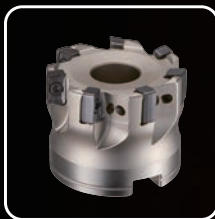


**EXTREME SAP** **EXSAP/MSX Type**

# EXTREME SAP

## EXSAP/MSX TYPE



Facemill type



Modular head type



Endmill type

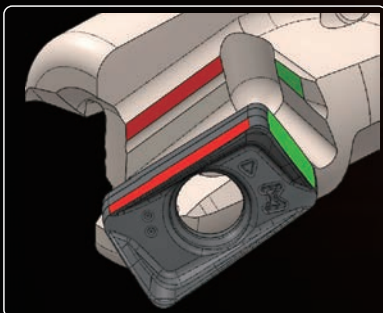
Various line up

Capable of a variety of applications such as facemilling , slotting and plunging

### Arc-shaped cutting edge trajectory

Due to the arc-geometry on peripheral cutting edge, cusp height can be smaller even in case of large ap.

Achieves high efficient & high precision machining for side walls.

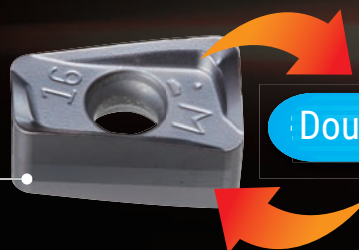


### Strong clamping system

Due to unique clamping system that holds insert in place, it is possible to achieve high efficient machining in roughing application.

### High precision G class periphery ground

capable of semi-finishing



Double sided 4 cutting edge insert

**EXTREME SAP** **EXSAP/MSX Type**

■ **EXSAP-11 type**



**High speed machining**  
with multi flutes & small insert

**Accuracy of tool diameter : 0-0.1mm**  
Achieves higher precision on semi-finishing process

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

PM breaker for general steel (up to 50HRC)

Grade: **JC7550**  
**JC7518**  
**DS118**  
**DS150**

SL breaker for hard to cut material  
such as Titanium alloy, Heat resistant alloy

■ **EXSAP-17 type**



**Max.depth of cut (ap)=15mm**  
From roughing to semi-finishing

**High rigidity insert**  
Achieves high precision machining even when using large ap

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

PM breaker for general steel (up to 50HRC)

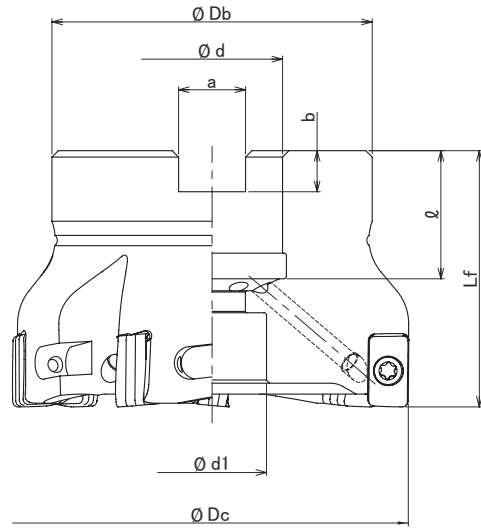
■ **Insert grades**

ISO	P					M					K				S					
	P01	P10	P20	P30	P40	M01	M10	M20	M30	M40	K01	K10	K20	K30	S01	S10	S20	S30		
Range																				
				JC8118														DS118		
					JC8050														DS150	
				JC7518																JC7518
					JC7550															JC7550

**EXTREME SAP** **EXSAP/MSX Type**

- EXSAP-11 Type
- Facemill Type

Through coolant hole



Cat.No.	Stock	No. of inserts	Dimensions (mm)								Arbor set bolt	Weight (kg)	Inserts
			φDc	Lf	φDb	φd	φd1	a	b	ℓ			
EXSAP-6040R-11-16	●	6	40	40	35	16	14	8.4	5.6	18	M8	0.22	ZNGU1105**ZER-**
EXSAP-7050R-11-22	●	7	50		22	16.5	10.4	6.3	20	M10	0.38		
EXSAP-7052R-11-22	●		52							M10	0.39		
EXSAP-7063R-11-22	●	63	50	27	20	12.4	7	22	M10	0.53			
EXSAP-7063R-11-27	●								M12X1.75X30*	0.62			
EXSAP-8080R-11-27	●	8	80	56						M12X1.75X30*	0.99		

