	C15	080M15	-	1350	CC12	C15C16	-
	20	1020	1.0402	C22	050A20	2C	1450	CC20	C20C21	-
	35	1035	1.0501	C35	060A35	-	1550	CC35	C35	-
	45	1045	1.0503	C45	080M40	-	1650	CC45	C45	-
	55	1055	1.0535	C55	07M55	-	1655	-	C55	-
	60	1060	1.0601	C60	080A62	43D	-	CC55	C60	-
	Y15	1213	1.7015	9SMn28	230M07	-	1912	S250	CF95 Mn28	SUM22
	-	12L13	1.0718	9SMnPb28	-	-	1914	S250Pb	CF95Mn Pb28	SUM22L
	-	-	1.0722	10SPb20	-	-	-	10PbF2	CF10 Pb20	-
	-	1140	1.0726	35S20	212M36	8M	1957	35MF4	-	-
	Y13	1215	1.0736	9SMn36	240M07	1B	-	S300	CF95Mn36	-
	-	12L14	1.0737	9SMn Pb36	-	-	1926	S300Pb	CF95Mn Pb36	-
	55Si2Mn	9255	1.0904	55Si9	250A53	45	2085	55S7	55Si8	-
	-	9262	1.0961	60SiCr7	-	-	-	60SC7	60SiCr8	-
	15	1015	1.1141	Ck15	080M15	32C	1370	XC12	C16	S15C
	40Mn	1039	1.1157	40Mn4	150M36	15	-	35M5	-	-
	25	1025	1.1158	Ck25	-	-	-	-	-	S25C
	35Mn2	1335	1.1167	36Mn5	-	-	2120	40Mn5	-	SMn438 (H)
	30Mn	1330	1.1170	28Mn6	150M28	14A	-	20M5	C28Mn	SCMn1
	35Mn	1035	1.1183	Cf35	060A35	-	1572	XS38TS	C36	S35C
	CK45	1045	1.1191	45	080M46	-	1672	XC42	C45	S45C
	55	1055	1.1203	Ck55	070M55	-	-	XC45	C50	S55C
	50	1050	1.1213	Cf53	060A52	-	1674	XC48TS	C53	S50C
	60Mn	1060	1.1221	Ck60	080A62	43D	1678	XC60	C60	S58C
	-	1095	1.2174	Ck101	060A96	-	1870	-	-	SUP4
	-	-	1.3401	X120Mn12	Z120M12	-	-	X120M12	XG120 Mn12	SCMnH/1
	Cr15 45C	52100	1.3505	100Cr6	534A99	31	2258	100C6	100Cr6	SUJ2
	-	ASTM A204Cr.A	1.5415	15Mo3	1501-240	-	2912	15D3	16Mo3KW	-
	-	4520	1.5426	16Mo5	1503-245-420	-	-	-	16Mo5	-
	-	ASTM A350LF5	1.5622	14Ni6	-	-	-	16N6	14Ni6	-
	-	ASTM A353	1.5662	X8Ni9	1501-509 510	-	-	-	X10Ni9	-
	-	2515	1.5680	12Ni19	-	-	-	Z18N5	-	-
	-	3135	1.5710	36NiCr6	640A35	111A	-	35NC6	-	SNC236
	-	3415	1.5732	14Ni Cr10	-	-	-	14NC11	16Ni Cr11	SNC415 (H)

ISO	China GB	USA AISI/ SAE	Germany		Great Britain		Sweden SS	France AFNOR	Italy UNI	Japan JIS
			W.-nr	DIN	BS	En				
P	Structural steel									
	-	3415 3310	1.5752	14Ni Cr14	655M13 655A12	36A	-	12NC15	-	SNC815(H)
	-	9840	1.6511	36CrNiMo4	816M40	110	-	40NCD3	38CrNi Mo4(KB)	-
	-	8620	1.6523	21NiCrMo2	850M20	362	2503	20NCD2	20NiCrMo2	SNCCM 220(H)
	-	8740	1.6546	40NiCrMo2	311-Type7	-	-	-	40NiCr Mo2(KB)	-
	40CrNiMoA	4340	1.6582	34CrNiMo6	817M40	24	2541	35NCD6	35CrNi Mo6(KB)	-
	-	-	1.6587	17CrNiMo6	820A16	-	-	18NCD6	-	SCR415(H)
	15Cr	5015	1.7015	15Cr3	523M15	-	-	12C3	-	SCR430(H)
	35Cr	5132	1.7033	34Cr4	530A32	18B	-	32C4	34Cr4 (KB)	SCR440(H)
	40Cr	5140	1.7035	41Cr4	530M40	18	-	42C4	41Cr4	SCR440
	40Cr	5140	1.7045	42Cr4	-	-	2245	-	-	-
	18CrMn	5115	1.7131	16Mn Cr15	(527M20)	-	2511	16MC5	16Mn Cr15	SUP9(A)
	20CrMn	5155	1.7176	55Cr3	527A60	48	-	55C3	-	SCM420; SCM430
	30CrMn	4130	1.7218	25CrMo4	1717CDS 110	-	2225	25CD4	25CrMo4 (KB)	SCM432; SCRRM3
	35CrMo	4137, 4135	1.7220	34CrMo4	708A37	19B	2234	35CD4	35CrMo4	SCM440
	40CrMoA	4140, 4142	1.7223	41CrMo4	708M40	19A	2244	42CD4TS	41CrMo4	SCM440 (H)
	42 CrMn 42 CrMnMo	4140	1.7225	42CrMo4	708M40	19A	2244	42CD4	42CrMo4	SCM415 (H)
	-	-	1.7262	15CrMo5	-	-	2216	12CD4	-	-
	-	ASTM A182 F11, F12	1.7335	13CrMo44	1501-620 Gr.27	-	-	15CD3.5, 15CD4.5	14Cr Mo44	-
	-	-	1.7361	32CrMo12	722M24	40B	2240	30CD12	32Cr Mo12	-
	-	ASTM A182 F.22	1.7380	10CrMo910	1501-62 2Gr.31, 45	-	2218	12CD9, 10	12Cr Mo9,10	-
	-	-	1.7715	14Mo V63	1503-660-440	-	-	-	-	-
	50CrVA	6150	1.8159	50CrV4	735A50	47	2230	50CV4	50CrV4	SUP10
	-	-	1.8509	41CrAlMo7	905M39	41B	2940	40CAD6,12	41CrAl Mo7	-
	-	-	1.8523	39CrMo V139	897M39	40C	-	-	36CrMo V12	-

