

PRODUCT  
NEWS

PN-E-012



# SHOULDER EXTREME

EXSAP/MSX type

for high efficient shoulder milling.

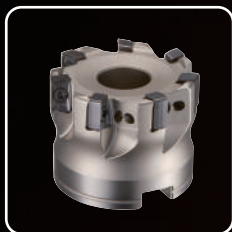


DIJET GmbH • [www.dijet.de](http://www.dijet.de)

High efficient & high precision shoulder milling cutter

## SHOULDER EXTREME EXSAP/MSX type

### Features



Facemill type



Modular head type



Endmill type

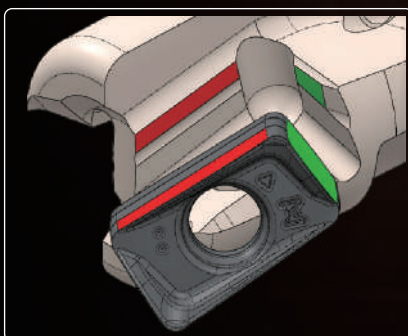
**NEW**

Various line up

EXSAP/ MSX are usable for wide applications such as face milling, slotting and plunging

Arc geometry on the periphery cutting edge

Cusp height can be smaller even in case of large ap and achieved high efficient & high precision machining for vertical wall



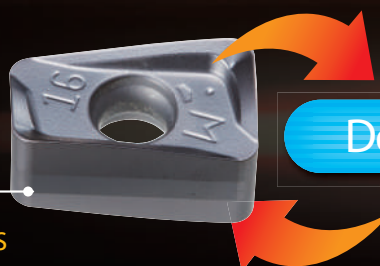
3D chipbreaker

Strongly clamp system

Due to unique clamp system possible to hold insert achieved high efficient machining in roughing

High precision G class periphery grinding

Applicable to semi finishing process



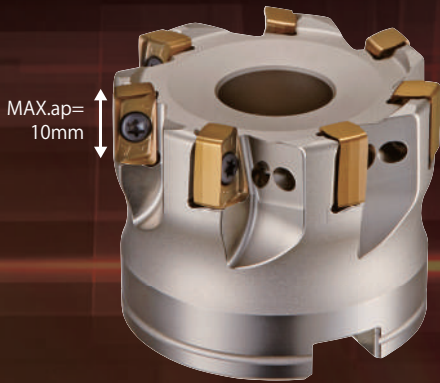
Double-side usable!

## EXSAP-11 type

**NEW**

Superior cutting performance by **multi blades with small inserts**.  
 Achieved high efficiency and high speed machining.

Accuracy of tool dia. with master insert 0~0.1  
 Achieves **even higher precision semi finishing process**



Grade: **JC8050**  
**JC8118**

PM breaker for general steel

Optimal breaker for mold steel &  
 High hardened steel less than 50HRC



Grade: **JC7550**  
**JC7518**

SL breaker for hard-to-cut materials

Optimal breaker for Titanium alloy and Inconel

## EXSAP-17 type

**Max.depth of cut (ap)=15mm** is possible  
 Possible to applicate from roughing process to semi finishing  
 even with large ap cutting



**High rigidity insert**  
 Achieved high precision machining even in large ap machining  
 due to the thick insert



Grade: **JC8050**  
**JC8118**

PM breaker for general steel

Optimal breaker for Mold steel and  
 High hardened steel less than 50HRC

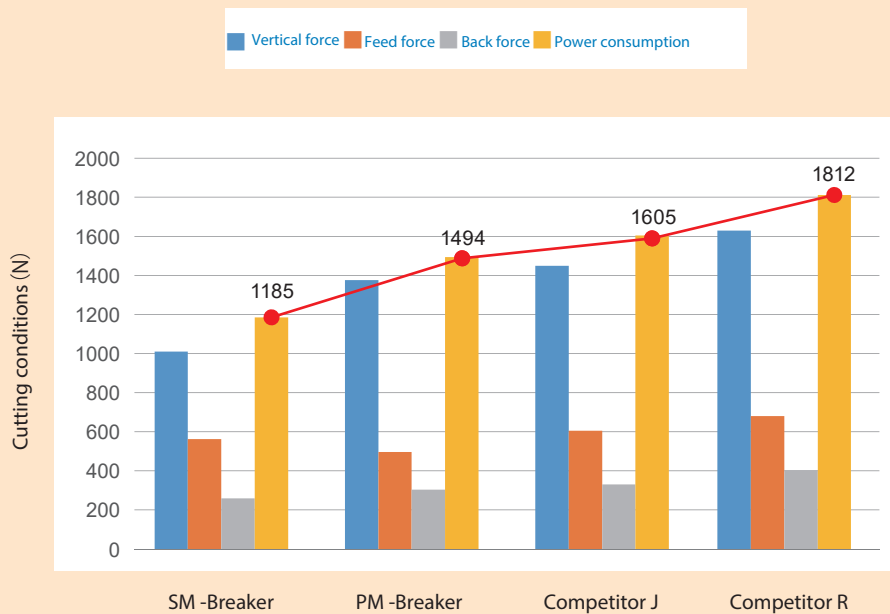
## Application

ISO	P					M					K				S				H		
	P01	P10	P20	P30	P40	M01	M10	M20	M30	M40	K01	K10	K20	K30	S01	S10	S20	S30	H01	H10	H20
Applicable range	JC8118					JC8118					JC8118								JC8118		
	JC8050					JC8050															
	JC7518					JC7518									JC7518				JC7518		
	JC7550					JC7550									JC7550						

## Cutting performance

EXSAP-11 type

### Cutting force comparison



Material : Ti-6AL-4V

● Tool dia. :  $\varnothing 16\text{mm}$

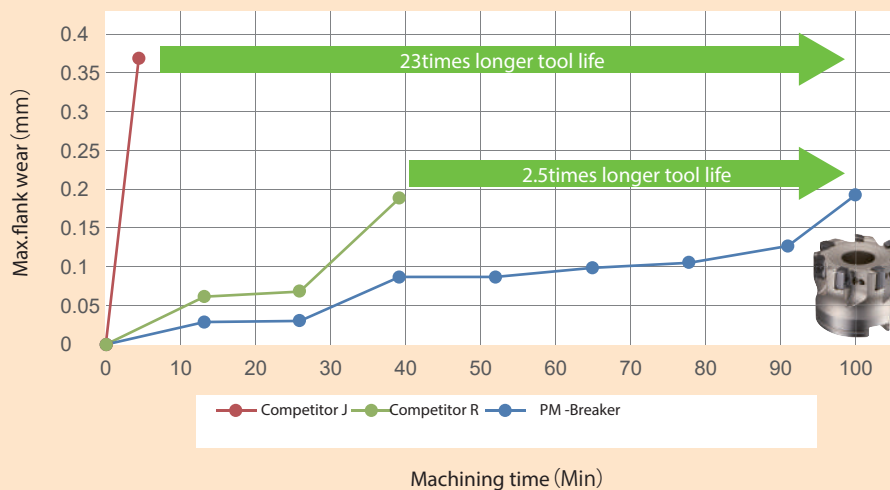
● Cutting conditions :

$V_c=60\text{m/min}$ ,  $f_z=0.1\text{mm/t}$   
 $a_p=5\text{mm}$ ,  $a_e=1\text{mm}$

Test by one insert  
 DOWN CUT  
 Air blow

SL breaker is 35% lower Cutting force than R company Even in the PM breaker Lower Cutting force than other companies.

### Tool life comparison (For roughing)



Material : NAK80

● Tool dia. :  $\varnothing 50\text{mm}$

● Cutting conditions :  
 $V_c=120\text{m/min}$ ,  $f_z=0.15\text{mm/t}$   
 $a_p=2\text{mm}$ ,  $a_e=35\text{mm}$

Test by one insert  
 DOWN CUT  
 Air blow

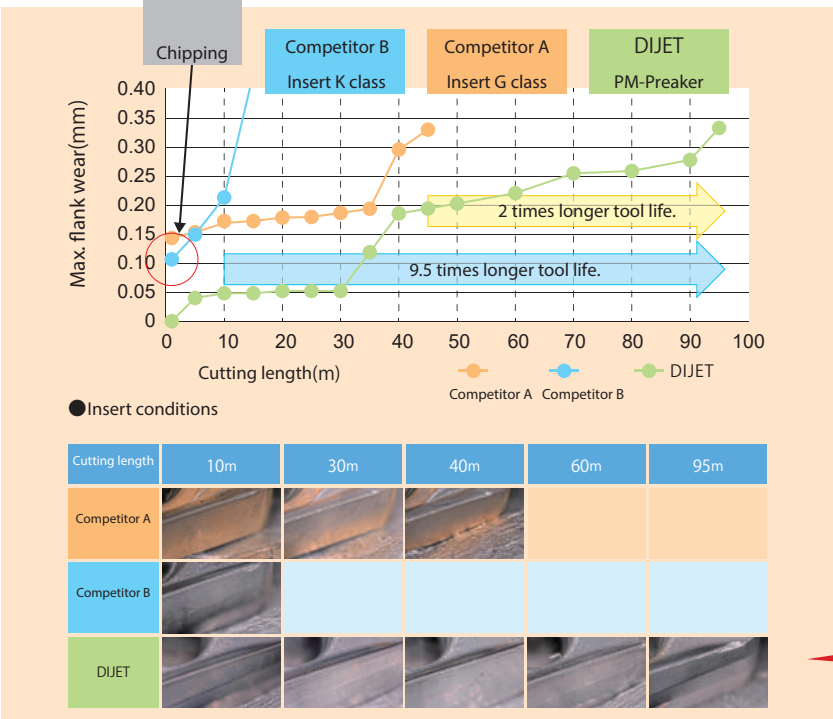
Because the initial wear is small and the cutting resistance is low, EXSAP achieves stable machining.

PM Breaker suppress rubbing. Both Ra and Rz are good. Achieved a beautiful finished surface.

DIJETPM-Breaker	Competitor J	Competitor R
Ra=0.24 $\mu\text{m}$	Ra=0.27 $\mu\text{m}$	Ra=0.49 $\mu\text{m}$
Rz=1.41 $\mu\text{m}$	Rz=1.71 $\mu\text{m}$	Rz=3.03 $\mu\text{m}$

EXSAP-17 type

## Tool life comparison (for roughing)



Material : P20

- Tool dia. :  $\phi 50\text{mm}$
- Insert Grade : JC8118
- Cutting conditions :  
 $V_c=150\text{m/min}$ ,  $f_z=0.3\text{mm/t}$ ,  
 $a_p=15\text{mm}$ ,  $a_e=3\text{mm}$

Test by one insert  
 UP & DOWN CUT  
 Air blow

Possible to stable roughing!

## Surface roughness comparison (for semi-finishing)

● Shoulder milling

Deflection (vertical wall) (height: 30mm)	Feed direction	Feed direction
$6\mu\text{m}$	$0.47\mu\text{m}$	$2.92\mu\text{m}$

(※)  $\nabla\nabla\nabla \Rightarrow Ra \leq 1.6\mu\text{m}$   $Rz \leq 6.3\mu\text{m}$

Possible to high precision machining at  $\nabla\nabla\nabla$  level!

Material : HPM-MAGIC (P20)

- Tool dia. :  $\phi 25\text{mm}$
- Insert grade : JC8050
- Cutting condition :  
 $V_c=250\text{m/min}$ ,  $f_z=0.15\text{mm/t}$ ,  
 $a_p=3\text{mm}$ ,  $a_e=0.2\text{mm}$

Test by two insert  
 DOWN CUT  
 Air blow

● Face milling

Competitor B

Competitor A

DIJET

Good surface roughness!

Material : HPM-MAGIC (P20)

- Tool dia. :  $\phi 50\text{mm}$
- Insert grade : JC8050
- Cutting condition :  
 $V_c=180\text{m/min}$ ,  $f_z=0.1\text{mm/t}$ ,  
 $a_p=3\text{mm}$ ,  $a_e=35\text{mm}$

Test by one insert  
 DOWN CUT  
 Air blow

# SHOULDER EXTREME

Line up

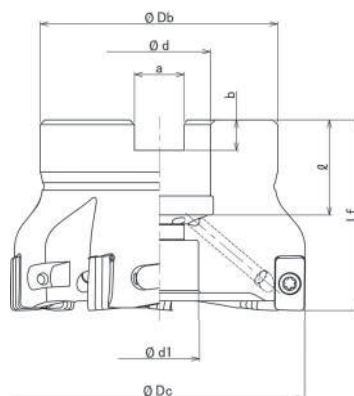
EXSAP-11 type

● Facemill type



● Through coolant hole

**NEW**



Type	Cat. No.	Stock	No. of inserts	Dimensions (mm)								Set bolt	Weight (kg)	Inserts	
				$\varnothing D_c$	$L_f$	$\varnothing D_b$	$\varnothing d$	$\varnothing d_1$	$a$	$b$	$\ell$				
Metric Bore	EXSAP-6040R-11-16	●	6	40	40	35	16	14	8.4	5.6	18	M8	Head cap screw (JIS Standard)	0.22	ZNGU1105**ZER-**
	EXSAP-7050R-11-22	●	7	50	40	47	22	16.5	10.4	6.3	20	M10		0.38	
	EXSAP-7052R-11-22	●	7	52	40	47	22	16.5	10.4	6.3	20	M10		0.39	
	EXSAP-7063R-11-22	●	7	63	40	50	22	17	10.4	6.3	20	M10		0.53	
	EXSAP-7063R-11-27	●	7	63	50	50	27	20	12.4	7	22	M12×1.75×30★		0.62	
	EXSAP-8080R-11-27	●	8	80	50	56	27	20	12.4	7	22	M12×1.75×30★		0.99	

●: Standard stock items □: Stock in Japan. (7 to 10 days delivery upon ordering)



Note)1. All cutters are supplied without inserts.

2. All cutters are supplied without wrench & MOLY.

3. ★ mark shows these cutter bodies are equipped with the set bolt because of the specified bolt size.

Expect for these cutter bodies, please use the set bolt equipped with arbor.

4. Please see page 19-20 for recommended Cutting conditions for shoulder milling, 25-26 for recommended Cutting conditions for Facemilling.

Parts	
Clamp screw	Wrench(not be included)
	
TSW-307H	A-10

Clamp screw	Recommended torque (N·m)
TSW-307H	2.1

**EXSAP-11 type**

● Endmill type

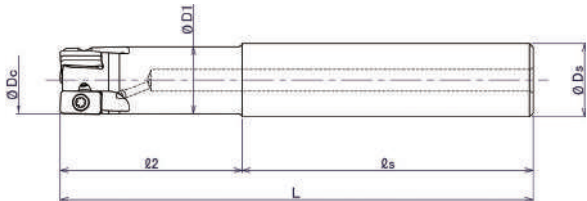


**NEW**

● Through coolant hole



Fig.1



Cat. No.	Stock	No. of inserts	Dimensions (mm)						Fig.	Inserts
			$\varnothing D_c$	$\ell_2$	$\ell_s$	$L$	$\varnothing D_1$	$\varnothing D_s$		
EXSAP-2016-11-50-S16+A	●	2	16	50	60	110	14.6	16	1	 ZNGU1105**ZER-**
EXSAP-3020-11-50-S20+A	●	3	20	50	80	130	18.3	20	1	
EXSAP-3025-11-50-S25+A	●	3	25	50	80	130	23.4	25	1	
EXSAP-4032-11-50-S32+A	●	4	32	50	80	130	29	32	1	

- : Standard stock items
- Note)1. All cutters are supplied without inserts.
- 2. All cutters are supplied without wrench & MQLY.
- 3. Please see page 21-22 for recommended Cutting conditions for shoulder milling, 27-28 for recommended Cutting conditions for Facemilling.

Parts	
Clamp screw	Wrench(not be included)
TSW-307H	A-10

Clamp screw	Recommended torque (N·m)
TSW-307H	2.1

## Line up

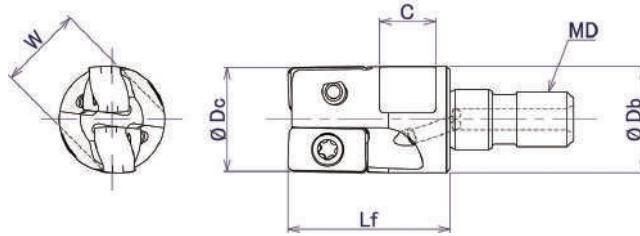
EXSAP-11 type


● Modular head type



● Through coolant hole



**NEW**



Cat. No.	Stock	No. of inserts	Dimensions (mm)						Inserts
			$\varphi D_c$	$L_f$	$\varphi D_b$	MD	C	W	
MSX-2016-11-M8	●	2	16	23	15	M8	8	12	 ZNGU1105**ZER**
MSX-3020-11-M10	●	3	20	30	18	M10	9	14	
MSX-3025-11-M12	●	3	25	35	22	M12	11	19	
MSX-4030-11-M16	□	4	30	43	29	M16	12	22	
MSX-4032-11-M16	●	4	32	43	29	M16	12	22	
MSX-5040-11-M16	●	5	40	43	29	M16	12	22	

●: Standard stock items □: Stock in Japan. (7 to 10 days delivery upon ordering)

- Note) 1. All cutters are supplied without inserts.  
 2. All cutters are supplied without wrench & MOLY.  
 3. Please see page 12 for recommended tightening torque.  
 4. Please see page 23-24 for recommended Cutting conditions for shoulder milling, 29-30 for recommended Cutting conditions for Facemilling.

