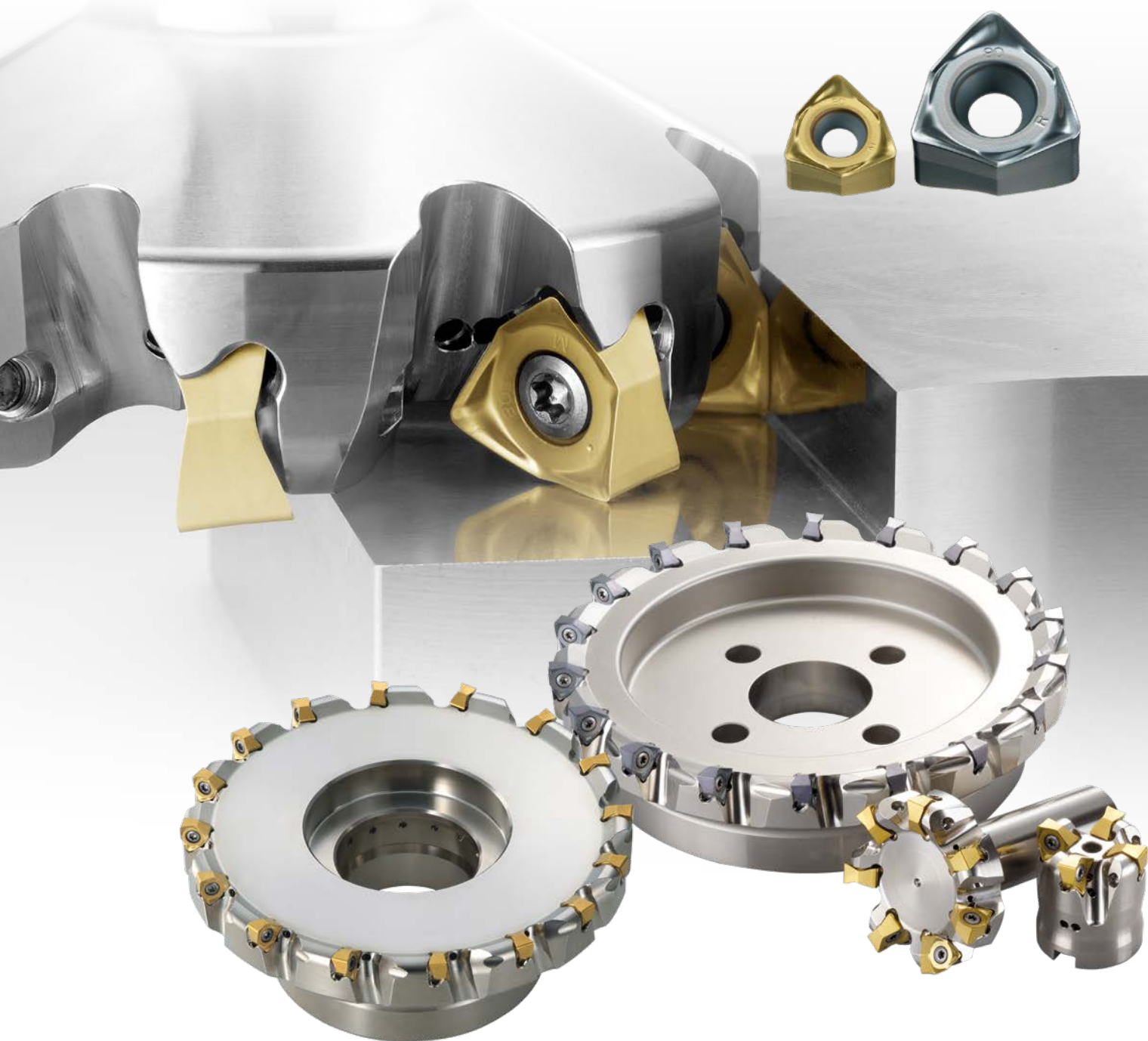


WWX SERIES

A NEW LEVEL OF VERSATILITY



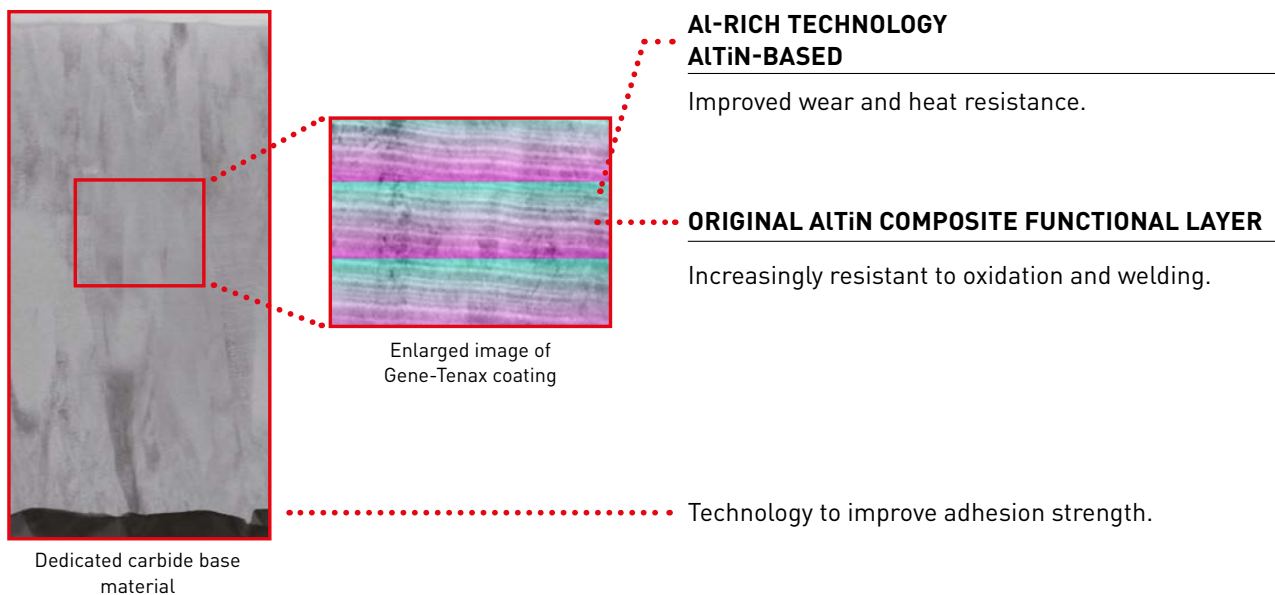
MP1220 / MP1230 / MP1240

MULTI-LAYER PVD COATING FOR MILLING

ONE INSERT SERIES TO SOLVE ALL PROBLEMS WHEN MACHINING STEELS, STAINLESS STEELS, HEAT RESISTANT AND TITANIUM ALLOYS.

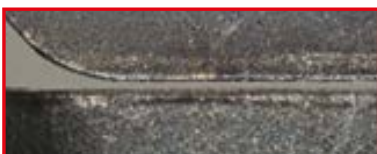
GENE-TENAX COATING

By controlling the coating structure at the nano level, damage to the coating has been vastly reduced compared to conventional lamination. By successfully laminating multiple films, simultaneous strengthening of heat, wear and welding resistance is achieved. Additionally the coating is now much less prone to cracking and with the increased adhesive strength, the most stable grade for milling has been created.



ACHIEVES TOUGHNESS FOR A WIDE RANGE OF WORK MATERIALS

STEEL MACHINING DAMAGE



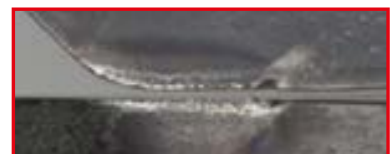
Cutting edge that is resistant to wear when machining steel

STAINLESS STEEL MACHINING DAMAGE



Cutting edge that is less susceptible to notching when machining stainless steel

HEAT RESISTANT AND TITANIUM ALLOYS MACHINING DAMAGE



Cutting edge that is resistant to chipping when machining heat resistant and titanium alloys



Thermal cracking



Notching

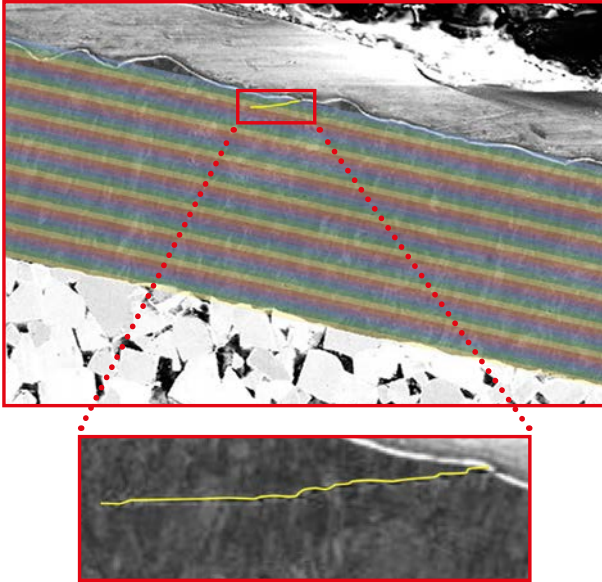


Chipped cutting edge

NEW MULTILAYER TECHNOLOGY

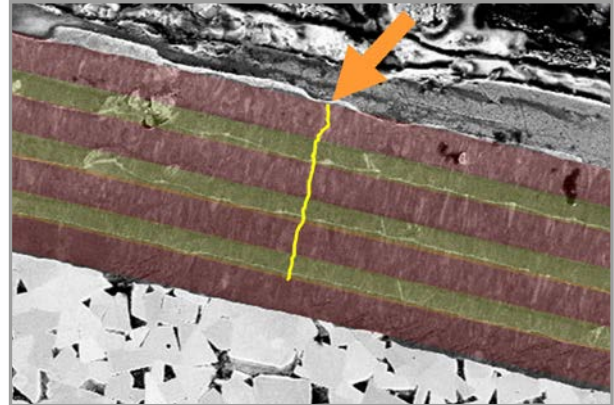
The adoption of a new multi-layer technology has succeeded in suppressing crack propagation and dramatically improved fracture resistance when compared to conventional technology.

MP1200 SERIES MULTI-LAYER TECHNOLOGY



Prevents cracks

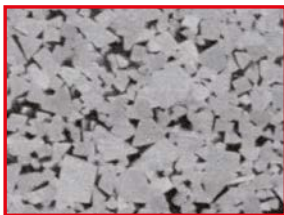
CONVENTIONAL LAYER TECHNOLOGY



MULTI-GRADE SYSTEM

Using simulation technology, precise analysis of the cutting edge load and temperature when machining different workpiece materials was carried out. This led to the creation of different substrates for three different grades and ensures optimal performance for each type of workpiece material. Ensuring the best performance over a wide range of applications.

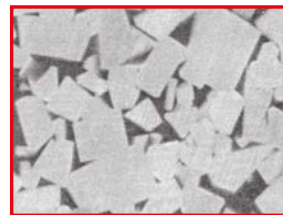
MP1220



MP1230



MP1240



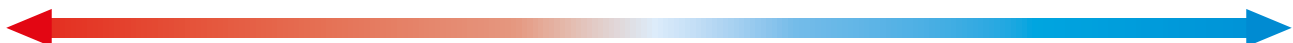
2μm

SELECTION GUIDELINES

Steel, Carbon steel

Stainless steel

Titanium alloys,
Heat resistant alloys



- Hard grade
- Stable cutting
- Emphasis on wear resistance and mechanical properties

- Tough grade
- Unstable cutting
- Emphasis on fracture resistance and thermal properties

WWX SERIES

STABLE AND RELIABLE

High performance 90° face milling cutter with double-sided trigon inserts for shoulder, face and copy milling.