type material cross comparison table

ISO	China GB	USA AISI/ SAE	Germany		Great Britain		Sweden SS	France AFNOR	Italy UNI	Japan JIS
			W.-nr	DIN	BS	En				
P	Tool steel									
	T10	W.110	1.1545	C105W1	-	-	1880	Y105	C98KU C100KU	-
	T12A	W.112	1.1663	C125W	-	-	-	Y2120	C120KU	SK2
	CrV9SiCr	L3	1.2067	100Cr6	BL3	-	-	Y100C6	-	-
	Cr12	D3	1.2080	X210Cr12	BD3	-	-	Z200Cr12	X210Cr 13KL X250Cr 12KL	SKD1
	4Cr5MoVSi	H13	1.2344	X40Cr MoV5 1	BH13	-	2242	Z40CDV5	X35CrMo V05KU X40CrMo V51KU	SKD61
	Cr6WV	A2	1.2363	X100Cr MoV5 1	BA2	-	2260	Z100CDV5	X100CrMo V51KU	SKD12
	CrWMo	-	1.2419	105WCr6	-	-	2140	105WC13	10WCr6 107WC r5KU	SKS31 SKS2 SKS3
	Cr12W	-	1.2436	X210Cr W12	-	-	2312	-	X215Cr W12 1KU	SKD2
	5CrNiMo	S1	1.2542	45WCrV7	BS1	-	2710	-	45WCrV 8KU	-
	3Cr2W8V	H21	1.2581	X30WCr V9 3 X30WCr V93KU	BH21	-	-	Z30WCV9	X28W09 KU X30WCr V9 3KU	SKD5
	Cr12MoV	-	1.2601	X165Cr MoV 12	-	-	2310	-	X165CrMo W12KU	SKD11
	5CrNiMo	L6	1.2713	55NiCr MoV6	-	-	-	55NCDV7	-	SKT4
	V	W210	1.2833	100V1	BW2	-	-	Y1105V	-	SKS43
	W6Mo5Cr 4V2 Co5	-	1.3243	S6-5-2-5	-	-	2733	Z85WDC CV	HS6-5-2-5	SKH55
	W18Cr4V co5	T4	1.3255	S18-1-2-5	BT4	-	-	Z80WKC V10-05-0 4-01	X78Wco 1805KU	SKH3
	W6Mo5Cr 4/v2	M2	1.3343	S6-5-2	BM2	-	2722	Z85WDCV 06-05-0 5-02	X82Wmo 0605KU	SKH9
	-	M7	1.3348	S2-9-2	-	-Z-	2782	Z100WCWV 09-02-0 4-02	HS2-9-2	-
	W18Cr4V	T1	1.3355	S18-0-1	BT1	-	-	Z80WCV 18-04-01	X75W18 KU	SKH2
	W6Mo5Cr 4V3	M3	-	S6-5-3	-	-	-	-	-	SKH52
-	M42	-	-	BM42	-	-	-	-	SKH59	

D

type material cross comparison table

ISO	China GB	USA AISI/ SAE	Germany DIN	Japan JIS	Daido(Japan) DAIDO	Main application
Plastic die steel						
-	-	P20 mod.	-	-	PX5N	For mass production of large mirror dies. Automobile rear light, front fender of car, video camera, household electrical appliances etc.
-	-	-	-	-	NAK55	For high-precision mirror die. Video camera, music disc, cosmetic containers, transparent covers, transparent films etc.
-	-	-	-	-	NaK80	For high-precision mirror dies. Video camera, music disc, cosmetic containers, transparent covers, transparent films etc.
3Cr13	420 mod.	-	SUS420J2 mod.	S-STAR	-	For ultra-mirror corrosion resistant precise dies. Accessories of camera, CD, lens, watch case.
Cold-working die steel						
-	02	-	SKS93	YK30	-	Stamping die, gauge calipers, paper cutter, auxiliary tools.
9CrWMn	01 mod.	-	SKS3 mod.	GOA	-	Blanking die, gauge calipers, drawing die, taps, Perforated punch.
Cr12MoV	D2	X165CrMoV12	SKD11	DC11	-	Blanking die, cold forming die, cold drawing die, forming roller, punch.
-	D2 mod.	-	SKD11 mod.	DC53	-	Blanking die, cold forming die, cold drawing die, forming roller, punch.
Hot-working die steel						
4Cr5MoSiV1	H13	X40CrMoV51	SKD61	DHA1	-	Aluminum compression die, connecting parts of compression die, hot stamping die, hot extrusion die, thermal shear cutting blade.
-	-	-	-	DH21	-	Long life aluminum compression die.
-	-	-	-	DH31-S	-	Large compression die.
-	-	-	-	DH2F	-	Compression die, plastic die.

