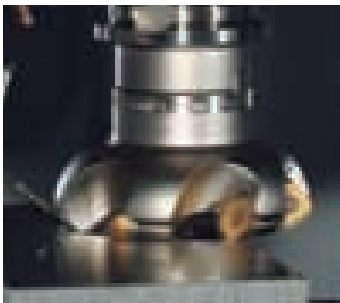


2007

Cutting Tools



Solid Carbide Endmills

Selection Guides

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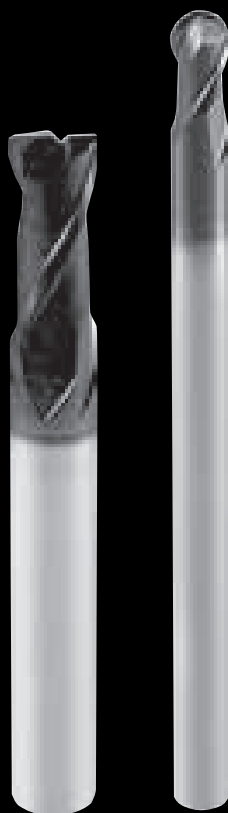
Specifications

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 - SED2000F(-L), SED4000F(-L), SEE4000F, SEE4000FP
- **Non-ferrous materials** 397
 - SEE2000NA, SEE4000NA
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 - SEF4000F(-L), SEF6000F(-L)
- **Die engraving** 401
 - SBD2000FN(-NL, -LS)

Part details 403







Regrinding procedure 404

9101



Features

P : Without chamfer

Application	Feature	Appearance	Cat. No.	Cutting edge	No. of flute	Mill dia. (mm)	Coated
General purpose (Steel, Cast iron etc.)	For steel, cast iron and hardened steel		SED2000F(-L)		2	ø1.0 ~ ø20.0	Flash
			SED4000F(-L)		4	ø2.0 ~ ø20.0	Flash
	For high-feed side and slot milling For steel, cast iron and difficult-to-cut materials		SEE4000F		4	ø4.0 ~ ø20.0	Flash
			SEE4000FP	P	4	ø4.0 ~ ø20.0	Flash
Hardened steel	With large helix angle for hardened steel		SEF4000F(-L)		4	ø3.0 ~ ø5.5	Flash
			SEF6000F(-L)		6	ø6.0 ~ ø20.0	Flash
Non-ferrous metals	Uncoated square endmills with sharp cutting edges		SEE2000NA	P	2	ø1.0 ~ ø16.0	-
			SEE4000NA	P	4	ø3.0 ~ ø16.0	-
Die Engraving Ball nose endmills	Ball endmills for various materials		SBD2000FN (-NL, -LS)		2	ø1.0 ~ ø20.0	Flash

R : Roughing M : Medium F : Finishing

Work materials																Application							Type	Page
Carbon steels, Alloy steels			Cast irons			Stainless steels			High Hardened steels more than HRC50	Heat resistant alloys		Light alloys		Copper, Carbon		Side milling	Slot milling	Plunging	Key-way	Taper	Copying	Thread milling		
R	M	F	R	M	F	R	M	F	M	F	M	F	M	F	M	F								
○	○	○	○	○	○			○									○	○	○				2 flutes for general machining	393
○	○	○	○	○	○			○									○						4 flutes for general machining	394
○	○	○	○	○	○			○	○			○	○				○	○	○				Multi-functional end mill with 4 flutes For 1xD slot milling	396
○	○	○	○	○	○			○	○			○	○				○	○	○				Multi-functional sharp-edge type endmill with 4 flutes For slot milling < 0.2xD	396
		○							○	○		○				○	×	×				Performs well in small cutting depth and high feed machining	399	
		○								○		○				○	×	×						
													○	○	○	○	○	○	○				Sharpness-priority type	397
													○	○	○	○	○	○						
	○	○		○	○			○	○	○		○	○								○		Suitable cutting edge with both sharpness and strong edge	401

○ : Best suitable ○ : Usable × : Unusable

Nomenclature

(Example)