The indexable inserts with 6 usable cutting edges offer lower cost per cutting edge and excellent process reliability thanks to a special negative geometry but with a positive, sharp cutting action.

Precise locating of the inserts ensures a true 90° corner milling operation, eliminating the need for secondary operations, thereby saving valuable production time and costs.

PRODUCT RANGE WWX200

- Arbor type: DC Ø 40 – 160 mm
- Shank type: DC Ø 25 – 50 mm
- Inserts with radii: 0.4 – 0.8
- Depth of cut: APMX 5 mm

APPLICATION

- General machining
- Face milling
- Shoulder milling



PRODUCT RANGE WWX400

- Arbor type: DC Ø 50 – 250 mm
- Shank type: DC Ø 50 – 80 mm
- Inserts with radii: 0.4 / 0.8 / 1.6 / 2.0
- Depth of cut: APMX 8 mm

FEATURES

- Low cutting force
- Good chip evacuation
- Large variety of grades and breakers available
- Double-sided trigon inserts with 6 cutting edges
- Superior surface finishing

WWX SERIES

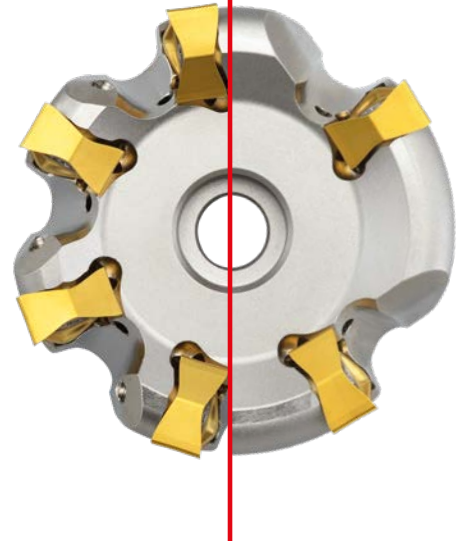
UNIQUE PROPERTIES

CHOICE AND AVAILABILITY

Diameters 25 – 160 mm (WWX200) / 50 – 250 mm (WWX400) are all available in coarse, fine and extra-fine pitch geometries. Providing a wide choice of sizes means the ideal milling body can be selected for a huge range of applications.

Additionally, each cutter body has an internal through coolant supply directed at each insert.

Extra fine pitch Coarse pitch



PERFECT 90° WALL MACHINING AND INSERTS WITH MAXIMUM DEPTH OF CUT UP TO 5 MM (WWX200) / 8 MM (WWX400)

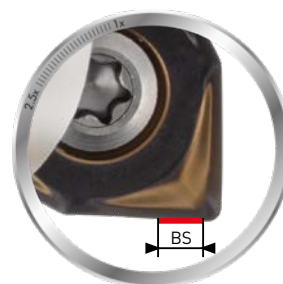
Clever positioning of the insert generates extremely low cutting resistance and helps to generate accurate 90° walls under all machining conditions.

LOW CUTTING FORCE

Innovative geometry generates low cutting forces. The increased insert thickness provides excellent resistance to breakage.

LARGE RADIUS OF MINOR CUTTING EDGE

To meet the modern expectations regarding surface finish quality, a specially defined radius ($R = 100 \mu\text{m}$) with a cutting width BS of 0.5 – 1.7 mm, is used as a wiper geometry across all L, M and R chipbreakers.



WWX SERIES

INSERTS

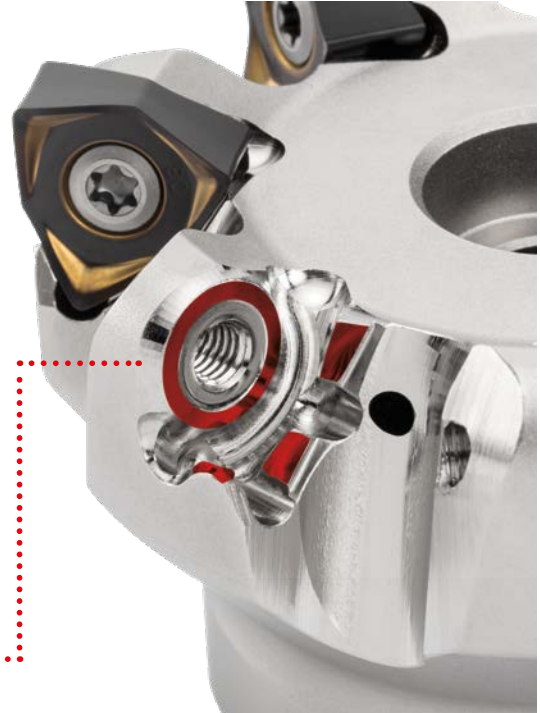
PRECISE INSERT POSITIONING IN COMBINATION WITH STRONG INSERT CLAMPING

Four contact surfaces inside the insert pocket, plus use of a large clamping screw provides precise, but stable and secure clamping of the inserts.

Therefore, WWX200 / WWX400 can be recommended for both semi-roughing and finish machining.



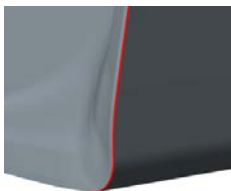
Strong X geometry



SHOULDER AND WALL MACHINING WITHOUT CHIP INTERFERENCE

Use of a convex main cutting edge allows for precise 90° shoulder machining and reduces contact between ejected chips and the workpiece.

WWX200 / WWX400



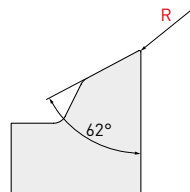
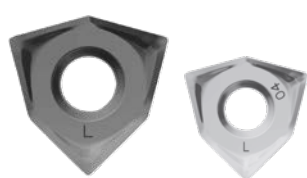
Conventional



WWX SERIES

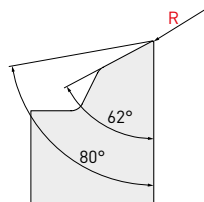
GRADES AND CHIPBREAKERS

An extensive choice of grades and chipbreakers ensures the optimal choice is available for stable and efficient machining over a wide range of applications.



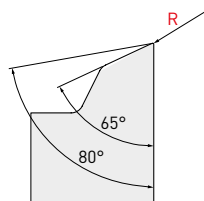
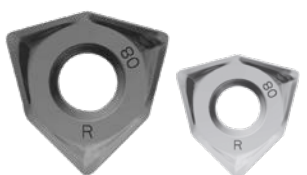
L-BREAKER

Recommended for machining that requires reduced cutting loads, or for machining HRSA materials.



M-BREAKER

Outstanding balance of cutting edge sharpness and stability. First choice all-rounder, suitable for a variety of materials and applications.

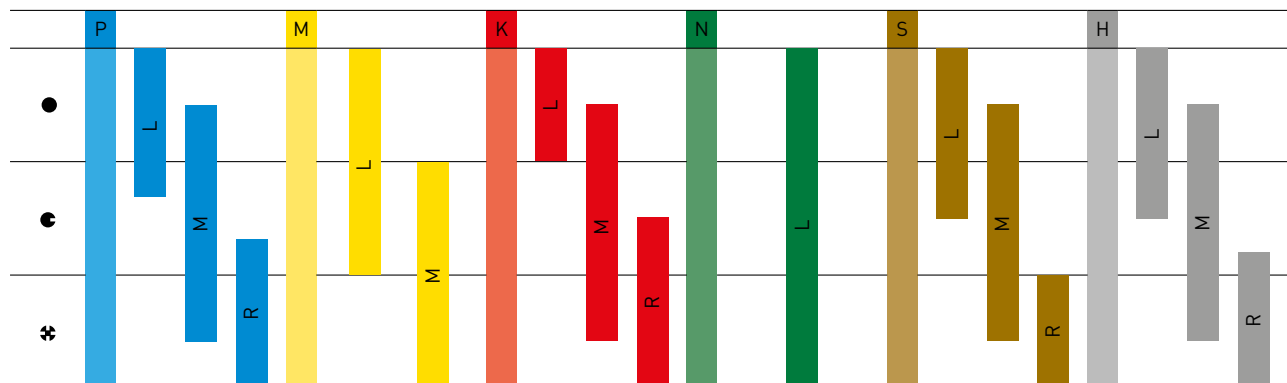


R-BREAKER

First recommendation for interrupted cutting conditions.

APPLICATION OF CHIPBREAKERS

Cutting conditions: ●: Stable cutting ●: General cutting ✖: Unstable cutting



WWX SERIES

GRADES FOR MACHINING A WIDE RANGE OF MATERIALS

P	CVD	PVD	M	CVD	PVD	K	CVD	PVD	S	PVD	H	PVD
P10	MV1020	MP1220 NEW	VP15TF	M10	MP1220 NEW	K10	MC5020	XC5010	S10	MP1220 NEW	H10	VP15TF
P20	MV1030	MP6120 NEW	M20	MV1030	MP1230 NEW	K20	MV1020	VP15TF	S20	MP9120 NEW	H20	VP15TF
P30		MP1230 NEW	M30		MP7130 NEW	K30	MV1030	VP15TF	S30	MP1230 NEW	H30	
P40		MP1240 NEW	M40		MP1240 NEW	K40		VP20RT	S40	MP1240 NEW	H40	

MP1220

For stable machining operations with an emphasis on wear resistance.

MP1230

Ideal for medium machining applications and for light interrupted cutting.

MP1240

The toughest grade for heavy machining and rough interrupted applications.

MV1020

This grade has advanced wear and thermal shock resistance and also achieves stable cutting at unprecedented cutting speeds, especially when machining steel and ductile cast iron, thus greatly reducing work time.

MV1030

The new Al-Rich coating also provides excellent wear resistance. An unprecedented performance against sudden breakage was also realised especially during problematic wet cutting and when machining stainless steels.

MP6120

For general milling of steel.

MP6130

For interrupted milling of steel.

MP7130

For general milling of stainless steel.

MC5020

For general milling of cast iron.

MP9120

For general milling of HRSA and titanium alloy.

MP9130

For interrupted and general milling of HRSA and Titanium alloy.

TF15

For general milling of aluminium.

VP15TF

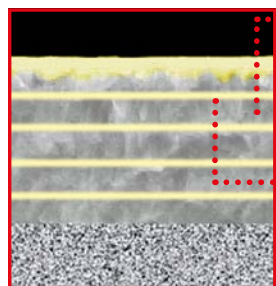
For stable machining when the coating is combined with a high wear and fracture resistant carbide substrate.

MP6100/MP7100/MP9100 SERIES

TOUGH-Σ TECHNOLOGY

A fusion of the separate coating technologies; PVD and multi-layering provides extra toughness.

Al-Ti-Cr-N BASED PVD COATING



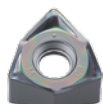
Graphical representation

BASE LAYER HIGH Al-(Al, Ti)N

The new technology Al-(Al, Ti)N coating provides stabilisation of the high hardness phase and succeeds in dramatically improving wear, crater and welding resistance.

