

Double Sided Insert Type Shoulder Mill

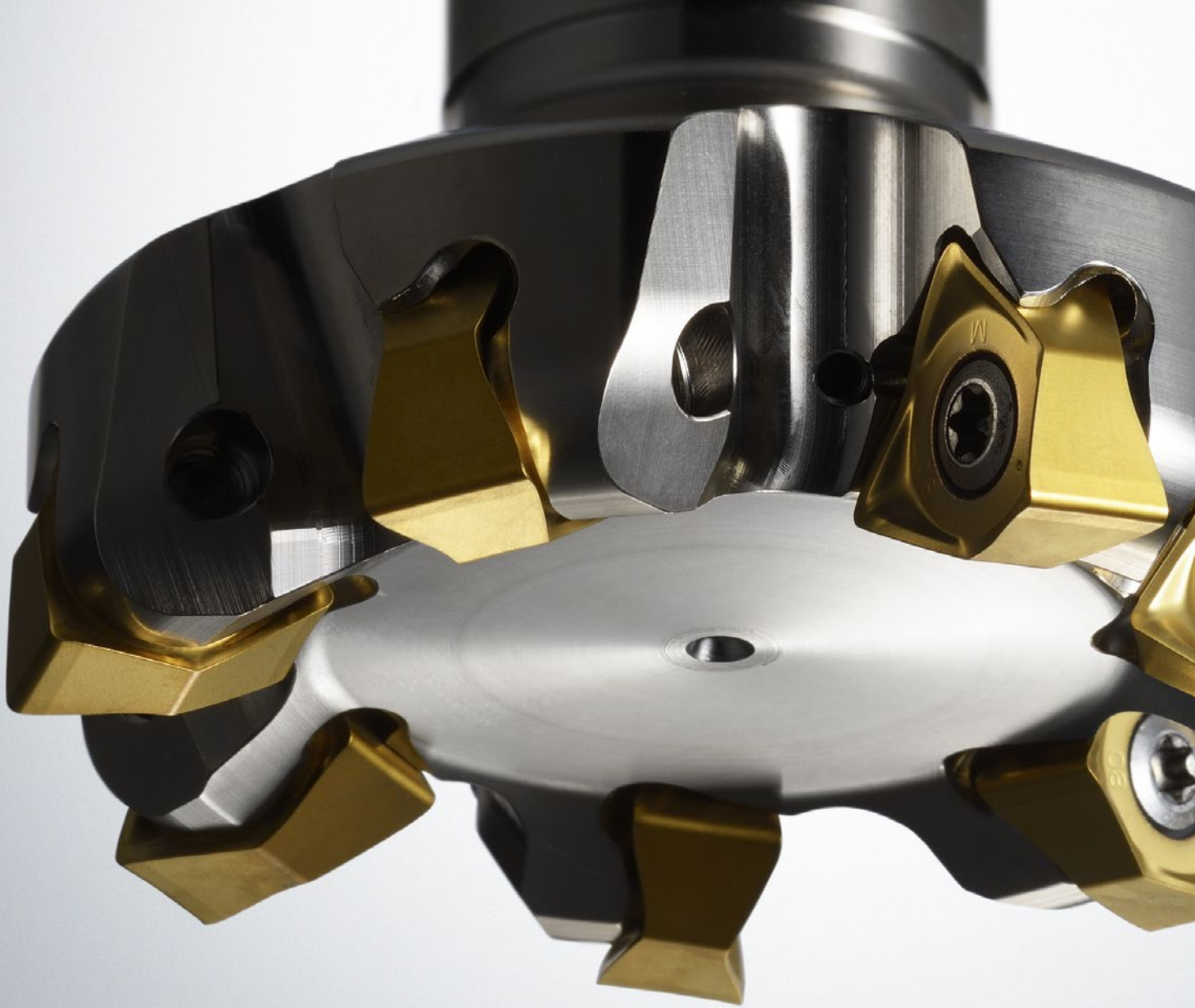
WWX400

Inserts
Grade
Expansion

High Rigidity and High Quality Performance

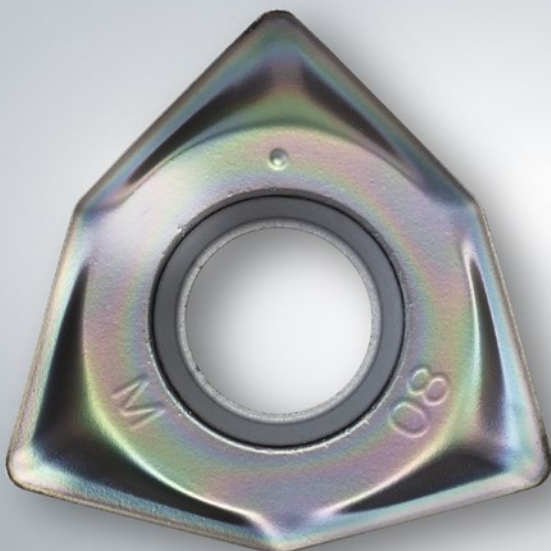


Strong  Geometry



Double Sided Insert Type Shoulder Mill

WWX400 Series



Economical double sided insert with 6 corners.



The insert thickness was greatly increased to markedly improve the fracture resistance (MMC comparison).



Stable and Reliable

The optimised "X-type" insert realizes stable and high-quality machining.

Strong  Geometry



Body damage is suppressed by arching the insert support.



Wide variety of holder sizes and insert grades available covering most all machined workpiece material applications. **2**



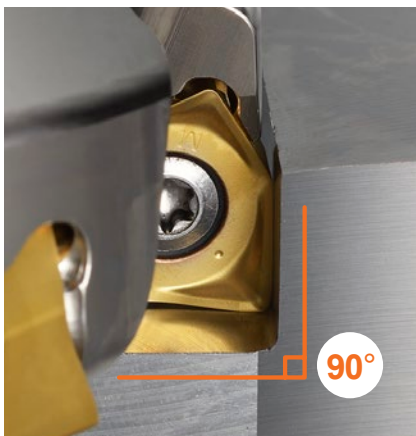
The optimised “X-type” insert meets the demand for greater strength.



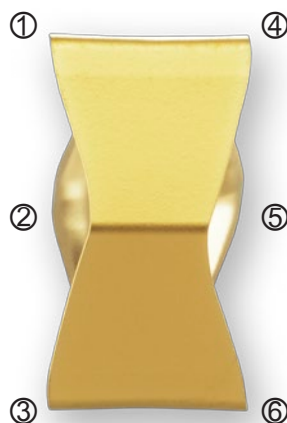
YouTube

■ The “X-Type” insert shape achieves both high quality surface finish and economic efficiency.

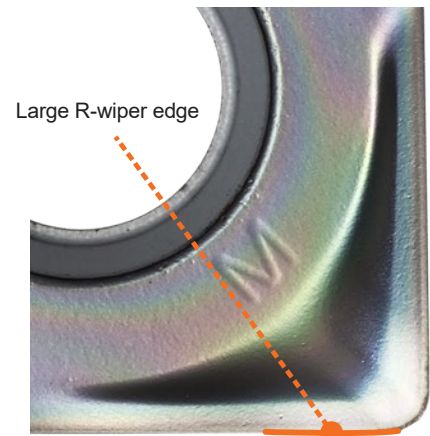
The insert’s main cutting edge can machine a 90° wall surface. Additionally, the large R-wiper edge is adopted for achieving a good surface finish, while, the optimised “X-type” with 6 corners contributes to lower tool costs.



High-quality wall surface machining is possible.



Economical double sided 6 corners.

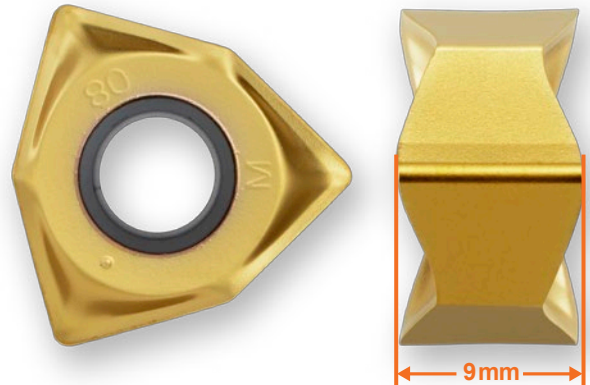


Large R-wiper edge achieves a good surface finish.