1 Type

Symbol	Type
S	solid carbide

2 Shape

Symbol	Type
E	Square
B	Ball nose

3 Helix angle

Symbol	Type
D	$\theta \approx 30^\circ$
E	$\theta \approx 45^\circ$
F	$\theta \geq 60^\circ$

4 No. of flutes

Symbol	Type
2	2 flutes
4	4 flutes
6	6 flutes

5 Mill dia.

6 Specification

Symbol	Description
-L	Long flute
-NL	Long taper neck
-LS	Long
F	Flash coat
NA	For non-ferrous metals
FN	Toughness-priority (Flash coat)
FP	Without chamfer (Flash coat)

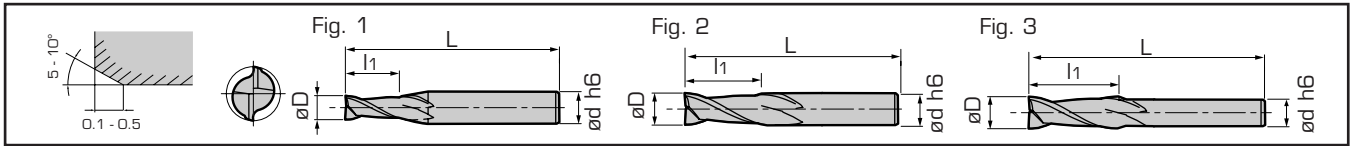
SED2000F / SED2000F-L / SED4000F / SED4000F-L



- Steels
- Stainless steels
- Cast irons
- Hardened steels

- 30° helix angle
- 2 and 4 flute
- Shoulder milling and slotting

øD (mm)	Tolerance (mm)
ø1.0 - ø2.9	0 -0.020
ø3.0 - ø6.0	-0.010 -0.030
ø6.5 - ø10.5	-0.010 -0.035
ø11.0 - ø16.0	-0.010 -0.040
ø17.0 - ø20.0	-0.015 -0.045



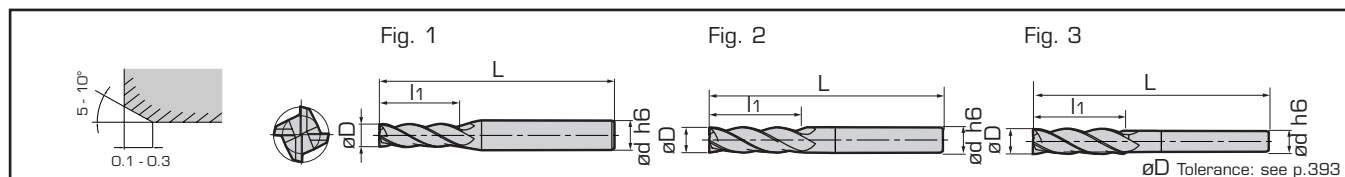
SED2000F (Standard)