Screw	Torque(N.m)	Wrench
TSW-307H	2.1	A-10

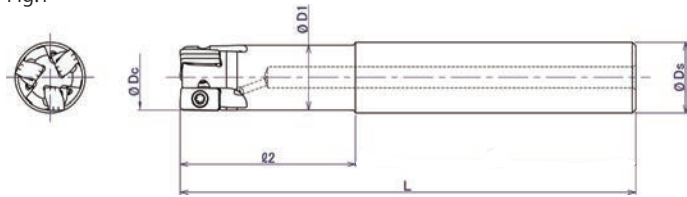
**EXTREME SAP** **EXSAP/MSX Type**

- EXSAP-11 Type
- Endmill Shank Type

Through coolant hole



Fig.1

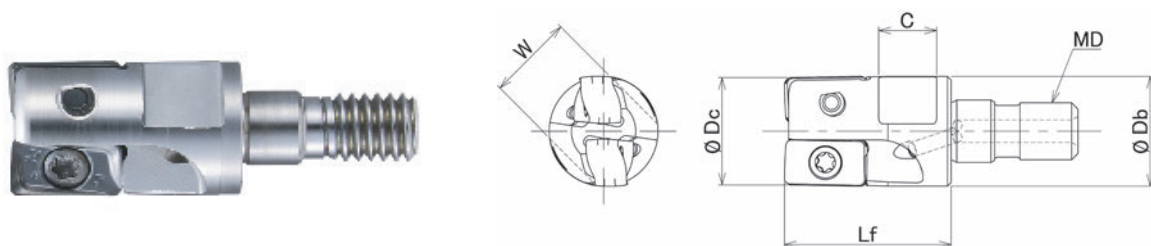


Cat.No.	Stock	No. of inserts	Dimensions (mm)					Inserts	Fig.
			φDc	ℓ2	L	φD1	φDs		
EXSAP-2016-11-50-S16+A	●	2	16	50	110	14.6	16	ZNGU1105**ZER-**	1
EXSAP-3020-11-50-S20+A	●	3	20	50	130	18.3	20		
EXSAP-3025-11-50-S25+A	●	2	25	50	130	23.4	25		
EXSAP-4030-11-50-S32+A	●	4	32	50	130	29	32		

Screw	Torque(N.m)	Wrench
TSW-307H	2.1	A-10

**EXTREME SAP** **EXSAP/MSX Type**

- EXSAP-11 Type
- Modular Head Type

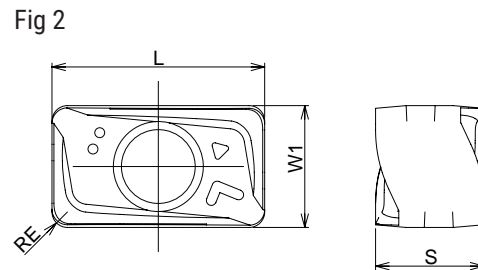
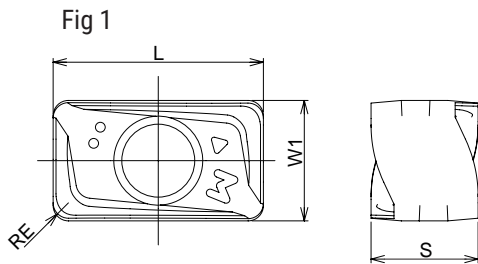


Cat.No.	Stock	No. of inserts	Dimensions (mm)						Inserts
			$\varnothing D_c$	$L_f$	$\varnothing D_b$	MD	C	W	
MSX-2016-11-M8	●	2	16	23	15	M8	8	12	ZNGU1105**ZER**
MSX-2017-11-M8	○		17						
MSX-2018-11-M8	○		18						
MSX-3020-11-M10	●	3	20	30	18	M10	9	14	
MSX-3021-11-M10	○		21						
MSX-3025-11-M12	●		25						
MSX-3026-11-M12	○	4	26	35	22	M12	11	19	
MSX-3028-11-M12	○		28						
MSX-4030-11-M16	○		30						
MSX-4032-11-M16	●	4	32	43	29	M16	12	22	
MSX-4033-11-M16	○		33						
MSX-4035-11-M16	○		35						
MSX-5040-11-M16	●	5	40						