The generous thickness of the insert provides high rigidity.

Be sure to experience the ease of use of the high rigidity made possible by the maximum insert thickness (9mm). The excellent high fracture resistance makes a seat unnecessary, so the insert is stabilised using a direct clamp.

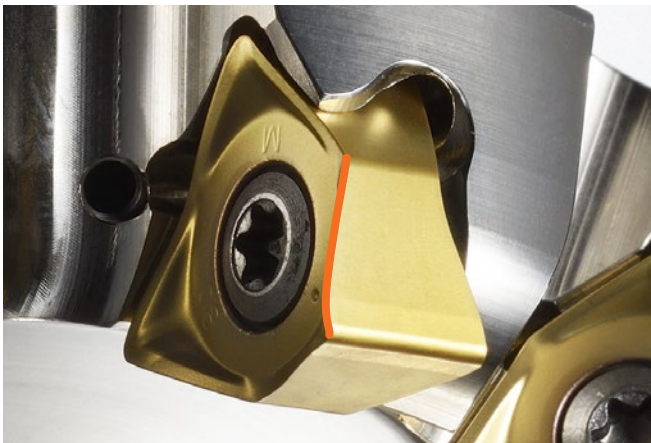
Strong  Geometry



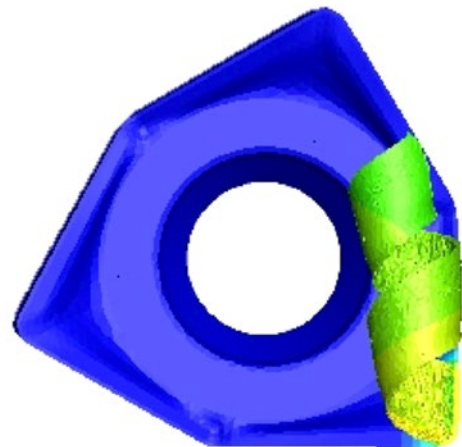
Excellent control and chip abrasion prevention.

CAE* analysis was used for the main cutting edge design. This resulted in changing from a straight to a curved cutting edge. Further, the rake angle shape of the optimised cutting edge greatly suppresses the scattering of chips to the bottom surface and outside periphery surface. This provides a good finish surface and markedly improved efficiency.

*CAE : Computer Aided Engineering



Curved cutting edge shape designed with an optimum rake face.



Chips are created with a good helical shape.



YouTube

Comments from Developer

The WWX400 was developed under the concept of “Stable and Worry-free” using an optimised insert shape with a maximum thickness of 9mm in response to recent trends of unmanned operations and the demand for increased efficiency. The main attributes improved were rigidity and fracture resistance. Attention was also given to the cutting edge shape to achieve improved finished surface quality and good chip discharge. Be sure to experience the proprietary “X-type” insert developed by Mitsubishi Materials.

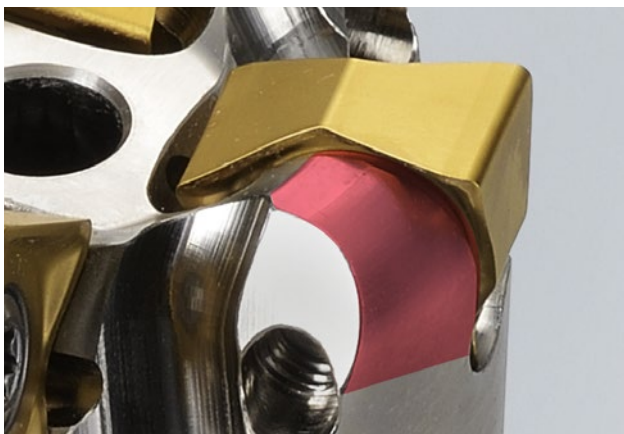


High-stability clamping and high-quality machining.



| The optimised insert support and high clamp rigidity improve stability.

The conical shaped seating surface widely supports the insert surface area, while the arched insert support provides necessary clearance to suppress body damage from scratches and chip abrasion. Additionally, the strong clamping force of the M5 screws prevents loosening to provide robust clamping.



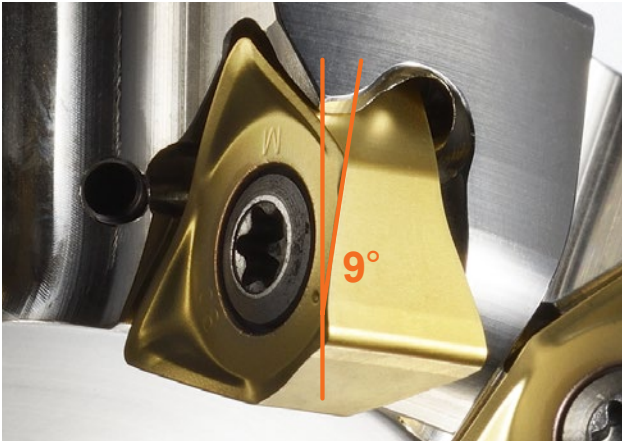
Arched insert support.



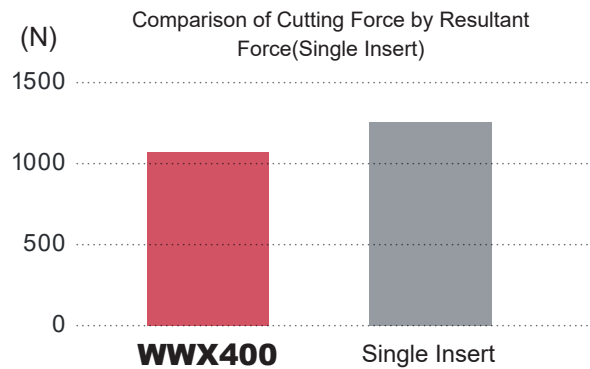
Conical shaped seat and M5 screw.

Low cutting resistance suppresses chatter vibration even for thin workpiece materials.

Although a double-sided insert type with an axial rake angle of 9°(close to that of a single-sided insert type) is used, the WWX400 insert achieves lower cutting resistance than a single-sided insert (in-house comparison) and suppresses chatter vibration when machining thin workpiece materials.



Axial Rake Angle of 9°



<Cutting Conditions>
 Workpiece Material : JIS SCM440
 Cutter Dia. : DC=80 mm
 Cutting Speed : vc= 160 m/min
 Feed per Tooth : fz=0.2 mm/t.
 Depth of Cut : ap=2.0 mm
 Width of Cut : ae=64 mm
 Cutting Mode : Dry Cutting



YouTube

Variety of cutter types, diameters & pitches.

Increasing the insert thickness, while achieving seat-less clamping made it possible to incorporate a large number of teeth while maintaining large chip pockets to provide a variety of cutter options. A standard inventory is maintained consisting of 3 pitch types of both arbor and shank type cutters of same diameter. Fine pitch types in particular allow a high table feed and greatly improve efficiency.