D

M type material cross comparison table

ISO	China GB	USA AISI/ SAE	Germany		Great Britain		Sweden SS	France AFNOR	Italy UNI	Japan JIS
			W.-nr	DIN	BS	En				
Stainless steel										
	0Cr13 1Cr12	403	1.4000	X6Cr13	403S17	-	2301	Z6C13	X6Cr13	SUS403
	-	-	1.4001	X7Cr14	-	-	-	-	-	-
	1Cr13	410	1.4006	Z10Cr13	410S21	56A	2302	Z10C14	X12Cr13	SUS410
	1Cr17	430	1.4016	X6Cr17	430S15	60	220	Z8C17	X8Cr17	SUS430
	2Cr13	410	1.4021	X20Cr13	S62	56B;56C	-	Z20C13	X20C13	SUS410
	-	-	1.4027	G-X20Cr14	420C29	56B	-	Z20C13M	-	SCS2
	4Cr13	-	1.4034	X46Cr13	420S45	56D	2304	Z40CM Z38C13M	X40Cr14	SUS420J2
	1Cr17Ni2	431	1.4057	X20CrNi172	431S29	57	2321	Z15Cni6.02	X16Cni16	SUS431
	Y1Cr17	430F	1.4104	X12CrMoS17	-	-	2383	Z10CF17	X10CrS17	SUS430F
	1Cr17Mo	434	1.4113	X6CrMo171	434S17	-	2325	Z8CD 17.01	X8CrMo17	SUS434
	-	-	1.4313	X5CrNi134	425C11	-	-	Z4CND 13.4M	-	SCS5
	-	-	1.4408	G-X6CrNiMo1810	316C16	-	-	-	-	SCS14
	4Cr9Si2	11W3	1.4718	X45CrSi93	401S45	52	-	Z45CS9	X45CrSi8	SUH1
	0Cr13Al	405	1.4724	X10CrAl13	403S17	-	-	Z10C13	X10CrAl12	SUS405
	Cr17	430	1.4742	X10CrAl18	430S15	60	-	Z10CA S18	X80CrSi Ni20	SUS430
	8Cr20Si2Ni	HNV6	1.4757	X80CrNiSi20	443S65	59	-	Z80CSN 20.02	X16Cr26	SUH4
	2Cr25N	446	1.4762	X10CrAl24	-	-	2322	Z10CA S24	-	SUH446
Austenitic stainless steel										
	0Cr18Ni9	304	1.4301	X5CrNi1810	304S15	58E	2332	Z6CN 18.09	X5CrNi1810	SUS304
	1Cr18Ni9MoZr	303	1.4305	X10CrNiSi189	303S21	58M	2346	Z10CNF 18.09	X10CrNi S18.09	SUS303
	0Cr19Ni10	304L	1.4306	X2CrNi1911	304S12	-	2352	Z2CN 18.10	X2CrNi 18.11	SCS19
	-	-	1.4308	G-X6CrNi189	304C15	-	-	Z6CN 18.10M	-	SCS13
	Cr17Ni7	301	1.4310	X12CrNi177	-	-	2331	Z12CN 17.07	X12CrNi 1707	SUS301
	-	304LN	1.4311	X2CrNiN1810	304S62	-	2371	Z2CN 18.10	-	SUS304LN
	0Cr19Ni9	304	1.4350	X5CrNi189	304S31	58E	-	Z6CN 18.09	X5CrNi1810	SUS304
	0Cr17Ni11Mo2	316	1.4401	X5CrNiMo1712	316S16	Z6CND 17.11	2347	1.4401	X5CrNi Mo1712	SUS316
	00Cr17Ni13Mo2	316LN	1.4429	X2CrNiMoN17133	-	-	2375	Z2CND 17.13	-	SUS316LN

D

M type material cross comparison table

ISO	China GB	USA AISI/ SAE	Germany		Great Britain		Sweden SS	France AFNOR	Italy UNI	Japan JIS
			W.-nr	DIN	BS	En				
Stainless steel										
	0Cr13; 1Cr12	403	1.4000	X6Cr13	403S17	-	2301	Z6C13	X6Cr13	SUS403
	-	-	1.4001	X7Cr14	-	-	-	-	-	-
	1Cr13	410	1.4006	Z10Cr13	410S21	56A	2302	Z10C14	X12Cr13	SUS410
	1Cr17	430	1.4016	X6Cr17	430S15	60	220	Z8C17	X8Cr17	SUS430
	2Cr13	410	1.4021	X20Cr13	S62	56B;56C	-	Z20C13	X20C13	SUS410
	-	-	1.4027	G-X20Cr14	420C29	56B	-	Z20C13M	-	SCS2
	4Cr13	-	1.4034	X46Cr13	420S45	56D	2304	Z40CM Z38C13M	X40Cr14	SUS420J2
	1Cr17Ni2	431	1.4057	X20CrNi172	431S29	57	2321	Z15Cni6.02	X16Cni16	SUS431
	Y1Cr17	430F	1.4104	X12CrMoS17	-	-	2383	Z10CF17	X10CrS17	SUS430F
	1Cr17Mo	434	1.4113	X6CrMo171	434S17	-	2325	Z8CD 17.01	X8CrMo17	SUS434
	-	-	1.4313	X5CrNi134	425C11	-	-	Z4CND 13.4M	-	SCS5
	-	-	1.4408	G-X6CrNiMo1810	316C16	-	-	-	-	SCS14
	4Cr9Si2	11W3	1.4718	X45CrSi93	401S45	52	-	Z45CS9	X45CrSi8	SUH1
	0Cr13Al	405	1.4724	X10CrAl13	403S17	-	-	Z10C13	X10CrAl12	SUS405
	Cr17	430	1.4742	X10CrAl18	430S15	60	-	Z10CA S18	X80CrSi Ni20	SUS430
	8Cr20Si2Ni	HNV6	1.4757	X80CrNiSi20	443S65	59	-	Z80CSN 20.02	X16Cr26	SUH4
	2Cr25N	446	1.4762	X10CrAl24	-	-	2322	Z10CA S24	-	SUH446
Austenitic stainless steel										
	0Cr18Ni9	304	1.4301	X5CrNi1810	304S15	58E	2332	Z6CN 18.09	X5CrNi1810	SUS304
	1Cr18Ni9MoZr	303	1.4305	X10CrNiSi189	303S21	58M	2346	Z10CNF 18.09	X10CrNi S18.09	SUS303
	0Cr19Ni10	304L	1.4306	X2CrNi1911	304S12	-	2352	Z2CN 18.10	X2CrNi 18.11	SCS19
	-	-	1.4308	G-X6CrNi189	304C15	-	-	Z6CN 18.10M	-	SCS13
	Cr17Ni7	301	1.4310	X12CrNi177	-	-	2331	Z12CN 17.07	X12CrNi 1707	SUS301
	-	304LN	1.4311	X2CrNiN1810	304S62	-	2371	Z2CN 18.10	-	SUS304LN
	0Cr19Ni9	304	1.4350	X5CrNi189	304S31	58E	-	Z6CN 18.09	X5CrNi1810	SUS304
	0Cr17Ni11Mo2	316	1.4401	X5CrNiMo1712	316S16	Z6CND 17.11	2347	1.4401	X5CrNi Mo1712	SUS316
	00Cr17Ni13Mo2	316LN	1.4429	X2CrNiMoN17133	-	-	2375	Z2CND 17.13	-	SUS316LN