Screw	Torque(N.m)	Wrench
TSW-307H	2.1	A-10

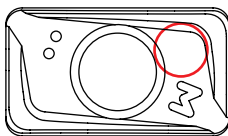
**EXTREME SAP** **EXSAP/MSX Type**

■ **Insert**

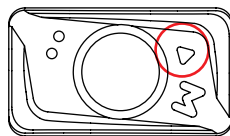


Cat.No	Tolerance	PVD Coating						Dimensions (mm)				Fig.
		DS118	DS150	JC7518	JC7550	JC8050	JC8118	RE	L	W1	S	
ZNGU110504ZER-PM	G					●	●	0.4	11	6.3	5.6	1
ZNGU110508ZER-PM						●	●	0.8				
ZNGU110516ZER-PM						●	●	1.6				
ZNGU110504ZER-SL		●	●	●	●			0.4				2
ZNGU110508ZER-SL		●	●	●	●			0.8				
ZNGU110516ZER-SL		●	●	●	●			1.6				

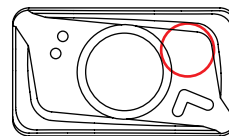
● **Grade markings**



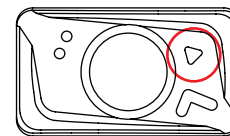
JC8118



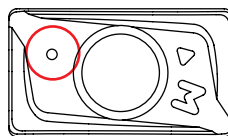
JC8050



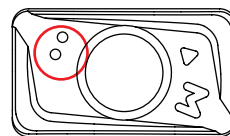
JC7518 / DS118



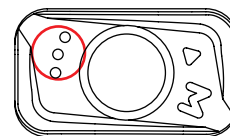
JC7550 / DS150



ZNGU110504ZER



ZNGU110508ZER



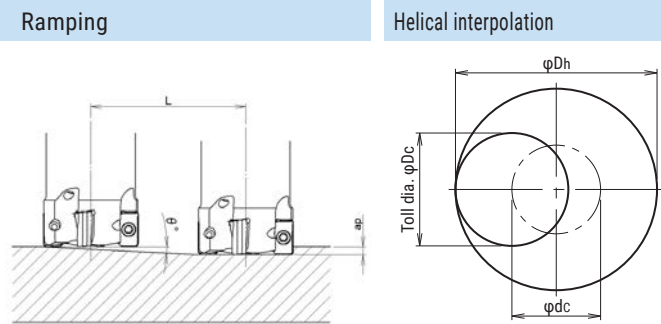
ZNGU110516ZER

# EXTREME SAP

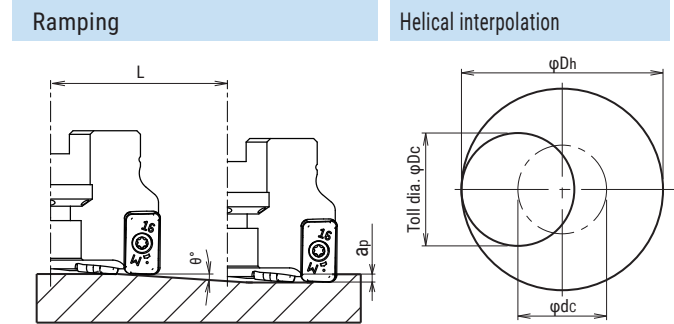
# EXSAP/MSX Type

## Recommended Data for Profile Milling

### EXSAP-11 Type



### EXSAP-17 Type



Cat. No.	Tool dia.	Effective Cutting dia.	Max. depth of cut : ap	Ramping		Helical interpolation	
				Max. ramping angle θ	Max. depth of cut : ap Total cutting length L(mm)	Min. Bore dia.	Max. Bore dia.
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	Not recommended			
EXSAP-7063R-11-27	63	61.1	1.5	Not recommended			
EXSAP-8080R-11-27	80	78.1	1.5	Not recommended			