DC=ø80mm
Fine Pitch Type



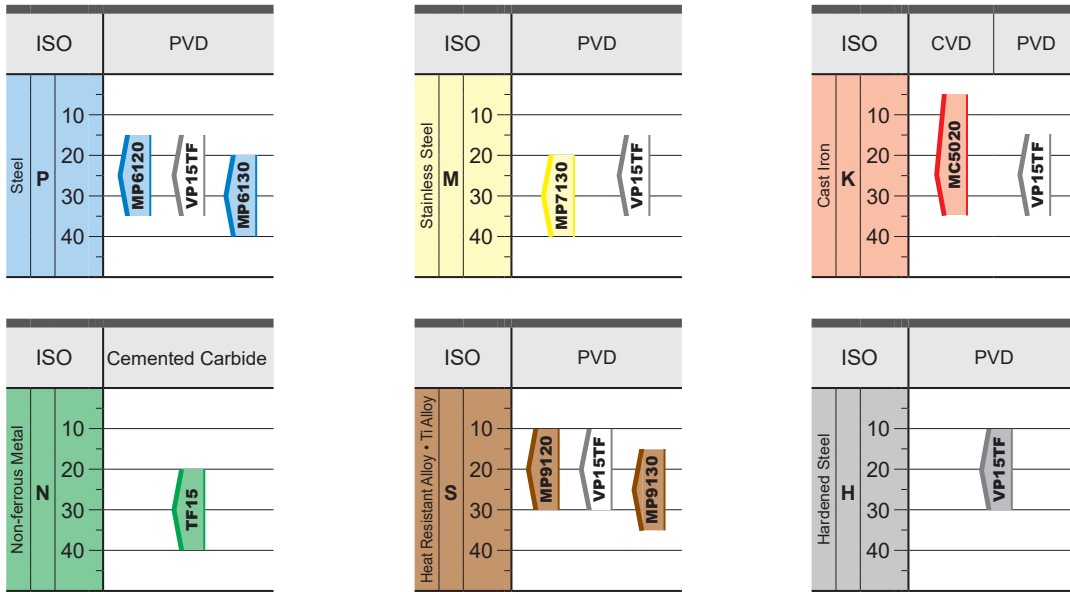
DC=ø80mm
Coarse Pitch Type

Comments from Developer

The result of pursuing “worry-free” is our cutter body. The highly rigid arching insert support achieves a stable installed feeling by using a conical shaped seat and the M5 screws. This design allows for long use and is the answer to the dissatisfied customers who have experienced “when damage to the insert has also made the cutter body unusable.”

Double Sided Insert Type Shoulder Mill

Insert Grades for a Wide Range of Materials



MP6100/MP7100/MP9100 Series

TOUGH-Σ Technology

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

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.

*Graphical Representation.

Al-Ti-Cr-N Based PVD Coating

*Graphical Representation.

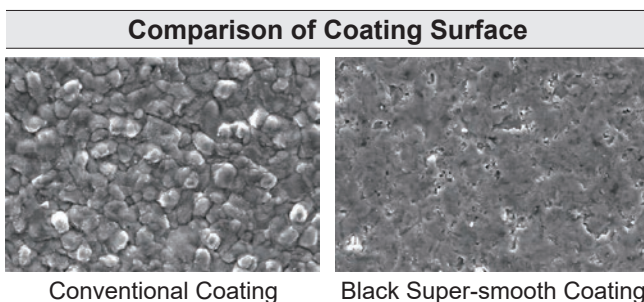
Best Layer of Each Work Material

P	(Al,Cr)N	Tough! Thermal Cracks	 Thermal Cracks
M	TiN	Tough! Notching	 Notching
S	CrN	Tough! Resistant Chipping	 Welding by Chipping

CVD Coating MC5020

First recommendation for cast iron milling.

MC5020 has excellent wear resistance and also controls thermal cracking and chipping that are common when machining ductile cast iron.



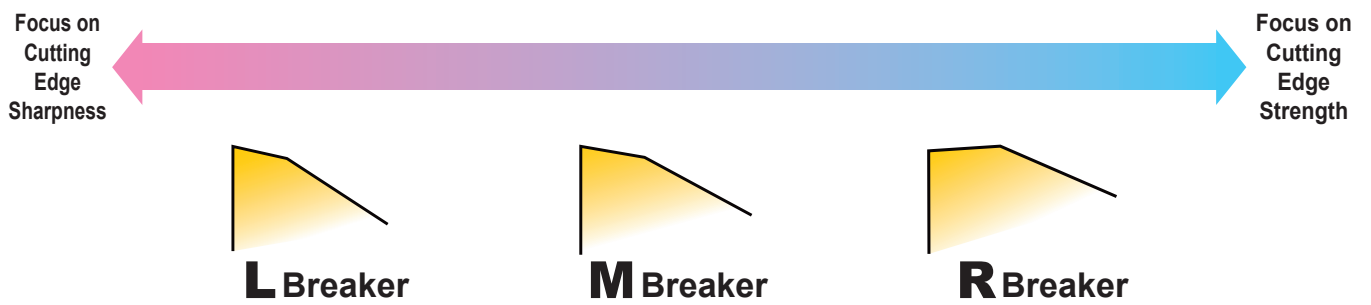
Black Super-smooth Coating

Black super-smooth coating prevents abnormal damage such as weld chipping.

Memo

A series of horizontal dashed lines for writing, spanning the width of the page.

Chip Breaker System

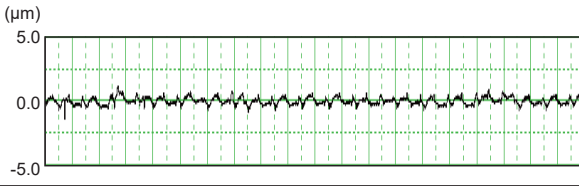
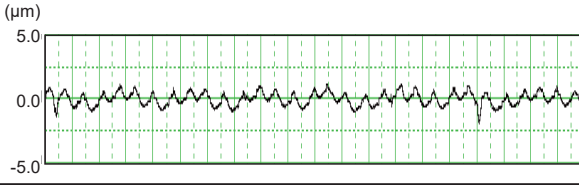
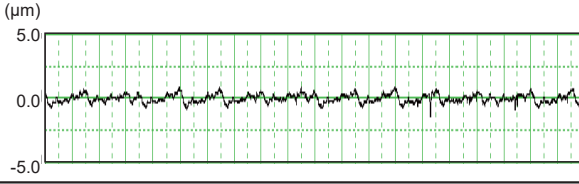


Workpiece Material	Cutting Conditions		
	Stable Cutting	General Cutting	Unstable Cutting
P	L	M	R
M	L	M	
K	L	M	R
N	L		
S	L	M	R
H	L	M	R

Cutting Performance

JIS SCM440 Finished Surface Comparison by Single Insert Cutting

WWX400 M class insert achieves the good surface finish as well as conventional G class product.

	Ra(μm)	Rz(μm)	Measured Value
WWX400 MP6120 (M class)	0.23	1.36	
Conventional (M class)	0.40	2.28	
Conventional (G class)	0.29	1.71	

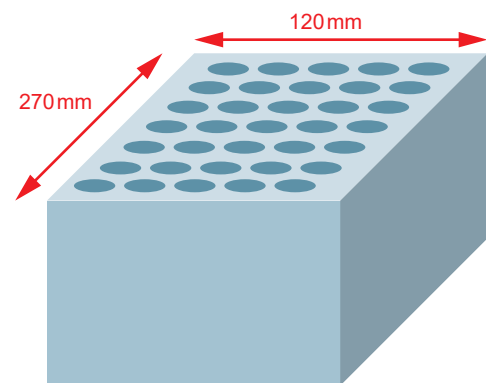
<Cutting Conditions>
 Workpiece Material : JIS SCM440
 Cutter Dia. : DC=ø80 mm
 Cutting Speed : vc = 220 m/min
 Feed per Tooth : fz = 0.1 mm/t.
 Depth of Cut : ap = 1.0 mm
 Width of Cut : ae = 64 mm (0.8DC)
 Cutting Mode : Dry Cutting

JIS SCM440 Fracture Resistance Comparison

High stability is achieved without fracturing even at a feed of fz=0.35mm/t.

fz (mm/t.)	0.2	0.25	0.3	0.35
WWX400 MP6120 (Grade M)	Good	Good	Good	Good
Conventional Single-sided Insert	NG			

Good : Cutting Length 1620mm Possible
NG : Fracture



810 mm × 2 = 1620 mm

<Cutting Conditions>
 Workpiece Material : JIS SCM440
 Cutter Dia. : DC=ø80 mm
 Cutting Speed : vc = 140 m/min
 Depth of Cut : ap = 2.0 mm
 Width of Cut : ae = 40 mm (0.5DC)
 Cutting Mode : Dry Cutting
 Single Insert

Double Sided Insert Type Shoulder Mill

SHOULDER MILLING

<GENERAL CUTTING>



WWX400

NEW

- P
- M
- K
- N
- S
- H

ø50



Fig.1
ø50

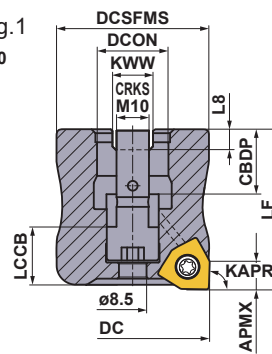
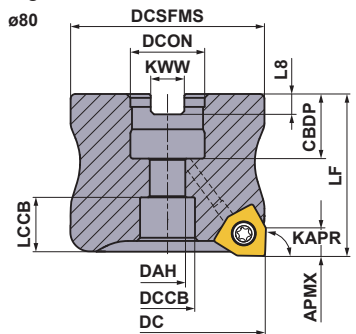


Fig.2
ø80



Right hand tool holder only.