● Standard stock in Europe ○ Standard stock in Japan

Cat. No.	Stock	No. of teeth	Dimensions (mm)				Fig.	Cat. No.	Stock	No. of teeth	Dimensions (mm)				Fig.					
			øD	l1	L	ød					øD	l1	L	ød						
SED2010F	●	2	1.0	2.5	40	4.0	1	SED2050F	●	2	5.0	13.0	50	6.0	1					
SED2011F	○		1.1					SED2055F	○		5.5					2				
SED2012F	○		1.2	3.0				60	8.0		SED2060F				●	6.0	16.0	60	8.0	1
SED2013F	○		1.3								SED2065F				○	6.5				
SED2014F	○		1.4	4.0				70	10.0		SED2070F	○	7.0	19.0	70	10.0	1			
SED2015F	○		1.5								SED2075F	○	7.5							
SED2016F	○		1.6	5.0				80	12.0		SED2080F	●	8.0	22.0	80	12.0	2			
SED2017F	○		1.7								SED2085F	○	8.5							
SED2018F	○		1.8	6.0				90	16.0		SED2090F	○	9.0	26.0	90	16.0	1			
SED2019F	○		1.9								SED2095F	○	9.5							
SED2020F	●		2.0	7.0	100	20.0		SED2100F	●		10.0	30.0	100	20.0	2					
SED2021F	○		2.1					SED2105F	○		10.5									
SED2022F	○		2.2	8.0	45	6.0		SED2110F	○		11.0	32.0	90	16.0	3					
SED2023F	○		2.3					SED2115F	○		11.5									
SED2024F	○		2.4	10.0	6.0	12.0		SED2120F	●		12.0	35.0	100	20.0	2					
SED2025F	○		2.5					SED2125F	○		12.5									
SED2026F	○		2.6	11.0	10.0	16.0		SED2130F	○		13.0	40.0	110	20.0	1					
SED2027F	○		2.7					SED2140F	○		14.0									
SED2028F	○		2.8	12.0	10.0	20.0		SED2150F	○		15.0	50.0	110	20.0	1					
SED2029F	○		2.9					SED2160F	○		16.0									
SED2030F	●	3.0	13.0	10.0	25.0	SED2170F	○	17.0	55.0	110	20.0	1								
SED2035F	○	3.5				SED2180F	○	18.0												
SED2040F	●	4.0	14.0	10.0	30.0	SED2190F	○	19.0	60.0	120	25.0	1								
SED2045F	○	4.5				SED2200F	○	20.0												

SED2000F-L (Long flute type)

Cat. No.	Stock	No. of teeth	Dimensions (mm)				Fig.	Cat. No.	Stock	No. of teeth	Dimensions (mm)				Fig.					
			øD	l1	L	ød					øD	l1	L	ød						
SED2010F-L	○	2	1.0	3.5	40	4.0	1	SED2090F-L	○	2	9.0	25.0	90	10.0	1					
SED2015F-L	○		1.5	5.0				SED2095F-L	○		9.5					2				
SED2020F-L	○		2.0	8.0				50	6.0		SED2100F-L				○	10.0	30.0	90	12.0	1
SED2025F-L	○		2.5	10.0							SED2105F-L				○	10.5				
SED2030F-L	○		3.0	12.0				60	8.0		SED2110F-L	○	11.0	35.0	100	15.0	2			
SED2035F-L	○		3.5	15.0							SED2115F-L	○	11.5							
SED2040F-L	○		4.0	16.0				70	10.0		SED2120F-L	○	12.0	40.0	110	20.0	1			
SED2045F-L	○		4.5								SED2130F-L	○	13.0							
SED2050F-L	○		5.0	17.0				80	12.0		SED2140F-L	○	14.0	45.0	120	25.0	2			
SED2055F-L	○		5.5								20.0	60	2					SED2150F-L	○	15.0
SED2060F-L	○		6.0	18.0	90	10.0		SED2160F-L	○		16.0	50.0	130	30.0	1					
SED2065F-L	○		6.5					25.0	70		8.0					1	SED2170F-L	○	17.0	
SED2070F-L	○		7.0	19.0	100	12.0		SED2180F-L	○		18.0	55.0	140	35.0	2					
SED2075F-L	○		7.5					25.0	70		8.0					1	SED2190F-L	○	19.0	
SED2080F-L	○		8.0	20.0	110	15.0		SED2200F-L	○		20.0	60.0	150	40.0	1					
SED2085F-L	○		8.5					90	10.0		1									



SED4000F (Standard)

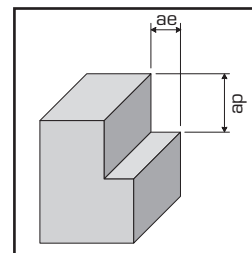
● Standard stock in Europe ○ Standard stock in Japan