Parts	
Clamp screw	Wrench(not be included)
	
TSW-307H	A-10

Clamp screw	Recommended torque (N·m)
TSW-307H	2.1



**EXSAP-11 type**

**Inserts**

**NEW**

Fig.1



Fig.1

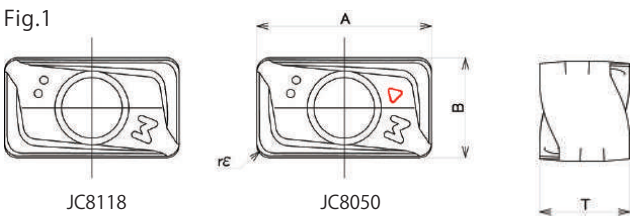
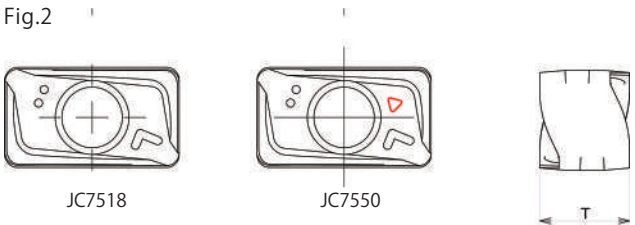


Fig.2



Fig.2

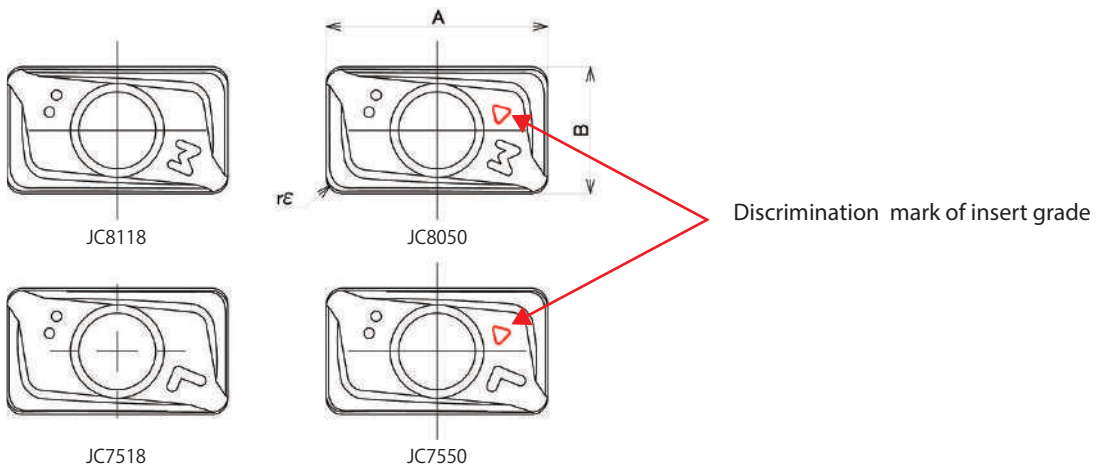


Cat. No.	Tolerance	PVD Coated				Dimensions(mm)				Fig.
		JC8118	JC8050	JC7518	JC7550	A	B	T	rε	
ZNGU110504ZER-PM	G	⊙	⊙			11	6.3	5.6	0.4	1
ZNGU110508ZER-PM	G	●	●			11	6.3	5.6	0.8	1
ZNGU110516ZER-PM	G	⊙	⊙			11	6.3	5.6	1.6	1
ZNGU110504ZER-SL	G			⊙	⊙	11	6.3	5.6	0.4	2
ZNGU110508ZER-SL	G			●	●	11	6.3	5.6	0.8	2
ZNGU110516ZER-SL	G			⊙	⊙	11	6.3	5.6	1.6	2

● : Standard stock items    ⊙ : Soon be stocked (Scheduled to be released in April 2022)  
10 inserts per case.

**Discrimination of grade for insert.**

Each grade shows discrimination mark on the insert surface.



## Line up

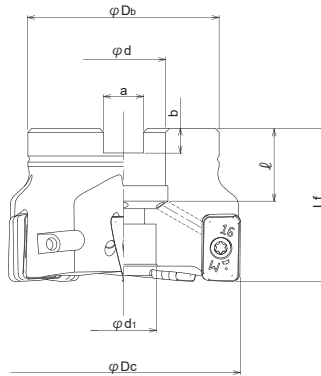
EXSAP-17 type

● Facemill type

**G-Body**



● Through coolant hole



● Body

Type	Cat. No.	Stock	No. of inserts	Dimensions (mm)								Set bolt	Weight (kg)	Inserts	
				$\phi Dc$	$Lf$	$\phi Db$	$\phi d$	$\phi d1$	a	b	l				
Metric Bore	EXSAP-4050R-22	●	4	50	40	47	22	17	10.4	6.3	20	M10	Head cap screw (JIS Standard)	0.38	ZNGU1709** ZER-PM
	EXSAP-5050R-22	●	5	50	40	47	22	17	10.4	6.3	20	M10		0.38	
	EXSAP-5052R-22	●	5	52	40	47	22	17	10.4	6.3	20	M10		0.41	
	EXSAP-5063R-22	●	5	63	40	50	22	17	10.4	6.3	20	M10		0.58	
	EXSAP-7080R-27	●	7	80	50	56	27	20	12.4	7	22	M12×1.75×30★		1.09	
	EXSAP-7100R-32	●	7	100	50	85	32	26	14.4	8	25	M16×2×25★		1.93	
	EXSAP-8125R-40	●	8	125	63	100	40	32	16.4	9	32	M20×2.5×40★		3.66	

●: Standard stock items

Note) 1. All cutters are supplied without inserts.

Note) 2. All cutters are supplied without wrench & MOLY.

Note) 3. ★ mark shows: these cutter bodies are equipped with the set bolt because of the specified bolt size.

Except for these cutter bodies, please use the set bolt equipped with arbor.

4. Attention to use 3.0mm corner radius insert (ZNGU170930ZER-PM); Body must be modified to 2.0mm radius or 1.5mm chamfer at corner.

5. Please see page 31-32 for recommended Cutting conditions for shoulder milling, 37-38 for recommended Cutting conditions for Facemilling.

Parts	
Clamp screw	Wrench(not be included)
TSW-410H	A-15T

Clamp screw	Recommended torque (N·m)
TSW-410H	3.5

**G-Body**

Adopted GN surface-hardening treatment on thermal resistant high strength steel gives high hardness over 65HRC and secure insert pocket and holder against thermal deformation, improved body durability and tool life by 30% or more. Make it difficult to be damaged even under severe cutting conditions. Also rust-proof and anti-welding effect is much improved.

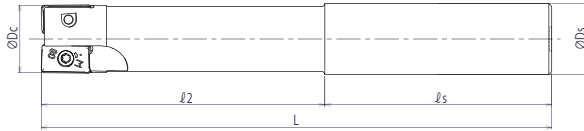
**EXSAP-17 type**


● Endmill type





**NEW**

● Without coolant hole



Cat. No.	Stock	No. of inserts	Dimensions (mm)					φDs	Inserts
			φDc	ℓ2	ℓs	L			
EXSAP-2025-30-S25+A	●	2	25	30	70	100		25	 ZNGU1709**ZER-PM
EXSAP-3032-35-S32+A	●	3	32	35	85	120		32	
EXSAP-4040-35-S32+A	●	4	40	35	85	120		32	

- : Standard stock items
- Note) 1. All cutters are supplied without inserts.
- 2. All cutters are supplied without wrench & MOLY.
- 3. Attention to use 3.0mm corner radius insert (ZNGU170930ZER-PM); Body must be modified to 2.0mm radius or 1.5mm chamfer at corner.
- 4. Please see page 33-34 for recommended Cutting conditions for shoulder milling, 39-40 for recommended Cutting conditions for Facemilling.

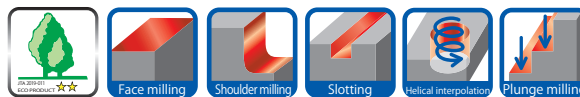
Parts	
Clamp screw	Wrench(not be included)
	
TSW-410H	A-15

Clamp screw	Recommended torque (N·m)
TSW-410H	3.5

Line up

EXSAP-17type

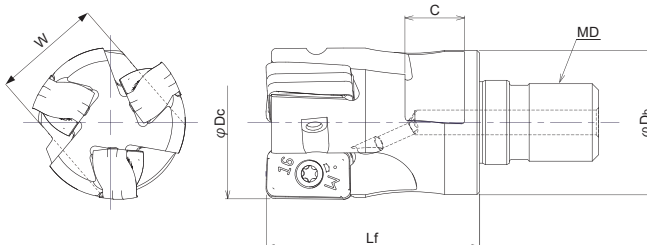
Modular head type



**G-Body**



● Through coolant hole



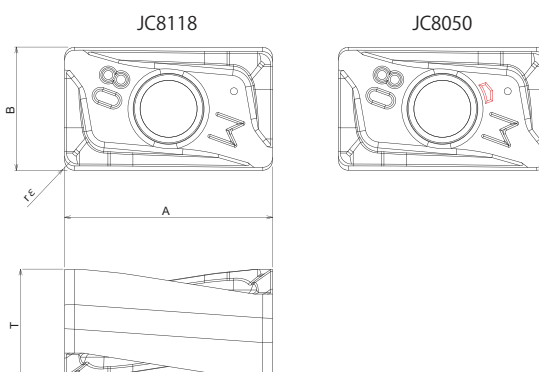
Body

Cat. No.	Stock	No. of inserts	Dimensions (mm)						inserts	Parts	
			$\phi Dc$	$L_f$	$\phi Db$	MD	C	W		Clamp screw	Wrench(not be included)
MSX-2025-M12	●	2	25	35	22	M12	11	19	ZNGU1709**ZER-PM	TSW-410H	A-15
MSX-2026-M12	□	2	26	35	22	M12	11	19			
MSX-2028-M12	□	2	28	35	22	M12	11	19			
MSX-2030-M16	□	2	30	43	29	M16	12	22			
MSX-2032-M16	●	2	32	43	29	M16	12	22			
MSX-3032-M16	●	3	32	43	29	M16	12	22			
MSX-3033-M16	□	3	33	43	29	M16	12	22			
MSX-3035-M16	□	3	35	43	29	M16	12	22			
MSX-4040-M16	●	4	40	43	29	M16	12	22			

- : Standard stock items □: Stock in Japan. (7 to 10 days delivery upon ordering)
- Note) 1. All cutters are supplied without inserts.  
 2. All cutters are supplied without wrench & MOLY.  
 3. Please see page 12 for recommended tightening torque.  
 4. Attention to use 3.0mm corner radius insert (ZNGU170930ZER-PM);  
 Body must be modified to 2.0mm radius or 1.5mm chamfer at corner.  
 5. Please see page 35-36 for recommended Cutting conditions for shoulder milling,  
 41-42 for recommended Cutting conditions for Facemilling.

Clamp screw	Recommended torque (N·m)
TSW-410H	3.5

Insert



Cat. No.	Tolerance	PVD Coated		Dimensions (mm)			
		JC8050	JC8118	A	B	T	$r\epsilon$
ZNGU170904ZER-PM	G	●	●	16.9	10	8.8	0.4
ZNGU170908ZER-PM	G	●	●	16.9	10	8.8	0.8
ZNGU170916ZER-PM	G	●	●	16.9	10	8.8	1.6
ZNGU170920ZER-PM	G	●	●	16.9	10	8.8	2
ZNGU170930ZER-PM	G	●	●	16.9	10	8.6	3

- : Standard stock items  
 10 inserts per case.

## Attention

**⚠ Attention to mounting head and MSN/ MGN shank arbor.**

### ■ Tightening procedure

#### ① Cleaning

Remove dirt and chips with air from the connecting thread and face of modular head and MSN/MGN shank arbor.

#### ② Initial Tightening

Tighten by hand until the head and the shank arbor faces touch.

#### ③ Final Tightening

Tighten slowly with torque control spanner wrench or DIJET DS type spanner wrench and confirm that there is no gap.

### ⚠ NOTE

- Note) 1. Only use the torque control spanner wrench or DIJET DS type spanner wrench.  
 2. Please gently apply pressure on wrench.  
 3. Please confirm that there is no gap between MSN/MGN shank arbor and modular head.

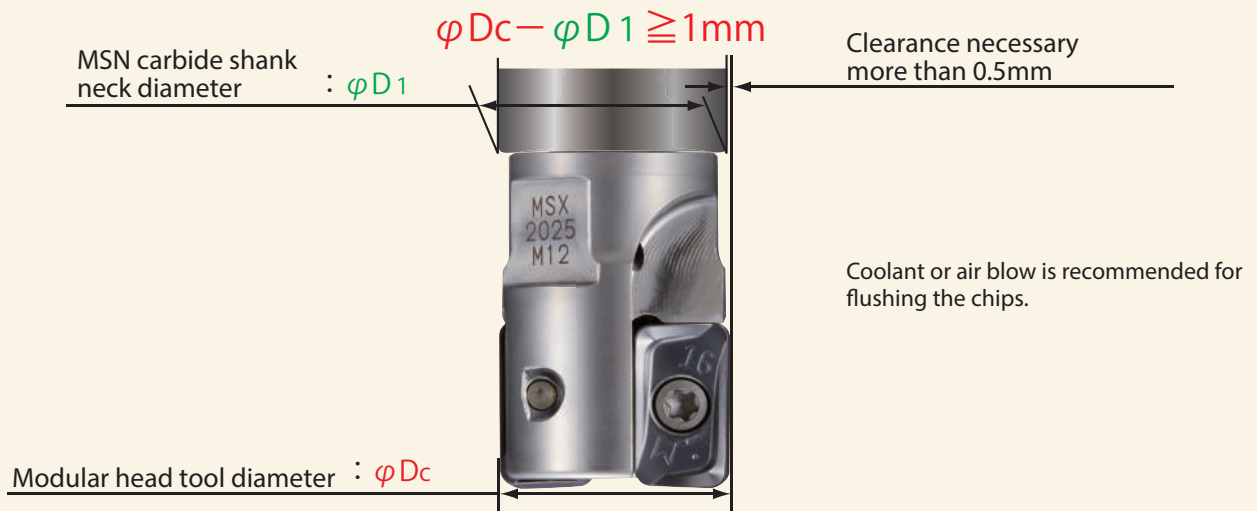
Thread	Tightening torque	Spanner size W(mm)
M6	8.0N·m	8☆
M8	16N·m	10, 12☆
M10	16N·m	14, 15
M12	20N·m	17, 19
M16	25N·m	22, 26

- Note) 1. Modular heads are supplied without spanner wrench.  
 2. In case of choosing torque control spanner wrench, confirm that the wrench size is match to the dimensions W & C of each modular head.  
 (There are some cases that modifying the thickness of spanner)

Attention : Final tightening without initial tightening cause connecting thread damage.

**⚠ Selection of "MSN Carbide shank arbor"**

In case of using modular head over  $\varnothing 16\text{mm}$ , please select **MSN carbide shank arbor that diameter ( $\varnothing D1$ ) is 1mm or more smaller than modular head ( $\varnothing Dc$ )**. A wrong selection causes damage to the carbide shank.



**⚠ Caution for the mounting to shrink fit holder.**

When you use a carbide shank and a modular head on the shrink fit holder, please shrink fit the only carbide shank without mounting a modular head together. **Please mount a modular head after shrinking fit operation.**

Note) In case of shrink fit MSN shank + modular head together, it will be difficult to loose due to heat desipation.

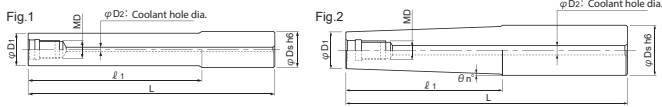
## Line up

### MSN Carbide shank arbor



#### ■ End mill shank type

- Through coolant hole ● For high productivity



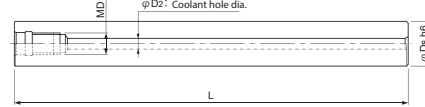
Cat. No.	Stock	Dimensions (mm)						MD	φD <sub>2</sub>	Weight (kg)	Fig.	
		φD <sub>s</sub>	ℓ <sub>1</sub>	L	φD <sub>1</sub>	θ n°	MD					
MSN-M8-20-S16C	●	16	20	75	15.5	-	M8	4	0.17	1		
MSN-M8-40-S16C	●	16	40	95	15.5	-			0.22	1		
MSN-M8-40T-S20C	□	20	40	100	14.5	3°30'			0.36	2		
MSN-M8-77T-S20C	●	20	77	143	14.5	1°45'			0.49	2		
MSN-M8-80-S16C	●	16	80	135	15.5	-			0.32	1		
MSN-M8-120-S16C	●	16	120	175	15.5	-			0.42	1		
MSN-M8-152-S16C	●	16	152	207	15.5	-			0.51	1		
MSN-M10-20-S20C	●	20	20	80	19.5	-			M10	4	0.29	1
MSN-M10-40-S20C	●	20	40	100	19.5	-					0.39	1
MSN-M10-40T-S20C	●	20	40	100	18.5	0°43'					0.39	2
MSN-M10-70-S20C	●	20	70	130	19.5	-	0.5	1				
MSN-M10-85T-S25C	●	25	85	161	18.5	2°	0.9	2				
MSN-M10-90-S20C	●	20	90	150	19.5	-	0.6	1				
MSN-M10-90T-S20C	●	20	90	150	18.5	0°19'	0.58	2				
MSN-M10-140-S20C	●	20	140	200	19.5	-	0.8	1				
MSN-M10-140T-S20C	●	20	140	200	18.5	0°12'	0.77	2				
MSN-M10-160-S20C	●	20	160	220	19.5	-	0.87	1				
MSN-M10-210-S20C	●	20	210	270	19.5	-	1.07	1				
MSN-M12-25-S25C	●	25	25	90	24	-	M12	6	0.53	1		
MSN-M12-55-S25C	●	25	55	120	24	-			0.72	1		
MSN-M12-100T-S32C	□	32	100	180	23.5	2°			1.61	2		
MSN-M12-105-S25C	●	25	105	170	24	-			1.03	1		
MSN-M12-135-S25C	●	25	135	215	24	-			1.3	1		
MSN-M12-155-S25C	●	25	155	220	24	-			1.34	1		
MSN-M12-200-S25C	●	25	200	265	24	-			1.58	1		
MSN-M16-25-S32C	●	32	25	90	29	-			M16	8	0.85	1
MSN-M16-55-S32C	●	32	55	120	29	-					1.13	1
MSN-M16-77-S32C	●	32	77	157	29	-					1.47	1
MSN-M16-97-S32C	●	32	97	177	29	-	1.64	1				
MSN-M16-105-S32C	●	32	105	170	29	-	1.59	1				
MSN-M16-117T-S32C	□	32	117	197	29	0°38'	1.88	2				
MSN-M16-127-S32C	●	32	127	207	29	-	1.89	1				
MSN-M16-127T-S32C	□	32	127	207	29	0°30'	2.23	2				
MSN-M16-155-S32C	●	32	155	220	29	-	2.04	1				
MSN-M16-177-S32C	●	32	177	257	29	-	2.32	1				
MSN-M16-177T-S32C	●	32	177	257	29	0°23'	2.78	2				
MSN-M16-195-S32C	●	32	195	260	29	-	2.4	1				
MSN-M16-197T-S32C	□	32	197	277	29	0°23'	3	2				
MSN-M16-225-S32C	●	32	225	290	29	-	2.57	1				
MSN-M16-245-S32C	●	32	245	310	29	-	2.74	1				
MSN-M16-295-S32C	●	32	295	360	29	-	3.17	1				

● : Standard stock items □ : Stock in Japan(7 to 10 days delivery upon ordering)  
 Note) Please see page 12 for recommended tightening torque.