M

D

M type material cross comparison table

ISO	China GB	USA AISI/ SAE	Germany		Great Britain		Sweden SS	France AFNOR	Italy UNI	Japan JIS
			W.-nr	DIN	BS	En				
M	Austenitic stainless steel									
	0Cr27Ni12Mo3	316L	1.4435	X2CrNiMo18143	316S12	-	2353	Z2CND 17.13	X2CrNiMo1713	SCS16
	00Cr19Ni13Mo3	317L	1.4438	X2CrNiMo17133	317S12	-	2367	Z2CND 19.15	X2CrNiMo18.16	SUS317L
	-	329L	1.4460	X8CrNiMo275	-	-	2324	-	-	SUS329L; SCH11; SCS11
	1Cr18Ni9Ti	321	1.4541	X6CrNiTi1810	2337	321S12	58B	Z6CNT 18.10	X6CrNiTi1811	SUS321
	1Cr18Ni11Nb	347	1.4550	X6CrNiNb1810	347S17	58F	2338	Z6CNN b18.1	X6CrNiTi1811	SUS347
	Cr18Ni12Mo2Ti	316Yi	1.4571	X6CrNiMoTi17122	320S17	58J	2350	Z6NDT 17.12	X6CrNiMoTi17	-
	-	-	1.4581	G-X5CrNiMoNb1810	318C7	-	-	Z4CNDN b1812M	XG8CrNiMo18	SCS22
	Cr17Ni12Mo3Nb	318	1.4583	X10CrNiMoNb1812	-	-	-	Z6CNDN b1713B	X6CrNiMoTiNb17	-
	1Cr23Ni13	309	1.4828	X15CrNiSi2012	309S24	-	-	Z15CNS 20.1	-	SUH309
	0Cr25Ni20	310S	1.4845	X12CrNi2521	310S24	-	2361	Z12CN 2520	X6CrNi2520	SUH310
	Cr15Ni36W3Ti	330	1.4864	X12NiCrSi3616	-	-	-	Z12CNS 35.1	-	SUH330
	-	-	1.4865	G-X40NiCrSi3818	330C11	-	-	-	XG50NiCr3919	SCH15
	5Cr2Mn9Ni4N	EV8	1.4871	X53CrMnNiN219	349S54; 321S12	58B	-	Z52CM N21.0	X53CrMnNiN219	SCH35
	1Cr18Ni9Ti	321	1.4878	X12CrNiTi189	321S320	58C	-	Z6CNT 18.12	X6CrNiTi1811	SU321

K type material cross comparison table

ISO	China GB	USA AISI/ SAE	Germany		Great Britain		Sweden SS	France AFNOR	Italy UNI	Japan JIS
			W.-nr	DIN	BS	En				
K	Nodular cast iron									
	QT400-18	60-40-18	GGG40	400/17	0717-02	FGS370-17	GS370-17	FGE38-17	FCD400	
	QT450-10	65-45-12	-	420/12	-	FGS400-12	GS400-12	FGE42-12	FCD450	
	QT500-7	70-50-12	GGG50	500/7	0727-02	FGS500-7	GS500-7	FGE50-7	FCD500	
	QT600-3	80-60-03	GGG60	600/7	0732-03	FGS600-2	GS600-2	FGE60-2	FCD600	
	Q1700-2	100-70-03	GGG70	700/2	0737-01	FGS700-2	GS700-2	FGE70-2	FCD700	
	QT800-2	120-90-02	GGG80	800/2	0864-03	FGS800-2	GS800-2	FGE80-2	FCD800	
	QT900-2	-	-	900/2	-	-	-	-	-	
	Grey cast iron									
	-	NO.60	GG40	-	0140	FGL400	-	-	-	
	HT350	NO.50	GG35	350	0135	FGL350	G35	FG35	FC350	
	HT300	NO.45	GG30	300	0130	FGL300	G30	FG30	FC300	
	HT250	NO.35	GG25	250	0125	FGL250	G25	FG25	FC250	
	HT200	NO.30	GG20	200	0120	FGL200	G20	FG20	FC200	
	HT150	NO.20	GG15	150	0115	FGL150	G15	FG15	FC150	
HT100	-	-	100	0110	-	G10	-	FC100		