Arbor Type

KAPR: 90°

GAMP: -6° GAMP: -7.2°--10°

DCON=inch size

(mm)

DC	Order Number	Stock	Coolant Hole	*2 No.T	LF	DCON	WT (kg)	APMX	RMPX	RPMX (min ⁻¹)	Fig.
		R									
80	WWX400R08004CA	●	○	4	50	25.4	1.0	8.2	0.16°	12200	2
80	WWX400R08005CA	●	○	5	50	25.4	1.0	8.2	0.16°	12200	2
80	WWX400R08007CA	●	○	7	50	25.4	0.9	8.2	0.16°	12200	2
100	WWX400R10005DA	●	○	5	50	31.75	1.4	8.2	—	10700	3
100	WWX400R10007DA	●	○	7	50	31.75	1.4	8.2	—	10700	3
100	WWX400R10009DA	●	○	9	50	31.75	1.3	8.2	—	10700	3
125	WWX400R12506EA	●	○	6	63	38.1	2.8	8.2	—	9500	3
125	WWX400R12508EA	●	○	8	63	38.1	2.8	8.2	—	9500	3
125	WWX400R12512EA	●	○	12	63	38.1	2.7	8.2	—	9500	3
160	WWX400R16008FA	●	○	8	63	50.8	4.5	8.2	—	8300	3
160	WWX400R16010FA	●	○	10	63	50.8	4.4	8.2	—	8300	3
160	WWX400R16014FA	●	○	14	63	50.8	4.3	8.2	—	8300	3
200	WWX400R20010KN	●	—	10	63	47.625	8.1	8.2	—	7300	5
200	WWX400R20012KN	●	—	12	63	47.625	8.1	8.2	—	7300	5
200	WWX400R20016KN	●	—	16	63	47.625	8.0	8.2	—	7300	5
250	WWX400R25012KN	●	—	12	63	47.625	12.1	8.2	—	6400	5
250	WWX400R25014KN	●	—	14	63	47.625	12.1	8.2	—	6400	5
250	WWX400R25018KN	●	—	18	63	47.625	12.0	8.2	—	6400	5

Note1) A set bolt to the arbor is not supplied with the body. Please refer to page 13, when ordering.

Note2) Please use a set bolt of the FMA type on the cutter body from 80 to 250 in diameter(DC).

* Number of Teeth

● : Inventory maintained in Japan.

Fig.3

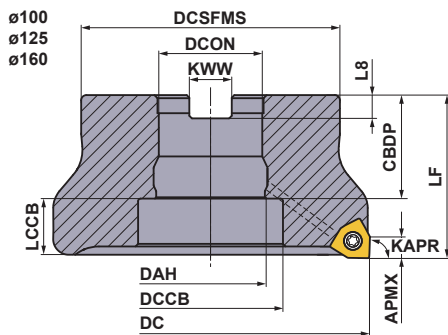


Fig.4

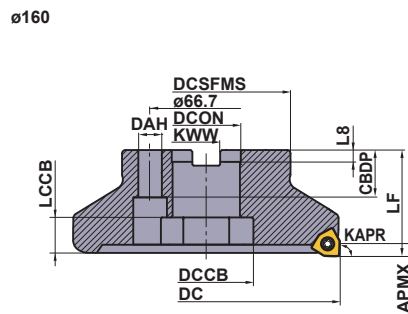
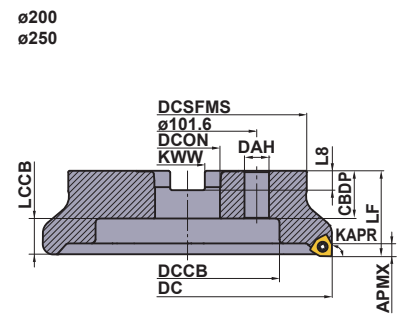


Fig.5



Right hand tool holder only.

Arbor Type

KAPR: 90°

GAMP: -6° GAMPF: -7.2°--12.8°

DCON = mm size

(mm)

DC	Order Number	Stock	Coolant Hole	*2 No.T	LF	DCON	WT (kg)	APMX	RMPX	RPMX (min ⁻¹)	Fig.
		R									
50	WWX400-050A03AR	●	○	3	55	22	0.5	8.2	0.4°	5000	1
50	WWX400-050A04AR	●	○	4	55	22	0.5	8.2	0.4°	5000	1
63	WWX400-063A03AR	●	○	3	40	22	0.5	8.2	0.26°	14100	2
63	WWX400-063A04AR	●	○	4	40	22	0.5	8.2	0.26°	14100	2
63	WWX400-063A05AR	●	○	5	40	22	0.5	8.2	0.26°	14100	2
80	WWX400-080A04AR	●	○	4	50	27	1.0	8.2	0.16°	12200	2
80	WWX400-080A05AR	●	○	5	50	27	1.0	8.2	0.16°	12200	2
80	WWX400-080A07AR	●	○	7	50	27	0.9	8.2	0.16°	12200	2
100	WWX400-100B05AR	●	○	5	50	32	1.6	8.2	—	10700	3
100	WWX400-100B07AR	●	○	7	50	32	1.5	8.2	—	10700	3
100	WWX400-100B09AR	●	○	9	50	32	1.5	8.2	—	10700	3
125	WWX400-125B06AR	●	○	6	63	40	3.0	8.2	—	9500	3
125	WWX400-125B08AR	●	○	8	63	40	3.0	8.2	—	9500	3
125	WWX400-125B12AR	●	○	12	63	40	2.9	8.2	—	9500	3
160	WWX400-160C08NR	●	—	8	63	40	4.5	8.2	—	8300	4
160	WWX400-160C10NR	●	—	10	63	40	4.4	8.2	—	8300	4
160	WWX400-160C14NR	●	—	14	63	40	4.4	8.2	—	8300	4
200	WWX400-200C10NR	●	—	10	63	60	6.7	8.2	—	7300	5
200	WWX400-200C12NR	●	—	12	63	60	6.7	8.2	—	7300	5
200	WWX400-200C16NR	●	—	16	63	60	6.6	8.2	—	7300	5
250	WWX400-250C12NR	●	—	12	63	60	11.5	8.2	—	6400	5
250	WWX400-250C14NR	●	—	14	63	60	11.5	8.2	—	6400	5
250	WWX400-250C18NR	●	—	18	63	60	11.4	8.2	—	6400	5

Note1) A set bolt to the arbor is not supplied with the body. Please refer to page 13, when ordering.

Note2) The milling cutter with cutting diameter DC=50 mm has a built-in set bolt. The set bolt cannot be replaced.

Therefore, absolutely do not disassemble the milling cutter.




Note3) Please use a set bolt of the FMC type on the cutter body from 63 to 100 in diameter(DC).

Note4) Please use a set bolt of the FMA type on the cutter body from 125 to 250 in diameter(DC).