#### ■ Straight arbor type

- Through coolant hole ● For high productivity



Cat. No.	Stock	Dimensions (mm)				Weight (kg)
		φD <sub>s</sub>	L	MD	φD <sub>2</sub>	
MSN-M8-87S-S14C	●	14	87	M8	4	0.16
MSN-M8-137S-S14C	●		137			0.26
MSN-M8-97S-S15C	●	15	97	M8	4	0.21
MSN-M8-147S-S15C	●		147			0.33
MSN-M8-197S-S15C	●		197			0.44
MSN-M8-107S-S16C	●	16	107	M8	4	0.27
MSN-M8-157S-S16C	●		157			0.4
MSN-M10-130S-S18C	●	18	130	M10	4	0.42
MSN-M10-190S-S18C	●		190			0.62
MSN-M10-240S-S18C	●		240			0.89
MSN-M10-130S-S20C	●	20	130	M10	4	0.53
MSN-M10-190S-S20C	●		190			0.78
MSN-M10-250S-S20C	●		250			1.02
MSN-M12-185S-S23C	●	23	185	M12	6	0.98
MSN-M12-265S-S23C	●		265			1.42
MSN-M12-185S-S24C	●	24	185	M12	6	1.07
MSN-M12-265S-S24C	●		265			1.54
MSN-M12-145S-S25C	●	25	145	M12	6	0.91
MSN-M12-215S-S25C	●		215			1.36
MSN-M12-285S-S25C	●		285			1.8
MSN-M16-160S-S28C	●	28	160	M16	8	1.22
MSN-M16-230S-S28C	□		230			1.77
MSN-M16-310S-S28C	●		310			2.41
MSN-M16-157S-S32C	●	32	157	M16	8	1.61
MSN-M16-217S-S32C	●		217			2.22
MSN-M16-287S-S32C	●		287			2.94
MSN-M16-357S-S32C	●		357			3.66

● : Standard stock items □ : Stock in Japan(7 to 10 days delivery upon ordering)  
 Note) Please see page 12 for recommended tightening torque.

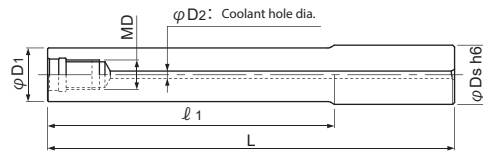
## ● MGN G-Body steel shank arbor

- Adopted ultra-rigid and improved body durability "G-Body".
- Short type
- Cost-effective and high strength steel shank arbor.

■ End mill shank type

● Through coolant hole

**G-Body**



Cat. No.	Stock	Dimensions (mm)							Weight (kg)
		$\varphi D_s$	$l_1$	$L$	$\varphi D_1$	$\theta_n^\circ$	MD	$\varphi D_2$	
MGN-M8-17-S16	<input type="checkbox"/>	16	17	97	15.5	—	M8	4	0.13
MGN-M10-30-S20	<input type="checkbox"/>	20	30	100	19	—	M10	4	0.21
MGN-M12-35-S25	<input type="checkbox"/>	25	35	105	24	—	M12	4	0.36
MGN-M12-85-S25	<input type="checkbox"/>	25	85	165	24	—	M12	4	0.57
MGN-M16-37-S32	<input type="checkbox"/>	32	37	107	29	—	M16	6	0.56
MGN-M16-77-S32	<input type="checkbox"/>	32	77	157	29	—	M16	6	0.83

: Stock in Japan(7 to 10 days delivery upon ordering)

Note) 1. In case of using modular head combined with MGN steel shank arbor, apply the recommended cutting conditions sheet (see page 16-22).  
2. Please see page 12 for recommended tightening torque.

## Cutting data

### EXSAP-11 type

#### ① Machining on Super duplex Stainless steel

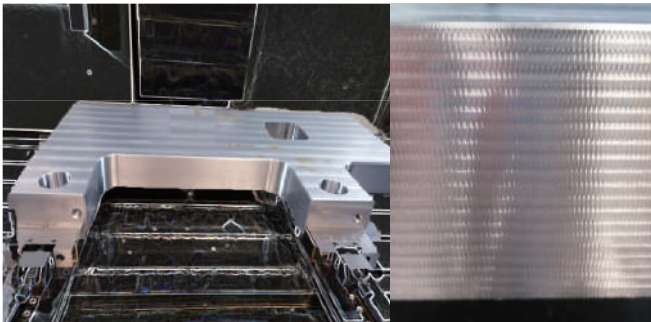


#### Result

Machining of three units completed compared to one unit with conventional products. In addition, reducing the cutting speed makes possible to machining four units.

Work	Part name	Parts	
	Material	Super duplex Stainless steel	
	Hardness	32HRC	
Tool	Tool No.	EXSAP-7050R-11-22	
	Insert No.	ZNGU110508ZER-PM (JC8050)	
Cutting conditions	Spindle speed Cutting speed	$n$	600 (min <sup>-1</sup> )
		$V_c$	95 (m/min)
	Feed speed	$V_f$	700 (mm/min)
		$f_z$	0.16 (mm/t)
	$a_p$ (mm)		5 (mm)
	$a_e$ (mm)		6 (mm)
	Coolant		Water coolant(internal)
	Machine		Vertical MC

#### ② Machining on Carbon steel

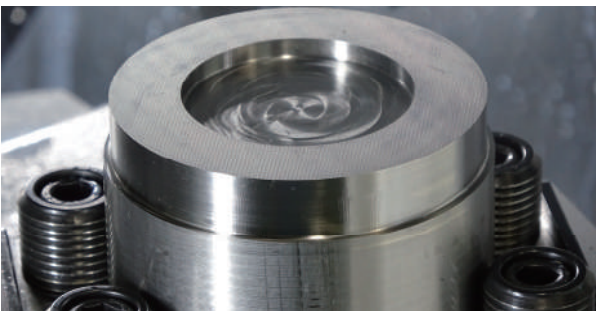


#### Result

It can be machined machine even high loading condition such as  $a_p=10\text{mm}$ ,  $a_e=1\text{mm}$ .

Work	Part name	Plate	
	Material	S45C	
	Hardness	200HB	
Tool	Tool No.	EXSAP-7050R-11-22	
	Insert No.	ZNGU110508ZER-PM (JC8050)	
Cutting conditions	Spindle speed Cutting speed	$n$	900 (min <sup>-1</sup> )
		$V_c$	140 (m/min)
	Feed speed	$V_f$	1,400 (mm/min)
		$f_z$	0.22 (mm/t)
	$a_p$ (mm)		10 (mm)
	$a_e$ (mm)		1 (mm)
	Coolant		Air blow(internal)
	Machine		Vertical MC

#### ③ Machining on Ti-alloy



#### Result

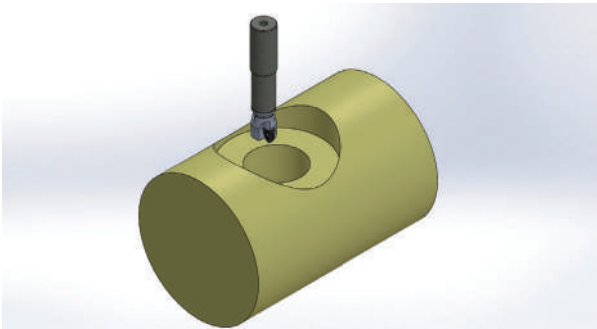
No welding and beautiful surface finish even in shoulder milling of hard-to-cut materials. After 1-hour machining, it is still possible to use.

Work	Part name	Test piece	
	Material	Ti-6AL-4V	
	Hardness	—	
Tool	Tool No.	MSX-2016-11-M8	
	Insert No.	ZNGU110508ZER-SL (JC7550)	
Cutting conditions	Spindle speed Cutting speed	$n$	1,200 (min <sup>-1</sup> )
		$V_c$	60 (m/min)
	Feed speed	$V_f$	300 (mm/min)
		$f_z$	0.125 (mm/t)
	$a_p$ (mm)		3 (mm)
	$a_e$ (mm)		1 (mm)
	Coolant		Water coolant(internal)
	Machine		Vertical MC



### EXSAP-17 type

#### ① Machining on Stainless steel

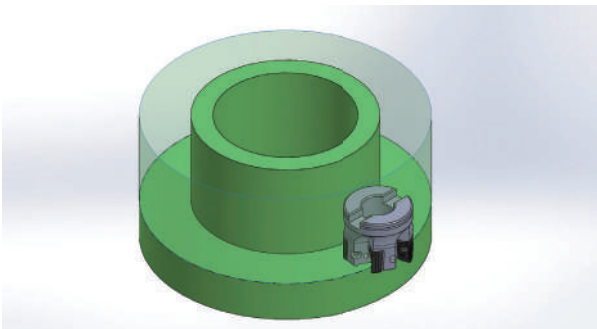


#### Result

Achieved 4 times longer tool life per corner compared with competitor's tool and has two more corners.

Work	Part name	Shaft		
	Material	SUS304		
	Hardness	—		
Tool	ool No.	MSX-2032-M16		
	Insert No.	ZNGU170908ZER-PM (JC8050)		
Cutting conditions	Spindle speed Cutting speed	$n$	1,230 (min <sup>-1</sup> )	
		$V_c$	124 (m/min)	
	Feed speed	$V_f$	490 (mm/min)	
		$f_z$	0.2 (mm/t)	
	$a_p$ (mm)		5.4 (mm)	
	$a_e$ (mm)		4 (mm)	
Coolant		Oile coolant(External)		
Machine		Vertical MC		

#### ② Machining on Hardend die steel

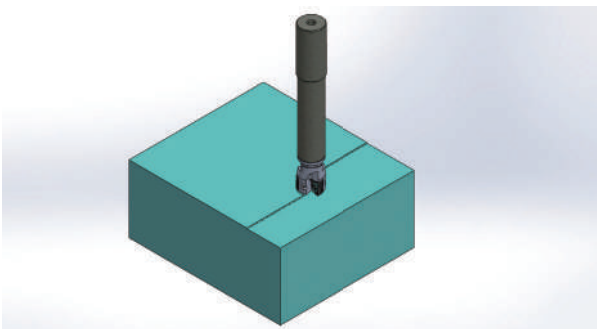


#### Result

Stable machining, better tool life and efficiency compared with conventional tool. EXSAP has 4 corners against 2 corners of conventional tool.

Work	Part name	Forging die		
	Material	DAC10		
	Hardness	48-52HRC		
Tool	Tool No.	EXSAP-5050R-22		
	Insert No.	ZNGU170908ZER-PM (JC8118)		
Cutting conditions	Spindle speed Cutting speed	$n$	570 (min <sup>-1</sup> )	
		$V_c$	90 (m/min)	
	Feed speed	$V_f$	300 (mm/min)	
		$f_z$	0.11 (mm/t)	
	$a_p$ (mm)		0.5 (mm)	
	$a_e$ (mm)		35 (mm)	
Coolant		Water coolant(External)		
Machine		Vertical MC		

#### ③ Machining on Carbon steel



#### Result

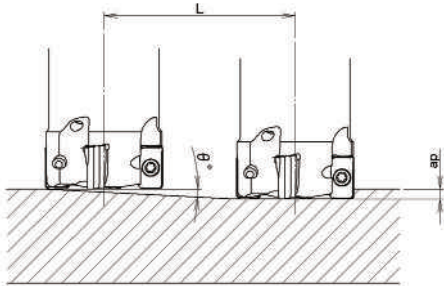
EXSAP could integrate roughing process with finishing process and achieved excellent surface roughness.

Work	Part name	Parts		
	Material	S50C		
	Hardness	—		
Tool	Tool No.	MSX-3032-M16		
	Insert No.	ZNGU170908ZER-PM (JC8050)		
Cutting conditions	Spindle speed Cutting speed	$n$	1,400 (min <sup>-1</sup> )	
		$V_c$	140 (m/min)	
	Feed speed	$V_f$	1,200 (mm/min)	
		$f_z$	0.29 (mm/t)	
	$a_p$ (mm)		1.0 (mm)	
	$a_e$ (mm)		20 (mm)	
Coolant		Water coolant(External)		
Machine		Vertical MC		

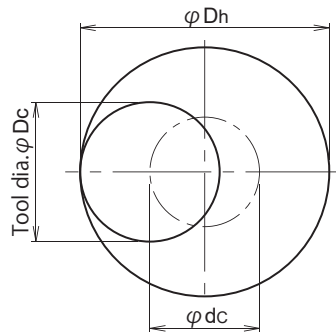
## Attention for profile milling

### EXSAP-11 type

#### Ramping



#### Helical interpolation



- ⊙ In case of ramping and helical interpolation, apply 80% or less feed speed from standard cutting condition table.
- ⊙ In case of helical interpolation, recommend wet cutting by coolant through the tool.

#### ● Calculation of tool pass dia.

$$\phi dc = \phi Dh - \phi Dc$$

Tool pass dia.      Bore dia.      Tool dia.

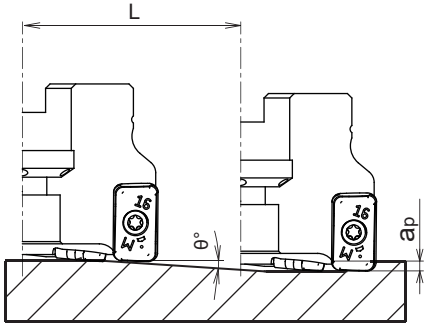
- Eff. cutting dia.  
=  $\phi Dc - 2 \times r\epsilon$  (CornerR) -0.3 (Overlapping parts)
  - Min. bore dia.  $\phi Dh$  min.  
=  $2 \times \{ \phi Dc - r\epsilon$  (CornerR) -0.4 (Overlapping parts) - B (Width of insert) }
  - Max. bore dia.  $\phi Dh$  max.  
=  $2 \times \{ \phi Dc - r\epsilon$  (CornerR) -0.4 (Overlapping parts) }
- Depth of cut per one circuit should not exceed max. depth of cut  $a_p$ .
- Down cutting is recommended, so tool pass rotation should be counterclockwise.

Cat. No.	Tool dia. (mm)	Eff. Cutting dia. (mm)	Max. depth of cut : $a_p$ (mm)	Ramping		Helical interpolation	
				Max. ramping angle $\theta$	Total cutting length at Max. $a_p$ : L (mm)	Min. bore dia. Dh min (mm)	Max. bore dia. Dh max (mm)
MSX-2016-11-M8	16	14.1	1.5	1.0°	86	18	29.6
MSX-3020-11-M10	20	18.1	1.5	0.7°	123	26	37.6
MSX-3025-11-M12	25	23.1	1.5	0.4°	215	36	47.6
MSX-4030-11-M16	30	28.1	1.5	0.3°	286	46	57.6
MSX-4032-11-M16	32	30.1	1.5	0.3°	286	50	61.6
MSX-5040-11-M16	40	38.1	1.5	0.2°	430	66	77.6
EXSAP-2016-11-**-S16	16	14.1	1.5	1.0°	86	18	29.6
EXSAP-3020-11-**-S20	20	18.1	1.5	0.7°	123	26	37.6
EXSAP-3025-11-**-S25	25	23.1	1.5	0.4°	215	36	47.6
EXSAP-4030-11-**-S32	30	28.1	1.5	0.3°	286	46	57.6
EXSAP-4032-11-**-S32	32	30.1	1.5	0.3°	286	50	61.6
EXSAP-5040-11-**-S32	40	38.1	1.5	0.2°	430	66	77.6
EXSAP-6040R-11-16	40	38.1	1.5	0.2°	430	66	77.6
EXSAP-7050R-11-22	50	48.1	1.5	0.15°	573	86	97.6
EXSAP-7052R-11-22	52	50.1	1.5	0.15°	573	90	101.6
EXSAP-7063R-11-22	63	61.1	1.5	※ Ramping&helical interpolation is not recommended.			
EXSAP-7063R-11-27	63	61.1	1.5				
EXSAP-8080R-11-27	80	78.1	1.5				

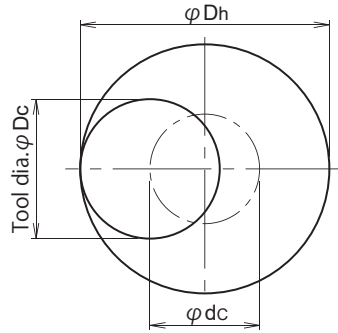
Note: Above figures at this table is for R0.8, so in case of the other corner radius, please calculate eff. cutting dia. and Min. & Max. bore dia. according to the above table for "Calculation of tool pass dia."

**EXSAP-17 type**

**Ramping**



**Helical interpolation**



© In case of ramping and helical interpolation, apply 80% or less feed speed from standard cutting condition table.  
 © In case of helical interpolation, recommend wet cutting by coolant through the tool.