Cat. No.	Stock	No. of teeth	Dimensions (mm)				Fig.	Cat. No.	Stock	No. of teeth	Dimensions (mm)				Fig.
			øD	l ₁	L	ød					øD	l ₁	L	ød	
SED4020F	●	4	2.0	6.0	40	4.0	1	SED4095F	○	4	9.5	19.0	70	10.0	1
SED4025F	○		2.5	8.0				45	6.0		SED4100F	●			10.0
SED4030F	●		3.0		10.0	60					8.0	SED4105F	○	10.5	26.0
SED4035F	○		3.5	11.0				70	8.0			SED4110F	○	11.0	
SED4040F	●		4.0		13.0	80					8.0	SED4115F	○	11.5	32.0
SED4045F	○		4.5	16.0				90	8.0			SED4120F	●	12.0	
SED4050F	●		5.0		19.0	100					10.0	SED4125F	○	12.5	38.0
SED4055F	○		5.5	25.0				110	10.0			SED4130F	○	13.0	
SED4060F	●		6.0		30.0	120					10.0	SED4140F	○	14.0	45.0
SED4065F	○		6.5	35.0				130	10.0			SED4150F	○	15.0	
SED4070F	○		7.0		40.0	140					10.0	SED4160F	○	16.0	55.0
SED4075F	○		7.5	45.0				150	10.0			SED4170F	○	17.0	
SED4080F	●		8.0		50.0	160					10.0	SED4180F	○	18.0	65.0
SED4085F	○		8.5	55.0				170	10.0			SED4190F	○	19.0	
SED4090F	○		9.0		60.0	180					10.0	SED4200F	○	20.0	75.0

SED4000F-L (Long flute type)

Cat. No.	Stock	No. of teeth	Dimensions (mm)				Fig.	Cat. No.	Stock	No. of teeth	Dimensions (mm)				Fig.
			øD	l ₁	L	ød					øD	l ₁	L	ød	
SED4030F-L	○	4	3.0	12.0	50	6.0	1	SED4100F-L	○	4	10.0	30.0	90	12.0	2
SED4035F-L	○		3.5	15.0				60	8.0		SED4105F-L				○
SED4040F-L	○		4.0		20.0	70					8.0	SED4110F-L	○	11.0	40.0
SED4045F-L	○		4.5	25.0				80	8.0			SED4115F-L	○	11.5	
SED4050F-L	○		5.0		30.0	90					10.0	SED4120F-L	○	12.0	50.0
SED4055F-L	○		5.5	35.0				100	10.0			SED4125F-L	○	12.5	
SED4060F-L	○		6.0		40.0	110					10.0	SED4130F-L	○	13.0	60.0
SED4065F-L	○		6.5	45.0				120	10.0			SED4140F-L	○	14.0	
SED4070F-L	○		7.0		50.0	130					10.0	SED4150F-L	○	15.0	70.0
SED4075F-L	○		7.5	55.0				140	10.0			SED4160F-L	○	16.0	
SED4080F-L	○		8.0		60.0	150					10.0	SED4170F-L	○	17.0	80.0
SED4085F-L	○		8.5	65.0				160	10.0			SED4180F-L	○	18.0	
SED4090F-L	○		9.0		70.0	170					10.0	SED4190F-L	○	19.0	90.0
SED4095F-L	○		9.5	75.0				180	10.0			SED4200F-L	○	20.0	

Cutting parameter



SED2000F / SED4000F

Shoulder milling $ap \leq 1.5D$, $ae \leq 0.2D$

Work materials	Carbon steels / Cast irons		Alloy steels / Tool steels		Stainless steels		Hardened steels	
Hardness	$\leq 30\text{HRC}$		$\leq 40\text{HRC}$		-		$\leq 45\text{HRC}$	
Vc (m/min)	70 - 100		30 - 60		30 - 60		20 - 40	
Conditions D	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)
$\varnothing 1.0$	27070	350	14430	140	14430	140	9550	60
$\varnothing 2.0$	13540		7170		7170		4780	
$\varnothing 3.0$	9020		4780		4780		3190	
$\varnothing 4.0$	6770	340	3580	180	3580	140	2390	65
$\varnothing 5.0$	5410		2870		2870		1910	
$\varnothing 6.0$	4510		2390		2390		1590	
$\varnothing 8.0$	3380	350	1790	180	1790	140	1190	65
$\varnothing 10.0$	2710		1430		1430		960	
$\varnothing 12.0$	2260		1190		1190		800	
$\varnothing 16.0$	1690	340	890	180	890	140	600	70
$\varnothing 20.0$	1350		710		710		470	

Note:

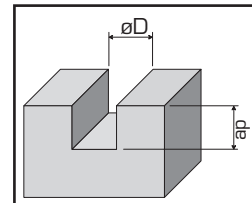
Down cut is generally recommended.