Ferrous metal hardness reference table

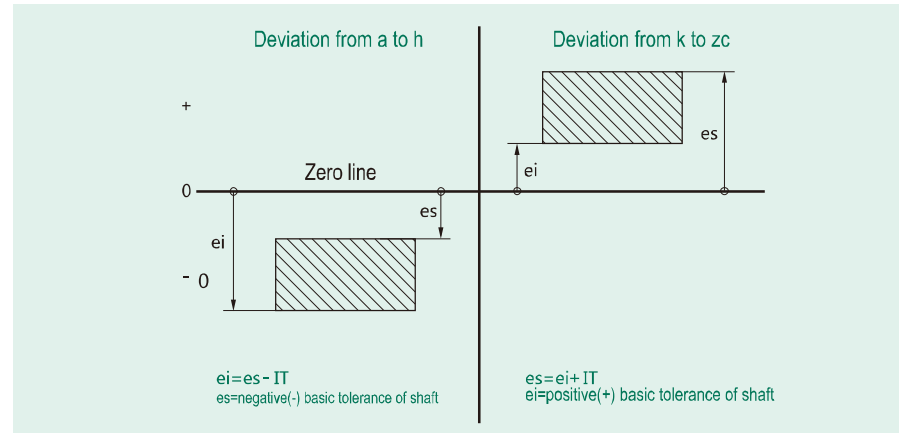
Rockwell hardness				Vickers hardness HV	Brinell hardness HB	Rockwell hardness				Vickers hardness HV	Brinell hardness HB
HRC	HRA	HRC	HRA			HRC	HRA	HRC	HRA		
70.0	86.6	1037	—	52.0	76.9	543	—	34.0	—	320	314
69.5	86.3	1017	—	51.5	76.7	534	—	33.5	—	316	310
69.0	86.1	997	—	51.0	76.3	525	501	33.0	—	312	306
68.5	85.8	978	—	50.5	76.1	517	494	32.5	—	308	302
68.0	85.5	959	—	50.0	75.8	509	488	32.0	—	304	298
67.5	85.2	941	—	49.5	75.5	501	481	31.5	—	300	294
67.0	85.0	923	—	49.0	75.3	493	474	31.0	—	296	291
66.5	84.7	906	—	48.5	75.0	485	468	30.5	—	292	287
66.0	84.4	889	—	48.0	74.7	478	461	30.0	—	289	283
65.5	84.1	872	—	47.5	74.5	470	455	29.5	—	285	280
65.0	83.9	856	—	47.0	74.2	463	449	29.0	—	281	276
64.5	83.6	840	—	46.5	73.9	456	442	28.5	—	278	273
64.0	83.3	825	—	46.0	73.7	449	436	28.0	—	274	269
63.5	83.1	810	—	45.5	73.4	443	430	27.5	—	271	266
63.0	82.8	795	—	45.0	73.2	436	424	27.0	—	268	263
62.5	82.5	780	—	44.5	72.9	429	418	26.5	—	264	260
62.0	82.2	766	—	44.0	72.6	423	413	26.0	—	261	257
61.5	82.0	752	—	43.5	72.4	417	407	25.5	—	258	254
61.0	81.7	739	—	43.0	72.1	411	401	25.0	—	255	251
60.5	81.4	726	—	42.5	71.8	405	396	24.5	—	252	248
60.0	81.2	713	—	42.0	71.6	399	391	24.0	—	249	245
59.5	80.9	700	—	41.5	71.3	393	385	23.5	—	246	242
59.0	80.6	688	—	41.0	71.1	388	380	23.0	—	243	240
58.5	80.3	676	—	40.5	70.8	382	375	22.5	—	240	237
58.0	80.1	664	—	40.0	70.5	377	370	22.0	—	237	234
57.5	79.8	653	—	39.5	70.3	372	365	21.5	—	234	232
57.0	79.5	642	—	39.0	70.0	367	360	21.0	—	231	229
56.5	79.3	631	—	38.5	—	362	355	20.5	—	229	227
56.0	79.0	620	—	38.0	—	357	350	20.0	—	226	225
55.5	78.7	609	—	37.5	—	352	345	19.5	—	223	222
55.0	78.5	599	—	37.0	—	347	341	19.0	—	221	220
54.5	78.2	589	—	36.5	—	342	336	18.5	—	218	218
54.0	77.9	579	—	36.0	—	338	332	18.0	—	216	216
53.5	77.7	570	—	35.5	—	333	327	17.5	—	214	214
53.0	77.4	561	—	35.0	—	329	323	17.0	—	211	211
52.5	77.1	551	—	34.5	—	324	318				