● Calculation of tool pass dia.

$$\phi dc = \phi Dh - \phi Dc$$

Tool pass dia.      Bore dia.      Tool dia.

- Eff. cutting dia.  
 $= \phi Dc - 2 \times r\epsilon$  ( CornerR ) -0.3 ( Overlapped parts )
- Min. bore dia.  $\phi Dh$  min.  
 $= 2 \times \{ \phi Dc - r\epsilon$  ( CornerR ) -0.4 ( Overlapped parts ) -B ( Width of insert ) }
- Max. bore dia.  $\phi Dh$  max.  
 $= 2 \times \{ \phi Dc - r\epsilon$  ( CornerR ) -0.4 ( Overlapped parts ) }

● Depth of cut per one circuit should not exceed max. depth of cut ap.

● Down cutting is recommended, so tool pass rotation should be counterclockwise.

Cat. No.	Tool dia. (mm)	Eff. Cutting dia. (mm)	Max. depth of cut : ap (mm)	Ramping		Helical interpolation			
				Max. ramping angle $\theta^\circ$	Total cutting length at Max. ap : L (mm)	Min. bore dia. Dh min (mm)	Max. bore dia. Dh max (mm)		
EXSAP/MSX-2025	25	21.5	1.5	0.7°	123	34	46		
MSX-2026-M12	26	22.5	1.5	0.7°	123	36	48		
MSX-2028-M12	28	25.5	1.5	0.6°	143	40	52		
MSX-2030-M16	30	26.5	1.5	0.6°	143	44	56		
EXSAP/MSX-*032	32	28.5	1.5	0.5°	172	48	60		
MSX-3033-M16	33	29.5	1.5	0.5°	172	50	62		
MSX-3035-M16	35	31.5	1.5	0.4°	215	54	66		
MSX-4040-M16	40	36.5	1.5	0.4°	215	64	76		
EXSAP-*050R-22	50	46.5	1.5	0.3°	286	84	96		
EXSAP-5052R-22	52	48.5	1.5	0.3°	286	88	100		
EXSAP-5063R-22	63	59.5	1.5	0.2°	430	110	122		
EXSAP-7080R-27	80	76.5	1.5	0.15°	573	144	156		
EXSAP-7100R-32	100	96.5	※ Ramping&helical interpolation is not recommended.						
EXSAP-8125R-40	125	121.5							

Note: Above figures at this table is for R1.6, so in case of the other corner radius, please calculate eff. cutting dia. and Min. & Max. bore dia. according to the above table for "Calculation of tool pass dia."

# SHOULDER EXTREME

Recommended cutting conditions for shoulder milling

EXSAP-11 type

FaceMill type

Work materials	Grades	Tool dia. (mm)									
		40					50/52				
		No. of teeth 6N					No. of teeth 7N				
		$l$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (C50,C55) Below 250HB	JC8050 (JC8118)	~150	~8	~20	1,430	1,540	~200	~8	~24	1,150	1,610
		200	~6	~6	1,270	1,220	250	~6	~7.3	1,020	1,290
		250	~4	~2	1,110	930	300	~5	~2.4	890	1,000
Cast steel (1.7225) Below 285HB	JC8050 (JC8118)	~150	~8	~20	1,430	1,540	~200	~8	~24	1,150	1,610
		200	~6	~6	1,270	1,220	250	~6	~7.3	1,020	1,290
		250	~4	~2	1,110	930	300	~5	~2.4	890	1,000
Die steel (1.2344, 1.2379) Below 255HB	JC8050 (JC8118)	~150	~8	~20	1,430	1,540	~200	~8	~24	1,150	1,610
		200	~6	~6	1,270	1,220	250	~6	~7.3	1,020	1,290
		250	~4	~2	1,110	930	300	~5	~2.4	890	1,000
Mold steel (1.2311, P20) 30~36HRC	JC8118 (JC8050)	~150	~8	~20	1,030	870	~200	~8	~24	830	1,050
		200	~6	~6	950	680	250	~6	~7.3	760	850
		250	~4	~2	880	530	300	~5	~2.4	700	690
Mold steel (1.2311, P21) 38~43HRC	JC8118 (JC8050)	~150	~8	~16	950	800	~200	~8	~20	760	960
		200	~6	~4.8	840	600	250	~6	~6	670	750
		250	~4	~1.6	720	430	300	~5	~2	570	560
Hardened die steel (1.2344, 1.2379) 42~52HRC	JC8118	~150	~5	~4.8	800	580	~200	~6	~8	640	540
		200	~4	~1.6	720	430	250	~5	~2.4	570	400
		250	~3	~0.5	640	310	300	~4	~0.8	510	290
Cast iron (GG25) 160~260HB	JC8118 (JC8050)	~150	~8	~22	1,590	1,720	~200	~8	~28	1,270	1,780
		200	~6	~6.7	1,430	1,200	250	~6	~8.5	1,150	1,450
		250	~4	~2.2	1,270	910	300	~5	~2.8	1,020	1,140
Nodular cast iron (GGG70) 170~300HB	JC8118 (JC8050)	~150	~8	~22	1,430	1,370	~200	~8	~28	1,150	1,610
		200	~6	~6.7	1,270	1,070	250	~6	~8.5	1,020	1,290
		250	~4	~2.2	1,110	800	300	~5	~2.8	890	1,000
Stainless steel Austenitic (AISI 304, 316, 317)	JC8050 (JC7550)	~150	~8	~20	950	800	~200	~8	~24	760	960
		200	~6	~6	880	630	250	~6	~7.3	700	780
		250	~4	~2	800	480	300	~5	~2.4	640	630
Stainless steel Ferritics/Martensitic (AISI 403, 420J2, 430)	JC8050 (JC7550)	~150	~8	~20	1,110	930	~200	~8	~24	890	1,120
		200	~6	~6	950	680	250	~6	~7.3	760	850
		250	~4	~2	800	480	300	~5	~2.4	640	630
Titanium alloy 35~43HRC	JC7550 (JC7518)	~150	~8	~14	560	440	~200	~8	~20	450	410
		200	~6	~4.2	480	350	250	~6	~6	380	320
		250	~4	~1.4	400	260	300	~5	~2	320	250
Inconel 35~43HRC	JC7550 (JC7518)	~150	~8	~14	240	140	~200	~8	~20	190	130
		200	~6	~4.2	200	110	250	~6	~6	160	100
		250	~4	~1.4	160	80	300	~5	~2	130	70

$l$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.



## FaceMill type

Work materials	Grades	Tool dia. (mm)									
		63					80				
		No. of teeth 7N					No. of teeth 8N				
		$l$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (C50,C55) Below 250HB	JC8050 (JC8118)	~250	~9	~30	910	1,270	~300	~9	~36	720	1,150
		300	~7	~9	810	1,020	~350	~7	~11	640	920
		350	~5	~3	710	800	~400	~5	~3.6	560	720
Cast steel (1.7225) Below 285HB	JC8050 (JC8118)	~250	~9	~30	910	1,270	~300	~9	~36	720	1,150
		300	~7	~9	810	1,020	~350	~7	~11	640	920
		350	~5	~3	710	800	~400	~5	~3.6	560	720
Die steel (1.2344, 1.2379) Below 255HB	JC8050 (JC8118)	~250	~9	~30	910	1,270	~300	~9	~36	720	1,150
		300	~7	~9	810	1,020	~350	~7	~11	640	920
		350	~5	~3	710	800	~400	~5	~3.6	560	720
Mold steel (1.2311, P20) 30~36HRC	JC8118 (JC8050)	~250	~9	~30	660	830	~300	~9	~36	520	750
		300	~7	~9	610	680	~350	~7	~11	480	610
		350	~5	~3	560	550	~400	~5	~3.6	440	490
Mold steel (1.2311, P21) 38~43HRC	JC8118 (JC8050)	~250	~9	~24	610	770	~300	~9	~28	480	690
		300	~7	~7.3	530	590	~350	~7	~8.5	420	540
		350	~5	~2.4	450	440	~400	~5	~2.8	360	400
Hardened die steel (1.2344, 1.2379) 42~52HRC	JC8118	~250	~9	~9	510	430	~300	~9	~10	400	380
		300	~7	~2.7	450	320	~350	~7	~3	360	290
		350	~5	~0.9	400	220	~400	~5	~1	320	200
Cast iron (GG25) 160~260HB	JC8118 (JC8050)	~250	~9	~34	1,010	1,410	~300	~9	~40	800	1,280
		300	~7	~10	910	1,150	~350	~7	~12	720	1,040
		350	~5	~3.4	810	910	~400	~5	~4	640	820
Nodular cast iron (GGG70) 170~300HB	JC8118 (JC8050)	~250	~9	~34	910	1,270	~300	~9	~40	720	1,150
		300	~7	~10	810	1,020	~350	~7	~12	640	920
		350	~5	~3.4	710	800	~400	~5	~4	560	720
Stainless steel Austenitic (AISI 304 316, 317)	JC8050 (JC7550)	~250	~9	~30	610	770	~300	~9	~36	480	690
		300	~7	~9	560	630	~350	~7	~11	440	560
		350	~5	~3	510	500	~400	~5	~3.6	400	450
Stainless steel Ferritics/Martensitic (AISI 403, 420J2, 430)	JC8050 (JC7550)	~250	~9	~30	710	890	~300	~9	~36	560	810
		300	~7	~9	610	680	~350	~7	~11	480	610
		350	~5	~3	510	500	~400	~5	~3.6	400	450
Titanium alloy 35~43HRC	JC7550 (JC7518)	~250	~9	~26	350	320	~300	~9	~30	280	290
		300	~7	~8	300	250	~350	~7	~9	240	230
		350	~5	~2	250	190	~400	~5	~3	200	180
Inconel 35~43HRC	JC7550 (JC7518)	~250	~9	~26	150	110	~300	~9	~30	120	100
		300	~7	~8	130	80	~350	~7	~9	100	70
		350	~5	~2.6	100	60	~400	~5	~3	80	50

$l$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

- \*1. The figure to be adjusted according to the machine rigidity or work rigidity.
- \*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.
- \*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.
- \*4. Use air blow to flush the chip out.  
In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

## Recommended cutting conditions for shoulder milling

EXSAP-11 type

### Endmill type

Work materials	Grades	Tool dia. (mm)														
		16					20					25				
		No. of teeth 2N					No. of teeth 3N					No. of teeth 3N				
		$l$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (C50,C55) Below 250HB	JC8050 (JC8118)	~30	~5	~4	3,580	1,000	~50	~5	~5	2,860	1,370	~70	~6	~7.2	2,290	1,100
		70	~3	~1.2	3,180	760	~120	~3	~1.5	2,550	1,070	120	~4	~2.2	2,040	860
Cast steel (1.7225) Below 285HB	JC8050 (JC8118)	~30	~5	~4	3,580	1,000	~50	~5	~5	2,860	1,370	~70	~6	~7.2	2,290	1,100
		70	~3	~1.2	3,180	760	120	~3	~1.5	2,550	1,070	120	~4	~2.2	2,040	860
Die steel (1.2344, 1.2379) Below 255HB	JC8050 (JC8118)	~30	~5	~4	3,580	1,000	~50	~5	~5	2,860	1,370	~70	~6	~7.2	2,290	1,100
		70	~3	~1.2	3,180	760	~120	~3	~1.5	2,550	1,070	120	~4	~2.2	2,040	860
Mold steel (1.2311, P20) 30~36HRC	JC8118 (JC8050)	~30	~5	~4	2,590	620	~50	~5	~5	2,070	870	~70	~6	~7.2	1,660	700
		70	~3	~1.2	2,390	480	120	~3	~1.5	1,910	690	120	~4	~2.2	1,530	550
Mold steel (1.2311, P21) 38~43HRC	JC8118 (JC8050)	~30	~5	~3.4	2,390	570	~50	~5	~4	1,910	800	~70	~6	~6	1,530	640
		70	~3	~1	2,090	420	~120	~3	~1.2	1,670	600	120	~4	~1.8	1,340	480
Hardened die steel (1.2344, 1.2379) 42~52HRC	JC8118	~30	~3	~1.6	1,990	320	~50	~3.5	~2	1,590	480	~70	~4	~3.2	1,270	380
		70	~2	~0.6	1,790	250	120	~2.5	~0.6	1,430	390	120	~3	~1	1,150	310
Cast iron (GG25) 160~260HB	JC8118 (JC8050)	~30	~5	~5	3,980	1,110	~50	~5	~6	3,180	1,530	~70	~6	~9.8	2,550	1,220
		70	~3	~1.5	3,580	860	~120	~3	~1.8	2,860	1,200	120	~4	~3	2,290	960
Nodular cast iron (GGG70) 170~300HB	JC8118 (JC8050)	~30	~5	~5	3,580	1,000	~50	~5	~6	2,860	1,370	~70	~6	~9.8	2,290	1,100
		70	~3	~1.5	3,180	760	120	~3	~1.8	2,550	1,070	120	~4	~3	2,040	860
Stainless steel Austenitic (AISI 304, 316, 317)	JC8050 (JC7550)	~30	~5	~4	2,390	570	~50	~5	~5	1,910	800	~70	~6	~7.2	1,530	640
		70	~3	~1.2	2,190	440	~120	~3	~1.5	1,750	630	120	~4	~2.2	1,400	500
Stainless steel Ferritics/Martensitic (AISI 403, 420J2, 430)	JC8050 (JC7550)	~30	~5	~3.2	2,790	670	~50	~5	~5	2,230	940	~70	~6	~7.2	1,780	750
		70	~3	~1	2,390	480	120	~3	~1.5	1,910	690	120	~4	~2.2	1,530	550
Titanium alloy 35~43HRC	JC7550 (JC7518)	~30	~5	~3.2	1,390	330	~50	~5	~4	1,110	430	~70	~6	~6	890	350
		70	~3	~1	1,190	260	~120	~3	~1.2	950	340	120	~4	~1.8	760	270
Inconel 35~43HRC	JC7550 (JC7518)	~30	~5	~3.2	600	110	~50	~5	~4	480	140	~70	~6	~6	380	110
		70	~3	~1	500	80	120	~3	~1.2	400	110	120	~4	~1.8	320	90

$l$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.



## Endmill type

Work materials	Grades	Tool dia. (mm)									
		30/32					40				
		No. of teeth 4N					No. of teeth 5N				
		$l$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (C50, C55) Below 250HB	JC8050 (JC8118)	~70	~6	~9.8	1,790	1,150	~70	~7	~14	1,430	1,290
		120	~4	~3	1,590	890	170	~5	~4.2	1,270	1,020
Cast steel (1.7225) Below 285HB	JC8050 (JC8118)	~70	~6	~9.8	1,790	1,150	~70	~7	~14	1,430	1,290
		120	~4	~3	1,590	890	170	~5	~4.2	1,270	1,020
Die steel (1.2344, 1.2379) Below 255HB	JC8050 (JC8118)	~70	~6	~9.8	1,790	1,150	~70	~7	~14	1,430	1,290
		120	~4	~3	1,590	890	170	~5	~4.2	1,270	1,020
Mold steel (1.2311, P20) 30~36HRC	JC8118 (JC8050)	~70	~6	~9.8	1,290	720	~70	~7	~14	1,030	720
		120	~4	~3	1,190	570	170	~5	~4.2	950	570
Mold Steel (1.2311, P21) 38~43HRC	JC8118 (JC8050)	~70	~6	~8	1,190	670	~70	~7	~10	950	670
		120	~4	~2.4	1,040	500	170	~5	~3	840	500
Hardened die steel (1.2344, 1.2379) 42~52HRC	JC8118	~70	~4	~3.6	990	400	~70	~4.5	~4	800	480
		120	~3	~1	900	320	170	~3.5	~1.2	720	360
Cast iron (GG25) 160~260HB	JC8118 (JC8050)	~70	~6	~12	1,990	1,270	~70	~7	~16	1,590	1,430
		120	~4	~3.6	1,790	1,000	170	~5	~4.8	1,430	1,000
Nodular cast iron (GGG70) 170~300HB	JC8118 (JC8050)	~70	~6	~12	1,790	1,150	~70	~7	~16	1,430	1,140
		120	~4	~3.6	1,590	890	170	~5	~4.8	1,270	890
Stainless steel Austenitic (AISI 304, 316, 317)	JC8050 (JC7550)	~70	~6	~9.8	1,190	670	~70	~7	~14	950	670
		120	~4	~3	1,090	520	170	~5	~4.2	880	530
Stainless steel Ferritics/Martensitic (AISI 403, 420J2, 430)	JC8050 (JC7550)	~70	~6	~9.8	1,390	780	~70	~7	~14	1,110	780
		120	~4	~3	1,190	570	170	~5	~4.2	950	570
Titanium alloy 35~43HRC	JC7550 (JC7518)	~70	~6	~8	700	360	~70	~7	~10	560	360
		120	~4	~2.4	600	290	170	~5	~3	480	290
Inconel 35~43HRC	JC7550 (JC7518)	~70	~6	~8	300	120	~70	~7	~10	240	120
		120	~4	~2.4	250	90	170	~5	~3	200	90