For easy chip flow, air-cooling rev. minimal quantity lubrication is recommended.

The above cutting parameter are suited for 2-flute endmills (SED2000F).

For 4-flute endmills (SED4000F) feed rate should be 1.5 times higher at unchanged number of revolutions.

When using tools with long flutes the number of revolutions and feed rate should be reduced to 50%.

Slotting $ap \leq 0.5D$ (for $D \leq \varnothing 3.0$, $ap \leq 0.25D$ is recommended.)

Work materials	Carbon steels / Cast irons		Alloy steels / Tool steels		Stainless steels		Hardened steels		
Hardness	$\leq 30\text{HRC}$		$\leq 40\text{HRC}$		-		$\leq 45\text{HRC}$		
Vc (m/min)	35 - 50		15 - 30		15 - 30		10 - 20		
Conditions D	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	
$\varnothing 1.0$	13540	170	7170	70	7170	70	4780	30	
$\varnothing 2.0$	6770		3580	65	3580		2390		
$\varnothing 3.0$	4510		2390	65	2390		1590		
$\varnothing 4.0$	3380	175	1790	90	1790	70	1190	35	
$\varnothing 5.0$	2710	170	1430		90		1430		960
$\varnothing 6.0$	2260		1190		85		1190		800
$\varnothing 8.0$	1690		175	900	90	900	600		
$\varnothing 10.0$	1350	170	720	85	720	65	480	35	
$\varnothing 12.0$	1130		600	80	600		400		
$\varnothing 16.0$	850		440	80	440		300		
$\varnothing 20.0$	680		360	80	360		230		

Note:

Down cut is generally recommended.

For easy chip flow, air-cooling rev. minimal quantity lubrication is recommended.

The above cutting parameter are suited for 2-flute endmills (SED2000F).

For tools with 4 flutes (SED4000F) feed rate should be 75% of above data at unchanged number of revolutions.

Tools with long flutes are not suited for slotting.

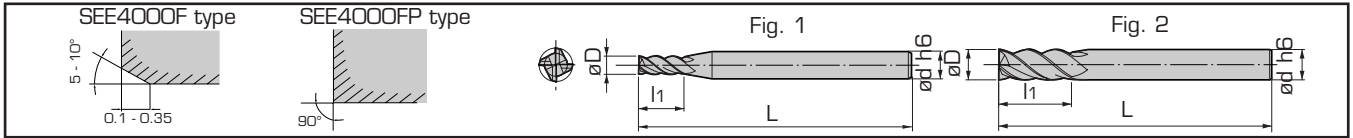
SEE4000F



- Steels
- Stainless steels
- Cast irons
- Heat resistant alloys

- 40° helix angle
- 4 flute
- Shoulder milling and slotting

øD (mm)	Tolerance (mm)
ø4.0 - ø6.0	-0.010 -0.030
ø7.0 - ø10.0	-0.010 -0.035
ø11.0 - ø16.0	-0.010 -0.040
ø17.0 - ø20.0	-0.015 -0.045



SEE4000F (Standard)