Fitting tolerance

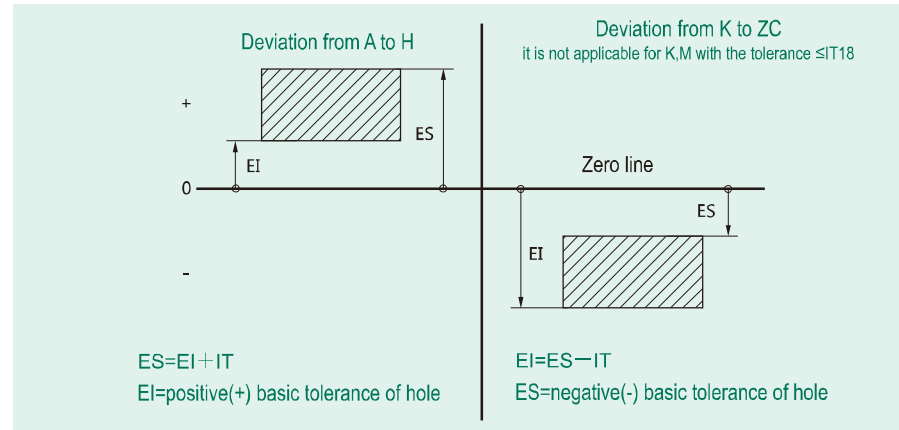
Basic dimension (mm)	Standard tolerance class																	
	IT1	IT2	IT3	IT4	IT5	IT6	IT7	IT8	IT9	IT10	IT11	IT12	IT13	IT14	IT15	IT16	IT17	IT18
大于 至	μm									mm								
-- 3	0.8	1.2	2	3	4	6	10	14	25	40	60	0.1	0.14	0.25	0.4	0.6	1	1.4
3 6	1	1.5	2.5	4	5	8	12	18	30	48	75	0.12	0.18	0.3	0.48	0.75	1.2	1.8
6 10	1	1.5	2.5	4	6	9	15	22	36	58	90	0.15	0.22	0.36	0.58	0.9	1.5	2.2
10 18	1.2	2	3	5	8	11	18	27	43	70	110	0.18	0.27	0.43	0.7	1.1	1.8	2.7
18 30	1.5	2.5	4	6	9	13	21	33	52	84	130	0.21	0.33	0.52	0.84	1.3	2.1	3.3
30 50	1.5	2.5	4	7	11	16	25	39	62	100	160	0.25	0.39	0.62	1	1.6	2.5	3.9
50 80	2	3	5	8	13	19	30	46	74	120	190	0.3	0.46	0.74	1.2	1.9	3	4.6
80 120	2.5	4	6	10	15	22	35	54	87	140	220	0.35	0.54	0.87	1.4	2.2	3.5	5.4
120 180	3.5	5	8	12	18	25	40	63	100	160	250	0.4	0.63	1	1.6	2.5	4	6.3
180 250	4.5	7	10	14	20	29	46	72	115	185	290	0.46	0.72	1.15	1.85	2.9	4.6	7.2
250 315	6	8	12	16	23	32	52	81	130	210	320	0.52	0.81	1.3	2.1	3.2	5.2	8.1
315 400	7	9	13	18	25	36	57	89	140	230	360	0.57	0.89	1.4	2.3	3.6	5.7	8.9
400 500	8	10	15	20	27	40	63	97	155	250	400	0.63	0.97	1.55	2.5	4	6.3	9.7
500 630	9	11	16	22	32	44	70	110	175	280	440	0.7	1.1	1.75	2.8	4.4	7	11
630 800	10	13	18	25	36	50	80	125	200	320	500	0.8	1.25	2	3.2	5	8	12.5
800 1000	11	15	21	28	40	56	90	140	230	360	560	0.9	1.4	2.3	3.6	5.6	9	14
1000 1250	13	18	24	33	47	66	105	165	260	420	660	1.05	1.65	2.6	4.2	6.6	10.5	16.5
1250 1600	15	21	29	39	55	78	125	195	310	500	780	1.25	1.95	3.1	5	7.8	12.5	19.5
1600 2000	18	25	35	46	65	92	150	230	370	600	920	1.5	2.3	3.7	6	9.2	15	23
2000 2500	22	30	41	55	78	110	175	280	440	700	1100	1.75	2.8	4.4	7	11	17.5	28
2500 3150	26	36	50	68	96	135	210	330	540	860	1350	2.1	3.3	5.4	8.6	13.5	21	33

Note : 1.If the basic dimension >500mm, the tolerance from IT1 to IT5 is on trial.
 2.If the basic dimension <=1mm, the tolerance from IT4 to IT18 are invalid.

The shaft lower deviation(ei) and upper deviation(es) can be obtained by basic tolerance and standard tolerance(IT) of shaft.



The hole lower deviation(EI) and upper deviation(ES) can be obtained by basic tolerance and standard tolerance(IT) of hole.



For example: for a hole with diameter 3mm, and tolerance H7, we can find that the lower deviation $EI=0$, in relation to H7 from the basic tolerance table, and the standard tolerance $IT=10\mu\text{m}$ corresponding to H7, thus the upper deviation $ES=EI+IT=10\mu\text{m}$.
 Therefore the hole fitting dimension is $\varnothing 3_0^{+0.01}$ mm.

Basic deviation value of shaft

Basic dimension mm	Basic deviation value													js
	Upper deviation es													
	Standard tolerance class													
>	≤	a	b	c	cd	d	e	ef	f	fg	g	h		
--	3	-270	-140	-60	-34	-20	-14	-10	-6	-4	-2	0		
3	6	-270	-140	-70	-46	-30	-20	-14	-10	-6	-4	0		
6	10	-280	-150	-80	-56	-40	-25	-18	-13	-8	-5	0		
10	14	-290	-150	-95		-50	-32		-16		-6	0		
14	18													
18	24	-300	-160	-110		-65	-40		-20		-7	0		
24	30													
30	40	-310	-170	-120		-80	-50		-25		-9	0		
40	50	-320	-180	-130										
50	65	-340	-190	-140		-100	-60		-30		-10	0		
65	80	-360	-200	-150										
80	100	-380	-220	-170		-120	-72		-36		-12	0		
100	120	-410	-240	-180										
120	140	-460	-260	-200		-145	-85		-43		-14	0		
140	160	-520	-280	-210										
160	180	-580	-310	-230		-170	-100		-50		-15	0		
180	200	-660	-340	-240										
200	225	-740	-380	-260		-190	-110		-56		-17	0		
225	250	-820	-420	-280										
250	280	-920	-480	-300		-210	-125		-62		-18	0		
280	315	-1050	-540	-330										
315	355	-1200	-600	-360		-230	-135		-68		-20	0		
355	400	-1350	-680	-400										
400	450	-1500	-760	-440		-260	-145		-76		-22	0		
450	500	-1650	-840	-480										
500	560					-290	-160		-80		-24	0		
560	630													
630	710					-320	-170		-86		-26	0		
710	800													
800	900					-360	-195		-98		-28	0		
900	1000													
1000	1120					-390	-220		-110		-30	0		
1120	1250													
1250	1400					-430	-240		-120		-32	0		
1400	1600													
1600	1800					-480	-260		-130		-34	0		
1800	2000													
2000	2240					-520	-290		-145		-38	0		
2240	2500													
2500	2800													
2800	3150													

In the formula Deviation = ± $\frac{IT_n}{2}$, IT_n is the IT value corresponding to 'n'.