$l$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

# SHOULDER EXTREME

Recommended cutting conditions for shoulder milling

EXSAP-11 type

## MSX and MSN type

Work materials	Grades	Tool dia. (mm)														
		16					20					25				
		No. of teeth 2N					No. of teeth 3N					No. of teeth 3N				
		$l$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (C50,C55) Below 250HB	JC8050 (JC8118)	~80	~5	~4	3,580	1,000	~100	~5	~5	2,860	1,370	~120	~6	~7.2	2,290	1,100
		120	~3	~1.2	3,180	760	150	~3	~1.5	2,550	1,070	190	~4	~2.2	2,040	860
		160	~2	~0.4	2,790	560	190	~2	~0.5	2,230	800	235	~3	~0.7	1,780	640
Cast steel (1.7225) Below 285HB	JC8050 (JC8118)	~80	~5	~4	3,580	1,000	~100	~5	~5	2,860	1,370	~120	~6	~7.2	2,290	1,100
		120	~3	~1.2	3,180	760	150	~3	~1.5	2,550	1,070	190	~4	~2.2	2,040	860
		160	~2	~0.4	2,790	560	190	~2	~0.5	2,230	800	235	~3	~0.7	1,780	640
Die steel (1.2344, 1.2379) Below 255HB	JC8050 (JC8118)	~80	~5	~4	3,580	1,000	~100	~5	~5	2,860	1,370	~120	~6	~7.2	2,290	1,100
		120	~3	~1.2	3,180	760	150	~3	~1.5	2,550	1,070	190	~4	~2.2	2,040	860
		160	~2	~0.4	2,790	560	190	~2	~0.5	2,230	800	235	~3	~0.7	1,780	640
Mold steel (1.2311, P20) 30~36HRC	JC8118 (JC8050)	~80	~5	~4	2,590	620	~100	~5	~5	2,070	870	~120	~6	~7.2	1,660	700
		120	~3	~1.2	2,390	480	150	~3	~1.5	1,910	690	190	~4	~2.2	1,530	550
		160	~2	~0.4	2,190	350	190	~2	~0.5	1,750	530	235	~3	~0.7	1,400	420
Mold steel (1.2311, P21) 38~43HRC	JC8118 (JC8050)	~80	~5	~3.4	2,390	570	~100	~5	~4	1,910	800	~120	~6	~6	1,530	640
		120	~3	~1	2,090	420	150	~3	~1.2	1,670	600	190	~4	~1.8	1,340	480
		160	~2	~0.3	1,790	290	190	~2	~0.4	1,430	430	235	~3	~0.6	1,150	350
Hardened die steel (1.2344, 1.2379) 42~52HRC	JC8118	~80	~3	~1.6	1,990	320	~100	~3.5	~2	1,590	480	~120	~4	~3.2	1,270	380
		120	~2	~0.6	1,790	250	150	~2.5	~0.6	1,430	390	190	~3	~1	1,150	310
		160	~1	~0.2	1,590	190	190	~1.5	~0.2	1,270	300	235	~2	~0.3	1,020	240
Cast iron (GG25) 160~260HB	JC8118 (JC8050)	~80	~5	~5	3,980	1,110	~100	~5	~6	3,180	1,530	~120	~6	~9.8	2,550	1,220
		120	~3	~1.5	3,580	860	150	~3	~1.8	2,860	1,200	190	~4	~3	2,290	960
		160	~2	~0.5	3,180	640	190	~2	~0.6	2,550	920	235	~3	~1	2,040	730
Nodular cast iron (GGG70) 170~300HB	JC8118 (JC8050)	~80	~5	~5	3,580	1,000	~100	~5	~6	2,860	1,370	~120	~6	~9.8	2,290	1,100
		120	~3	~1.5	3,180	760	150	~3	~1.8	2,550	1,070	190	~4	~3	2,040	860
		160	~2	~0.5	2,790	560	190	~2	~0.6	2,230	800	235	~3	~1	1,780	640
Stainless steel Austenitic (AISI 304, 316, 317)	JC8050 (JC7550)	~80	~5	~4	2,390	570	~100	~5	~5	1,910	800	~120	~6	~7.2	1,530	640
		120	~3	~1.2	2,190	440	150	~3	~1.5	1,750	630	190	~4	~2.2	1,400	500
		160	~2	~0.4	1,990	320	190	~2	~0.5	1,590	480	235	~3	~0.7	1,270	380
Stainless steel Ferritics/Martensitic (AISI 403, 420J2, 430)	JC8050 (JC7550)	~80	~5	~3.2	2,790	670	~100	~5	~5	2,230	940	~120	~6	~7.2	1,780	750
		120	~3	~1	2,390	480	150	~3	~1.5	1,910	690	190	~4	~2.2	1,530	550
		160	~2	~0.4	1,990	320	190	~2	~0.5	1,590	480	235	~3	~0.7	1,270	380
Titanium alloy 35~43HRC	JC7550 (JC7518)	~80	~5	~3.2	1,390	330	~100	~5	~4	1,110	430	~120	~6	~6	890	350
		120	~3	~1	1,190	260	150	~3	~1.2	950	340	190	~4	~1.8	760	270
		160	~2	~0.3	990	200	190	~2	~0.4	800	260	235	~3	~0.6	640	210
Inconel 35~43HRC	JC7550 (JC7518)	~80	~5	~3.2	600	110	~100	~5	~4	480	140	~120	~6	~6.0	380	110
		120	~3	~1	500	80	150	~3	~1.2	400	110	190	~4	~1.8	320	90
		160	~2	~0.3	400	60	190	~2	~0.4	320	80	235	~3	~0.6	250	60

$l$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

- \*1. The figure to be adjusted according to the machine rigidity or work rigidity.
  - \*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.
  - \*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.
  - \*4. Use air blow to flush the chip out.
- In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.





## MSX and MSN type

Work materials	Grades	Tool dia. (mm)									
		30/32					40				
		No. of teeth 4N					No. of teeth 5N				
		$l$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (C50,C55) Below 250HB	JC8050 (JC8118)	~160	~6	~9.8	1,790	1,150	~160	~7	~14	1,430	1,290
		240	~4	~3	1,590	890	240	~5	~4.2	1,270	1,020
		290	~3	~1	1,390	670	290	~3	~1.4	1,110	780
Cast steel (1.7225) Below 285HB	JC8050 (JC8118)	~160	~6	~9.8	1,790	1,150	~160	~7	~14	1,430	1,290
		240	~4	~3	1,590	890	240	~5	~4.2	1,270	1,020
		290	~3	~1	1,390	670	290	~3	~1.4	1,110	780
Die steel (1.2344, 1.2379) Below 255HB	JC8050 (JC8118)	~160	~6	~9.8	1,790	1,150	~160	~7	~14	1,430	1,290
		240	~4	~3	1,590	890	240	~5	~4.2	1,270	1,020
		290	~3	~1	1,390	670	290	~3	~1.4	1,110	780
Mold steel (1.2311, P20) 30~36HRC	JC8118 (JC8050)	~160	~6	~9.8	1,290	720	~160	~7	~14	1,030	720
		240	~4	~3	1,190	570	240	~5	~4.2	950	570
		290	~3	~1	1,090	440	290	~3	~1.4	880	440
Mold steel (1.2311, P21) 38~43HRC	JC8118 (JC8050)	~160	~6	~8	1,190	670	~160	~7	~10	950	670
		240	~4	~2.4	1,040	500	240	~5	~3	840	500
		290	~3	~0.8	900	360	290	~3	~1	720	360
Hardened die steel (1.2344, 1.2379) 42~52HRC	JC8118	~160	~4	~3.6	990	400	~160	~4.5	~4	800	480
		240	~3	~1	900	320	240	~3.5	~1.2	720	360
		290	~2	~0.4	800	260	290	~2.5	~0.4	640	260
Cast iron (GG25) 160~260HB	JC8118 (JC8050)	~160	~6	~12	1,990	1,270	~160	~7	~16	1,590	1,430
		240	~4	~3.6	1,790	1,000	240	~5	~4.8	1,430	1,000
		290	~3	~1.2	1,590	760	290	~3	~1.6	1,270	760
Nodular cast iron (GGG70) 170~300HB	JC8118 (JC8050)	~160	~6	~12	1,790	1,150	~160	~7	~16	1,430	1,140
		240	~4	~3.6	1,590	890	240	~5	~4.8	1,270	890
		290	~3	~1.2	1,390	670	290	~3	~1.6	1,110	670
Stainless steel Austenitic (AISI 304, 316, 317)	JC8050 (JC7550)	~160	~6	~9.8	1,190	670	~160	~7	~14	950	670
		240	~4	~3	1,090	520	240	~5	~4.2	880	530
		290	~3	~1	990	400	290	~3	~1.4	800	400
Stainless steel Ferritic/Martensitic (AISI 403, 420J2, 430)	JC8050 (JC7550)	~160	~6	~9.8	1,390	780	~160	~7	~14	1,110	780
		240	~4	~3	1,190	570	240	~5	~4.2	950	570
		290	~3	~1	990	400	290	~3	~1.4	800	400
Titanium alloy 35~43HRC	JC7550 (JC7518)	~160	~6	~8	700	360	~160	~7	~10	560	360
		240	~4	~2.4	600	290	240	~5	~3	480	290
		290	~3	~0.8	500	220	290	~3	~1	400	220
Inconel 35~43HRC	JC7550 (JC7518)	~160	~6	~8	300	120	~160	~7	~10	240	120
		240	~4	~2.4	250	90	240	~5	~3	200	90
		290	~3	~0.8	200	60	290	~3	~1	160	60

$l$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

- \*1. The figure to be adjusted according to the machine rigidity or work rigidity.
- \*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.
- \*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.
- \*4. Use air blow to flush the chip out.  
In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

Recommended cutting conditions for facemilling

EXSAP-11 type

## FaceMill type

Work materials	Grades	Tool dia. (mm)									
		40					50/52				
		No. of teeth 6N					No. of teeth 7N				
		$l$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (C50,C55) Below 250HB	JC8050 (JC8118)	~150	~2	~24	1,430	1,720	~200	~2	~30	1,150	1,610
		200	~1.2	~24	1,270	1,300	250	~1.2	~30	1,020	1,210
		250	~0.5	~24	1,110	930	300	~0.5	~30	890	870
Cast steel (1.2225) Below 285HB	JC8050 (JC8118)	~150	~2	~24	1,430	1,720	~200	~2	~30	1,150	1,610
		200	~1.2	~24	1,270	1,300	250	~1.2	~30	1,020	1,210
		250	~0.5	~24	1,110	930	300	~0.5	~30	890	870
Die steel (1.2344, 1.2379) Below 255HB	JC8050 (JC8118)	~150	~2	~24	1,430	1,720	~200	~2	~30	1,150	1,610
		200	~1.2	~24	1,270	1,300	250	~1.2	~30	1,020	1,210
		250	~0.5	~24	1,110	930	300	~0.5	~30	890	870
Mold steel (1.2311, P20) 30~36HRC	JC8118 (JC8050)	~150	~2	~24	1,030	1,110	~200	~2	~30	830	1,050
		200	~1.2	~24	950	860	250	~1.2	~30	760	800
		250	~0.5	~24	880	630	300	~0.5	~30	700	590
Mold steel (1.2311, P21) 38~43HRC	JC8118 (JC8050)	~150	~1.8	~24	950	910	~200	~1.8	~30	760	850
		200	~1	~24	840	660	250	~1	~30	670	610
		250	~0.5	~24	720	430	300	~0.5	~30	570	400
Hardened die steel (1.2344, 1.2379) 42~52HRC	JC8118	~150	~1	~16	800	580	~200	~1	~20	640	540
		200	~0.5	~16	720	430	250	~0.5	~20	570	400
		250	~0.3	~16	640	310	300	~0.3	~20	510	290
Cast iron (GG25) 160~260HB	JC8118 (JC8050)	~150	~2	~24	1,590	1,910	~200	~2	~30	1,270	1,780
		200	~1.2	~24	1,430	1,460	250	~1.2	~30	1,150	1,370
		250	~0.5	~24	1,270	1,070	300	~0.5	~30	1,020	1,000
Nodular cast iron (GGG70) 170~300HB	JC8118 (JC8050)	~150	~2	~24	1,430	1,720	~200	~2	~30	1,150	1,610
		200	~1.2	~24	1,270	1,300	250	~1	~30	1,020	1,210
		250	~0.5	~24	1,110	930	300	~0.5	~30	890	870
Stainless steel Austenitic (AISI 304, 316, 317)	JC8050 (JC7550)	~150	~2	~16	950	1,030	~200	~2	~20	760	960
		200	~1.2	~16	880	900	250	~1.2	~20	700	830
		250	~0.5	~16	800	670	300	~0.5	~20	640	630
Stainless steel Ferritics/Martensitic (AISI 403, 420J2, 430)	JC8050 (JC7550)	~150	~2	~24	1,110	1,200	~200	~2	~30	890	1,120
		200	~1.2	~24	950	970	250	~1.2	~30	760	900
		250	~0.5	~24	800	670	300	~0.5	~30	640	630
Titanium alloy 35~43HRC	JC7550 (JC7518)	~150	~1.8	~16	560	400	~200	~1.8	~20	450	380
		200	~1	~16	480	290	250	~1	~20	380	270
		250	~0.4	~16	400	190	300	~0.4	~20	320	180
Inconel 35~43HRC	JC7550 (JC7518)	~150	~1.8	~16	240	160	~200	~1.8	~20	190	150
		200	~1	~16	200	110	250	~1	~20	160	100
		250	~0.4	~16	160	70	300	~0.4	~20	130	60

$l$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

\*5. In case of slotting, reduce Feed speed ( $V_f$ ) to 50% or below of the above date.



## FaceMill type

Work materials	Grades	Tool dia. (mm)									
		63					80				
		No. of teeth 7N					No. of teeth 8N				
		$l$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (C50,C55) Below 250HB	JC8050 (JC8118)	~250	~2	~38	910	1,270	~300	~2	~48	720	1,150
		300	~1.2	~38	810	960	~350	~1.2	~48	640	870
		350	~0.5	~38	710	700	~400	~0.5	~48	560	630
Cast steel (1.7225) Below 285HB	JC8050 (JC8118)	~250	~2	~38	910	1,270	~300	~2	~48	720	1,150
		300	~1.2	~38	810	960	~350	~1.2	~48	640	870
		350	~0.5	~38	710	700	~400	~0.5	~48	560	630
Die steel (1.2344, 1.2379) Below 255HB	JC8050 (JC8118)	~250	~2	~38	910	1,270	~300	~2	~48	720	1,150
		300	~1.2	~38	810	960	~350	~1.2	~48	640	870
		350	~0.5	~38	710	700	~400	~0.5	~48	560	630
Mold steel (1.2311, P20) 30~36HRC	JC8118 (JC8050)	~250	~2	~38	660	830	~300	~2	~48	520	750
		300	~1.2	~38	610	640	~350	~1.2	~48	480	580
		350	~0.5	~38	560	470	~400	~0.5	~48	440	420
Mold steel (1.2311, P21) 38~43HRC	JC8118 (JC8050)	~250	~1.8	~38	610	680	~300	~1.8	~48	480	610
		300	~1	~38	530	480	~350	~1	~48	420	440
		350	~0.5	~38	450	320	~400	~0.5	~48	360	290
Hardened die steel (1.2344, 1.2379) 42~52HRC	JC8118	~250	~1	~25	510	430	~300	~1	~32	400	380
		300	~0.5	~25	450	320	~350	~0.5	~32	360	290
		350	~0.3	~25	400	220	~400	~0.3	~32	320	200
Cast iron (GG25) 160~260HB	JC8118 (JC8050)	~250	~2	~38	1,010	1,410	~300	~2	~48	800	1,280
		300	~1.2	~38	910	1,080	~350	~1.2	~48	720	980
		350	~0.5	~38	810	790	~400	~0.5	~48	640	720
Nodular cast iron (GGG70) 170~300HB	JC8118 (JC8050)	~250	~2	~38	910	1,270	~300	~2	~48	720	1,150
		300	~1.2	~38	810	960	~350	~1.2	~48	640	870
		350	~0.5	~38	710	700	~400	~0.5	~48	560	630
Stainless steel Austenitic (AISI 304, 316, 317)	JC8050 (JC7550)	~250	~2	~25	610	770	~300	~2	~32	480	690
		300	~1.2	~25	560	670	~350	~1.2	~32	440	600
		350	~0.5	~25	510	500	~400	~0.5	~32	400	450
Stainless steel Ferritics/Martensitic (AISI 403, 420J2, 430)	JC8050 (JC7550)	~250	~2	~38	710	890	~300	~2	~48	560	810
		300	~1.2	~38	610	730	~350	~1.2	~48	480	650
		350	~0.5	~38	510	500	~400	~0.5	~48	400	450
Titanium alloy 35~43HRC	JC7550 (JC7518)	~250	~1.8	~25	350	290	~300	~1.8	~32	280	270
		300	~1	~25	300	210	~350	~1	~32	240	190
		350	~0.4	~25	250	140	~400	~0.4	~32	200	130
Inconel 35~43HRC	JC7550 (JC7518)	~250	~1.8	~25	150	120	~300	~1.8	~32	120	110
		300	~1	~25	130	80	~350	~1	~32	100	70
		350	~0.4	~25	100	50	~400	~0.4	~32	80	40

$l$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut ap or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut ap or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

\*5. In case of slotting, reduce Feed speed (Vf) to 50% or below of the above date.