Cat. No.	Tool dia.	Effective Cutting dia.	Max. depth of cut : ap	Ramping		Helical interpolation	
				Max. ramping angle θ	Max. depth of cut : ap Total cutting length L(mm)	Min. Bore dia.	Max. Bore dia.
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	Not recommended				
EXSAP-8125R-40	125	121.5	Not recommended				

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

- Calculation of tool pass dia.

$$\varphi_{Dc} = \varphi_{Dh} - \varphi_{Dc}$$

Tool pass dia.    Bore dia.    Tool Dia.

- Depth of cut per one circuit should not exceed max. depth of cut Ap
- Down cutting is recommended, tool pass rotation should be counterclockwise

**EXTREME SAP****EXSAP/MSX Type**

■ Recommended cutting conditions

■ **EXSAP-11 Type**

■ Facemill type / Side milling

Material	Grade	Tool dia.(mm)									
		40					50/52				
		6N					7N				
		$\ell$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$\ell$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (S50C, S55C) 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 (GM190, ICD5) 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
Tool & die steel (SKD61, SKD11) 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 (HPM7, PX5, P20) 30-36 HRC	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 (NAK80, HPM1, 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 (SKD61, DAC, DHA) 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
Grey cast iron (FC250) 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 (FCD700) 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
Austenitic stainless steel (SUS304, 316, 317)17Cr	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
Ferritic & martensitic stainless steel (SUS403, 420J2, 430)13Cr	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 (Ti-6Al-4V) 35-43HRC	DS150 (JC7550) (DS118)	~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
Heat resistant alloy (INCO718) 35-43HRC	DS118 (JC7518) (DS150)	~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

Note

1. Please adjust cutting conditions according to machine rigidity or work rigidity.
2. In case of chatter occurring, recommended to reduce  $a_p$  or rpm and keep feed per tooth.
3.  $a_p$  should be reduced when using on low rigidity machine.
4. Use air blow.



# EXTREME SAP

# EXSAP/MSX Type

■ Recommended cutting conditions

■ **EXSAP-11 Type**

■ Facemill type / Side milling

Material	Grade	Tool dia.(mm)									
		63					80				
		7N					8N				
		ℓ (mm)	ap (mm)	ap×ae (mm <sup>2</sup> )	n (min <sup>-1</sup> )	Vf (mm/min)	ℓ (mm)	ap (mm)	ap×ae (mm <sup>2</sup> )	n (min <sup>-1</sup> )	Vf (mm/min)
Carbon steel (S50C, S55C) 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 (GM190, ICD5) 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
Tool & die steel (SKD61, SKD11) 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 (HPM7, PX5, P20) 30-36 HRC	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 (NAK80, HPM1, 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 (SKD61, DAC, DHA) 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
Grey cast iron (FC250) 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 (FCD700) 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
Austenitic stainless steel (SUS304, 316, 317)17Cr	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
Ferritic & martensitic stainless steel (SUS403, 420J2, 430)13Cr	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 (Ti-6Al-4V) 35-43HRC	DS150 (JC7550) (DS118)	~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
Heat resistant alloy (INCO718) 35-43HRC	DS118 (JC7518) (DS150)	~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

Note

1. Please adjust cutting conditions according to machine rigidity or work rigidity.
2. In case of chatter occurring, recommended to reduce ap or rpm and keep feed per tooth.
3. ap should be reduced when using on low rigidity machine.
4. Use air blow.