Note: 1. If basic dimension ≤ 1mm, the basic deviation a and b are not adopted.
 2. Within the range from js7 to js11, if the value of IT_n is odd number, then the final deviation = ± $\frac{IT_{n-1}}{2}$

Basic deviation value													js							
Lower deviation ei																				
Standard tolerance class																				
IT5 和 IT6	IT7	IT8	IT4 和 IT7	≤ IT3 > IT7	Standard tolerance class															
			j		k		m	n	p	r	s	t	u	v	x	y	z	zn	zb	zc
-2	-4	-6	0	0	+2	+4	+6	+10	+14		+18		+20		+26	+32	+40	+60		
-2	-4		+1	0	+4	+8	+12	+15	+19		+23		+28		+34	+42	+52	+67	+80	
-2	-5		+1	0	+6	+10	+15	+19	+23		+28		+34		+42	+52	+67	+80		
-3	-6		+1	0	+7	+12	+18	+23	+28		+33		+39	+45	+50	+64	+90	+130		
-4	-8		+2	0	+8	+15	+22	+28	+35		+41	+47	+54	+63	+73	+98	+136	+188		
-5	-10		+2	0	+9	+17	+26	+34	+43		+48	+60	+68	+80	+94	+112	+148	+200	+274	
-5	-10		+2	0	+9	+17	+26	+34	+43		+48	+60	+70	+81	+97	+114	+136	+180	+242	+325
-7	-12		+2	0	+11	+20	+32	+41	+53	+66	+87	+102	+122	+144	+172	+226	+300	+405		
-7	-12		+2	0	+11	+20	+32	+43	+59	+75	+102	+120	+146	+174	+210	+274	+360	+480		
-9	-15		+3	0	+13	+23	+37	+51	+71	+91	+124	+146	+178	+214	+258	+335	+445	+585		
-9	-15		+3	0	+13	+23	+37	+54	+79	+104	+144	+172	+210	+254	+310	+400	+525	+690		
-9	-15		+3	0	+13	+23	+37	+63	+92	+122	+170	+202	+248	+300	+365	+470	+620	+800		
-11	-18		+3	0	+15	+27	+43	+65	+100	+134	+190	+228	+280	+340	+415	+535	+700	+900		
-11	-18		+3	0	+15	+27	+43	+68	+108	+146	+210	+252	+310	+380	+465	+600	+780	+1000		
-11	-18		+3	0	+15	+27	+43	+77	+122	+166	+236	+284	+350	+425	+520	+670	+880	+1150		
-11	-18		+3	0	+15	+27	+43	+80	+130	+180	+258	+310	+385	+470	+575	+740	+960	+1250		
-11	-18		+3	0	+15	+27	+43	+84	+140	+196	+284	+340	+425	+520	+640	+820	+1050	+1350		
-16	-26		+4	0	+20	+34	+56	+94	+158	+218	+315	+385	+475	+580	+710	+920	+1200	+1550		
-16	-26		+4	0	+20	+34	+56	+98	+170	+240	+350	+425	+525	+650	+790	+1000	+1300	+1700		
-18	-28		+4	0	+21	+37	+62	+108	+190	+268	+390	+475	+590	+730	+900	+1150	+1500	+1900		
-18	-28		+4	0	+21	+37	+62	+114	+208	+294	+435	+530	+660	+820	+1000	+1300	+1650	+2100		
-20	-32		+5	0	+23	+40	+68	+126	+232	+330	+490	+595	+740	+920	+1100	+1450	+1850	+2400		
-20	-32		+5	0	+23	+40	+68	+132	+252	+360	+540	+660	+820	+1000	+1250	+1600	+2100	+2600		
			0	0	+26	+44	+78	+150	+280	+400	+600									
			0	0	+26	+44	+78	+155	+310	+450	+660									
			0	0	+30	+50	+88	+175	+340	+500	+740									
			0	0	+30	+50	+88	+185	+380	+560	+840									
			0	0	+34	+56	+100	+210	+430	+620	+940									
			0	0	+34	+56	+100	+220	+470	+680	+1050									
			0	0	+40	+66	+120	+250	+520	+780	+1150									
			0	0	+40	+66	+120	+260	+580	+840	+1300									
			0	0	+48	+78	+140	+300	+640	+960	+1450									
			0	0	+48	+78	+140	+330	+720	+1050	+1600									
			0	0	+58	+92	+170	+370	+820	+1200	+1850									
			0	0	+58	+92	+170	+400	+920	+1350	+2000									
			0	0	+68	+110	+195	+440	+1000	+1500	+2300									
			0	0	+68	+110	+195	+460	+1100	+1650	+2500									
			0	0	+76	+135	+240	+550	+1250	+1900	+2900									
			0	0	+76	+135	+240	+580	+1400	+2100	+3200									