Recommended cutting conditions for facemilling

EXSAP-11 type

## Endmill type

Work materials	Grades	Tool dia. (mm)														
		16					20					25				
		No. of teeth 2N					No. of teeth 3N					No. of teeth 3N				
		$l$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (C50,C55) Below 250HB	JC8050 (JC8118)	~30	~1	~10	2,980	830	~70	~1.2	~12	2,390	1,150	~70	~1.2	~15	1,910	920
		70	~0.5	~10	2,590	570	120	~0.6	~12	2,070	810	120	~0.6	~15	1,660	650
Cast steel (1.7225) Below 285HB	JC8050 (JC8118)	~30	~1	~10	2,980	830	~70	~1.2	~12	2,390	1,150	~70	~1.2	~15	1,910	920
		70	~0.5	~10	2,590	570	120	~0.6	~12	2,070	810	120	~0.6	~15	1,660	650
Die steel (1.2344, 1.2379) Below 255HB	JC8050 (JC8118)	~30	~1	~10	2,980	830	~70	~1.2	~12	2,390	1,150	~70	~1.2	~15	1,910	920
		70	~0.5	~10	2,590	570	120	~0.6	~12	2,070	810	120	~0.6	~15	1,660	650
Mold steel (1.2311, P20) 30~36HRC	JC8118 (JC8050)	~30	~1	~10	2,590	670	~70	~1.2	~12	2,070	930	~70	~1.2	~15	1,660	750
		70	~0.5	~10	2,390	480	120	~0.6	~12	1,910	690	120	~0.6	~15	1,530	550
Mold steel (1.2311, P21) 38~43HRC	JC8118 (JC8050)	~30	~0.8	~10	2,190	530	~70	~1	~12	1,750	740	~70	~1	~15	1,400	590
		70	~0.4	~10	1,990	360	120	~0.5	~12	1,590	520	120	~0.5	~15	1,270	420
Hardened die steel (1.2344, 1.2379) 42~52HRC	JC8118	~30	~0.4	~6	1,790	360	~70	~0.5	~8	1,430	430	~70	~0.5	~10	1,150	350
		70	~0.3	~6	1,590	250	120	~0.4	~8	1,270	300	120	~0.4	~10	1,020	240
Cast iron (GG25) 160~260HB	JC8118 (JC8050)	~30	~1	~10	3,580	1,000	~70	~1.2	~12	2,860	1,370	~70	~1.2	~15	2,290	1,100
		70	~0.5	~10	3,180	700	120	~0.6	~12	2,550	990	120	~0.6	~15	2,040	800
Nodular cast iron (GGG70) 170~300HB	JC8118 (JC8050)	~30	~1	~10	2,790	780	~70	~1.2	~12	2,230	1,070	~70	~1.2	~15	1,780	850
		70	~0.5	~10	2,590	570	120	~0.6	~12	2,070	810	120	~0.6	~15	1,660	650
Stainless steel Austenitic (AISI 304, 316, 317)	JC8050 (JC7550)	~30	~1	~6	2,190	610	~70	~1.2	~8	1,750	840	~70	~1.2	~10	1,400	670
		70	~0.5	~6	1,990	440	120	~0.6	~8	1,590	620	120	~0.6	~10	1,270	500
Stainless steel Ferritics/Martensitic (AISI 403, 420J2, 430)	JC8050 (JC7550)	~30	~1	~10	2,980	830	~70	~1.2	~12	2,390	1,150	~70	~1.2	~15	1,910	920
		70	~0.5	~10	2,590	570	120	~0.6	~12	2,070	810	120	~0.6	~15	1,660	650
Titanium alloy 35~43HRC	JC7550 (JC7518)	~30	~0.8	~6	1,190	240	~70	~1	~8	950	290	~70	~1	~10	760	230
		70	~0.4	~6	990	160	120	~0.5	~8	800	190	120	~0.5	~10	640	150
Inconel 35~43HRC	JC7550 (JC7518)	~30	~0.8	~6	600	110	~70	~1	~8	480	130	~70	~1	~10	380	110
		70	~0.4	~6	500	70	120	~0.5	~8	400	80	120	~0.5	~10	320	80

$l$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

\*5. In case of slotting, reduce Feed speed ( $V_f$ ) to 50% or below of the above date.



## Endmill type

Work materials	Grades	Tool dia. (mm)									
		30/32					40				
		No. of teeth 4N					No. of teeth 5N				
		$l$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (C50, C55) Below 250HB	JC8050 (JC8118)	~70	~1.5	~18	1,590	1,020	~70	~1.6	~24	1,430	1,290
		120	~0.8	~18	1,380	720	170	~1	~24	1,270	950
Cast steel (1.7225) Below 285HB	JC8050 (JC8118)	~70	~1.5	~18	1,590	1,020	~70	~1.6	~24	1,430	1,290
		120	~0.8	~18	1,380	720	170	~1	~24	1,270	950
Die steel (1.2344, 1.2379) Below 255HB	JC8050 (JC8118)	~70	~1.5	~18	1,590	1,020	~70	~1.6	~24	1,430	1,290
		120	~0.8	~18	1,380	720	170	~1	~24	1,270	950
Mold steel (1.2311, P20) 30~36HRC	JC8118 (JC8050)	~70	~1.5	~18	1,380	830	~70	~1.6	~24	1,030	820
		120	~0.8	~18	1,270	610	170	~1	~24	950	620
Mold Steel (1.2311, P21) 38~43HRC	JC8118 (JC8050)	~70	~1.2	~18	1,170	660	~70	~1.4	~24	950	710
		120	~0.6	~18	1,060	470	170	~0.8	~24	840	500
Hardened die steel (1.2344, 1.2379) 42~52HRC	JC8118	~70	~0.6	~12	950	380	~70	~0.8	~16	800	440
		120	~0.4	~12	850	270	170	~0.4	~16	720	320
Cast iron (GG25) 160~260HB	JC8118 (JC8050)	~70	~1.5	~18	1,910	1,220	~70	~1.6	~24	1,590	1,430
		120	~0.8	~18	1,700	880	170	~1	~24	1,430	1,070
Nodular cast iron (GGG70) 170~300HB	JC8118 (JC8050)	~70	~1.5	~18	1,490	950	~70	~1.6	~24	1,430	5,720
		120	~0.8	~18	1,380	720	170	~1	~24	1,270	640
Stainless steel Austenitic (AISI 304, 316, 317)	JC8050 (JC7550)	~70	~1.5	~12	1,170	750	~70	~1.6	~16	950	860
		120	~0.8	~12	1,060	550	170	~1	~16	880	660
Stainless steel Ferritics/Martensitic (AISI 403, 420J2, 430)	JC8050 (JC7550)	~70	~1.5	~18	1,590	1,020	~70	~1.6	~24	1,110	1,000
		120	~0.8	~18	1,380	720	170	~1	~24	950	710
Titanium alloy 35~43HRC	JC7550 (JC7518)	~70	~0.8	~12	640	260	~70	~1.4	~16	560	310
		120	~0.5	~12	530	170	170	~0.8	~16	480	220
Inconel 35~43HRC	JC7550 (JC7518)	~70	~0.8	~12	320	130	~70	~1.4	~16	240	120
		120	~0.5	~12	270	90	170	~0.8	~16	200	80

$l$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

\*5. In case of slotting, reduce Feed speed ( $V_f$ ) to 50% or below of the above date.

## Recommended cutting conditions for facemilling

EXSAP-11 type

### MSX and MSN type

Work materials	Grades	Tool dia. (mm)														
		16					20					25				
		No. of teeth 2N					No. of teeth 3N					No. of teeth 3N				
		$l$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (C50,C55) Below 250HB	JC8050 (JC8118)	~80	~1	~10	2,980	830	~100	~1.2	~12	2,390	1,150	~120	~1.2	~15	1,910	920
		120	~0.5	~10	2,590	570	150	~0.6	~12	2,070	810	190	~0.6	~15	1,660	650
		160	~0.2	~10	2,190	350	190	~0.3	~12	1,750	530	235	~0.3	~15	1,400	420
Cast steel (1.7225) Below 285HB	JC8050 (JC8118)	~80	~1	~10	2,980	830	~100	~1.2	~12	2,390	1,150	~120	~1.2	~15	1,910	920
		120	~0.5	~10	2,590	570	150	~0.6	~12	2,070	810	190	~0.6	~15	1,660	650
		160	~0.2	~10	2,190	350	190	~0.3	~12	1,750	530	235	~0.3	~15	1,400	420
Die steel (1.2344, 1.2379) Below 255HB	JC8050 (JC8118)	~80	~1	~10	2,980	830	~100	~1.2	~12	2,390	1,150	~120	~1.2	~15	1,910	920
		120	~0.5	~10	2,590	570	150	~0.6	~12	2,070	810	190	~0.6	~15	1,660	650
		160	~0.2	~10	2,190	350	190	~0.3	~12	1,750	530	235	~0.3	~15	1,400	420
Mold steel (1.2311, P20) 30~36HRC	JC8118 (JC8050)	~80	~1	~10	2,590	670	~100	~1.2	~12	2,070	930	~120	~1.2	~15	1,660	750
		120	~0.5	~10	2,390	480	150	~0.6	~12	1,910	690	190	~0.6	~15	1,530	550
		160	~0.2	~10	2,190	310	190	~0.3	~12	1,750	470	235	~0.3	~15	1,400	380
Mold steel (1.2311, P21) 38~43HRC	JC8118 (JC8050)	~80	~0.8	~10	2,190	530	~100	~1	~12	1,750	740	~120	~1	~15	1,400	590
		120	~0.4	~10	1,990	360	150	~0.5	~12	1,590	520	190	~0.5	~15	1,270	420
		160	~0.2	~10	1,790	210	190	~0.3	~12	1,430	340	235	~0.3	~15	1,150	280
Hardened die steel (1.2344, 1.2379) 42~52HRC	JC8118	~80	~0.4	~6	1,790	360	~100	~0.5	~8	1,430	430	~120	~0.5	~10	1,150	350
		120	~0.3	~6	1,590	250	150	~0.4	~8	1,270	300	190	~0.4	~10	1,020	240
		160	~0.2	~6	1,390	170	190	~0.2	~8	1,110	200	235	~0.2	~10	890	160
Cast iron (GG25) 160~260HB	JC8118 (JC8050)	~80	~1	~10	3,580	1,000	~100	~1.2	~12	2,860	1,370	~120	~1.2	~15	2,290	1,100
		120	~0.5	~10	3,180	700	150	~0.6	~12	2,550	990	190	~0.6	~15	2,040	800
		160	~0.2	~10	2,790	450	190	~0.3	~12	2,230	670	235	~0.3	~15	1,780	530
Nodular cast iron (GGG70) 170~300HB	JC8118 (JC8050)	~80	~1	~10	2,790	780	~100	~1.2	~12	2,230	1,070	~120	~1.2	~15	1,780	850
		120	~0.5	~10	2,590	570	150	~0.6	~12	2,070	810	190	~0.6	~15	1,660	650
		160	~0.2	~10	2,390	380	190	~0.3	~12	1,910	570	235	~0.3	~15	1,530	460
Stainless steel Austenitic (AISI 304, 316, 317)	JC8050 (JC7550)	~80	~1	~6	2,190	610	~100	~1.2	~8	1,750	840	~120	~1.2	~10	1,400	670
		120	~0.5	~6	1,990	440	150	~0.6	~8	1,590	620	190	~0.6	~10	1,270	500
		160	~0.2	~6	1,790	290	190	~0.3	~8	1,430	430	235	~0.3	~10	1,150	350
Stainless steel Ferritics/Martensitic (AISI 403, 420J2, 430)	JC8050 (JC7550)	~80	~1	~10	2,980	830	~100	~1.2	~12	2,390	1,150	~120	~1.2	~15	1,910	920
		120	~0.5	~10	2,590	570	150	~0.6	~12	2,070	810	190	~0.6	~15	1,660	650
		160	~0.2	~10	2,190	350	190	~0.3	~12	1,750	530	235	~0.3	~15	1,400	420
Titanium alloy 35~43HRC	JC7550 (JC7518)	~80	~0.8	~6	1,190	240	~100	~1	~8	950	290	~120	~1	~10	760	230
		120	~0.4	~6	990	160	150	~0.5	~8	800	190	190	~0.5	~10	640	150
		160	~0.2	~6	800	100	190	~0.3	~8	640	120	235	~0.3	~10	510	90
Inconel 35~43HRC	JC7550 (JC7518)	~80	~0.8	~6	600	110	~100	~1	~8	480	130	~120	~1	~10	380	110
		120	~0.4	~6	500	70	150	~0.5	~8	400	80	190	~0.5	~10	320	80
		160	~0.2	~6	400	40	190	~0.3	~8	320	50	235	~0.3	~10	250	50

$l$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

\*5. In case of slotting, reduce Feed speed ( $V_f$ ) to 50% or below of the above date.



## MSX and MSN type

Work materials	Grades	Tool dia. (mm)									
		30/32					40				
		No. of teeth 4N					No. of teeth 5N				
		$l$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (C50,C55) Below 250HB	JC8050 (JC8118)	~160	~1.5	~18	1,590	1,020	~160	~1.6	~24	1,430	1,290
		240	~0.8	~18	1,380	720	240	~1	~24	1,270	950
		290	~0.3	~18	1,170	470	290	~0.4	~24	1,110	670
Cast steel (1.7225) Below 285HB	JC8050 (JC8118)	~160	~1.5	~18	1,590	1,020	~160	~1.6	~24	1,430	1,290
		240	~0.8	~18	1,380	720	240	~1	~24	1,270	950
		290	~0.3	~18	1,170	470	290	~0.4	~24	1,110	670
Die steel (1.2344, 1.2379) Below 255HB	JC8050 (JC8118)	~160	~1.5	~18	1,590	1,020	~160	~1.6	~24	1,430	1,290
		240	~0.8	~18	1,380	720	240	~1	~24	1,270	950
		290	~0.3	~18	1,170	470	290	~0.4	~24	1,110	670
Mold steel (1.2311, P20) 30~36HRC	JC8118 (JC8050)	~160	~1.5	~18	1,380	830	~160	~1.6	~24	1,030	820
		240	~0.8	~18	1,270	610	240	~1	~24	950	620
		290	~0.3	~18	1,170	420	290	~0.4	~24	880	440
Mold steel (1.2311, P21) 38~43HRC	JC8118 (JC8050)	~160	~1.2	~18	1,170	660	~160	~1.4	~24	950	710
		240	~0.6	~18	1,060	470	240	~0.8	~24	840	500
		290	~0.3	~18	950	300	290	~0.4	~24	720	320
Hardened die steel (1.2344, 1.2379) 42~52HRC	JC8118	~160	~0.6	~12	950	380	~160	~0.8	~16	800	440
		240	~0.4	~12	850	270	240	~0.4	~16	720	320
		290	~0.2	~12	740	180	290	~0.2	~16	640	220
Cast iron (GG25) 160~260HB	JC8118 (JC8050)	~160	~1.5	~18	1,910	1,220	~160	~1.6	~24	1,590	1,430
		240	~0.8	~18	1,700	880	240	~1	~24	1,430	1,070
		290	~0.3	~18	1,490	600	290	~0.4	~24	1,270	760
Nodular cast iron (GGG70) 170~300HB	JC8118 (JC8050)	~160	~1.5	~18	1,490	950	~160	~1.6	~24	1,430	5,720
		240	~0.8	~18	1,380	720	240	~1	~24	1,270	640
		290	~0.3	~18	1,270	510	290	~0.4	~24	1,110	670
Stainless steel Austenitic (AISI 304, 316, 317)	JC8050 (JC7550)	~160	~1.5	~12	1,170	750	~160	~1.6	~16	950	860
		240	~0.8	~12	1,060	550	240	~1	~16	880	660
		290	~0.3	~12	950	380	290	~0.4	~16	800	480
Stainless steel Ferritics/Martensitic (AISI 403, 420J2, 430)	JC8050 (JC7550)	~160	~1.5	~18	1,590	1,020	~160	~1.6	~24	1,110	1,000
		240	~0.8	~18	1,380	720	240	~1	~24	950	710
		290	~0.3	~18	1,170	470	290	~0.4	~24	800	480
Titanium alloy 35~43HRC	JC7550 (JC7518)	~160	~0.8	~12	640	260	~160	~1.4	~16	560	310
		240	~0.5	~12	530	170	240	~0.8	~16	480	220
		290	~0.2	~12	420	100	290	~0.3	~16	400	140
Inconel 35~43HRC	JC7550 (JC7518)	~160	~0.8	~12	320	130	~160	~1.4	~16	240	120
		240	~0.5	~12	270	90	240	~0.8	~16	200	80
		290	~0.2	~12	210	50	290	~0.3	~16	160	50

$l$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

- \*1. The figure to be adjusted according to the machine rigidity or work rigidity.
- \*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.
- \*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.
- \*4. Use air blow to flush the chip out.  
In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.
- \*5. In case of slotting, reduce Feed speed ( $V_f$ ) to 50% or below of the above date.

## Recommended cutting conditions for shoulder milling

EXSAP-17 type

### Facemill type

Work materials	Grades	Tool dia. (mm)														
		50					50/52					63				
		No. of teeth 4N					No. of teeth 5N					No. of teeth 5N				
		$l$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (C50,C55) Below 250HB	JC8050	~100	~15	~40	1,270	1,520	~100	~15	~40	1,270	1,910	~100	~15	~45	1,010	1,770
		150	~12	~25	1,150	1,150	150	~12	~25	1,150	1,440	150	~12	~30	910	1,370
		200	~10	~15	1,020	820	200	~10	~15	1,020	1,020	200	~10	~20	810	1,010
Cast steel (1.7225) Below 285HB	JC8050	~100	~15	~40	1,150	1,380	~100	~15	~40	1,150	1,730	~100	~15	~45	910	1,590
		150	~12	~25	1,020	1,020	150	~12	~25	1,020	1,280	150	~12	~30	810	1,220
		200	~10	~15	890	710	200	~10	~15	890	890	200	~10	~20	710	890
Die steel (1.2344, 1.2379) Below 255HB	JC8050	~100	~15	~40	1,270	1,520	~100	~15	~40	1,270	1,910	~100	~15	~45	1,010	1,770
		150	~12	~25	1,150	1,150	150	~12	~25	1,150	1,440	150	~12	~30	910	1,370
		200	~10	~15	1,020	820	200	~10	~15	1,020	1,020	200	~10	~20	810	1,010
Mold steel (1.2311, P20) 30~36HRC	JC8118	~100	~15	~40	950	1,140	~100	~15	~40	950	1,430	~100	~15	~45	760	1,330
		150	~12	~25	860	860	150	~12	~25	860	1,080	150	~12	~30	680	1,020
		200	~10	~15	760	610	200	~10	~15	760	760	200	~10	~20	610	760
Mold steel (1.2311, P21) 38~43HRC	JC8118	~100	~15	~30	760	760	~100	~15	~30	760	950	~100	~15	~30	610	760
		150	~12	~20	670	540	150	~12	~20	670	670	150	~12	~25	530	530
		200	~10	~12	570	340	200	~10	~12	570	430	200	~10	~15	450	340
Hardened die steel (1.2344, 1.2379) 42~52HRC	JC8118	~100	~15	~18	640	510	~100	~15	~18	640	640	~100	~15	~25	510	510
		150	~12	~12	570	340	150	~12	~12	570	430	150	~12	~15	450	340
		200	~10	~5	510	200	200	~10	~5	510	260	200	~10	~8	400	200
Cast iron (GG25) 160~260HB	JC8118	~100	~15	~40	1,590	1,910	~100	~15	~40	1,590	2,390	~100	~15	~45	1,260	2,210
		150	~12	~25	1,460	1,460	150	~12	~25	1,460	1,830	150	~12	~30	1,160	1,740
		200	~10	~15	1,340	1,070	200	~10	~15	1,340	1,340	200	~10	~20	1,060	1,330
Nodular cast iron (GGG70) 170~300HB	JC8118	~100	~15	~40	950	950	~100	~15	~40	950	1,190	~100	~15	~45	760	1,140
		150	~12	~25	830	660	150	~12	~25	830	830	150	~12	~30	660	830
		200	~10	~15	700	420	200	~10	~15	700	530	200	~10	~20	560	560
Stainless steel Austenitic (AISI 304, 316, 317)	JC8050	~100	~15	~40	760	610	~100	~15	~40	760	760	~100	~15	~45	610	610
		150	~12	~25	700	420	150	~12	~25	700	530	150	~12	~30	560	420
		200	~10	~15	640	260	200	~10	~15	640	320	200	~10	~20	510	260
Stainless steel Ferritics/Martensitic (AISI 403, 420J2, 430)	JC8118	~100	~15	~40	1,150	1,150	~100	~15	~40	1,150	1,440	~100	~15	~45	910	1,370
		150	~12	~25	1,020	820	150	~12	~25	1,020	1,020	150	~12	~30	810	1,010
		200	~10	~15	890	530	200	~10	~15	890	670	200	~10	~20	710	710

$l$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and

Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.