**EXTREME SAP****EXSAP/MSX Type**

## ■ Recommended cutting conditions

■ **EXSAP-11 Type**

## ■ Endmill type / Side milling

Material	Grade	Tool dia.(mm)														
		16					20					25				
		2N					3N					3N				
		ℓ (mm)	a <sub>p</sub> (mm)	a <sub>p</sub> ×a <sub>e</sub> (mm <sup>2</sup> )	n (min <sup>-1</sup> )	V <sub>f</sub> (mm/min)	ℓ (mm)	a <sub>p</sub> (mm)	a <sub>p</sub> ×a <sub>e</sub> (mm <sup>2</sup> )	n (min <sup>-1</sup> )	V <sub>f</sub> (mm/min)	ℓ (mm)	a <sub>p</sub> (mm)	a <sub>p</sub> ×a <sub>e</sub> (mm <sup>2</sup> )	n (min <sup>-1</sup> )	V <sub>f</sub> (mm/min)
Carbon steel (S50C, S55C) 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 (GM190, ICD5) 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
Tool & die steel (SKD61, SKD11) 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 (HPM7, PX5, P20) 30-36 HRC	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 (NAK80, HPM1, 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 (SKD61, DAC, DHA) 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
Grey cast iron (FC250) 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 (FCD700) 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
Austenitic stainless steel (SUS304, 316, 317)17Cr	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
Ferritic & martensitic stainless steel (SUS403, 420J2, 430)13Cr	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 (Ti-6Al-4V) 35-43HRC	DS150 (JC7550) (DS118)	~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
Heat resistant alloy (INCO718) 35-43HRC	DS118 (JC7518) (DS150)	~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

## Note

1. Please adjust cutting conditions according to machine rigidity or work rigidity.
2. In case of chatter occurring, recommended to reduce a<sub>p</sub> or rpm and keep feed per tooth.
3. a<sub>p</sub> should be reduced when using on low rigidity machine.
4. Use air blow.

**EXTREME SAP****EXSAP/MSX Type**

■ Recommended cutting conditions

■ **EXSAP-11 Type**

■ Endmill type / Side milling

Material	Grade	Tool dia.(mm)									
		30/32					40				
		4N					5N				
		$\ell$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$\ell$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (S50C, S55C) 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 (GM190, ICD5) 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
Tool & die steel (SKD61, SKD11) 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 (HPM7, PX5, P20) 30-36 HRC	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 (NAK80, HPM1, 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 (SKD61, DAC, DHA) 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
Grey cast iron (FC250) 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 (FCD700) 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
Austenitic stainless steel (SUS304, 316, 317)17Cr	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
Ferritic & martensitic stainless steel (SUS403, 420J2, 430)13Cr	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 (Ti-6Al-4V) 35-43HRC	DS150 (JC7550) (DS118)	~70	~6	~8	700	360	~70	~7	~10	560	360
		120	~4	~2.4	600	290	170	~5	~3	480	290
Heat resistant alloy (INCO718) 35-43HRC	DS118 (JC7518) (DS150)	~70	~6	~8	300	120	~70	~7	~10	240	120
		120	~4	~2.4	250	90	170	~5	~3	200	90

Note

1. Please adjust cutting conditions according to machine rigidity or work rigidity.
2. In case of chatter occurring, recommended to reduce  $a_p$  or rpm and keep feed per tooth.
3.  $a_p$  should be reduced when using on low rigidity machine.
4. Use air blow.

**EXTREME SAP****EXSAP/MSX Type**

## ■ Recommended cutting conditions

■ **EXSAP-11 Type**

## ■ Modular head type / Side milling

Material	Grade	Tool dia.(mm)														
		16/17/18					20/21					25/26/28				
		2N					3N					3N				
		ℓ (mm)	a <sub>p</sub> (mm)	a <sub>p</sub> ×a <sub>e</sub> (mm <sup>2</sup> )	n (min <sup>-1</sup> )	V <sub>f</sub> (mm/min)	ℓ (mm)	a <sub>p</sub> (mm)	a <sub>p</sub> ×a <sub>e</sub> (mm <sup>2</sup> )	n (min <sup>-1</sup> )	V <sub>f</sub> (mm/min)	ℓ (mm)	a <sub>p</sub> (mm)	a <sub>p</sub> ×a <sub>e</sub> (mm <sup>2</sup> )	n (min <sup>-1</sup> )	V <sub>f</sub> (mm/min)
Carbon steel (S50C, S55C) 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 (GM190, ICD5) 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
Tool & die steel (SKD61, SKD11) 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 (HPM7, PX5, P20) 30-36 HRC	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 (NAK80, HPM1, 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 (SKD61, DAC, DHA) 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
Grey cast iron (FC250) 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 (FCD700) 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
Austenitic stainless steel (SUS304, 316, 317)17Cr	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
Ferritic & martensitic stainless steel (SUS403, 420J2, 430)13Cr	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 (Ti-6Al-4V) 35-43HRC	DS150 (JC7550) (DS118)	~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
Heat resistant alloy (INCO718) 35-43HRC	DS118 (JC7518) (DS150)	~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