BEST LAYER FOR EACH MATERIAL

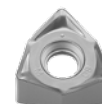
P	[Al,Cr]N	M	TiN	S	CrN
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Thermal Cracks



Notching



Welding by Chipping

MV1000 SERIES

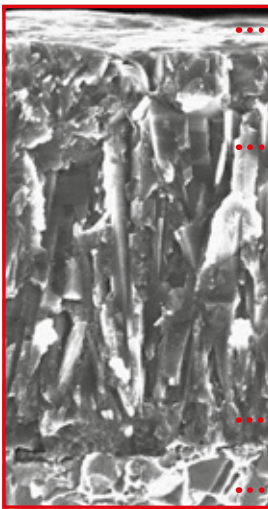
COATED CARBIDE GRADE FOR MILLING

ADVANCED WEAR RESISTANCE

By adopting the newly developed Al-Rich coating technology, the (Al,Ti)N with a high Al content ratio displays very high hardness. This greatly improves oxidation and wear resistance.

ADVANCED THERMAL SHOCK RESISTANCE

The extreme heat resistance of this new series achieves amazing stability, not only during dry cutting, but also when wet cutting where inserts are usually prone to thermal cracking.



EXCELLENT WELDING RESISTANCE

Smooth surface.

OUTSTANDING WEAR RESISTANCE

Newly developed Al-Rich coating.

EXCELLENT CHIPPING RESISTANCE FOR STABLE MACHINING

Newly developed bonding layer.

FRACTURE RESISTANCE FOR THE ULTIMATE STABILITY

Exclusive cemented carbide substrate.

Graphical representation



NEW LEVEL OF VERSATILITY



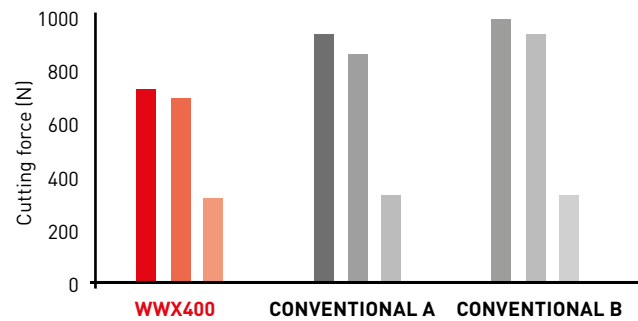
BENEFITS

- Inserts with the capability to machine up to APMX = 5 mm (WWX200)/8 mm (WWX400)
- Unique negative insert design with six cutting edges for high productivity machining enables lower costs per component
- Multi-edge, self-locating inserts enable robust and reliable machining
- Use over several different machining processes without changing tools provides flexibility

WWX400

CUTTING FORCE

Material	1.7225 / 42CrM04
Tool	WWX400 Ø 80
Vc (m/min)	160
fz (mm/t.)	0.2
ap (mm)	2.0
ae (mm)	64
Cutting mode	Single insert

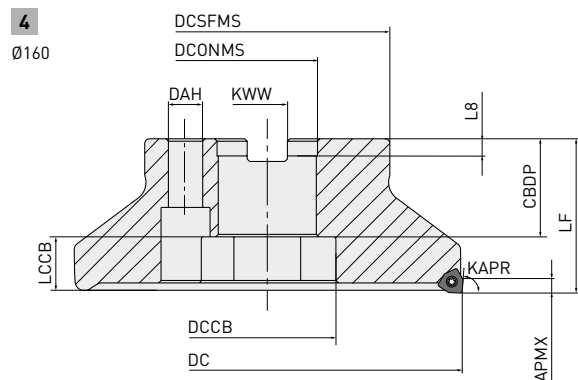
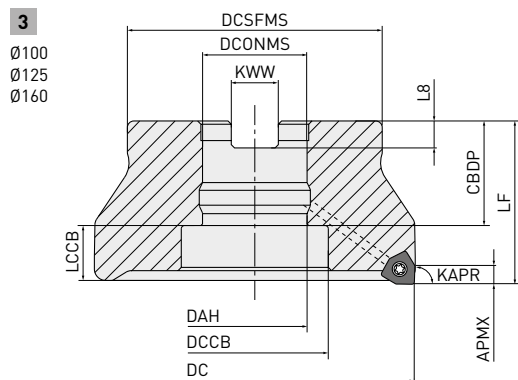
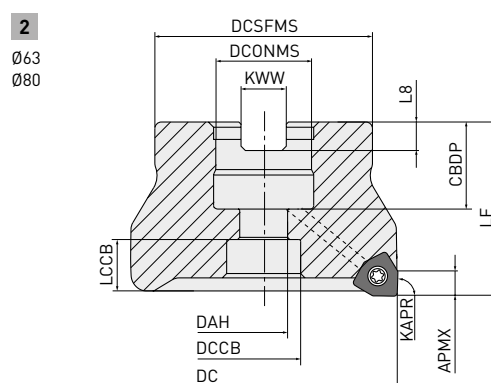
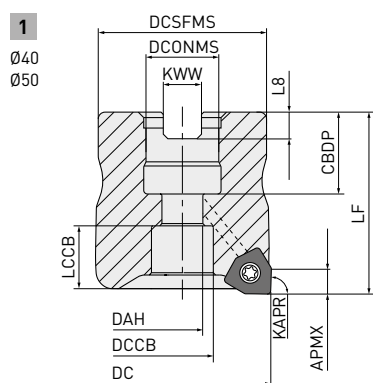


WWX200



90° FACE MILLING CUTTER

P M K N S H



Right hand tool holder only.

ARBOR TYPE

Order number	Stock	APMX	DC	DCONMS	LF	RPMX	WT	ZEFP		Type
WWX200-040A03AR	●	5	40	16	40	21600	0.2	3	○	1
WWX200-040A04AR	●	5	40	16	40	21600	0.2	4	○	1
WWX200-050A04AR	●	5	50	22	40	18600	0.4	4	○	1
WWX200-050A05AR	●	5	50	22	40	18600	0.4	5	○	1
WWX200-050A06AR	●	5	50	22	40	18600	0.3	6	○	1
WWX200-063A05AR	●	5	63	22	40	16000	0.5	5	○	2
WWX200-063A06AR	●	5	63	22	40	16000	0.5	6	○	2
WWX200-063A07AR	●	5	63	22	40	16000	0.5	7	○	2
WWX200-080A05AR	●	5	80	27	50	13600	1.1	5	○	2
WWX200-080A07AR	●	5	80	27	50	13600	1.0	7	○	2

1/2

WWX200 – 90° FACE MILLING CUTTER – ARBOR TYPE

Order number	Stock	APMX	DC	DCONMS	LF	RPMX	WT	ZEFP		Type
WWX200-080A09AR	●	5	80	27	50	13600	1.0	9	○	2
WWX200-100B06AR	●	5	100	32	50	11700	1.7	6	○	3
WWX200-100B08AR	●	5	100	32	50	11700	1.7	8	○	3
WWX200-100B11AR	●	5	100	32	50	11700	1.7	11	○	3
WWX200-125B07AR	●	5	125	40	63	10100	3.1	7	○	3
WWX200-125B11AR	●	5	125	40	63	10100	3.0	11	○	3
WWX200-125B14AR	●	5	125	40	63	10100	3.0	14	○	3
WWX200-160C09NR	●	5	160	40	63	8600	4.6	9	—	4
WWX200-160C12NR	●	5	160	40	63	8600	4.6	12	—	4
WWX200-160C16NR	●	5	160	40	63	8600	4.6	16	—	4

2/2

1. The maximum spindle speeds RPMX are set to ensure tool and insert stability.
2. When using the tool at high spindle speeds, ensure that the tool and arbor are correctly balanced.
3. ○ = With through coolant holes
4. A set bolt to the arbor is not supplied with the body. Please refer to page 21, when ordering.
5. Please use a set bolt of the FMC type on the cutter body from 40 to 100 in diameter [DC].
6. Please use a set bolt of the FMA type on the cutter body from 125 to 160 in diameter [DC].



MOUNTING DIMENSIONS

Order number	CBDP	DAH	DCCB	DCONMS	DCSFMS	KWW	LCCB	L8	Type
WWX200-040A03AR	18	9	13.6	16	37	8.4	13.8	5.6	1
WWX200-040A04AR	18	9	13.6	16	37	8.4	13.8	5.6	1
WWX200-050A04AR	20	11	17	22	47	10.4	11.8	6.3	1
WWX200-050A05AR	20	11	17	22	47	10.4	11.8	6.3	1
WWX200-050A06AR	20	11	17	22	47	10.4	11.8	6.3	1
WWX200-063A05AR	20	11	17	22	50	10.4	11.8	6.3	2
WWX200-063A06AR	20	11	17	22	50	10.4	11.8	6.3	2
WWX200-063A07AR	20	11	17	22	50	10.4	11.8	6.3	2
WWX200-080A05AR	23	13	20	27	56	12.4	11.8	7	2
WWX200-080A07AR	23	13	20	27	56	12.4	11.8	7	2
WWX200-080A09AR	23	13	20	27	56	12.4	11.8	7	2
WWX200-100B06AR	26	32	45	32	78	14.4	16.8	8	3
WWX200-100B08AR	26	32	45	32	78	14.4	16.8	8	3
WWX200-100B11AR	26	32	45	32	78	14.4	16.8	8	3
WWX200-125B07AR	35	42	56	40	89	16.4	21.8	9	3
WWX200-125B11AR	35	42	56	40	89	16.4	21.8	9	3
WWX200-125B14AR	35	42	56	40	89	16.4	21.8	9	3
WWX200-160C09NR	40	—	56	40	100	16.4	21.8	9	4
WWX200-160C12NR	40	—	56	40	100	16.4	21.8	9	4
WWX200-160C16NR	40	—	56	40	100	16.4	21.8	9	4

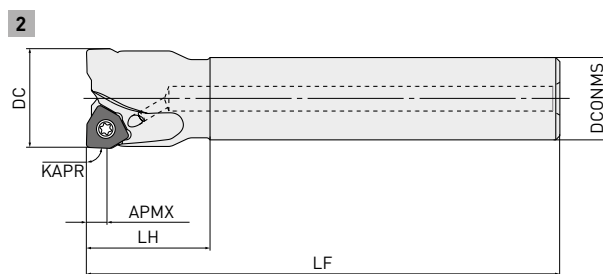
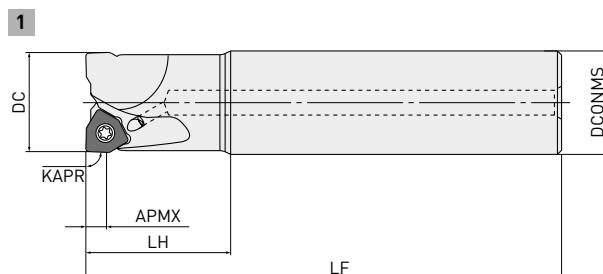
1/1

WWX200



90° FACE MILLING CUTTER

P M K N S H



Right hand tool holder only.