* Number of Teeth

Spare Parts

(mm)

Tool Holder Type	*		
			
WWX400	TS5R	TKY20T	MK1KS

* Clamp Torque (N · m) : TS5R = 5.0

Double Sided Insert Type Shoulder Mill

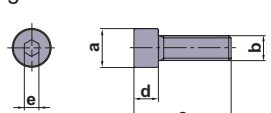
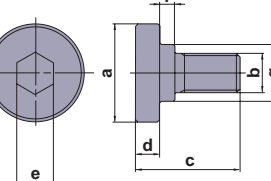
Mounting Dimensions

(mm)

DC	Order Number	DCON	CBDP	DAH	DCCB	LCCB	DCSFMS	KWW	L8	Fig.
50	WWX400-050A03AR	22	20	—	—	12.2	47	10.4	6.3	1
50	WWX400-050A04AR	22	20	—	—	12.2	47	10.4	6.3	1
63	WWX400-063A03AR	22	20	11	17	11.2	50	10.4	6.3	2
63	WWX400-063A04AR	22	20	11	17	11.2	50	10.4	6.3	2
63	WWX400-063A05AR	22	20	11	17	11.2	50	10.4	6.3	2
80	WWX400R08004CA	25.4	26	13	20	14.2	56	9.5	6	2
80	WWX400R08005CA	25.4	26	13	20	14.2	56	9.5	6	2
80	WWX400R08007CA	25.4	26	13	20	14.2	56	9.5	6	2
80	WWX400-080A04AR	27	23	13	20	14.2	56	12.4	7	2
80	WWX400-080A05AR	27	23	13	20	14.2	56	12.4	7	2
80	WWX400-080A07AR	27	23	13	20	14.2	56	12.4	7	2
100	WWX400R10005DA	31.75	37	31.75	45	11.2	70	12.7	8	3
100	WWX400R10007DA	31.75	37	31.75	45	11.2	70	12.7	8	3
100	WWX400R10009DA	31.75	37	31.75	45	11.2	70	12.7	8	3
100	WWX400-100B05AR	32	32	32	45	16.2	78	14.4	8	3
100	WWX400-100B07AR	32	32	32	45	16.2	78	14.4	8	3
100	WWX400-100B09AR	32	32	32	45	16.2	78	14.4	8	3
125	WWX400R12506EA	38.1	42	38.1	56	19.2	80	15.9	10	3
125	WWX400R12508EA	38.1	42	38.1	56	19.2	80	15.9	10	3
125	WWX400R12512EA	38.1	42	38.1	56	19.2	80	15.9	10	3
125	WWX400-125B06AR	40	40	40	56	21.2	89	16.4	9	3
125	WWX400-125B08AR	40	40	40	56	21.2	89	16.4	9	3
125	WWX400-125B12AR	40	40	40	56	21.2	89	16.4	9	3
160	WWX400-160C08NR	40	40	14	56	21.2	100	16.4	9	4
160	WWX400-160C10NR	40	40	14	56	21.2	100	16.4	9	4
160	WWX400-160C14NR	40	40	14	56	21.2	100	16.4	9	4
160	WWX400R16008FA	50.8	45	50.8	72	16.2	100	19.1	11	3
160	WWX400R16010FA	50.8	45	50.8	72	16.2	100	19.1	11	3
160	WWX400R16014FA	50.8	45	50.8	72	16.2	100	19.1	11	3
200	WWX400R20010KN	47.625	35	18	135	26.2	175	25.4	14.22	5
200	WWX400R20012KN	47.625	35	18	135	26.2	175	25.4	14.22	5
200	WWX400R20016KN	47.625	35	18	135	26.2	175	25.4	14.22	5
200	WWX400-200C10NR	60	32	18	135	29.2	160	25.7	14.22	5
200	WWX400-200C12NR	60	32	18	135	29.2	160	25.7	14.22	5
200	WWX400-200C16NR	60	32	18	135	29.2	160	25.7	14.22	5
250	WWX400R25012KN	47.625	35	18	180	26.2	210	25.4	14.22	5
250	WWX400R25014KN	47.625	35	18	180	26.2	210	25.4	14.22	5
250	WWX400R25018KN	47.625	35	18	180	26.2	210	25.4	14.22	5
250	WWX400-250C12NR	60	32	18	180	29.2	210	25.7	14.22	5
250	WWX400-250C14NR	60	32	18	180	29.2	210	25.7	14.22	5
250	WWX400-250C18NR	60	32	18	180	29.2	210	25.7	14.22	5

Set Bolt (Sold Separately)

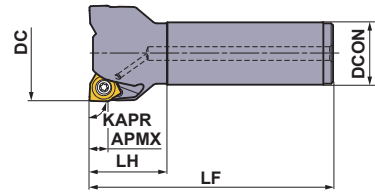
(mm)

Tool Holder Type	Set Bolt		Fig.	Reference Dimensions							Geometry
	With Coolant Hole	Without Coolant Hole		a	b	c	d	e	f	g	
	Order Number	Order Number									
WWX400R080○○CA	HSC12035H	HSC12035 HSC12045	1	18	M12×1.75	47 57	12	10	—	—	Fig.1 
WWX400R100○○DA	MBA16033H	—	2	40	M16×2	43	10	14	6	23	
WWX400R125○○EA	MBA20040H	—	2	50	M20×2.5	54	14	17	6	27	Fig.2 
WWX400R160○○FA	MBA24045H	—	2	65	M24×3	59	14	17	10	37	
WWX400R200○○KN	No Coolant Hole	—	1	24	M16×2	43	16	14	—	—	
WWX400R250○○KN	No Coolant Hole	—	1	24	M16×2	43	16	14	—	—	
WWX400-063A○○AR	HSC10030H	HSC10035	1	16	M10×1.5	40	10	6	—	—	
WWX400-080A○○AR	HSC12035H	HSC12035 HSC12045	1	18	M12×1.75	47 57	12	10	—	—	
WWX400-100B○○AR	MBA16033H	—	2	40	M16×2	43	10	14	6	23	
WWX400-125B○○AR	MBA20040H	—	2	50	M20×2.5	54	14	17	6	27	
WWX400-160C○○NR	No Coolant Hole	—	2	50	M20×2.5	54	14	17	6	27	
WWX400-200C○○NR	No Coolant Hole	—	1	24	M16×2	43	16	14	—	—	
WWX400-250C○○NR	No Coolant Hole	—	1	24	M16×2	43	16	14	—	—	

Note 1) Internal coolant is necessary with the set bolt.

Note 2) The milling cutter with cutting diameter DC=50 mm has a built-in set bolt.

Please use a 7 mm Allen wrench to tighten/loosen the set bolt.



Right hand tool holder only.

Shank Type

With Coolant Hole




(mm)

DC	Order Number	Stock	* No.T	LF	DCON	LH	WT (kg)	APMX	RMPX	RPMX (min ⁻¹)
		R								
50	WWX400R5003SA32M	●	3	125	32	40	0.8	8.2	0.4°	16000
50	WWX400R5004SA32M	●	4	125	32	40	0.8	8.2	0.4°	16000
63	WWX400R6303SA32M	●	3	125	32	40	1.0	8.2	0.26°	14100
63	WWX400R6304SA32M	●	4	125	32	40	1.0	8.2	0.26°	14100
63	WWX400R6305SA32M	●	5	125	32	40	1.0	8.2	0.26°	14100
80	WWX400R8004SA32M	●	4	125	32	40	1.3	8.2	0.16°	12200
80	WWX400R8005SA32M	●	5	125	32	40	1.3	8.2	0.16°	12200
80	WWX400R8007SA32M	●	7	125	32	40	1.2	8.2	0.16°	12200

* Number of Teeth

Spare Parts

(mm)

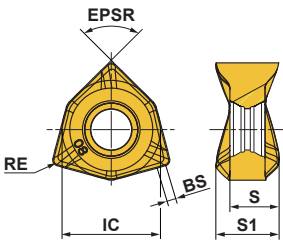
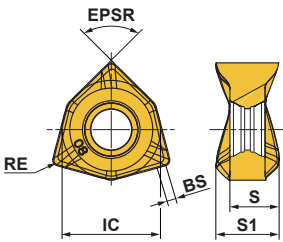
Tool Holder Type	*		
			