## Facemill type

Work materials	Grades	Tool dia. (mm)														
		80					100					125				
		No. of teeth 7N					No. of teeth 7N					No. of teeth 8N				
		$l$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (C50,C55) Below 250HB	JC8050	~100	~15	~45	800	1,960	~100	~15	~45	640	1,570	~100	~15	~45	510	1,430
		150	~12	~30	720	1,510	150	~12	~30	570	1,200	150	~12	~30	460	1,100
		200	~10	~20	640	1,120	200	~10	~20	510	890	200	~10	~20	410	820
Cast steel (1.7225) Below 285HB	JC8050	~100	~15	~45	720	1,760	~100	~15	~45	570	1,400	~100	~15	~45	460	1,290
		150	~12	~30	640	1,340	150	~12	~30	510	1,070	150	~12	~30	410	980
		200	~10	~20	560	980	200	~10	~20	450	790	200	~10	~20	360	720
Die steel (1.2344, 1.2379) Below 255HB	JC8050	~100	~15	~45	800	1,960	~100	~15	~45	640	1,570	~100	~15	~45	510	1,430
		150	~12	~30	720	1,510	150	~12	~30	570	1,200	150	~12	~30	460	1,100
		200	~10	~20	640	1,120	200	~10	~20	510	890	200	~10	~20	410	820
Mold steel (1.2311, P20) 30~36HRC	JC8118	~100	~15	~45	600	1,470	~100	~15	~45	480	1,180	~100	~15	~45	380	1,060
		150	~12	~30	540	1,130	150	~12	~30	430	900	150	~12	~30	340	820
		200	~10	~20	480	840	200	~10	~20	380	670	200	~10	~20	310	620
Mold steel (1.2311, P21) 38~43HRC	JC8118	~100	~15	~30	480	840	~100	~15	~30	380	670	~100	~15	~30	310	620
		150	~12	~25	420	590	150	~12	~25	330	460	150	~12	~25	270	430
		200	~10	~15	360	380	200	~10	~15	290	300	200	~10	~15	230	280
Hardened die steel (1.2344, 1.2379) 42~52HRC	JC8118	~100	~15	~25	400	560	~100	~15	~25	320	450	~100	~15	~25	250	400
		150	~12	~15	360	380	150	~12	~15	290	300	150	~12	~15	230	280
		200	~10	~8	320	220	200	~10	~8	250	180	200	~10	~8	200	160
Cast iron (GG25) 160~260HB	JC8118	~100	~15	~45	990	2,430	~100	~15	~45	800	1,960	~100	~15	~45	640	1,790
		150	~12	~30	920	1,930	150	~12	~30	730	1,530	150	~12	~30	590	1,420
		200	~10	~20	840	1,470	200	~10	~20	670	1,170	200	~10	~20	530	1,060
Nodular cast iron (GGG70) 170~300HB	JC8118	~100	~15	~45	600	1,260	~100	~15	~45	480	1,010	~100	~15	~45	380	910
		150	~12	~30	520	910	150	~12	~30	410	720	150	~12	~30	330	660
		200	~10	~20	440	620	200	~10	~20	350	490	200	~10	~20	280	450
Stainless steel Austenitic (AISI 304, 316, 317)	JC8050	~100	~15	~45	480	670	~100	~15	~45	380	530	~100	~15	~45	310	500
		150	~12	~30	440	460	150	~12	~30	350	370	150	~12	~30	280	340
		200	~10	~20	400	280	200	~10	~20	320	220	200	~10	~20	250	200
Stainless steel Ferritics/Martensitic (AISI 403, 420J2, 430)	JC8118	~100	~15	~45	720	1,510	~100	~15	~45	570	1,200	~100	~15	~45	460	1,100
		150	~12	~30	640	1,120	150	~12	~30	510	890	150	~12	~30	410	820
		200	~10	~20	560	780	200	~10	~20	450	630	200	~10	~20	360	580

$l$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

## Recommended cutting conditions for shoulder milling

EXSAP-17 type

### Endmill type

Work materials	Grades	Tool dia. (mm)									
		25					32				
		No. of teeth 2N					No. of teeth 2N				
		$l$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (C50, C55) Below 250HB	JC8050	~60	~10	~15	2,550	1,530	~70	~12	~24	1,990	1,190
		90	~7	~10	2,290	1,150	100	~9	~18	1,790	900
Cast steel (1.7225) Below 285HB	JC8050	~60	~10	~15	2,290	1,370	~70	~12	~24	1,790	1,070
		90	~7	~10	2,040	1,020	100	~9	~18	1,590	800
Die steel (1.2344, 1.2379) Below 255HB	JC8050	~60	~10	~15	2,550	1,530	~70	~12	~24	1,990	1,190
		90	~7	~10	2,290	1,150	100	~9	~18	1,790	900
Mold steel (1.2311, P20) 30~36HRC	JC8118	~60	~10	~15	1,910	1,150	~70	~12	~24	1,490	890
		90	~7	~10	1,720	860	100	~9	~18	1,340	670
Mold steel (1.2311, P21) 38~43HRC	JC8118	~60	~10	~12	1,530	770	~70	~12	~18	1,190	600
		90	~7	~6	1,340	540	100	~9	~13	1,040	420
Hardened die steel (1.2344, 1.2379) 42~52HRC	JC8118	~60	~10	~8	1,270	510	~70	~12	~12	990	400
		90	~7	~4	1,150	350	100	~9	~8	900	270
Cast iron (GG25) 160~260HB	JC8118	~60	~10	~15	3,180	1,910	~70	~12	~24	2,490	1,490
		90	~7	~10	2,930	1,470	100	~9	~18	2,290	1,150
Nodular cast iron (GGG70) 170~300HB	JC8118	~60	~10	~15	1,910	960	~70	~12	~24	1,490	750
		90	~7	~10	1,660	660	100	~9	~18	1,290	520
Stainless steel Austenitic (AISI 304, 316, 317)	JC8050	~60	~10	~15	1,530	610	~70	~12	~24	1,190	480
		90	~7	~10	1,400	420	100	~9	~18	1,090	330
Stainless steel Ferritics/Martensitic (AISI 403, 420J2, 430)	JC8118	~60	~10.0	~15	2,290	1,150	~70	~12	~24	1,790	900
		90	~7.0	~10	2,040	820	100	~9	~18	1,590	640

$l$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

## Endmill type

Work materials	Grades	Tool dia. (mm)				
		32				
		No. of teeth 3N				
		$l$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (C50, C55) Below 250HB	JC8050	~70	~12	~24	1,990	1,790
		100	~9	~18	1,790	1,340
Cast steel (1.7225) Below 285HB	JC8050	~70	~12	~24	1,790	1,610
		100	~9	~18	1,590	1,190
Die steel (1.2344, 1.2379) Below 255HB	JC8050	~70	~12	~24	1,990	1,790
		100	~9	~18	1,790	1,340
Mold steel (1.2311, P20) 30~36HRC	JC8118	~70	~12	~24	1,490	1,340
		100	~9	~18	1,340	1,010
Mold steel (1.2311, P21) 38~43HRC	JC8118	~70	~12	~18	1,190	890
		100	~9	~13	1,040	620
Hardened die steel (1.2344, 1.2379) 42~52HRC	JC8118	~70	~12	~12	990	590
		100	~9	~8	900	410
Cast iron (GG25) 160~260HB	JC8118	~70	~12	~24	2,490	2,240
		100	~9	~18	2,290	1,720
Nodular cast iron (GGG70) 170~300HB	JC8118	~70	~12	~24	1,490	1,120
		100	~9	~18	1,290	770
Stainless steel Austenitic (AISI 304, 316, 317)	JC8050	~70	~12	~24	1,190	710
		100	~9	~18	1,090	490
Stainless steel Ferritics/Martensitic (AISI 403, 420J2, 430)	JC8118	~70	~12	~24	1,790	1,340
		100	~9	~18	1,590	950

$l$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

## Recommended cutting conditions for shoulder milling

EXSAP-17 type

### MSX and MSN type

Work materials	Grades	Tool dia. (mm)									
		25/26/28					30/32				
		No. of teeth 2N					No. of teeth 2N				
		$l$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (C50, C55) Below 250HB	JC8050	~90	~10	~15	2,450	1,470	~100	~12	~24	2,050	1,230
		140	~7	~10	2,200	1,100	150	~9	~18	1,850	930
		210	~4	~5	1,960	780	210	~6	~9	1,640	660
Cast steel (1.7225) Below 285HB	JC8050	~90	~10	~15	2,200	1,320	~100	~12	~24	1,850	1,110
		140	~7	~10	1,960	980	150	~9	~18	1,640	820
		210	~4	~5	1,710	680	210	~6	~9	1,440	580
Die steel (1.2344, 1.2379) Below 255HB	JC8050	~90	~10	~15	2,450	1,470	~100	~12	~24	2,050	1,230
		140	~7	~10	2,200	1,100	150	~9	~18	1,850	930
		210	~4	~5	1,960	780	210	~6	~9	1,640	660
Mold steel (1.2311, P20) 30~36HRC	JC8118	~90	~10	~15	1,840	1,100	~100	~12	~24	1,540	920
		140	~7	~10	1,650	830	150	~9	~18	1,390	700
		210	~4	~5	1,470	590	210	~6	~9	1,230	490
Mold steel (1.2311, P21) 38~43HRC	JC8118	~90	~10	~12	1,470	740	~100	~12	~18	1,230	620
		140	~7	~6	1,290	520	150	~9	~13	1,080	430
		210	~4	~2	1,100	330	210	~6	~7	920	280
Hardened die steel (1.2344, 1.2379) 42~52HRC	JC8118	~90	~10	~8	1,220	490	~100	~12	~12	1,030	410
		140	~7	~4	1,100	330	150	~9	~8	920	280
		210	~4	~2	980	200	210	~6	~3	820	160
Cast iron (GG25) 160~260HB	JC8118	~90	~10	~15	3,060	1,840	~100	~12	~24	2,570	1,540
		140	~7	~10	2,820	1,410	150	~9	~18	2,360	1,180
		210	~4	~5	2,570	1,030	210	~6	~12	2,160	860
Nodular cast iron (GGG70) 170~300HB	JC8118	~90	~10	~15	1,840	920	~100	~12	~24	1,540	770
		140	~7	~10	1,590	640	150	~9	~18	1,330	530
		210	~4	~5	1,350	410	210	~6	~9	1,130	340
Stainless steel Austenitic (AISI 304, 316, 317)	JC8050	~90	~10	~15	1,470	590	~100	~12	~24	1,230	490
		140	~7	~10	1,350	410	150	~9	~18	1,130	340
		210	~4	~5	1,220	240	210	~6	~9	1,030	210
Stainless steel Ferritics/Martensitic (AISI 403, 420J2, 430)	JC8118	~90	~10	~15	2,200	1,100	~100	~12	~24	1,850	930
		140	~7	~10	1,960	780	150	~9	~18	1,640	660
		210	~4	~5	1,710	510	210	~6	~9	1,440	430

$l$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.



## MSX and MSN type

Work materials	Grades	Tool dia. (mm)									
		32/33/35					40				
		No. of teeth 3N					No. of teeth 4N				
		$l$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (C50, C55) Below 250HB	JC8050	~100	~12	~24	1,930	1,740	~100	~15	~30	1,590	1,910
		150	~9	~18	1,740	1,310	150	~10	~20	1,430	1,430
		210	~6	~9	1,540	920	210	~8	~12	1,270	1,020
Cast steel (1.7225) Below 285HB	JC8050	~100	~12	~24	1,740	1,570	~100	~15	~30	1,430	1,720
		150	~9	~18	1,540	1,160	150	~10	~20	1,270	1,270
		210	~6	~9	1,350	810	210	~8	~12	1,110	890
Die steel (1.2344, 1.2379) Below 255HB	JC8050	~100	~12	~24	1,930	1,740	~100	~15	~30	1,590	1,910
		150	~9	~18	1,740	1,310	150	~10	~20	1,430	1,430
		210	~6	~9	1,540	920	210	~8	~12	1,270	1,020
Mold steel (1.2311, P20) 30~36HRC	JC8118	~100	~12	~24	1,450	1,310	~100	~15	~30	1,190	1,430
		150	~9	~18	1,300	980	150	~10	~20	1,070	1,070
		210	~6	~9	1,160	700	210	~8	~12	950	760
Mold steel (1.2311, P21) 38~43HRC	JC8118	~100	~12	~18	1,160	870	~100	~15	~20	950	950
		150	~9	~13	1,010	610	150	~10	~15	840	670
		210	~6	~7	870	390	210	~8	~8	720	430
Hardened die steel (1.2344, 1.2379) 42~52HRC	JC8118	~100	~12	~12	960	580	~100	~12	~12	800	640
		150	~9	~8	870	390	150	~10	~8	720	430
		210	~6	~3	770	230	210	~8	~3	640	260
Cast iron (GG25) 160~260HB	JC8118	~100	~12	~24	2,410	2,170	~100	~15	~30	1,990	2,390
		150	~9	~18	2,220	1,670	150	~10	~20	1,830	1,830
		210	~6	~12	2,030	1,220	210	~8	~16	1,670	1,340
Nodular cast iron (GGG70) 170~300HB	JC8118	~100	~12	~24	1,450	1,090	~100	~15	~30	1,190	1,190
		150	~9	~18	1,250	750	150	~10	~20	1,030	820
		210	~6	~9	1,060	480	210	~8	~12	880	530
Stainless steel Austenitic (AISI 304, 316, 317)	JC8050	~100	~12	~24	1,160	700	~100	~15	~30	950	760
		150	~9	~18	1,060	480	150	~10	~20	880	530
		210	~6	~9	960	290	210	~8	~12	800	320
Stainless steel Ferritics/Martensitic (AISI 403, 420J2, 430)	JC8118	~100	~12	~24	1,740	1,310	~100	~15	~30	1,430	1,430
		150	~9	~18	1,540	920	150	~10	~20	1,270	1,020
		210	~6	~9	1,350	610	210	~8	~12	1,110	670

$l$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut ap or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut ap or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

Recommended cutting conditions for facemilling

EXSAP-17 type

## Facemill type

Work materials	Grades	Tool dia. (mm)														
		50					50/52					63				
		No. of teeth 4N					No. of teeth 5N					No. of teeth 5N				
		$l$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (C50,C55) Below 250HB	JC8050	~150	~4	~50	950	1,140	~150	~4	~1Dc	950	1,430	~150	~4	~63	760	1,330
		200	~3	~40	830	830	200	~3	~40	830	1,040	200	~3	~55	660	990
		300	~2	~30	700	560	300	~2	~30	700	700	300	~2	~40	560	700
Cast steel (1.7225) Below 285HB	JC8050	~150	~4	~50	950	1,140	~150	~4	~1Dc	950	1,430	~150	~4	~63	760	1,330
		200	~3	~40	830	830	200	~3	~40	830	1,040	200	~3	~55	660	990
		300	~2	~30	700	560	300	~2	~30	700	700	300	~2	~40	560	700
Die steel (1.2344, 1.2379) Below 255HB	JC8050	~150	~4	~50	950	950	~150	~4	~1Dc	950	1,190	~150	~4	~63	760	1,140
		200	~3	~40	830	660	200	~3	~40	830	830	200	~3	~55	660	830
		300	~2	~30	700	420	300	~2	~30	700	530	300	~2	~40	560	560
Mold steel (1.2311, P20) 30~36HRC	JC8118	~150	~4	~50	830	830	~150	~4	~1Dc	830	1,040	~150	~4	~63	660	990
		200	~3	~40	760	610	200	~3	~40	760	760	200	~3	~55	610	760
		300	~2	~30	700	420	300	~2	~30	700	530	300	~2	~40	560	560
Mold steel (1.2311, P21) 38~43HRC	JC8118	~150	~3	~50	700	700	~150	~3	~1Dc	700	880	~150	~3	~63	560	700
		200	~2.5	~40	640	510	200	~2.5	~40	640	640	200	~2.5	~55	510	510
		300	~1.5	~30	570	340	300	~1.5	~30	570	430	300	~1.5	~40	450	340
Hardened die steel (1.2344, 1.2379) 42~52HRC	JC8118	~150	~2.5	~40	570	460	~150	~2.5	~40	570	570	~150	~2.5	~55	450	450
		200	~2	~30	510	310	200	~2	~30	510	380	200	~2	~40	400	300
		300	~1.5	~20	450	180	300	~1.5	~20	450	230	300	~1.5	~32	350	180
Cast iron (GG25) 160~260HB	JC8118	~150	~6	~50	1,150	1,380	~150	~6	~1Dc	1,150	1,730	~150	~6	~63	910	1,590
		200	~4	~40	950	950	200	~4	~40	950	1,190	200	~4	~55	760	1,140
		300	~2	~30	830	660	300	~2	~30	830	830	300	~2	~40	660	830
Nodular cast iron (GGG70) 170~300HB	JC8118	~150	~4	~50	830	830	~150	~4	~1Dc	830	1,040	~150	~4	~63	660	990
		200	~3	~40	760	610	200	~3	~40	760	760	200	~3	~55	610	760
		300	~2	~30	700	420	300	~2	~30	700	530	300	~2	~40	560	560
Stainless steel Austenitic (AISI 304, 316, 317)	JC8050	~150	~4	~40	700	560	~150	~4	~40	700	700	~150	~4	~55	560	560
		200	~3	~30	640	380	200	~3	~30	640	480	200	~3	~40	510	380
		300	~2	~20	570	230	300	~2	~20	570	290	300	~2	~32	450	230
Stainless steel Ferritics/Martensitic (AISI 403, 420J2, 430)	JC8118	~150	~4	~50	950	950	~150	~4	~1Dc	950	1,190	~150	~4	~63	760	1,140
		200	~3	~40	830	660	200	~3	~40	830	830	200	~3	~55	660	830
		300	~2	~30	700	420	300	~2	~30	700	530	300	~2	~40	560	560

$l$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

\*5. In case of slotting, reduce Feed speed ( $V_f$ ) to 50% or below of the above date.