● Standard stock in Europe ○ Standard stock in Japan

Cat. No.	Stock	No. of teeth	Dimensions (mm)				Fig.	Cat. No.	Stock	No. of teeth	Dimensions (mm)				Fig.
			øD	l1	L	ød					øD	l1	L	ød	
SEE4040F	●	4	4.0	11.0	45	6.0	1	●	4	13.0	26.0	75	16.0	1	
SEE4050F	●		5.0	13.0	50					14.0					
SEE4060F	●		6.0			15.0	30.0			80					20.0
SEE4070F	●		7.0	16.0	32	90					20.0				
SEE4080F	●		8.0	19.0			38			100		2			
SEE4090F	●		9.0	22.0	70	10.0					1				
SEE4100F	●		10.0				11.0			75		12.0	2		
SEE4110F	●		11.0	12.0	26.0	2					1				
SEE4120F	●		12.0				26.0			2		2	2		
SEE4130F	●		4	13.0	26.0	75					16.0				●
SEE4140F	●	14.0		30.0			80	20.0							
SEE4150F	●	15.0							38	100		2			
SEE4160F	●	16.0		19.0	70	10.0	1								
SEE4170F	●	17.0						11.0	75	12.0	2				
SEE4180F	●	18.0		12.0	26.0	2	1								
SEE4190F	●	19.0						26.0	2	2	2				
SEE4200F	●	20.0		26.0	2	2	2								

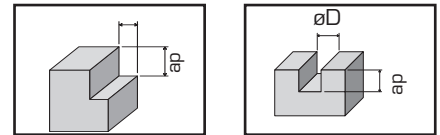
SEE4000FP

Cat. No.	Stock	No. of teeth	Dimensions (mm)				Fig.	Cat. No.	Stock	No. of teeth	Dimensions (mm)				Fig.
			øD	l1	L	ød					øD	l1	L	ød	
SEE4040FP	●	4	4.0	11.0	45	6.0	1	●	4	13.0	26.0	75	16.0	1	
SEE4050FP	●		5.0	13.0	50					14.0					
SEE4060FP	●		6.0			15.0	30.0			80					20.0
SEE4070FP	●		7.0	16.0	32	90					20.0				
SEE4080FP	●		8.0	19.0			38			100		2			
SEE4090FP	●		9.0	22.0	70	10.0					1				
SEE4100FP	●		10.0				11.0			75		12.0	1		
SEE4110FP	●		11.0	12.0	26.0	2					1				
SEE4120FP	●		12.0				26.0			2		2	2		
SEE4130FP	●		4	13.0	26.0	75					16.0				●
SEE4140FP	●	14.0		30.0			80	20.0							
SEE4150FP	●	15.0							38	100		2			
SEE4160FP	●	16.0		19.0	70	10.0	1								
SEE4170FP	●	17.0						11.0	75	12.0	2				
SEE4180FP	●	18.0		12.0	26.0	2	1								
SEE4190FP	●	19.0						26.0	2	2	2				
SEE4200FP	●	20.0		26.0	2	2	2								

Cutting parameter

SEE4000F

Shoulder milling and Slotting



Work materials	Carbon steels / Cast irons		Alloy steels / Prehardened steels		Stainless steels (e.g. X5CrNi18-10)		Heat resistant alloys (e.g. Inconel, Hastelloy)		
Hardness	≤ 30HRC		≤ 40HRC		-		≤ 45HRC		
Vc (m/min)	60 - 80		50 - 65		20 - 35		10 - 18		
Shoulder milling	ap ≤ 1.5D, ae ≤ 0.1D						ap ≤ 1.5D, ae ≤ 0.05D		
Slotting	ap ≤ 1.0D				ap ≤ 0.5D		ap ≤ 0.2D		
Conditions	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	
ø 4.0	6300	760	5100	510	2700	210	1400	80	
ø 5.0	5000	810	4100	520	2200	220	1100		
ø 6.0	4200	850	3400	540	1800	210	950	90	
ø 7.0	3600	870	2900	710	1500	310	810		
ø 8.0	3100	880	2500	720	1300	360	710	100	
ø 9.0	2800	910	2200	730	1200	370	630		
ø 10.0	2500		2000		1100	360	570	110	
ø 11.0	2300	930	1800	660	1000	320	520	100	
ø 12.0	2100	850	1700	620	920	300	470		
ø 13.0	1900	780	1500	570	850	270	440	90	
ø 14.0	1800	720	1400	530	790	250	400		
ø 15.0	1600	670	1300	490	740	230	380	80	
ø 16.0	1500	700	1200	460	690	250	350		
ø 17.0	1400	650		430	650	230	330	70	
ø 18.0		620	410	610	220	310			
ø 19.0	1300	580	1000	390	580	210	300		
ø 20.0	1200	560		370	550	200	280		