## Note

1. Please adjust cutting conditions according to machine rigidity or work rigidity.
2. In case of chatter occurring, recommended to reduce a<sub>p</sub> or rpm and keep feed per tooth.
3. a<sub>p</sub> should be reduced when using on low rigidity machine.
4. Use air blow.

**EXTREME SAP**
**EXSAP/MSX Type**
**Recommended cutting conditions**
**EXSAP-11 Type**
**Modular head type / Side milling**

Material	Grade	Tool dia.(mm)									
		30/32/33/35					40				
		4N					5N				
		$\ell$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$\ell$ (mm)	$a_p$ (mm)	$a_p \times a_e$ (mm <sup>2</sup> )	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (S50C, S55C) 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 (GM190, ICD5) 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
Tool & die steel (SKD61, SKD11) 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 (HPM7, PX5, P20) 30-36 HRC	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 (NAK80, HPM1, 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 (SKD61, DAC, DHA) 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
Grey cast iron (FC250) 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 (FCD700) 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
Austenitic stainless steel (SUS304, 316, 317)17Cr	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
Ferritic & martensitic stainless steel (SUS403, 420J2, 430)13Cr	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 (Ti-6Al-4V) 35-43HRC	DS150 (JC7550) (DS118)	~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
Heat resistant alloy (INCO718) 35-43HRC	DS118 (JC7518) (DS150)	~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

**Note**

1. Please adjust cutting conditions according to machine rigidity or work rigidity.
2. In case of chatter occurring, recommended to reduce  $a_p$  or rpm and keep feed per tooth.
3.  $a_p$  should be reduced when using on low rigidity machine.
4. Use air blow.

**EXTREME SAP****EXSAP/MSX Type**

## ■ Recommended cutting conditions

■ **EXSAP-11 Type**

## ■ Facemill type / Face milling

Material	Grade	Tool dia.(mm)									
		40					50/52				
		刃数6N					刃数7N				
		$\ell$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ ( $\text{min}^{-1}$ )	$V_f$ (mm/min)	$\ell$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ ( $\text{min}^{-1}$ )	$V_f$ (mm/min)
Carbon steel (S50C, S55C) 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 (GM190, JCD5) 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
Tool & die steel (SKD61, SKD11) 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 (HPM7, PX5, P20) 30-36 HRC	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 (NAK80, HPM1, 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 (SKD61, DAC, DHA) 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
Grey cast iron (FC250) 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 (FCD700) 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
Austenitic stainless steel (SUS304, 316, 317) 17Cr	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
Ferritic & martensitic stainless steel (SUS403, 420J2, 430) 13Cr	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 (Ti-6Al-4V) 35-43HRC	DS150 (JC7550) (DS118)	~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
Heat resistant alloy (INCO718) 35-43HRC	DS118 (JC7518) (DS150)	~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

## Note

1. Please adjust cutting conditions according to machine rigidity or work rigidity.
2. In case of chatter occurring, recommended to reduce  $a_p$  or rpm and keep feed per tooth.
3.  $a_p$  should be reduced when using on low rigidity machine.
4. Use air blow.
5. In case of slotting, apply 50% or less feed ( $V_f$ ) from standard cutting condition table.