SHANK TYPE

Order number	Stock	APMX	DC	DCONMS	LF	RPMX	WT	LH	ZEFP		Type
WWX200R2502SA20S	●	5	25	20	115	29600	0.3	30	2	○	2
WWX200R2502SA25S	●	5	25	25	115	29600	0.4	35	2	○	1
WWX200R2502SA25L	●	5	25	25	170	29600	0.6	70	2	○	1
WWX200R2502WA25S	●	5	25	25	91	29600	0.3	35	2	○	1
WWX200R2802SA25S	●	5	28	25	115	27400	0.4	35	2	○	2
WWX200R2802SA25L	●	5	28	25	170	27400	0.6	35	2	○	2
WWX200R3002SA25S	●	5	30	25	125	26200	0.5	35	2	○	2
WWX200R3202SA32S	●	5	32	32	125	26200	0.7	45	2	○	1
WWX200R3202WA32S	●	5	32	32	105	26200	0.6	45	2	○	1
WWX200R3203SA32S	●	5	32	32	125	26200	0.7	45	3	○	1
WWX200R3203SA32L	●	5	32	32	190	26200	1.0	90	3	○	1
WWX200R3203WA32S	●	5	32	32	105	26200	0.6	45	3	○	1
WWX200R3503SA32L	●	5	35	32	190	25100	1.1	45	3	○	2
WWX200R4003SA32S	★	5	40	32	125	21600	0.8	45	3	○	2
WWX200R4004SA32S	★	5	40	32	125	21600	0.8	45	4	○	2
WWX200R5004SA32S	★	5	50	32	125	18600	0.9	45	4	○	2
WWX200R5005SA32S	★	5	50	32	125	18600	0.9	45	5	○	2
WWX200R5006SA32S	★	5	50	32	125	18600	0.9	45	6	○	2

1/1

1. The maximum spindle speeds RPMX are set to ensure tool and insert stability.
2. When using the tool at high spindle speeds, ensure that the tool and arbor are correctly balanced.
3. ○ = With through coolant holes



WWX400

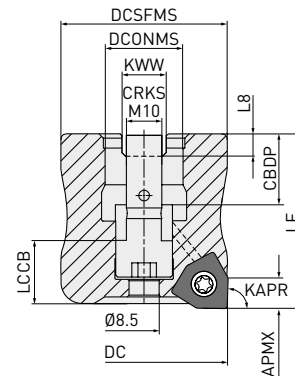


90° FACE MILLING CUTTER

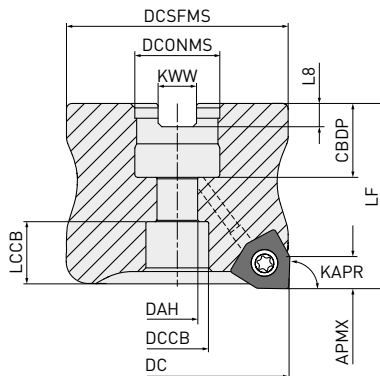
P M K N S H



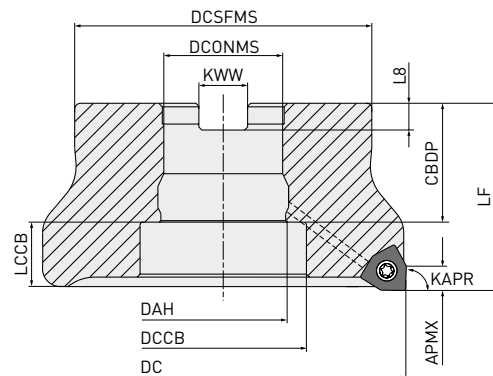
1
Ø50



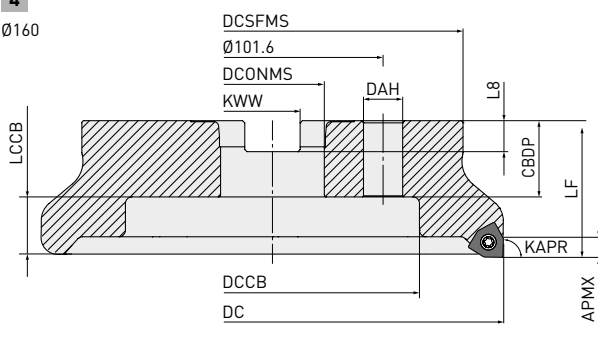
2
Ø63
Ø80



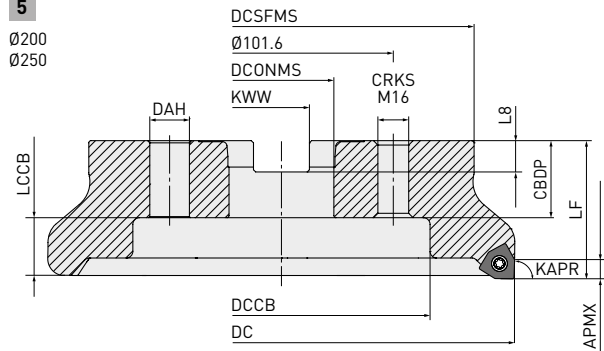
3
Ø100
Ø125



4
Ø160



5
Ø200
Ø250



Right hand tool holder only.

DC	Set bolt	Geometry	
Ø 50, Ø 63	HSC10030H	1	
Ø 80	HSC12035H		
Ø 100	MBA16033H		
Ø 125	MBA20040H		
Ø 160, Ø200, Ø250	—		

WWX400 – 90° FACE MILLING CUTTER – ARBOR TYPE

Order number	Stock	APMX	DC	DCONMS	GAMF	LF	RMPX	RPMX	WT	ZEFP		Type
WWX400-050A03AR	★	8	50	22	-12.8°	55	0.4°	5000	0.5	3	○	1
WWX400-050A04AR	●	8	50	22	-12.8°	55	0.4°	5000	0.5	4	○	1
WWX400-063A03AR	★	8	63	22	-11°	40	0.26°	14100	0.5	3	○	2
WWX400-063A04AR	●	8	63	22	-11°	40	0.26°	14100	0.5	4	○	2
WWX400-063A05AR	●	8	63	22	-11°	40	0.26°	14100	0.5	5	○	2
WWX400-080A04AR	★	8	80	27	-9.2°	50	0.16°	12200	1	4	○	2
WWX400-080A05AR	●	8	80	27	-9.2°	50	0.16°	12200	1	5	○	2
WWX400-080A07AR	●	8	80	27	-9.2°	50	0.16°	12200	0.9	7	○	2
WWX400-100B05AR	★	8	100	32	-8.5°	50	—	10700	1.6	5	○	3
WWX400-100B07AR	●	8	100	32	-8.5°	50	—	10700	1.5	7	○	3
WWX400-100B09AR	●	8	100	32	-8.5°	50	—	10700	1.5	9	○	3
WWX400-125B06AR	★	8	125	40	-7.8°	63	—	9500	3	6	○	3
WWX400-125B08AR	●	8	125	40	-7.8°	63	—	9500	3	8	○	3
WWX400-125B12AR	★	8	125	40	-7.8°	63	—	9500	2.9	12	○	3
WWX400-160C08NR	★	8	160	40	-7.3°	63	—	8300	4.5	8	—	4
WWX400-160C10NR	★	8	160	40	-7.3°	63	—	8300	4.4	10	—	4
WWX400-160C14NR	★	8	160	40	-10°	63	—	8300	4.4	14	—	4
WWX400-200C10NR	★	8	200	60	-7.2°	63	—	7300	6.7	10	—	5
WWX400-200C12NR	★	8	200	60	-7.2°	63	—	7300	6.7	12	—	5
WWX400-200C16NR	★	8	200	60	-8.5°	63	—	7300	6.6	16	—	5
WWX400-250C12NR	★	8	250	60	-7.2°	63	—	6400	11.5	12	—	5
WWX400-250C14NR	★	8	250	60	-7.2°	63	—	6400	11.5	14	—	5
WWX400-250C18NR	★	8	250	60	-7.2°	63	—	6400	11.4	18	—	5

1/1

1. The maximum spindle speeds RPMX are set to ensure tool and insert stability.
2. When using the tool at high spindle speeds, ensure that the tool and arbor are correctly balanced.
3. ○ = With through coolant holes
4. A set bolt to the arbor is not supplied with the body. Please refer to page 19, when ordering.
5. Please use a set bolt of the FMC type on the cutter body from 63 to 100 in diameter [DC].
6. Please use a set bolt of the FMA type on the cutter body from 125 to 250 in diameter [DC].

21 

WWX400 – 90° FACE MILLING CUTTER – ARBOR TYPE**MOUNTING DIMENSIONS**

Order number	CBDP	DAH	DCCB	DCONMS	DCSFMS	KWW	LCCB	L8	Type
WWX400-050A03AR	20	—	—	22	47	10.4	12.2	6.3	1
WWX400-050A04AR	20	—	—	22	47	10.4	12.2	6.3	1
WWX400-063A03AR	20	11	17	22	50	10.4	11.2	6.3	2
WWX400-063A04AR	20	11	17	22	50	10.4	11.2	6.3	2
WWX400-063A05AR	20	11	17	22	50	10.4	11.2	6.3	2
WWX400-080A04AR	23	13	20	27	56	12.4	14.2	7.0	2
WWX400-080A05AR	23	13	20	27	56	12.4	14.2	7.0	2
WWX400-080A07AR	23	13	20	27	56	12.4	14.2	7.0	2
WWX400-100B05AR	32	32	45	32	78	14.4	16.2	8.0	3
WWX400-100B07AR	32	32	45	32	78	14.4	16.2	8.0	3
WWX400-100B09AR	32	32	45	32	78	14.4	16.2	8.0	3
WWX400-125B06AR	40	40	56	40	89	16.4	21.2	9.0	3
WWX400-125B08AR	40	40	56	40	89	16.4	21.2	9.0	3
WWX400-125B12AR	40	40	56	40	89	16.4	21.2	9.0	3
WWX400-160C08NR	40	14	56	40	100	16.4	21.2	9.0	4
WWX400-160C10NR	40	14	56	40	100	16.4	21.2	9.0	4
WWX400-160C14NR	40	14	56	40	100	16.4	21.2	9.0	4
WWX400-200C10NR	32	18	135	60	160	25.7	29.2	14.22	5
WWX400-200C12NR	32	18	135	60	160	25.7	29.2	14.22	5
WWX400-200C16NR	32	18	135	60	160	25.7	29.2	14.22	5
WWX400-250C12NR	32	18	180	60	210	25.7	29.2	14.22	5
WWX400-250C14NR	32	18	180	60	210	25.7	29.2	14.22	5
WWX400-250C18NR	32	18	180	60	210	25.7	29.2	14.22	5

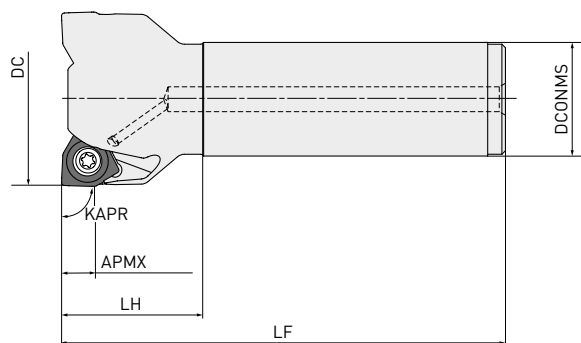
1/1

WWX400



90° FACE MILLING CUTTER

P M K N S H



Right hand tool holder only.