WWX400	TS5R	TKY20T	MK1KS

* Clamp Torque (N · m) : TS5R = 5.0

Double Sided Insert Type Shoulder Mill

(mm)

Inserts

Workpiece Material	P	Steels	●	●												Cutting Conditions (Guide) : ● : Stable Cutting ● : General Cutting ✚ : Unstable Cutting Edge Preparation : E : Round F : Sharp	
	M	Stainless Steels			●												
Shape	K	Cast Irons	●														
	N	Non-ferrous Metals															
	S	Heat Resistant Alloys, Titanium Alloys				●	●										
H	Hardened Steels																
Order Number	Class	Edge Preparation	Coated						Carbide	IC	S	S1	BS	RE	Geometry		
			MC5020	MP6120	MP6130	MP7130	MP9120	MP9130	VP15TF							TF15	
NEW	6NGU1409040PNER-L	G	E	●	●	●	●	●	●			14	7	9	1.7	0.4	
	6NGU1409080PNER-L	G	E	●	●	●	●	●	●			14	7	9	1.3	0.8	
	6NGU1409040PNFR-L	G	F							●		14	7	9	1.7	0.4	
	6NGU1409080PNFR-L	G	F							●		14	7	9	1.3	0.8	
	6NMU1409040PNER-M	M	E	●	●	●	●	●	●			14	7	9	1.7	0.4	
	6NMU1409080PNER-M	M	E	●	●	●	●	●	●			14	7	9	1.3	0.8	
	6NMU1409080PNER-R	M	E	●	●	●	●	●	●			14	7	9	1.3	0.8	

● = NEW

Cutting Conditions (Guide) :

● : Stable Cutting ● : General Cutting ✖ : Unstable Cutting

Recommended Cutting Conditions

■ Dry Cutting Cutting Speed

(mm)

Workpiece Material	Properties	Cutting Conditions	Grade	ae				
				0.5DC≥	0.8DC≥	DC(Slot)		
				vc (m/min)				
P	Mild Steels	Hardness ≤180HB	●	MP6120	240(200–280)	220(180–260)	200(160–240)	
			●	MP6130	230(190–270)	210(170–250)	190(150–230)	
			✖	MP6130,VP15TF	210(170–250)	190(150–230)	170(130–210)	
	Carbon Steels Alloy Steels	Hardness 180–280HB	●	MP6120	210(170–250)	190(150–230)	170(130–210)	
			●	MP6130	200(160–240)	180(140–220)	160(120–200)	
			✖	MP6130,VP15TF	180(140–220)	160(120–200)	140(100–180)	
	Carbon Steels Alloy Steels Alloy Tool Steels	Hardness 280–350HB ≤350HB (Annealing)	●	MP6120	200(160–240)	180(140–220)	160(120–200)	
			●	MP6130	190(150–230)	170(130–210)	150(110–190)	
			✖	MP6130,VP15TF	170(130–210)	150(110–190)	130(90–170)	
	Pre-hardened Steels	Hardness 35–45HRC	●	MP6120	140(120–160)	–	–	
			●	MP6130	120(100–140)	–	–	
			✖	MP6130,VP15TF	110(90–130)	–	–	
M	Austenitic Stainless Steels	Hardness ≤200HB	●	MP7130	180(160–200)	160(140–180)	–	
			●	MP7130,VP15TF	170(150–190)	150(130–170)	–	
			✖	MP7130,VP15TF	150(130–170)	130(110–150)	–	
	Austenitic Stainless Steels	Hardness >200HB	●	MP7130	170(150–190)	150(130–170)	–	
			●	MP7130,VP15TF	160(140–180)	140(120–160)	–	
			✖	MP7130,VP15TF	140(120–160)	120(100–140)	–	
	Ferritic and Martensitic Stainless Steels	Hardness ≤200HB	●	MP7130	180(160–200)	160(140–180)	–	
			●	MP7130,VP15TF	170(150–190)	150(130–170)	–	
			✖	MP7130,VP15TF	150(130–170)	130(110–150)	–	
	Duplex Stainless Steels	Hardness ≤280HB	●	MP7130	160(140–180)	140(120–160)	–	
			●	MP7130,VP15TF	150(130–170)	130(110–150)	–	
			✖	MP7130,VP15TF	130(110–150)	110(90–130)	–	
	Precipitation Hardening Stainless Steels	Hardness <450HB	●	MP7130	140(120–160)	–	–	
			●	MP7130,VP15TF	130(110–150)	–	–	
			✖	MP7130,VP15TF	110(90–130)	–	–	
	K	Gray Cast Irons	Tensile Strength ≤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,VP15TF	220(180–260)	200(160–240)	180(140–220)	
Ductile Cast Irons		Tensile Strength ≤450MPa	●	MC5020	220(180–160)	200(160–240)	180(140–220)	
			●	MC5020	210(170–250)	190(150–230)	170(130–210)	
			●	VP15TF	210(170–250)	190(150–230)	–	
			✖	MC5020,VP15TF	190(150–230)	170(130–210)	150(110–190)	
Ductile Cast Irons		Tensile Strength ≤800MPa	●	MC5020	180(140–220)	160(120–200)	140(100–180)	
			●	MC5020	170(130–210)	150(110–190)	130(90–170)	
			●	VP15TF	170(130–210)	150(110–190)	–	
			✖	MC5020,VP15TF	150(110–190)	130(90–170)	110(70–150)	
H	Hardened Steels	Hardness 40–55HRC	●	VP15TF	50(30–70)	–	–	
			●	VP15TF	50(30–70)	–	–	

Note 1) The recommended cutting speed has been calculated for a depth of cut 2mm. Please reduce the cutting speed by an appropriate amount corresponding to the increase in cutting depth.

Double Sided Insert Type Shoulder Mill

Cutting Conditions (Guide) :

● : Stable Cutting ● : General Cutting ✖ : Unstable Cutting

Recommended Cutting Conditions

Wet Cutting Cutting Speed

(mm)

Workpiece Material	Properties	Cutting Conditions	Grade	ae				
				0.5DC≥	0.8DC≥	DC(Slot)		
				vc (m/min)				
P	Mild Steels	Hardness ≤180HB	●	MP6120	150(140–160)	130(120–140)	120(110–130)	
			●	MP6130	140(130–150)	120(110–130)	110(100–120)	
			✖	MP6130,VP15TF	120(110–130)	100(90–110)	90(80–100)	
	Carbon Steels Alloy Steels	Hardness 180–280HB	●	MP6120	150(140–160)	130(120–140)	120(110–130)	
			●	MP6130	140(130–150)	120(110–130)	110(100–120)	
			✖	MP6130,VP15TF	120(110–130)	100(90–110)	90(80–100)	
	Carbon Steels Alloy Steels Alloy Tool Steels	Hardness 280–350HB ≤350HB (Annealing)	●	MP6120	140(130–150)	120(110–130)	110(100–120)	
			●	MP6130	130(120–140)	110(100–120)	100(90–110)	
			✖	MP6130,VP15TF	110(100–120)	90(80–100)	80(70–90)	
	Pre-hardened Steels	Hardness 35–45HRC	●	MP6120	110(100–120)	—	—	
			●	MP6130	100(90–110)	—	—	
			✖	MP6130,VP15TF	80(70–90)	—	—	
M	Austenitic Stainless Steels	Hardness ≤200HB	●	MP7130	130(120–140)	110(100–120)	—	
			●	MP7130,VP15TF	120(110–130)	100(90–110)	—	
			✖	MP7130,VP15TF	100(90–110)	80(70–90)	—	
	Austenitic Stainless Steels	Hardness >200HB	●	MP7130	130(120–140)	110(100–120)	—	
			●	MP7130,VP15TF	120(110–130)	100(90–110)	—	
			✖	MP7130,VP15TF	100(90–110)	80(70–90)	—	
	Ferritic and Martensitic Stainless Steels	Hardness ≤200HB	●	MP7130	130(120–140)	110(100–120)	—	
			●	MP7130,VP15TF	120(110–130)	100(90–110)	—	
			✖	MP7130,VP15TF	100(90–110)	80(70–90)	—	
	Duplex Stainless Steels	Hardness ≤280HB	●	MP7130	120(110–130)	100(90–110)	—	
			●	MP7130,VP15TF	110(100–120)	90(80–100)	—	
			✖	MP7130,VP15TF	90(80–100)	70(60–80)	—	
	Precipitation Hardening Stainless Steels	Hardness <450HB	●	MP7130	120(110–130)	—	—	
			●	MP7130,VP15TF	110(100–120)	—	—	
			✖	MP7130,VP15TF	90(80–100)	—	—	
	K	Gray Cast Irons	Tensile Strength ≤350MPa	●	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,VP15TF	140(120–160)	120(100–140)	100(80–120)	
Ductile Cast Irons		Tensile Strength ≤450MPa	●	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,VP15TF	140(120–160)	120(100–140)	100(80–120)	
Ductile Cast Irons		Tensile Strength ≤800MPa	●	MC5020	160(150–170)	140(130–150)	120(110–130)	
			●	MC5020	150(140–160)	130(120–140)	110(100–120)	
			●	VP15TF	150(140–160)	130(120–140)	—	
			✖	MC5020,VP15TF	130(120–140)	110(100–120)	90(80–100)	
N	Aluminium Alloys	Content Si <5%	●	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 Alloys	—	●	MP9120	80(60–100)	—	—	
			●	MP9120	70(50–90)	—	—	
			✖	MP9130	60(40–80)	—	—	
	Heat Resistant Alloys	—	●	MP9120	60(50–70)	—	—	
			●	MP9120	50(30–60)	—	—	
			✖	MP9130	40(20–40)	—	—	
H	Hardened Steels	Hardness 40–55HRC	●	VP15TF	50(30–70)	—	—	
			●	VP15TF	50(30–70)	—	—	