# EXTREME SAP

# EXSAP/MSX Type

■ Recommended cutting conditions

■ **EXSAP-11 Type**

■ Facemill type / Face milling

Material	Grade	Tool dia.(mm)									
		63					80				
		7N					8N				
		ℓ (mm)	ap (mm)	ae (mm)	n (mm)	Vf (mm/min)	ℓ (mm)	ap (mm)	ae (mm)	n (min <sup>-1</sup> )	Vf (mm/min)
Carbon steel (S50C, S55C) 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 (GM190, ICD5) 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
Tool & die steel (SKD61, SKD11) 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 (HPM7, PX5, P20) 30-36 HRC	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 (NAK80, HPM1, 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 (SKD61, DAC, DHA) 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
Grey cast iron (FC250) 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 (FCD700) 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
Austenitic stainless steel (SUS304, 316, 317) 17Cr	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
Ferritic & martensitic stainless steel (SUS403, 420J2, 430) 13Cr	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 (Ti-6Al-4V) 35-43HRC	DS150 (JC7550) (DS118)	~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
Heat resistant alloy (INCO718) 35-43HRC	DS118 (JC7518) (DS150)	~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

Note

1. Please adjust cutting conditions according to machine rigidity or work rigidity.
2. In case of chatter occurring, recommended to reduce ap or rpm and keep feed per tooth.
3. ap should be reduced when using on low rigidity machine.
4. Use air blow.
5. In case of slotting , apply 50% or less feed (Vf) from standard cutting condition table.

**EXTREME SAP****EXSAP/MSX Type**

■ Recommended cutting conditions

■ **EXSAP-11 Type**

■ Endmill type / Face milling

Material	Grade	Tool dia.(mm)														
		16					20					25				
		2N					3N					3N				
		ℓ (mm)	a <sub>p</sub> (mm)	a <sub>e</sub> (mm)	n (min <sup>-1</sup> )	V <sub>f</sub> (mm/min)	ℓ (mm)	a <sub>p</sub> (mm)	a <sub>e</sub> (mm)	n (min <sup>-1</sup> )	V <sub>f</sub> (mm/min)	ℓ (mm)	a <sub>p</sub> (mm)	a <sub>e</sub> (mm)	n (min <sup>-1</sup> )	V <sub>f</sub> (mm/min)
Carbon steel (S50C, S55C) 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 (GM190, ICD5) 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
Tool & die steel (SKD61, SKD11) 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 (HPM7, PX5, P20) 30-36 HRC	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 (NAK80, HPM1, 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 (SKD61, DAC, DHA) 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
Grey cast iron (FC250) 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 (FCD700) 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
Austenitic stainless steel (SUS304, 316, 317)17Cr	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
Ferritic & martensitic stainless steel (SUS403, 420J2, 430)13Cr	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 (Ti-6Al-4V) 35-43HRC	DS150 (JC7550) (DS118)	~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
Heat resistant alloy (INCO718) 35-43HRC	DS118 (JC7518) (DS150)	~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

Note

1. Please adjust cutting conditions according to machine rigidity or work rigidity.
2. In case of chatter occurring, recommended to reduce a<sub>p</sub> or rpm and keep feed per tooth.
3. a<sub>p</sub> should be reduced when using on low rigidity machine.
4. Use air blow.
5. In case of slotting, apply 50% or less feed (V<sub>f</sub>) from standard cutting condition table.



**EXTREME SAP**
**EXSAP/MSX Type**
**Recommended cutting conditions**
**EXSAP-11 Type**
**Endmill type / Face milling**

Material	Grade	Tool dia.(mm)									
		30/32					40				
		4N					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 (S50C, S55C) 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 (GM190, ICD5) 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
Tool & die steel (SKD61, SKD11) 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 (HPM7, PX5, P20) 30-36 HRC	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 (NAK80, HPM1, 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 (SKD61, DAC, DHA) 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
Grey cast iron (FC250) 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 (FCD700) 170-300HB	JC8118 (JC8050)	~70	~1.5	~18	1,490	950	~70	~1.6	~24	1,430	1,290
		120	~0.8	~18	1,380	720	170	~1	~24	1,270	950
Austenitic stainless steel (SUS304, 316, 317) 17Cr	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
Ferritic & martensitic stainless steel (SUS403, 420J2, 430) 13Cr	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 (Ti-6Al-4V) 35-43HRC	DS150 (JC7550) (DS118)	~70	~0.8	~12	640	260	~70	~1.4	~16	560	310
		120	~0.5	~12	530	170	170	~0.8	~16	480	220
Heat resistant alloy (INCO718) 35-43HRC	DS118 (JC7518) (DS150)	~70	~0.8	~12	320	130	~70	~1.4	~16	240	120
		120	~0.5	~12	270	90	170	~0.8	~16	200	80

**Note**

1. Please adjust cutting conditions according to machine rigidity or work rigidity.
2. In case of chatter occurring, recommended to reduce  $a_p$  or rpm and keep feed per tooth.
3.  $a_p$  should be reduced when using on low rigidity machine.
4. Use air blow.
5. In case of slotting, apply 50% or less feed ( $V_f$ ) from standard cutting condition table.