SHANK TYPE

Order number	Stock	APMX	DC	DCONMS	GAMF	LF	RMPX	RPMX	WT	LH	ZEFP	
WWX400R5003SA32M	★	8	50	32	-12.8°	125	0.45°	16000	0.83	40	3	○
WWX400R5004SA32M	★	8	50	32	-12.8°	125	0.45°	16000	0.81	40	4	○
WWX400R6303SA32M	★	8	63	32	-11.0°	125	0.31°	14100	1.00	40	3	○
WWX400R6304SA32M	★	8	63	32	-11.0°	125	0.31°	14100	0.97	40	4	○
WWX400R6305SA32M	★	8	63	32	-11.0°	125	0.31°	14100	0.95	40	5	○
WWX400R8004SA32M	★	8	80	32	-9.2°	125	0.21°	12200	1.27	40	4	○
WWX400R8005SA32M	★	8	80	32	-9.2°	125	0.21°	12200	1.24	40	5	○
WWX400R8007SA32M	★	8	80	32	-9.2°	125	0.21°	12200	1.19	40	7	○

1/1

1. The maximum spindle speeds RPMX are set to ensure tool and insert stability.
2. When using the tool at high spindle speeds, ensure that the tool and arbor are correctly balanced.
3. ○ = With through coolant holes



SPARE PARTS

Tool holder type			
	Clamp screw	Wrench (Insert)	Anti-seize lubricant
WWX400 Arbor type			
WWX400 Shank type	TS5R	TKY20T	MK1KS

* Clamp torque (N • m): TS5R = 5.0

● : Inventory maintained. ★ : Inventory maintained in Japan.

WWX200/400

RECOMMENDED CUTTING CONDITIONS

CUTTING SPEED / DRY CUTTING

Material	Properties	Cutting conditions	Grade	Vc		
				ae ≤ 0.5 DC	ae ≤ 0.8 DC	ae = DC
Mild steel	≤180HB	●	MV1020	300 (250 – 350)	280 (230 – 330)	250 (200 – 300)
		●	MP1220	240 (200 – 280)	220 (180 – 260)	200 (160 – 240)
		●	MP6120	240 (200 – 280)	220 (180 – 260)	200 (160 – 240)
		●	MV1030	230 (190 – 270)	210 (170 – 250)	190 (150 – 230)
		●	MV1020	290 (240 – 340)	260 (210 – 320)	240 (190 – 290)
		●	MP1230	230 (190 – 270)	210 (170 – 250)	190 (150 – 230)
		●	MV1030	230 (190 – 270)	210 (170 – 250)	190 (150 – 230)
		●	MP6130	230 (190 – 270)	210 (170 – 250)	190 (150 – 230)
		✱	MP1230	210 (170 – 250)	190 (150 – 230)	170 (130 – 210)
		✱	MP6130	210 (170 – 250)	190 (150 – 230)	170 (130 – 210)
		✱	VP15TF	210 (170 – 250)	190 (150 – 230)	170 (130 – 210)
Carbon steel Alloy steel	180 – 280HB	●	MV1020	260 (210 – 310)	240 (190 – 280)	210 (160 – 260)
		●	MP1220	210 (170 – 250)	190 (150 – 230)	170 (130 – 210)
		●	MP6120	210 (170 – 250)	190 (150 – 230)	170 (130 – 210)
		●	MV1030	200 (160 – 240)	180 (140 – 220)	160 (120 – 200)
		●	MV1020	250 (200 – 300)	230 (180 – 270)	200 (150 – 250)
		●	MP1230	200 (160 – 240)	180 (140 – 220)	160 (120 – 200)
		●	MV1030	200 (160 – 240)	180 (140 – 220)	160 (120 – 200)
		●	MP6130	200 (160 – 240)	180 (140 – 220)	160 (120 – 200)
		✱	MP1230	180 (140 – 220)	160 (120 – 200)	140 (100 – 180)
		✱	MP6130	180 (140 – 220)	160 (120 – 200)	140 (100 – 180)
		✱	VP15TF	180 (140 – 220)	160 (120 – 200)	140 (100 – 180)
Carbon steel Alloy steel Alloy tool steel	280 – 350HB ≤350HB	●	MV1020	260 (210 – 310)	240 (190 – 280)	210 (160 – 260)
		●	MP1220	200 (160 – 240)	180 (140 – 220)	170 (130 – 210)
		●	MP6120	200 (160 – 240)	180 (140 – 220)	160 (120 – 200)
		●	MV1030	200 (160 – 240)	180 (140 – 220)	200 (150 – 250)
		●	MV1020	250 (200 – 300)	230 (180 – 270)	200 (150 – 250)
		●	MP1230	190 (150 – 230)	170 (130 – 210)	150 (110 – 190)
		●	MV1030	190 (150 – 230)	170 (130 – 210)	150 (110 – 190)
		●	MP6130	190 (150 – 230)	170 (130 – 210)	150 (110 – 190)
		✱	MP1230	170 (130 – 210)	150 (110 – 190)	130 (90 – 170)
		✱	MP6130	170 (130 – 210)	150 (110 – 190)	130 (90 – 170)
		✱	VP15TF	170 (130 – 210)	150 (110 – 190)	130 (90 – 170)
Pre-hardened steel	35 – 45HRC	●	MP1220	140 (120 – 160)	—	—
		●	MP6120	140 (120 – 160)	—	—
		✱	MP1230	120 (100 – 140)	—	—
		●	MP6130	120 (100 – 140)	—	—
		✱	MP1230	110 (90 – 130)	—	—
		✱	MP6130	110 (90 – 130)	—	—
		✱	VP15TF	110 (90 – 130)	—	—

1/3

WWX200/400 – CUTTING SPEED / DRY CUTTING

Material	Properties	Cutting conditions	Grade	Vc		
				ae ≤ 0.5 DC	ae ≤ 0.8 DC	ae = DC
M	Austenitic stainless steel	≤200HB	● MV1030	180 (160 – 200)	160 (140 – 180)	—
			● MP1230	180 (160 – 200)	160 (140 – 180)	—
			● MP7130	180 (160 – 200)	160 (140 – 180)	—
			● MV1030	170 (150 – 190)	150 (130 – 170)	—
			● MP1230	170 (150 – 190)	150 (130 – 170)	—
			● MP7130	170 (150 – 190)	150 (130 – 170)	—
			● VP15TF	170 (150 – 190)	150 (130 – 170)	—
			✱ MP1240	150 (130 – 170)	130 (110 – 150)	—
			✱ MP7130	150 (130 – 170)	130 (110 – 150)	—
			✱ VP15TF	150 (130 – 170)	130 (110 – 150)	—
		>200HB	● MV1030	170 (150 – 190)	150 (130 – 170)	—
			● MP1230	170 (150 – 190)	150 (130 – 170)	—
			● MP7130	170 (150 – 190)	150 (130 – 170)	—
			● MV1030	160 (140 – 180)	140 (120 – 160)	—
			● MP1230	160 (140 – 180)	140 (120 – 160)	—
			● MP7130	160 (140 – 180)	140 (120 – 160)	—
			● VP15TF	160 (140 – 180)	140 (120 – 160)	—
			✱ MP1240	140 (120 – 160)	120 (100 – 140)	—
			✱ MP7130	140 (120 – 160)	120 (100 – 140)	—
			✱ VP15TF	140 (120 – 160)	120 (100 – 140)	—
M	Ferritic and martensitic Stainless steel	≤200HB	● MV1030	180 (160 – 200)	160 (140 – 180)	—
			● MP1220	180 (160 – 200)	160 (140 – 180)	—
			● MP1230	180 (160 – 200)	160 (140 – 180)	—
			● MP7130	180 (160 – 200)	160 (140 – 180)	—
			● MV1030	170 (150 – 190)	150 (130 – 170)	—
			● MP1230	170 (150 – 190)	150 (130 – 170)	—
			● MP7130	170 (150 – 190)	150 (130 – 170)	—
			● VP15TF	170 (150 – 190)	150 (130 – 170)	—
			✱ MP1240	150 (130 – 170)	130 (110 – 150)	—
			✱ MP7130	150 (130 – 170)	130 (110 – 150)	—
			✱ VP15TF	150 (130 – 170)	130 (110 – 150)	—
	Duplex stainless steel	≤280HB	● MP1230	160 (140 – 180)	140 (120 – 160)	—
			● MP7130	160 (140 – 180)	140 (120 – 160)	—
			● MP1230	150 (130 – 170)	130 (110 – 150)	—
			● MP7130	150 (130 – 170)	130 (110 – 150)	—
			● VP15TF	150 (130 – 170)	130 (110 – 150)	—
			✱ MP1240	130 (110 – 150)	110 (90 – 130)	—
			✱ MP7130	130 (110 – 150)	110 (90 – 130)	—
			✱ VP15TF	130 (110 – 150)	110 (90 – 130)	—
	Precipitation hardening Stainless steel	<450HB	● MP1230	140 (120 – 160)	—	—
			● MP7130	140 (120 – 160)	—	—
			● MP1230	130 (110 – 150)	—	—
			● MP7130	130 (110 – 150)	—	—
			● VP15TF	130 (110 – 150)	—	—
			✱ MP1240	110 (90 – 130)	—	—
			✱ MP7130	110 (90 – 130)	—	—
			✱ VP15TF	110 (90 – 130)	—	—

WWX200/400 – CUTTING SPEED / DRY CUTTING

Material	Properties	Cutting conditions	Grade	Vc		
				ae ≤ 0.5 DC	ae ≤ 0.8 DC	ae = DC
K	Gray cast iron	≤350MPa	● MC5020	250 (210 – 290)	230 (190 – 270)	210 (170 – 250)
			● MC5020	240 (200 – 280)	220 (180 – 260)	200 (160 – 240)
			● VP15TF	240 (200 – 280)	220 (180 – 260)	—
			✱ MC5020	220 (180 – 260)	200 (160 – 240)	180 (140 – 220)
			✱ VP15TF	220 (180 – 260)	200 (160 – 240)	180 (140 – 220)
	Ductile cast iron	≤450MPa	● MV1020	240 (200 – 310)	220 (170 – 280)	200 (150 – 260)
			● MV1030	210 (170 – 250)	190 (150 – 230)	170 (130 – 210)
			● MC5020	220 (180 – 260)	200 (160 – 240)	180 (140 – 220)
			● MV1020	230 (190 – 300)	210 (160 – 270)	190 (140 – 250)
			● MV1030	210 (170 – 250)	190 (150 – 230)	170 (130 – 210)
			● MC5020	210 (170 – 250)	190 (150 – 230)	170 (130 – 210)
			● VP15TF	210 (170 – 250)	190 (150 – 230)	—
			✱ MC5020	190 (150 – 230)	170 (130 – 210)	150 (110 – 190)
			✱ VP15TF	190 (150 – 230)	170 (130 – 210)	150 (110 – 190)
	Ductile cast iron	≤800MPa	● MV1020	210 (160 – 280)	190 (140 – 250)	160 (120 – 210)
			● MC5020	180 (140 – 220)	160 (120 – 200)	140 (100 – 180)
			● MV1030	170 (130 – 210)	150 (110 – 190)	130 (90 – 170)
			● MV1020	200 (150 – 270)	180 (130 – 240)	150 (110 – 200)
			● MV1030	170 (130 – 210)	150 (110 – 190)	130 (90 – 170)
			● MC5020	170 (130 – 210)	150 (110 – 190)	130 (90 – 170)
			● VP15TF	170 (130 – 210)	150 (110 – 190)	—
			✱ MC5020	150 (110 – 190)	130 (90 – 170)	110 (70 – 150)
			✱ VP15TF	150 (110 – 190)	130 (90 – 170)	110 (70 – 150)
H	Hardened steel	40 – 55HRC	● ● VP15TF	50 (30 – 70)	—	—
			● MP6120	40 (30 – 70)	—	—

3/3

1. To discharge chips effectively, use an air blow when machining. When the air blow is less effective at discharging chips, we recommend wet cutting.
2. When large vibration occurs, reduce the cutting conditions.
3. For interrupted cutting, reduce the cutting speed and feed rate by 20 %.