Note 1) Refer to the above table and set up cutting conditions according to cutting applications.

Memo

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Double Sided Insert Type Shoulder Mill

Recommended Cutting Conditions

Depth of Cut / Feed per Tooth

Workpiece Material	Properties	Cutting Conditions	Grade	ae			
				0.5DC ≥			
				Breaker	ap	fz (mm/t.)	
P	Mild Steels	●	MP6120	L,M	≤4.0	0.13(0.10—0.15)	
		●	MP6130	L,M	≤4.0	0.13(0.10—0.15)	
		●		M,R	≤4.0	0.16(0.10—0.20)	
		⚙	MP6130,VP15TF	M,R	≤4.0	0.13(0.10—0.15)	
	Carbon Steels Alloy Steels	Hardness 180—280HB	●	MP6120	L,M	≤4.0	0.13(0.10—0.15)
			●	MP6130	L,M	≤4.0	0.13(0.10—0.15)
			●		M,R	≤4.0	0.16(0.10—0.20)
			⚙	MP6130,VP15TF	M,R	≤4.0	0.13(0.10—0.15)
	Carbon Steels Alloy Steels Alloy Tool Steels	Hardness 280—350HB ≤350HB (Annealing)	●	MP6120	L,M	≤3.0	0.13(0.10—0.15)
			●	MP6130	L,M	≤3.0	0.13(0.10—0.15)
			●		M,R	≤3.0	0.16(0.10—0.20)
			⚙	MP6130,VP15TF	M,R	≤3.0	0.13(0.10—0.15)
Pre-hardened Steels	Hardness 35—45HRC	●	MP6120	L,M	≤2.0	0.13(0.10—0.15)	
		●	MP6130	L,M	≤2.0	0.13(0.10—0.15)	
		●		M,R	≤2.0	0.16(0.10—0.20)	
		⚙	MP6130,VP15TF	M,R	≤2.0	0.13(0.10—0.15)	
M	Austenitic Stainless Steels	● ●	MP7130	L,M	≤4.0	0.13(0.10—0.15)	
		●	VP15TF	M	≤4.0	0.16(0.10—0.20)	
		⚙	MP7130,VP15TF	M	≤4.0	0.13(0.10—0.15)	
	Austenitic Stainless Steels	Hardness >200HB	●	MP7130	L,M	≤4.0	0.13(0.10—0.15)
			●	MP7130	L,M	≤3.0	0.13(0.10—0.15)
			●	VP15TF	M	≤3.0	0.16(0.10—0.20)
			⚙	MP7130,VP15TF	M	≤3.0	0.13(0.10—0.15)
	Ferritic and Martensitic Stainless Steels	Hardness ≤200HB	● ●	MP7130	L,M	≤4.0	0.13(0.10—0.15)
			●	VP15TF	M	≤4.0	0.16(0.10—0.20)
			⚙	MP7130,VP15TF	M	≤3.0	0.13(0.10—0.15)
	Duplex Stainless Steels	Hardness ≤280HB	● ●	MP7130	L,M	≤3.0	0.13(0.10—0.15)
			● ●	MP7130	L,M	≤4.0	0.13(0.10—0.15)
			●	VP15TF	M	≤3.0	0.16(0.10—0.20)
			●	VP15TF	M	≤4.0	0.16(0.10—0.20)
			⚙	MP7130,VP15TF	M	≤3.0	0.13(0.10—0.15)
			⚙	MP7130,VP15TF	M	≤4.0	0.13(0.10—0.15)
	Precipitation Hardening Stainless Steels	Hardness <450HB	●	MP7130	L,M	≤2.0	0.13(0.10—0.15)
			●	MP7130	L,M	≤2.0	0.13(0.10—0.15)
●			VP15TF	M	≤2.0	0.16(0.10—0.20)	
⚙			MP7130,VP15TF	M	≤2.0	0.13(0.10—0.15)	
K	Gray Cast Irons	● ●	MC5020	L,M	≤4.0	0.13(0.10—0.15)	
		●	VP15TF	M,R	≤4.0	0.16(0.10—0.20)	
		⚙	MC5020,VP15TF	M,R	≤4.0	0.13(0.10—0.15)	
	Ductile Cast Irons	Tensile Strength ≤800MPa	● ●	MC5020	L,M	≤4.0	0.13(0.10—0.15)
			●	VP15TF	M,R	≤4.0	0.16(0.10—0.20)
			⚙	MC5020,VP15TF	M,R	≤4.0	0.13(0.10—0.15)
N	Aluminium Alloys	Content Si < 5%	● ● ●	TF15	L	≤4.0	0.13(0.10—0.15)
S	Titanium Alloys	● ●	MP9120	L,M	≤2.0	0.10(0.05—0.13)	
		⚙	MP9130	L,M	≤2.0	0.10(0.05—0.13)	
	Heat Resistant Alloys	—	● ●	MP9120	L,M	≤2.0	0.10(0.05—0.13)
			⚙	MP9130	L,M	≤2.0	0.10(0.05—0.13)
H	Hardened Steels	Hardness 40—55HRC	●	VP15TF	M	≤2.0	0.05(0.05—0.10)
			●	VP15TF	M,R	≤2.0	0.05(0.05—0.10)

Note 1) Refer to the above table and set up cutting conditions according to cutting applications.