**EXTREME SAP****EXSAP/MSX Type**

## ■ Recommended cutting conditions

■ **EXSAP-11 Type**

## ■ Modular head type / Face milling

Material	Grade	Tool dia.(mm)														
		16/17/18					20/21					25/26/28				
		2N					3N					3N				
		ℓ (mm)	a <sub>p</sub> (mm)	a <sub>e</sub> (mm)	n (min <sup>-1</sup> )	V <sub>f</sub> (mm/min)	ℓ (mm)	a <sub>p</sub> (mm)	a <sub>e</sub> (mm)	n (min <sup>-1</sup> )	V <sub>f</sub> (mm/min)	ℓ (mm)	a <sub>p</sub> (mm)	a <sub>e</sub> (mm)	n (min <sup>-1</sup> )	V <sub>f</sub> (mm/min)
Carbon steel (S50C, S55C) 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 (GM190, ICD5) 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
Tool & die steel (SKD61, SKD11) 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 (HPM7, PX5, P20) 30-36 HRC	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 (NAK80, HPM1, 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 (SKD61, DAC, DHA) 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
Grey cast iron (FC250) 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 (FCD700) 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
Austenitic stainless steel (SUS304, 316, 317) 17Cr	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
Ferritic & martensitic stainless steel (SUS403, 420J2, 430) 13Cr	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 (Ti-6Al-4V) 35-43HRC	DS150 (JC7550) (DS118)	~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
Heat resistant alloy (INCO718) 35-43HRC	DS118 (JC7518) (DS150)	~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

## Note

1. Please adjust cutting conditions according to machine rigidity or work rigidity.
2. In case of chatter occurring, recommended to reduce a<sub>p</sub> or rpm and keep feed per tooth.
3. a<sub>p</sub> should be reduced when using on low rigidity machine.
4. Use air blow.
5. In case of slotting, apply 50% or less feed (V<sub>f</sub>) from standard cutting condition table.

**EXTREME SAP**

**EXSAP/MSX Type**

■ Recommended cutting conditions

■ **EXSAP-11 Type**

■ Modular head type / Face milling

Material	Grade	Tool dia.(mm)									
		30/32/33/35					40				
		4N					5N				
		$\ell$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)	$\ell$ (mm)	$a_p$ (mm)	$a_e$ (mm)	$n$ (min <sup>-1</sup> )	$V_f$ (mm/min)
Carbon steel (S50C, S55C) 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 (GM190, ICD5) 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
Tool & die steel (SKD61, SKD11) 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 (HPM7, PX5, P20) 30-36 HRC	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 (NAK80, HPM1, 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 (SKD61, DAC, DHA) 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
Grey cast iron (FC250) 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 (FCD700) 170-300HB	JC8118 (JC8050)	~160	~1.5	~18	1,490	950	~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	1,270	510	290	~0.4	~24	1,110	670
Austenitic stainless steel (SUS304, 316, 317) 17Cr	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
Ferritic & martensitic stainless steel (SUS403, 420J2, 430) 13Cr	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 (Ti-6Al-4V) 35-43HRC	DS150 (JC7550) (DS118)	~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
Heat resistant alloy (INCO718) 35-43HRC	DS118 (JC7518) (DS150)	~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

Note

1. Please adjust cutting conditions according to machine rigidity or work rigidity.
2. In case of chatter occurring, recommended to reduce  $a_p$  or rpm and keep feed per tooth.
3.  $a_p$  should be reduced when using on low rigidity machine.
4. Use air blow.
5. In case of slotting , apply 50% or less feed ( $V_f$ ) from standard cutting condition table.