• Basic deviation value of hole

Dimensions mm	Basic deviation value																						
	EI Lower deviation EI										ES Upper deviation ES												
	Standard tolerance class													IT6	IT7	IT8	≤IT8	>IT8	≤IT8	>IT8	≤IT8	>IT8	≤IT7
	>	≤	A	B	C	CD	D	E	EF	F	FG	G	H	JS	J	K	M	N	P	ZC			
---	3	+270	+140	+60	+34	+20	+14	+10	+6	+4	+2	0		+2	+4	+6	0	0	-2	-2	-4	-4	
3	6	+270	+140	+70	+46	+30	+20	+14	+10	+6	+4	0		+5	+6	+10	-1+Δ	-4+Δ	-4	-8+Δ	0		
6	10	+280	+150	+80	+56	+40	+25	+18	+13	+8	+5	0		+5	+8	+12	-1+Δ	-6+Δ	-6	-10+Δ	0		
10	14																						
14	18	+290	+150	+95		+50	+32		+16		+6	0		+6	+10	+15	-1+Δ	-7+Δ	-7	-12+Δ	0		
18	24																						
24	30	+300	+160	+110		+65	+40		+20		+7	0		+8	+12	+20	-2+Δ	-8+Δ	-8	-15+Δ	0		
30	40	+310	+170	+120		+80	+50		+25		+9	0		+10	+14	+24	-2+Δ	-9+Δ	-9	-17+Δ	0		
40	50	+320	+180	+130																			
50	65	+340	+190	+140		+100	+60		+30		+10	0		+13	+18	+28	-2+Δ	-11+Δ	-11	-20+Δ	0		
65	80	+360	+200	+150																			
80	100	+380	+220	+170		+120	+72		+36		+12	0		+16	+22	+34	-3+Δ	-13+Δ	-13	-23+Δ	0		
100	120	+410	+240	+180																			
120	140	+460	+260	+200																			
140	160	+520	+280	+210		+145	+85		+43		+14	0		+18	+26	+41	-3+Δ	-15+Δ	-15	-27+Δ	0		
160	180	+580	+310	+230																			
180	200	+660	+340	+240																			
200	225	+740	+380	+260		+170	+100		+50		+15	0		+22	+30	+47	-4+Δ	-17+Δ	-17	-31+Δ	0		
225	260	+820	+420	+280																			
260	280	+920	+480	+300		+190	+110		+56		+17	0		+25	+36	+55	-4+Δ	-20+Δ	-20	-34+Δ	0		
280	315	+1050	+540	+330																			
315	355	+1200	+600	+360		+210	+125		+62		+18	0		+29	+39	+60	-4+Δ	-21+Δ	-21	-37+Δ	0		
355	400	+1350	+680	+400																			
400	450	+1500	+760	+440		+230	+135		+68		+20	0		+33	+43	+66	-5+Δ	-23+Δ	-23	-40+Δ	0		
450	500	+1650	+840	+480																			
500	560					+260	+145		+76		+22	0											
560	630																						
630	710					+290	+160		+80		+24	0											
710	800																						
800	900					+320	+170		+86		+26	0											
900	1000																						
1000	1120					+350	+195		+98		+28	0											
1120	1250																						
1250	1400					+390	+220		+110		+30	0											
1400	1600																						
1600	1800					+430	+240		+120		+32	0											
1800	2000																						
2000	2240					+480	+260		+130		+34	0											
2240	2500																						
2500	2800					+520	+290		+145		+38	0											
2800	3150																						

Note: 1. If basic dimension ≤1mm, the basic deviation A and B are not adopted, so is the N when IT≥IT8

2. Within the range from JS7 to JS11, if the value of ITn is odd number, then the final deviation is $\pm \frac{ITn-1}{2}$

3. Regarding to the K, M, N with IT≤IT8 or the P to ZC with IT≤IT7, the Δ value can be selected from the right-side sheet.

For example: within the range 8-30mm of K7, Δ=8μm, therefore ES=-2+8=+6μm
within the range 18-30mm of S6: Δ=4μm, therefore ES=-.35+4=-.31μm

4. Special cases: within the range 250-315mm of M5, ES=-9μm (instead -11μm)

μm

Basic deviation value													Value					
Upper deviation ES																		
Standard tolerance class >IT7													Standard tolerance class					
P	R	S	T	U	V	X	Y	Z	ZA	ZB	ZC	IT3	IT4	IT5	IT6	IT7	IT8	
-6	-10	-14		-18		-20		-26	-32	-40	-60	0	0	0	0	0	0	
-12	-15	-19		-23		-28		-35	-42	-50	-80	1	1.5	1	3	4	6	
-15	-19	-23		-28		-34		-42	-52	-67	-97	1	1.5	2	3	6	7	
-18	-23	-28		-33		-40		-50	-64	-90	-130	1	2	3	3	7	9	
			-39		-45		-60											-77
-22	-28	-35		-41	-47	-54	-63	-73	-98	-136	-188	1.5	2	3	4	8	12	
			-48															-55
-26	-34	-43		-48	-60	-68	-80	-94	-112	-148	-200	1.5	3	4	5	9	14	
			-54															-70
-32	-41	-53		-66	-87	-102	-122	-144	-172	-226	-300	2	3	5	6	11	16	
			-75															-102
-37	-51	-71		-91	-124	-146	-178	-214	-258	-335	-445	2	4	5	7	13	19	
			-104															-144
-43	-63	-92		-122	-170	-202	-248	-300	-365	-470	-620	3	4	6	7	15	23	
			-134															-190
-50	-77	-108		-166	-236	-284	-350	-425	-520	-670	-880	3	4	6	9	17	26	
			-252															-310
-56	-94	-158		-218	-315	-385	-475	-580	-710	-920	-1200	4	4	7	9	20	29	
			-252															-350
-62	-108	-190		-268	-390	-475	-590	-730	-900	-1150	-1500	4	5	7	11	21	32	
			-114															-208
-68	-126	-232		-330	-490	-595	-740	-920	-1100	-1450	-1850	5	5	7	13	23	34	
			-252															-360
-78	-150	-280		-400	-600													
			-155			-310	-450	-660										
-88	-175	-340		-500	-740													
			-185			-380	-560	-840										
100	-210	-430		-620	-940													
			-220			-470	-680	-1050										
-120	-250	-520		-780	-1150													
			-260			-580	-840	-1300										
-140	-300	-640		-960	-1450													
			-330			-720	-1050	-1600										
-170	-370	-820		-1200	-1850													
			-400			-920	-1350	-2000										
-195	-440	-1000		-1500	-2300													
			-460			-1100	-1650	-2500										
-240	-550	-1250		-1900	-2900													