WWX200/400

RECOMMENDED CUTTING CONDITIONS

CUTTING SPEED/WET CUTTING

Material	Properties	Cutting conditions	Grade	Vc		
				ae ≤ 0.5 DC	ae ≤ 0.8 DC	ae = DC
Mild steel	≤180HB	●	MV1020	220 (210 – 230)	190 (180 – 210)	180 (160 – 190)
		●	MP1220	150 (140 – 160)	130 (120 – 140)	120 (110 – 130)
		●	MP6120	150 (140 – 160)	130 (120 – 140)	120 (110 – 130)
		●	MV1030	140 (130 – 150)	120 (110 – 130)	110 (100 – 120)
		●	MV1020	210 (200 – 220)	180 (170 – 200)	170 (150 – 180)
		●	MP1230	140 (130 – 150)	120 (110 – 130)	110 (100 – 120)
		●	MV1030	140 (130 – 150)	120 (110 – 130)	110 (100 – 120)
		●	MP6130	140 (130 – 150)	120 (110 – 130)	110 (100 – 120)
		✱	MP1230	120 (110 – 130)	100 (90 – 110)	90 (80 – 100)
		✱	MP6130	120 (110 – 130)	100 (90 – 110)	90 (80 – 100)
		✱	VP15TF	120 (110 – 130)	100 (90 – 110)	90 (80 – 100)
Carbon steel Alloy steel	180 – 280HB	●	MV1020	200 (190 – 210)	170 (160 – 190)	160 (150 – 170)
		●	MP1220	150 (140 – 160)	130 (120 – 140)	120 (110 – 130)
		●	MP6120	150 (140 – 160)	130 (120 – 140)	120 (110 – 130)
		●	MV1030	140 (130 – 150)	120 (110 – 130)	110 (100 – 120)
		●	MV1020	190 (180 – 200)	160 (150 – 180)	150 (140 – 160)
		●	MP1230	140 (130 – 150)	120 (110 – 130)	110 (100 – 120)
		●	MV1030	140 (130 – 150)	120 (110 – 130)	110 (100 – 120)
		●	MP6130	140 (130 – 150)	120 (110 – 130)	110 (100 – 120)
		✱	MP1230	120 (110 – 130)	90 (80 – 100)	80 (70 – 90)
		✱	MP6130	120 (110 – 130)	100 (90 – 110)	90 (80 – 100)
		✱	VP15TF	120 (110 – 130)	100 (90 – 110)	90 (80 – 100)
Carbon steel Alloy steel Alloy tool steel	280 – 350HB ≤350HB	●	MV1020	200 (190 – 210)	170 (160 – 190)	160 (150 – 170)
		●	MP1220	140 (130 – 150)	120 (110 – 130)	110 (100 – 120)
		●	MP6120	140 (130 – 150)	120 (110 – 130)	110 (100 – 120)
		●	MV1030	140 (130 – 150)	120 (110 – 130)	110 (100 – 120)
		●	MV1020	190 (180 – 200)	160 (150 – 180)	150 (140 – 160)
		●	MP1230	130 (120 – 140)	110 (100 – 120)	100 (90 – 110)
		●	MV1030	140 (130 – 150)	120 (110 – 130)	110 (100 – 120)
		●	MP6130	130 (120 – 140)	110 (100 – 120)	100 (90 – 110)
		✱	MP1230	110 (100 – 120)	90 (80 – 100)	80 (70 – 90)
		✱	MP6130	110 (100 – 120)	90 (80 – 100)	80 (70 – 90)
		✱	VP15TF	110 (100 – 120)	90 (80 – 100)	80 (70 – 90)
Pre-hardened steel	35 – 45HRC	●	MP1220	110 (100 – 120)	—	—
		●	MP6120	110 (100 – 120)	—	—
		●	MP1230	100 (90 – 110)	—	—
		●	MP6130	100 (90 – 110)	—	—
		✱	MP1230	80 (70 – 90)	—	—
		✱	MP6130	80 (70 – 90)	—	—
		✱	VP15TF	80 (70 – 90)	—	—

WWX200/400 – CUTTING SPEED / WET CUTTING

Material	Properties	Cutting conditions	Grade	Vc		
				ae ≤ 0.5 DC	ae ≤ 0.8 DC	ae = DC
M	Austenitic stainless steel	≤200HB	● MP1230	130 (120 – 140)	110 (100 – 120)	—
			● MP7130	130 (120 – 140)	110 (100 – 120)	—
			● MP1230	120 (110 – 130)	100 (90 – 110)	—
			● MP7130	120 (110 – 130)	100 (90 – 110)	—
			● VP15TF	120 (110 – 130)	100 (90 – 110)	—
			✱ MP1240	100 (90 – 110)	80 (70 – 90)	—
			✱ MP7130	100 (90 – 110)	80 (70 – 90)	—
			✱ VP15TF	100 (90 – 110)	80 (70 – 90)	—
		>200HB	● MP1230	130 (120 – 140)	110 (100 – 120)	—
			● MP7130	130 (120 – 140)	110 (100 – 120)	—
			● MP1230	120 (110 – 130)	100 (90 – 110)	—
			● MP7130	120 (110 – 130)	100 (90 – 110)	—
			● VP15TF	120 (110 – 130)	100 (90 – 110)	—
			✱ MP1240	100 (90 – 110)	80 (70 – 90)	—
			✱ MP7130	100 (90 – 110)	80 (70 – 90)	—
			✱ VP15TF	100 (90 – 110)	80 (70 – 90)	—
	Ferritic and martensitic Stainless steel	≤200HB	● MP1220	130 (120 – 140)	110 (100 – 120)	—
			● MP1230	130 (120 – 140)	110 (100 – 120)	—
			● MP7130	130 (120 – 140)	110 (100 – 120)	—
			● MP1230	120 (110 – 130)	100 (90 – 110)	—
			● MP7130	120 (110 – 130)	100 (90 – 110)	—
			● VP15TF	120 (110 – 130)	100 (90 – 110)	—
			✱ MP1240	100 (90 – 110)	80 (70 – 90)	—
			✱ MP7130	100 (90 – 110)	80 (70 – 90)	—
			✱ VP15TF	100 (90 – 110)	80 (70 – 90)	—
	Duplex stainless steel	≤280HB	● MP1230	120 (110 – 130)	100 (90 – 110)	—
			● MP7130	120 (110 – 130)	100 (90 – 110)	—
			● MP1230	110 (100 – 120)	90 (80 – 100)	—
			● MP7130	110 (100 – 120)	90 (80 – 100)	—
			● VP15TF	110 (100 – 120)	90 (80 – 100)	—
			✱ MP1240	90 (80 – 100)	70 (60 – 80)	—
			✱ MP7130	90 (80 – 100)	70 (60 – 80)	—
			✱ VP15TF	90 (80 – 100)	70 (60 – 80)	—
	Precipitation hardening Stainless steel	<450HB	● MP1230	120 (110 – 130)	—	—
			● MP7130	120 (110 – 130)	—	—
			● MP1230	110 (100 – 120)	—	—
			● MP7130	110 (100 – 120)	—	—
			● VP15TF	110 (100 – 120)	—	—
			✱ MP1240	90 (80 – 100)	—	—
			✱ MP7130	90 (80 – 100)	—	—
			✱ VP15TF	90 (80 – 100)	—	—

2/3

WWX200/400 – CUTTING SPEED /WET CUTTING

Material	Properties	Cutting conditions	Grade	Vc		
				ae ≤ 0.5 DC	ae ≤ 0.8 DC	ae = DC
K	Gray cast iron	●	MC5020	170 (150 – 190)	150 (130 – 170)	130 (110 – 150)
		●	MC5020	160 (140 – 180)	140 (120 – 160)	120 (100 – 140)
		●	VP15TF	160 (140 – 180)	140 (120 – 160)	—
		✱	MC5020	140 (120 – 160)	120 (100 – 140)	100 (80 – 120)
		✱	VP15TF	140 (120 – 160)	120 (100 – 140)	100 (80 – 120)
		✱	VP15TF	140 (120 – 160)	120 (100 – 140)	100 (80 – 120)
	Ductile cast iron	●	MV1020	200 (180 – 240)	180 (150 – 220)	150 (130 – 200)
		●	MC5020	170 (150 – 190)	150 (130 – 170)	130 (110 – 150)
		●	MV1030	160 (140 – 180)	140 (120 – 160)	120 (100 – 140)
		●	MV1020	190 (170 – 230)	170 (140 – 210)	140 (120 – 190)
		●	MV1030	160 (140 – 180)	140 (120 – 160)	120 (100 – 140)
		●	MC5020	160 (140 – 180)	140 (120 – 160)	120 (100 – 140)
		●	VP15TF	160 (140 – 180)	140 (120 – 160)	—
		✱	MC5020	140 (120 – 160)	120 (100 – 140)	100 (80 – 120)
		✱	VP15TF	140 (120 – 160)	120 (100 – 140)	100 (80 – 120)
	Ductile cast iron	●	MV1020	180 (170 – 210)	160 (150 – 190)	140 (120 – 160)
		●	MC5020	160 (150 – 170)	140 (130 – 150)	120 (110 – 130)
		●	MV1030	150 (140 – 160)	130 (120 – 140)	110 (100 – 120)
		●	MV1020	170 (160 – 200)	150 (140 – 180)	120 (110 – 150)
		●	MV1030	150 (140 – 160)	130 (120 – 140)	110 (100 – 120)
		●	MC5020	150 (140 – 160)	130 (120 – 140)	110 (100 – 120)
		●	VP15TF	150 (140 – 160)	130 (120 – 140)	—
		✱	MC5020	130 (120 – 140)	110 (100 – 120)	90 (80 – 100)
N	Aluminium alloy	●	TF15	500 (300 – 900)	500 (300 – 900)	500 (300 – 900)
		●	TF15	500 (300 – 900)	500 (300 – 900)	500 (300 – 900)
		✱	TF15	400 (200 – 800)	400 (200 – 800)	400 (200 – 800)
S	Titanium alloy	●	MP1220	80 (60 – 100)	—	—
		●	MP9120	80 (60 – 100)	—	—
		●	MP1230	70 (50 – 90)	—	—
		●	MP9120	70 (50 – 90)	—	—
		✱	MP1240	60 (40 – 80)	—	—
		✱	MP9130	60 (40 – 80)	—	—
	Heat resistant alloy	●	MP1220	60 (50 – 70)	—	—
		●	MP9120	60 (50 – 70)	—	—
		●	MP1230	50 (30 – 60)	—	—
		●	MP9120	50 (30 – 60)	—	—
		✱	MP1240	40 (20 – 40)	—	—
		✱	MP9130	40 (20 – 40)	—	—
H	Hardened steel	●	VP15TF	50 (30 – 70)	—	—
		●	MP6120	40 (30 – 70)	—	—

3/3

1. To discharge chips effectively, use an air blow when machining. When the air blow is less effective at discharging chips, we recommend wet cutting.
2. When large vibration occurs, reduce the cutting conditions.
3. For interrupted cutting, reduce the cutting speed and feed rate by 20 %.