Cutting Conditions (Guide) :

● : Stable Cutting ● : General Cutting ✖ : Unstable Cutting

(mm)

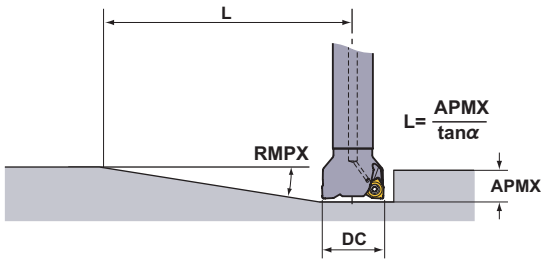
ae							Cutting Mode
0.8DC≥			DC(Slot)				
Breaker	ap	fz (mm/t.)	Breaker	ap	fz (mm/t.)		
L,M	≤3.0	0.13(0.10-0.15)	L,M	≤2.0	0.13(0.10-0.15)	Dry, Wet	
L,M	≤3.0	0.13(0.10-0.15)	L,M	≤2.0	0.13(0.10-0.15)	Dry, Wet	
M,R	≤3.0	0.16(0.10-0.20)	—	—	—	Dry, Wet	
M,R	≤3.0	0.13(0.10-0.15)	M	≤2.0	0.13(0.10-0.15)	Dry, Wet	
L,M	≤3.0	0.13(0.10-0.15)	L,M	≤2.0	0.13(0.10-0.15)	Dry, Wet	
L,M	≤3.0	0.13(0.10-0.15)	L,M	≤2.0	0.13(0.10-0.15)	Dry, Wet	
M,R	≤3.0	0.16(0.10-0.20)	—	—	—	Dry, Wet	
M,R	≤3.0	0.13(0.10-0.15)	M	≤2.0	0.13(0.10-0.15)	Dry, Wet	
L,M	≤3.0	0.13(0.10-0.15)	L,M	≤3.0	0.13(0.10-0.15)	Dry, Wet	
L,M	≤3.0	0.13(0.10-0.15)	L,M	≤2.0	0.13(0.10-0.15)	Dry, Wet	
M,R	≤3.0	0.16(0.10-0.20)	—	—	—	Dry, Wet	
M,R	≤3.0	0.13(0.10-0.15)	M	≤2.0	0.13(0.10-0.15)	Dry, Wet	
—	—	—	—	—	—	Dry, Wet	
—	—	—	—	—	—	Dry, Wet	
—	—	—	—	—	—	Dry, Wet	
—	—	—	—	—	—	Dry, Wet	
L,M	≤3.0	0.13(0.10-0.15)	—	—	—	Dry, Wet	
M	≤3.0	0.16(0.10-0.20)	—	—	—	Dry, Wet	
M	≤3.0	0.13(0.10-0.15)	—	—	—	Dry, Wet	
L,M	≤3.0	0.13(0.10-0.15)	—	—	—	Dry, Wet	
L,M	≤3.0	0.13(0.10-0.15)	—	—	—	Dry, Wet	
M	≤3.0	0.16(0.10-0.20)	—	—	—	Dry, Wet	
M	≤3.0	0.13(0.10-0.15)	—	—	—	Dry, Wet	
L,M	≤3.0	0.13(0.10-0.15)	—	—	—	Dry, Wet	
M	≤3.0	0.16(0.10-0.20)	—	—	—	Dry, Wet	
M	≤3.0	0.13(0.10-0.15)	—	—	—	Dry, Wet	
L,M	≤3.0	0.13(0.10-0.15)	—	—	—	Dry	
L,M	≤3.0	0.13(0.10-0.15)	—	—	—	Wet	
M	≤3.0	0.16(0.10-0.20)	—	—	—	Dry	
M	≤3.0	0.16(0.10-0.20)	—	—	—	Wet	
M	≤3.0	0.16(0.10-0.20)	—	—	—	Dry	
M	≤3.0	0.13(0.10-0.15)	—	—	—	Wet	
—	—	—	—	—	—	Dry, Wet	
—	—	—	—	—	—	Dry, Wet	
—	—	—	—	—	—	Dry, Wet	
—	—	—	—	—	—	Dry, Wet	
L,M	≤3.0	0.13(0.10-0.15)	L,M	≤2.0	0.13(0.10-0.15)	Dry, Wet	
M,R	≤3.0	0.16(0.10-0.20)	—	—	—	Dry, Wet	
M,R	≤3.0	0.13(0.10-0.15)	M,R	≤2.0	0.13(0.10-0.15)	Dry, Wet	
L,M	≤3.0	0.13(0.10-0.15)	L,M	≤2.0	0.13(0.10-0.15)	Dry, Wet	
M,R	≤3.0	0.16(0.10-0.20)	—	—	—	Dry, Wet	
M,R	≤3.0	0.13(0.10-0.15)	M,R	≤2.0	0.13(0.10-0.15)	Dry, Wet	
L	≤3.0	0.13(0.10-0.15)	L	≤2.0	0.13(0.10-0.15)	Wet	
—	—	—	—	—	0.10(0.05-0.13)	Wet	
—	—	—	—	—	0.10(0.05-0.13)	Wet	
—	—	—	—	—	0.10(0.05-0.13)	Wet	
—	—	—	—	—	0.10(0.05-0.13)	Wet	
—	—	—	—	—	0.05(0.05-0.10)	Dry, Wet	
—	—	—	—	—	0.05(0.05-0.10)	Dry, Wet	

Memo

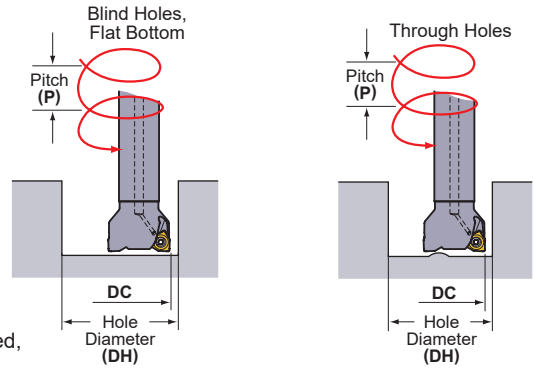
A series of horizontal dashed lines for writing, spanning the width of the page.

Ramping / Helical Milling

● Ramping



● Helical Milling



Refer to the table below for cutting conditions. For feed per tooth and cutting speed, follow the cutting conditions for slot milling.

DC	RE	APMX	Ramping		Helical Milling (Blind Hole, Flat Bottom)				Helical Milling (Through Hole)	
			RMPX	L *	DH max.	P max.	DH min.	P max.	DH min.	P max.
50	0.4	8	0.40°	1175	98.5	1.06	95.2	0.99	82.5	0.7
50	0.8	8	0.40°	1175	97.7	1.05	95.2	0.99	82.5	0.7
63	0.4	8	0.26°	1807	124.5	0.88	121.2	0.83	108.6	0.6
63	0.8	8	0.26°	1807	123.7	0.87	121.2	0.83	108.6	0.6
80	0.4	8	0.16°	2936	158.5	0.69	155.2	0.66	142.6	0.5
80	0.8	8	0.16°	2936	157.7	0.68	155.3	0.66	142.6	0.5

(mm)

DC = Cutting Diameter
APMX = Depth of Cut Max.

RMPX = Ramping Angle Max.
DH = Desired Hole Diameter

P = Pitch

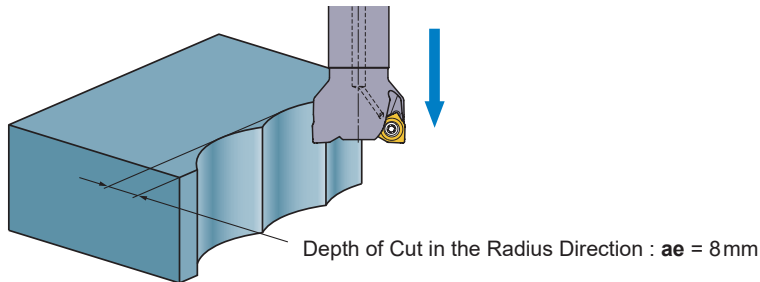
Note 1) When ramping and helical milling, it is recommended to reduce the feed per tooth.

Note 2) When ramping and helical milling, long continuous chips may be scattered so please be careful.

<Helical Milling>

To obtain a flat bottom surface when helical milling, it requires to remove "the uncut part" in the centre of the workpiece material at a final pass. When helical milling, make sure that the depth of cut per helical pass doesn't exceed the maximum depth of cut (**APMX**).

● Plunging





Double Sided Insert Type Shoulder Mill

WWX400

For Your Safety

●Don't handle inserts and chips without gloves. ●Please machine within the recommended application range and exchange expired tools with new ones in advance of breakage. ●Please use safety covers and wear safety glasses. ●When using compounded cutting oils, please take fire precautions. ●When attaching inserts or spare parts, please use only the correct wrench or driver. ●When using rotating tools, please make a trial run to check run-out, vibration and abnormal sounds etc.

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(Tools specifications subject to change without notice.)