SEE4000FP

Shoulder milling and Slotting

Work materials	Carbon steels / Cast irons		Alloy steels / Prehardened steels		Stainless steels (e.g. X5CrNi18-10)	
Hardness	≤ 30HRC		≤ 40HRC		-	
Vc (m/min)	50 - 80		35 - 65		20 - 45	
Shoulder milling	ap ≤ 1.0D, ae ≤ 0.01D					
Slotting	ap ≤ 0.2D					
Conditions	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)
D						
ø 4.0	5500	440	4300	280	2700	160
ø 5.0	4400	350	3500		2200	
ø 6.0	3700	440	2900	350	1800	140
ø 7.0	3100		2500		1500	150
ø 8.0	2700		2100		1300	160
ø 9.0	2400	400	1900	310	1200	150
ø 10.0	2200		1700		1100	150
ø 11.0	2000	370	1500	290	1000	160
ø 12.0	1800	340	1400	260	920	150
ø 13.0	1700	310	1300	250	850	140
ø 14.0	1500	290	1200	230	790	140
ø 15.0	1400	270	1100	210	740	130
ø 16.0	1300	300	1000	200	690	
ø 17.0		280		650		
ø 18.0	1200	270	970	190	610	120
ø 19.0	1100	280	920	180	580	110
ø 20.0		260	870	170	550	

Note SEE4000F + SEE4000FP:


Down cut is generally recommended.

For easy chip flow, air-cooling rev. minimal quantity lubrication is recommended.

When machining stainless steels and heat resistant alloys coolant (water soluble or water insoluble) should be used.

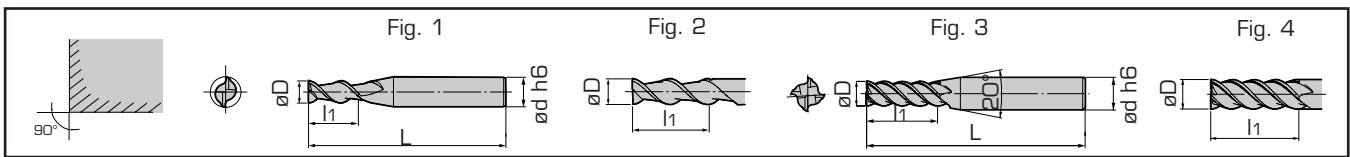
Tool overhang should be as small as possible. Number of revolutions and feed rate should be reduced to minimise vibrations.

SEE2000NA / SEE4000NA

 Aluminium and nonferrous metals

- 47° helix angle
- 2 and 4 flute
- Extreme sharp cutting edge
- Shoulder milling and slotting

øD (mm)	Tolerance (mm)
ø1.0 - ø2.0	0 -0.030
ø3.0 - ø6.0	-0.010 -0.040
ø7.0 - ø10.0	-0.010 -0.045
ø11.0 - ø16.0	-0.010 -0.050



SEE2000NA

● Standard stock in Europe ○ Standard stock in Japan

Cat. No.	Stock	No. of teeth	Dimensions (mm)				Fig.	Cat. No.	Stock	No. of teeth	Dimensions (mm)				Fig.
			øD	l1	L	ød					øD	l1	L	ød	
SEE2010NA	○	2	1.0	3.0	40	4.0	1	SEE2090NA	○	2	9.0	19.0	70	10.0	1
SEE2020NA	○		2.0	6.0				SEE2100NA	○		10.0	22.0			2
SEE2030NA	○		3.0	8.0	45	6.0		SEE2110NA	○		11.0	75	12.0	1	
SEE2040NA	○		4.0	11.0				SEE2120NA	○		12.0			2	
SEE2050NA	○		5.0	13.0	50	8.0		SEE2130NA	○		13.0	90	16.0	1	
SEE2060NA	○		6.0					SEE2140NA	○		14.0				
SEE2070NA	○		7.0	16.0	60	1		SEE2150NA	○		15.0	30.0	2		
SEE2080NA	○		8.0	19.0	8.0	2		SEE2160NA	○		16.0	32.0			