WWX200

RECOMMENDED CUTTING CONDITIONS

DEPTH OF CUT / FEED PER TOOTH

Material	Properties	Cutting conditions	Coolant	ae ≤ 0.5 DC		ae ≤ 0.8 DC		ae = DC	
				 ap	fz	 ap	fz	 ap	fz
P	Mild steel	≤180HB	  	L, M	≤ 3.0 0.13 [0.10–0.15]	L, M	≤ 3.0 0.13 [0.10–0.15]	L, M	≤ 2.0 0.13 [0.10–0.15]
			  	L, M	≤ 3.0 0.13 [0.10–0.15]	L, M	≤ 3.0 0.13 [0.10–0.15]	L, M	≤ 2.0 0.13 [0.10–0.15]
			  	M, R	≤ 3.0 0.16 [0.10–0.20]	M, R	≤ 3.0 0.16 [0.10–0.20]	—	—
			  	M, R	≤ 3.0 0.13 [0.10–0.15]	M, R	≤ 3.0 0.13 [0.10–0.15]	M	≤ 2.0 0.13 [0.10–0.15]
	Carbon steel Alloy steel Alloy tool steel	180 – 280HB	  	L, M	≤ 3.0 0.13 [0.10–0.15]	L, M	≤ 3.0 0.13 [0.10–0.15]	L, M	≤ 2.0 0.13 [0.10–0.15]
			  	L, M	≤ 3.0 0.13 [0.10–0.15]	L, M	≤ 3.0 0.13 [0.10–0.15]	L, M	≤ 2.0 0.13 [0.10–0.15]
			  	M, R	≤ 3.0 0.16 [0.10–0.20]	M, R	≤ 3.0 0.16 [0.10–0.20]	—	—
			  	M, R	≤ 3.0 0.13 [0.10–0.15]	M, R	≤ 3.0 0.13 [0.10–0.15]	M, R	≤ 2.0 0.13 [0.10–0.15]
	Carbon steel Alloy steel Alloy tool steel	280 – 350HB ≤350HB	  	L, M	≤ 3.0 0.13 [0.10–0.15]	L, M	≤ 3.0 0.13 [0.10–0.15]	L, M	≤ 2.0 0.13 [0.10–0.15]
			  	L, M	≤ 3.0 0.13 [0.10–0.15]	L, M	≤ 3.0 0.13 [0.10–0.15]	L, M	≤ 2.0 0.13 [0.10–0.15]
			  	M, R	≤ 3.0 0.16 [0.10–0.20]	M, R	≤ 3.0 0.16 [0.10–0.20]	—	—
			  	M, R	≤ 3.0 0.13 [0.10–0.15]	M, R	≤ 3.0 0.13 [0.10–0.15]	M	≤ 2.0 0.13 [0.10–0.15]
	Pre-hardened steel	35 – 45HRC	  	M	≤ 2.0 0.13 [0.10–0.15]	—	—	—	—
			  	M	≤ 2.0 0.13 [0.10–0.15]	—	—	—	—
			  	R	≤ 2.0 0.16 [0.10–0.20]	—	—	—	—
			  	R	≤ 2.0 0.13 [0.10–0.15]	—	—	—	—
M	Austenitic stainless steel	≤200HB	  	L, M	≤ 3.0 0.13 [0.10–0.15]	L, M	≤ 3.0 0.13 [0.10–0.15]	—	—
			  	L, M	≤ 2.0 0.13 [0.10–0.15]	L, M	≤ 3.0 0.13 [0.10–0.15]	—	—
			  	M	≤ 3.0 0.16 [0.10–0.20]	M	≤ 3.0 0.16 [0.10–0.20]	—	—
			  	M	≤ 3.0 0.13 [0.10–0.15]	M	≤ 3.0 0.13 [0.10–0.15]	—	—
		>200HB	  	L, M	≤ 2.0 0.13 [0.10–0.15]	L, M	≤ 3.0 0.13 [0.10–0.15]	—	—
			  	L, M	≤ 3.0 0.13 [0.10–0.15]	L, M	≤ 2.0 0.13 [0.10–0.15]	—	—
			  	M	≤ 2.0 0.16 [0.10–0.20]	M	≤ 3.0 0.16 [0.10–0.20]	—	—
			  	M	≤ 2.0 0.13 [0.10–0.15]	M	≤ 3.0 0.13 [0.10–0.15]	—	—
	Ferritic and martensitic Stainless steel	≤200HB	  	L, M	≤ 3.0 0.13 [0.10–0.15]	L, M	≤ 3.0 0.13 [0.10–0.15]	—	—
			  	L, M	≤ 2.0 0.13 [0.10–0.15]	L, M	≤ 2.0 0.13 [0.10–0.15]	—	—
			  	M	≤ 3.0 0.16 [0.10–0.20]	M	≤ 3.0 0.16 [0.10–0.20]	—	—
			  	M	≤ 3.0 0.13 [0.10–0.15]	M	≤ 3.0 0.13 [0.10–0.15]	—	—
	Duplex stainless steel	≤280HB	  	L, M	≤ 2.0 0.13 [0.10–0.15]	L, M	≤ 3.0 0.13 [0.10–0.15]	—	—
			  	L, M	≤ 3.0 0.13 [0.10–0.15]	L, M	≤ 3.0 0.13 [0.10–0.15]	—	—
			  	M	≤ 2.0 0.16 [0.10–0.20]	M	≤ 3.0 0.16 [0.10–0.20]	—	—
			  	M	≤ 3.0 0.16 [0.10–0.20]	M	≤ 3.0 0.16 [0.10–0.20]	—	—
	Precipitation Hardening stainless steel	<450HB	  	L, M	≤ 2.0 0.13 [0.10–0.15]	—	—	—	—
			  	M	≤ 2.0 0.16 [0.10–0.20]	—	—	—	—
			  	M	≤ 2.0 0.13 [0.10–0.15]	—	—	—	—
			  	M	≤ 2.0 0.13 [0.10–0.15]	—	—	—	—

1/2

1. To discharge chips effectively, use an air blow when machining. When the air blow is less effective at discharging chips, we recommend wet cutting.
2. When large vibration occurs, reduce the cutting conditions.
3. For interrupted cutting, reduce the cutting speed and feed rate by 20 %.

WWX200 – DEPTH OF CUT / FEED PER TOOTH

Material	Properties	Cutting conditions	Coolant	ae ≤ 0.5 DC			ae ≤ 0.8 DC			ae = DC			
					ap	fz		ap	fz		ap	fz	
K	Gray cast iron	≤350MPa				L, M	≤ 3.0	0.13	[0.10–0.15]	L, M	≤ 3.0	0.13	[0.10–0.15]
						M, R	≤ 3.0	0.16	[0.10–0.20]	M, R	≤ 3.0	0.16	[0.10–0.20]
						M, R	≤ 3.0	0.13	[0.10–0.15]	M, R	≤ 3.0	0.13	[0.10–0.15]
	Ductile cast iron	≤800MPa				L, M	≤ 3.0	0.13	[0.10–0.15]	L, M	≤ 3.0	0.13	[0.10–0.15]
						M, R	≤ 3.0	0.16	[0.10–0.20]	M, R	≤ 3.0	0.16	[0.10–0.20]
						M, R	≤ 3.0	0.13	[0.10–0.15]	M, R	≤ 3.0	0.13	[0.10–0.15]
N	Aluminium alloy					L	≤ 3.0	0.13	[0.10–0.15]	L	≤ 3.0	0.13	[0.10–0.15]
S	Titanium alloy	—				L, M	≤ 2.0	0.10	[0.05–0.13]	—	—	—	—
						L, M	≤ 2.0	0.10	[0.05–0.13]	—	—	—	—
						L, M	≤ 2.0	0.10	[0.05–0.13]	—	—	—	—
						L, M	≤ 2.0	0.10	[0.05–0.13]	—	—	—	—
	Heat resistant alloy	—				L, M	≤ 2.0	0.10	[0.05–0.13]	—	—	—	—
						L, M	≤ 2.0	0.10	[0.05–0.13]	—	—	—	—
H	Hardened steel	40 – 55HRC				M	≤ 2.0	0.05	[0.05–0.10]	—	—	—	—
						M, R	≤ 2.0	0.05	[0.05–0.10]	—	—	—	—

2/2

2/2

1. To discharge chips effectively, use an air blow when machining. When the air blow is less effective at discharging chips, we recommend wet cutting.
2. When large vibration occurs, reduce the cutting conditions.
3. For interrupted cutting, reduce the cutting speed and feed rate by 20 %.