## Facemill type

Work materials	Grades	Tool dia. (mm)														
		80					100					125				
		No. of teeth 7N					No. of teeth 7N					No. of teeth 8N				
		$l$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (C50,C55) Below 250HB	JC8050	~150	~4	~80	600	1,470	~150	~4	~100	480	1,010	~150	~4	~125	380	910
		200	~3	~65	520	1,090	200	~3	~80	410	720	200	~3	~100	330	660
		300	~2	~50	440	770	300	~2	~60	350	490	300	~2	~75	280	450
Cast steel (1.7225) Below 285HB	JC8050	~150	~4	~80	600	1,470	~150	~4	~100	480	1,010	~150	~4	~125	380	910
		200	~3	~65	520	1,090	200	~3	~80	410	720	200	~3	~100	330	660
		300	~2	~50	440	770	300	~2	~60	350	490	300	~2	~75	280	450
Die steel (1.2344, 1.2379) Below 255HB	JC8050	~150	~4	~80	600	1,260	~150	~4	~100	480	840	~150	~4	~125	380	760
		200	~3	~65	520	910	200	~3	~80	410	570	200	~3	~100	330	530
		300	~2	~50	440	620	300	~2	~60	350	370	300	~2	~75	280	340
Mold steel (1.2311, P20) 30~36HRC	JC8118	~150	~4	~80	520	1,090	~150	~4	~100	410	720	~150	~4	~125	330	660
		200	~3	~65	480	840	200	~3	~80	380	530	200	~3	~100	310	500
		300	~2	~50	440	620	300	~2	~60	350	370	300	~2	~75	280	340
Mold steel (1.2311, P21) 38~43HRC	JC8118	~150	~3	~80	440	770	~150	~4	~100	350	490	~150	~4	~125	280	450
		200	~2.5	~65	400	560	200	~3	~80	320	340	200	~3	~100	250	300
		300	~1.5	~50	360	380	300	~2	~60	290	200	300	~2	~75	230	180
Hardened die steel (1.2344, 1.2379) 42~52HRC	JC8118	~150	~2.5	~65	360	500	~150	~4	~80	290	300	~150	~4	~100	230	280
		200	~2.0	~50	320	340	200	~3	~60	250	180	200	~3	~75	200	160
		300	~1.5	~35	280	200	300	~2	~40	220	150	300	~2	~50	180	140
Cast iron (GG25) 160~260HB	JC8118	~150	~6	~80	720	1,760	~150	~4	~100	570	1,200	~150	~4	~125	460	1,100
		200	~4	~65	600	1,260	200	~3	~80	480	840	200	~3	~100	380	760
		300	~2	~50	520	910	300	~2	~60	410	570	300	~2	~75	330	530
Nodular cast iron (GGG70) 170~300HB	JC8118	~150	~4	~80	520	1,090	~150	~4	~100	410	720	~150	~4	~125	330	660
		200	~3	~65	480	840	200	~3	~80	380	530	200	~3	~100	310	500
		300	~2	~50	440	620	300	~2	~60	350	370	300	~2	~75	280	340
Stainless steel Austenitic (AISI 304, 316, 317)	JC8050	~150	~4	~65	440	620	~150	~4	~80	350	370	~150	~4	~100	280	340
		200	~3	~50	400	420	200	~3	~60	320	220	200	~3	~75	250	200
		300	~2	~35	360	250	300	~2	~40	290	200	300	~2	~50	230	180
Stainless steel Ferritics/Martensitic (AISI 403, 420J2, 430)	JC8118	~150	~4	~80	600	1,260	~150	~4	~100	480	840	~150	~4	~125	380	760
		200	~3	~65	520	910	200	~3	~80	410	570	200	~3	~100	330	530
		300	~2	~50	440	620	300	~2	~60	350	370	300	~2	~75	280	340

$l$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

\*5. In case of slotting, reduce Feed speed ( $V_f$ ) to 50% or below of the above date.

## Recommended cutting conditions for facemilling

EXSAP-17 type

### Endmill type

Work materials	Grades	Tool dia. (mm)									
		25					32				
		No. of teeth 2N					No. of teeth 2N				
		$l$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (C50, C55) Below 250HB	JC8050	~60	~3	~1Dc	1,910	1,150	~70	~3.5	~1Dc	1,490	890
		90	~2	~20	1,660	830	100	~2.5	~25	1,290	650
Cast steel (1.7225) Below 285HB	JC8050	~60	~3	~1Dc	1,910	1,150	~70	~3.5	~1Dc	1,490	890
		90	~2	~20	1,660	830	100	~2.5	~25	1,290	650
Die steel (1.2344, 1.2379) Below 255HB	JC8050	~60	~3	~1Dc	1,910	960	~70	~3.5	~1Dc	1,490	750
		90	~2	~20	1,660	660	100	~2.5	~25	1,290	520
Mold steel (1.2311, P20) 30~36HRC	JC8118	~60	~3	~1Dc	1,660	830	~70	~3.5	~1Dc	1,290	650
		90	~2	~20	1,530	610	100	~2.5	~25	1,190	480
Mold steel (1.2311, P21) 38~43HRC	JC8118	~60	~2	~1Dc	1,400	700	~70	~2.5	~1Dc	1,090	550
		90	~1	~20	1,270	510	100	~2	~25	990	400
Hardened die steel (1.2344, 1.2379) 42~52HRC	JC8118	~60	~1	~20	1,150	460	~70	~2	~25	900	360
		90	~1	~15	1,020	310	100	~1.5	~20	800	240
Cast iron (GG25) 160~260HB	JC8118	~60	~5	~1Dc	2,550	1,530	~70	~5.5	~1Dc	1,990	1,190
		90	~3	~20	2,290	1,150	100	~3.5	~25	1,790	900
Nodular cast iron (GGG70) 170~300HB	JC8118	~60	~3	~1Dc	1,660	830	~70	~3.5	~1Dc	1,290	650
		90	~2	~20	1,530	610	100	~2.5	~25	1,190	480
Stainless steel Austenitic (AISI 304, 316, 317)	JC8050	~60	~3	~20	1,400	560	~70	~3.5	~25	1,090	440
		90	~2	~15	1,270	380	100	~2.5	~20	990	300
Stainless steel Ferritics/Martensitic (AISI 403, 420J2, 430)	JC8118	~60	~3	~1Dc	1,910	960	~70	~3.5	~1Dc	1,490	750
		90	~2	~20	1,660	660	100	~2.5	~25	1,290	520

$l$  : Overhung length    $a_p$  : Axial depth of cut    $a_e$  : Radial depth of cut    $n$  : Spindle speed    $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

\*5. In case of slotting, reduce Feed speed ( $V_f$ ) to 50% or below of the above date.



## Endmill type

Work materials	Grades	Tool dia. (mm)				
		32				
		No. of teeth 3N				
		$l$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (C50, C55) Below 250HB	JC8050	~70	~3.5	~1Dc	1,490	1,340
		100	~2.5	~25	1,290	970
Cast steel (1.7225) Below 285HB	JC8050	~70	~3.5	~1Dc	1,490	1,340
		100	~2.5	~25	1,290	970
Die steel (1.2344, 1.2379) Below 255HB	JC8050	~70	~3.5	~1Dc	1,490	1,120
		100	~2.5	~25	1,290	770
Mold steel (1.2311, P20) 30~36HRC	JC8118	~70	~3.5	~1Dc	1,290	970
		100	~2.5	~25	1,190	710
Mold steel (1.2311, P21) 38~43HRC	JC8118	~70	~2.5	~1Dc	1,090	820
		100	~2	~25	990	590
Hardened die steel (1.2344, 1.2379) 42~52HRC	JC8118	~70	~2	~25	900	540
		100	~1.5	~20	800	360
Cast iron (GG25) 160~260HB	JC8118	~70	~5.5	~1Dc	1,990	1,790
		100	~3.5	~25	1,790	1,340
Nodular cast iron (GGG70) 170~300HB	JC8118	~70	~3.5	~1Dc	1,290	970
		100	~2.5	~25	1,190	710
Stainless steel Austenitic (AISI 304, 316, 317)	JC8050	~70	~3.5	~25	1,090	650
		100	~2.5	~20	990	450
Stainless steel Ferritics/Martensitic (AISI 403, 420J2, 430)	JC8118	~70	~3.5	~1Dc	1,490	1,120
		100	~2.5	~25	1,290	770

$l$  : Overhung length    $a_p$  : Axial depth of cut    $a_e$  : Radial depth of cut    $n$  : Spindle speed    $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

\*5. In case of slotting, reduce Feed speed ( $V_f$ ) to 50% or below of the above date.

Recommended cutting conditions for facemilling

EXSAP-17 type

## MSX and MSN type

Work materials	Grades	Tool dia. (mm)									
		25/26/28					30/32				
		No. of teeth 2N					No. of teeth 2N				
		$l$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (C50, C55) Below 250HB	JC8050	~90	~3	~1Dc	1,840	1,100	~100	~3.5	~1Dc	1,540	920
		140	~2	~20	1,590	800	150	~2.5	~25	1,330	670
		210	~1	~15	1,350	540	210	~1.5	~20	1,130	450
Cast steel (1.7225) Below 285HB	JC8050	~90	~3	~1Dc	1,840	1,100	~100	~3.5	~1Dc	1,540	920
		140	~2	~20	1,590	800	150	~2.5	~25	1,330	670
		210	~1	~15	1,350	540	210	~1.5	~20	1,130	450
Die steel (1.2344, 1.2379) Below 255HB	JC8050	~90	~3	~1Dc	1,840	920	~100	~3.5	~1Dc	1,540	770
		140	~2	~20	1,590	640	150	~2.5	~25	1,330	530
		210	~1	~15	1,350	410	210	~1.5	~20	1,130	340
Mold steel (1.2311, P20) 30~36HRC	JC8118	~90	~3	~1Dc	1,590	800	~100	~3.5	~1Dc	1,330	670
		140	~2	~20	1,470	590	150	~2.5	~25	1,230	490
		210	~1	~15	1,350	410	210	~1.5	~20	1,130	340
Mold steel (1.2311, P21) 38~43HRC	JC8118	~90	~2	~1Dc	1,350	680	~100	~2.5	~1Dc	1,130	570
		140	~1.5	~20	1,220	490	150	~2	~25	1,030	410
		210	~1	~15	1,100	330	210	~1.5	~20	920	280
Hardened die steel (1.2344, 1.2379) 42~52HRC	JC8118	~90	~1.5	~20	1,100	440	~100	~2	~25	920	370
		140	~1	~15	980	290	150	~1.5	~20	820	250
		210	~0.5	~10	860	170	210	~1	~15	720	140
Cast iron (GG25) 160~260HB	JC8118	~90	~5	~1Dc	2,450	1,470	~100	~5.5	~1Dc	2,050	1,230
		140	~3	~20	2,200	1,100	150	~3.5	~25	1,850	930
		210	~1	~15	1,960	780	210	~1.5	~20	1,640	660
Nodular cast iron (GGG70) 170~300HB	JC8118	~90	~3	~1Dc	1,590	800	~100	~3.5	~1Dc	1,330	670
		140	~2	~20	1,470	590	150	~2.5	~25	1,230	490
		210	~1	~15	1,350	410	210	~1.5	~20	1,130	340
Stainless steel Austenitic (AISI 304, 316, 317)	JC8050	~90	~3	~20	1,350	540	~100	~3.5	~25	1,130	450
		140	~2	~15	1,220	370	150	~2.5	~20	1,030	310
		210	~1	~10	1,100	220	210	~1.5	~15	920	180
Stainless steel Ferritics/Martensitic (AISI 403, 420J2, 430)	JC8118	~90	~3	~1Dc	1,840	920	~100	~3.5	~1Dc	1,540	770
		140	~2	~20	1,590	640	150	~2.5	~25	1,330	530
		210	~1	~15	1,350	410	210	~1.5	~20	1,130	340

$l$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

\*1. The figure to be adjusted according to the machine rigidity or work rigidity.

\*2. In case of chatter occurring, recommend to reduce the depth of cut  $a_p$  or Feed speed.

\*3. If machine does not have enough power, recommend to reduce the depth of cut  $a_p$  or Spindle speed and Feed speed.

\*4. Use air blow to flush the chip out.

In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.

\*5. In case of slotting, reduce Feed speed ( $V_f$ ) to 50% or below of the above date.



## MSX and MSN type

Work materials	Grades	Tool dia. (mm)									
		32/33/35					40				
		No. of teeth 3N					No. of teeth 4N				
		$l$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$l$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (C50, C55) Below 250HB	JC8050	~100	~3.5	~1Dc	1,450	1,310	~100	~3.5	~40	1,190	1,430
		150	~2.5	~25	1,250	940	150	~2.5	~32	1,030	1,030
		210	~1.5	~20	1,060	640	210	~1.5	~24	880	700
Cast steel (1.7225) Below 285HB	JC8050	~100	~3.5	~1Dc	1,450	1,310	~100	~3.5	~40	1,190	1,430
		150	~2.5	~25	1,250	940	150	~2.5	~32	1,030	1,030
		210	~1.5	~20	1,060	640	210	~1.5	~24	880	700
Die steel (1.2344, 1.2379) Below 255HB	JC8050	~100	~3.5	~1Dc	1,450	1,090	~100	~3.5	~40	1,190	1,190
		150	~2.5	~25	1,250	750	150	~2.5	~32	1,030	820
		210	~1.5	~20	1,060	480	210	~1.5	~24	880	530
Mold steel (1.2311, P20) 30~36HRC	JC8118	~100	~3.5	~1Dc	1,250	940	~100	~3.5	~40	1,030	1,030
		150	~2.5	~25	1,160	700	150	~2.5	~32	950	760
		210	~1.5	~20	1,060	480	210	~1.5	~24	880	530
Mold steel (1.2311, P21) 38~43HRC	JC8118	~100	~2.5	~1Dc	1,060	800	~100	~2.5	~40	880	880
		150	~2	~25	960	580	150	~2	~32	800	640
		210	~1.5	~20	870	390	210	~1.5	~24	720	430
Hardened die steel (1.2344, 1.2379) 42~52HRC	JC8118	~100	~2	~25	870	520	~100	~2	~32	720	580
		150	~1.5	~20	770	350	150	~1.5	~24	640	380
		210	~1	~15	680	200	210	~1	~18	560	220
Cast iron (GG25) 160~260HB	JC8118	~100	~5.5	~1Dc	1,930	1,740	~100	~5.5	~40	1,590	1,910
		150	~3.5	~25	1,740	1,310	150	~3.5	~32	1,430	1,430
		210	~1.5	~20	1,540	920	210	~1.5	~24	1,270	1,020
Nodular cast iron (GGG70) 170~300HB	JC8118	~100	~3.5	~1Dc	1,250	940	~100	~3.5	~40	1,030	1,030
		150	~2.5	~25	1,160	700	150	~2.5	~32	950	760
		210	~1.5	~20	1,060	480	210	~1.5	~24	880	530
Stainless steel Austenitic (AISI 304, 316, 317)	JC8050	~100	~3.5	~25	1,060	640	~100	~3.5	~32	880	700
		150	~2.5	~20	960	430	150	~2.5	~24	800	480
		210	~1.5	~15	870	260	210	~1.5	~18	720	290
Stainless steel Ferritics/Martensitic (AISI 403, 420J2, 430)	JC8118	~100	~3.5	~1Dc	1,450	1,090	~100	~3.5	~40	1,190	1,190
		150	~2.5	~25	1,250	750	150	~2.5	~32	1,030	820
		210	~1.5	~20	1,060	480	210	~1.5	~24	880	530

$l$  : Overhung length  $a_p$  : Axial depth of cut  $a_e$  : Radial depth of cut  $n$  : Spindle speed  $V_f$  : Feed speed

Note:

- \*1. The figure to be adjusted according to the machine rigidity or work rigidity.
- \*2. In case of chatter occurring, recommend to reduce the depth of cut or Feed speed.
- \*3. If machine does not have enough power, recommend to reduce the depth of cut or Spindle speed and Feed speed.
- \*4. Use air blow to flush the chip out.  
In particular, Please pay attention to chip disposal when machining cavities with a vertical MC.
- \*5. In case of slotting, reduce Feed speed ( $V_f$ ) to 50% or below of the above date.



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