WWX400

RECOMMENDED CUTTING CONDITIONS

DEPTH OF CUT / FEED PER TOOTH

Material	Properties	Cutting conditions	Coolant	ae ≤ 0.5 DC			ae ≤ 0.8 DC			ae = DC		
					ap	fz		ap	fz		ap	fz
P	Mild steel	≤180HB			L,M	≤ 4.0 0.13 [0.10–0.15]	L,M	≤ 3.0 0.13 [0.10–0.15]	L,M	≤ 2.0 0.13 [0.10–0.15]	L,M	≤ 2.0 0.13 [0.10–0.15]
					L,M	≤ 4.0 0.13 [0.10–0.15]	L,M	≤ 3.0 0.13 [0.10–0.15]	L,M	≤ 2.0 0.13 [0.10–0.15]	L,M	≤ 2.0 0.13 [0.10–0.15]
					M,R	≤ 4.0 0.16 [0.10–0.20]	M,R	≤ 3.0 0.16 [0.10–0.20]	—	—	—	—
					M,R	≤ 4.0 0.13 [0.10–0.15]	M,R	≤ 3.0 0.13 [0.10–0.15]	M	≤ 2.0 0.13 [0.10–0.15]	M	≤ 2.0 0.13 [0.10–0.15]
	Carbon steel Alloy steel Alloy tool steel	180 – 280HB			L,M	≤ 4.0 0.13 [0.10–0.15]	L,M	≤ 3.0 0.13 [0.10–0.15]	L,M	≤ 2.0 0.13 [0.10–0.15]	L,M	≤ 2.0 0.13 [0.10–0.15]
					L,M	≤ 4.0 0.13 [0.10–0.15]	L,M	≤ 3.0 0.13 [0.10–0.15]	L,M	≤ 2.0 0.13 [0.10–0.15]	L,M	≤ 2.0 0.13 [0.10–0.15]
					M,R	≤ 4.0 0.16 [0.10–0.20]	M,R	≤ 3.0 0.16 [0.10–0.20]	—	—	—	—
					M,R	≤ 4.0 0.13 [0.10–0.15]	M,R	≤ 3.0 0.13 [0.10–0.15]	M	≤ 2.0 0.13 [0.10–0.15]	M	≤ 2.0 0.13 [0.10–0.15]
	Carbon steel Alloy steel Alloy tool steel	280 – 350HB ≤350HB			L,M	≤ 3.0 0.13 [0.10–0.15]	L,M	≤ 3.0 0.13 [0.10–0.15]	L,M	≤ 3.0 0.13 [0.10–0.15]	L,M	≤ 3.0 0.13 [0.10–0.15]
					L,M	≤ 3.0 0.13 [0.10–0.15]	L,M	≤ 3.0 0.13 [0.10–0.15]	L,M	≤ 2.0 0.13 [0.10–0.15]	L,M	≤ 2.0 0.13 [0.10–0.15]
					M,R	≤ 3.0 0.16 [0.10–0.20]	M,R	≤ 3.0 0.16 [0.10–0.20]	—	—	—	—
					M,R	≤ 3.0 0.13 [0.10–0.15]	M,R	≤ 3.0 0.13 [0.10–0.15]	M	≤ 2.0 0.13 [0.10–0.15]	M	≤ 2.0 0.13 [0.10–0.15]
	Pre-hardened steel	35 – 45HRC			L,M	≤ 2.0 0.13 [0.10–0.15]	—	—	—	—	—	—
					L,M	≤ 2.0 0.13 [0.10–0.15]	—	—	—	—	—	—
					M,R	≤ 2.0 0.16 [0.10–0.20]	—	—	—	—	—	—
					M,R	≤ 2.0 0.13 [0.10–0.15]	—	—	—	—	—	—
M	Austenitic stainless steel	≤200HB			L,M	≤ 4.0 0.13 [0.10–0.15]	L,M	≤ 3.0 0.13 [0.10–0.15]	—	—	—	—
					L,M	≤ 2.0 0.13 [0.10–0.15]	L,M	≤ 2.0 0.13 [0.10–0.15]	—	—	—	—
					M	≤ 4.0 0.16 [0.10–0.20]	M	≤ 3.0 0.16 [0.10–0.20]	—	—	—	—
					M	≤ 4.0 0.13 [0.10–0.15]	M	≤ 3.0 0.13 [0.10–0.15]	—	—	—	—
		>200HB			L,M	≤ 4.0 0.13 [0.10–0.15]	L,M	≤ 3.0 0.13 [0.10–0.15]	—	—	—	—
					L,M	≤ 2.0 0.13 [0.10–0.15]	L,M	≤ 2.0 0.13 [0.10–0.15]	—	—	—	—
					L,M	≤ 3.0 0.13 [0.10–0.15]	L,M	≤ 3.0 0.13 [0.10–0.15]	—	—	—	—
					M	≤ 3.0 0.16 [0.10–0.20]	M	≤ 3.0 0.16 [0.10–0.20]	—	—	—	—
	Ferritic and martensitic Stainless steel	≤200HB			M	≤ 3.0 0.13 [0.10–0.15]	M	≤ 3.0 0.13 [0.10–0.15]	—	—	—	—
					L,M	≤ 4.0 0.13 [0.10–0.15]	L,M	≤ 3.0 0.13 [0.10–0.15]	—	—	—	—
					L,M	≤ 2.0 0.13 [0.10–0.15]	L,M	≤ 2.0 0.13 [0.10–0.15]	—	—	—	—
					M	≤ 4.0 0.16 [0.10–0.20]	M	≤ 3.0 0.16 [0.10–0.20]	—	—	—	—
	Duplex stainless steel	≤280HB			M	≤ 3.0 0.13 [0.10–0.15]	M	≤ 3.0 0.13 [0.10–0.15]	—	—	—	—
					L,M	≤ 3.0 0.13 [0.10–0.15]	L,M	≤ 3.0 0.13 [0.10–0.15]	—	—	—	—
					M	≤ 4.0 0.16 [0.10–0.20]	M	≤ 3.0 0.16 [0.10–0.20]	—	—	—	—
					M	≤ 3.0 0.13 [0.10–0.15]	M	≤ 3.0 0.13 [0.10–0.15]	—	—	—	—
	Precipitation Hardening stainless steel	<450HB			M	≤ 4.0 0.13 [0.10–0.15]	M	≤ 3.0 0.16 [0.10–0.20]	—	—	—	—
					L,M	≤ 2.0 0.13 [0.10–0.15]	—	—	—	—	—	—
					L,M	≤ 2.0 0.13 [0.10–0.15]	—	—	—	—	—	—
					M	≤ 2.0 0.16 [0.10–0.20]	—	—	—	—	—	—

1/2

1. To discharge chips effectively, use an air blow when machining. When the air blow is less effective at discharging chips, we recommend wet cutting.
2. When large vibration occurs, reduce the cutting conditions.
3. For interrupted cutting, reduce the cutting speed and feed rate by 20 %.

WWX400 – DEPTH OF CUT / FEED PER TOOTH

Material	Properties	Cutting conditions	Coolant	ae ≤ 0.5 DC			ae ≤ 0.8 DC			ae = DC		
					ap	fz		ap	fz		ap	fz
K	Gray cast iron	≤350MPa	   	L,M	≤ 4.0	0.13 [0.10–0.15]	L,M	≤ 3.0	0.13 [0.10–0.15]	L,M	≤ 2.0	0.13 [0.10–0.15]
			  	M,R	≤ 4.0	0.16 [0.10–0.20]	M,R	≤ 3.0	0.16 [0.10–0.20]	—	—	—
			  	M,R	≤ 4.0	0.13 [0.10–0.15]	M,R	≤ 3.0	0.13 [0.10–0.15]	M,R	≤ 2.0	0.13 [0.10–0.15]
	Ductile cast iron	≤800MPa	   	L,M	≤ 4.0	0.13 [0.10–0.15]	L,M	≤ 3.0	0.13 [0.10–0.15]	L,M	≤ 2.0	0.13 [0.10–0.15]
			  	M,R	≤ 4.0	0.16 [0.10–0.20]	M,R	≤ 3.0	0.16 [0.10–0.20]	—	—	—
			  	M,R	≤ 4.0	0.13 [0.10–0.15]	M,R	≤ 3.0	0.13 [0.10–0.15]	M,R	≤ 2.0	0.13 [0.10–0.15]
N	Aluminium alloy	Si<5%	   	L	≤ 4.0	0.13 [0.10–0.15]	L	≤ 3.0	0.13 [0.10–0.15]	L	≤ 2.0	0.13 [0.10–0.15]
S	Titanium alloy	—	  	L,M	≤ 2.0	0.10 [0.05–0.13]	—	—	—	—	—	—
			 	L,M	≤ 2.0	0.10 [0.05–0.13]	—	—	—	—	—	—
	Heat resistant alloy	—	  	L,M	≤ 2.0	0.10 [0.05–0.13]	—	—	—	—	—	—
			 	L,M	≤ 2.0	0.10 [0.05–0.13]	—	—	—	—	—	—
H	Hardened steel	40 – 55HRC	  	M	≤ 2.0	0.05 [0.05–0.10]	—	—	—	—	—	—
			  	M,R	≤ 2.0	0.05 [0.05–0.10]	—	—	—	—	—	—

2/

2/2

1. To discharge chips effectively, use an air blow when machining. When the air blow is less effective at discharging chips, we recommend wet cutting.
2. When large vibration occurs, reduce the cutting conditions.
3. For interrupted cutting, reduce the cutting speed and feed rate by 20 %.

SYMBOLS

 Recommended cutting conditions	MACHINING TYPE
NEW Completely new products or expansions released in the current Spring or Autumn product launch and are not included in the latest version of the General Catalogue.	 Roughing
NEW Products or expansions that have already been introduced in one of the previous Spring or Autumn product launches but are not included in the latest General Catalogue.	 Medium cutting
APPLICATION	 Light cutting
 Face milling	 Pre-finishing
 Chamfer milling	 Finishing
 Shoulder milling with R	 Fine-finishing
 Face milling close to a wall	TOOL MATERIAL
 Shoulder milling	 Ultra micro grain carbide Ultra micro grain carbide substrate material.
 Side milling	 Cubic boron nitride Mitsubishi Materials' original CBN material.
 Slot milling	 Ceramic For high speed efficient machining of super alloys due to the excellent high temperature strength property.
 Ramping	 High hardness powder metallurgy HSS High hardness powder metallurgy HSS substrate material.
 Pocket milling	 High grade high alloy HSS High grade high alloy HSS substrate material.
 Slot milling with R	 Cobalt high speed steel Cobalt high speed steel substrate material.
 Copy milling	 High speed steel High speed steel substrate material.
 T-Slot milling	

SYMBOLS

COATING



SMART MIRACLE coating

New smooth and dense coating technology for high efficiency milling of difficult to cut materials.



CRN coating

Newly developed CrN coating for Copper Electrodes machining.



Violet coating

Increased tool life of 2-3 times more than TiN coated products.



DP coating

New generation coating suitable for a wide range of materials.



MIRACLE coating

The original Miracle (Al,Ti)N coating. Also suitable for dry cutting.



[Al, Ti]N coating

[Al,Ti]N highly versatile application range.



[Al,Ti,Cr]N multi-layer coating

For carbon, alloy and hardened steels.



IMPACT MIRACLE coating

Single phase nano crystal coating technology has higher film hardness and heat resistance.



MIRACLE coating

The original MIRACLE (Al,Ti)N coating. Also suitable for dry cutting.



VFR coating

The [AlCrSi]N/[AlTiSi]N PVD multilayer coating is ideal for machining of extremely hard materials up to 70 HRC.



DLC coating

Hardness similar to CVD diamond coating achieved with high adhesion strength.



Diamond coating

Suitable for CFRP and CFRP-aluminium materials.



Diamond coating

Suitable for graphite machining.



Diamond coating

The original CVD diamond coating.



CVD Diamond coating

Unique multi-layer micro-grain diamond crystal control technology drastically improves wear resistance and smoothness.

CUTTING EDGE PROPERTIES



Sharp corner edge

Indicates the end mill has a sharp corner edge.



Gash land

Indicates the end mill cutting edge has a protective chamfer.



Rake angle



Helix angle

Indicates the helix angle of the end mill.



Point angle

Indicates the drill point angle.



Roughing flute geometry



Variable helix



Rounded gash



Corner angle

WEB THINNING



X type point geometry

X web thinning used at the drill point.



XR type point geometry

XR web thinning used at the drill point.



S type point geometry

Easy cutting geometry.



N type point geometry

Effective when the point web is thick.



Chipbreaker

SYMBOLS

TOLERANCES



Tolerance of taper angle
Indicates the tolerance of the taper angle.



R tolerance
Indicates the radial tolerance of a ball nose end mill.



R tolerance
Indicates the radial tolerance of the corner radius.



R tolerance
Indicates the radial tolerance of a cutter with a corner radius.



Outside diameter tolerance
Indicates the diameter tolerance of the end mill.



Peak tolerance
Indicates the tolerance for the end diameter.



Shank diameter tolerance



Shank diameter tolerance



Drill tolerance / diameter

COOLANT HOLES



External coolant



Internal coolant



Internal coolant



Centered, internal coolant hole



Radial, internal coolant holes



Internal coolant holes



Internal coolant holes

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