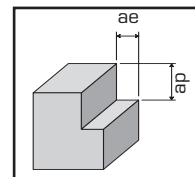
SEE4000NA

Cat. No.	Stock	No. of teeth	Dimensions (mm)				Fig.	Cat. No.	Stock	No. of teeth	Dimensions (mm)				Fig.
			øD	l1	L	ød					øD	l1	L	ød	
SEE4030NA	○	4	3.0	10.0	45	6.0	3	SEE4100NA	○	4	10.0	26.0	70	10.0	4
SEE4040NA	○		4.0	13.0				SEE4110NA	○		11.0				3
SEE4050NA	○		5.0	15.0	50	8.0		SEE4120NA	○		12.0	75	12.0	4	
SEE4060NA	○		6.0	16.0				SEE4130NA	○		13.0				
SEE4070NA	○		7.0	20.0	60	3		SEE4140NA	○		14.0	32.0	90	16.0	3
SEE4080NA	○		8.0	21.0	8.0	4		SEE4150NA	○		15.0				
SEE4090NA	○		9.0	24.0	70	3		SEE4160NA	○		16.0	4			

Cutting parameter

SEE2000NA / SEE4000NA

Shoulder milling



Work materials	Aluminium		Aluminium alloys (Si)		Aluminium alloys (Mg)		Aluminium alloys (Zn-Mg)		Copper alloys	
Vc (m/min)	250 - 300		30 - 50		75 - 125		200 - 250		30 - 60	
Shoulder milling	ap ≤ 1.5D, ae ≤ 0.2D								ap ≤ 1.5D, ae ≤ 0.1D	
Conditions D	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)
∅ 1.0	47770	800	7960	200	19110	380	39810	400	14330	150
∅ 2.0	43790	780	6370	160	15920	320	35830	360	7170	
∅ 3.0	29190		4250	170	10620	330	23890	350	4780	
∅ 4.0	21900	1000	3190	220	7960	440	17910	490	3580	
∅ 5.0	17520	1010	2550	230	6370		14330	500	2870	
∅ 6.0	14600	1000	2120		260	5310	450	11940	490	2390
∅ 8.0	10950		1590	3980		520	8960	580	1790	
∅ 10.0	8760	1190	1270	3190	7170		580		1430	
∅ 12.0	7300		1060	290	2650	600	5970	680	1190	
∅ 16.0	5470	800	280	1990	4480		900			

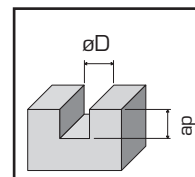
Note:

Down cut is generally recommended.

For easy chip flow, air-cooling rev. minimal quantity lubrication is recommended.

The above cutting parameter are suited for 2-flute endmills (SEE2000NA).

For 4-flute endmills (SEE4000NA) feed rate should be 1.5 times higher at unchanged number of revolutions.



Slotting

Work materials	Aluminium		Aluminium alloys (Si)		Aluminium alloys (Mg)		Aluminium alloys (Zn-Mg)		Copper alloys	
Vc (m/min)	250 - 300		30 - 50		75 - 125		200 - 250		30 - 60	
Slotting	ap ≤ 1.0D								ap ≤ 0.5D	
Conditions D	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)
∅ 1.0	47770	560	7960	140	19110	270	39810	280	14330	110
∅ 2.0	43790	550	6370	110	15920	220	35830	250	7170	100
∅ 3.0	29190		4250	120	10620	230	23890			
∅ 4.0	21900	680	3190	140	7960	310	17910	350	3580	110
∅ 5.0	17520	690	2550	150	6370		14330		2870	
∅ 6.0	14600	680	2120		170	5310	320	11940	410	2390
∅ 8.0	10950		1590	3980		370	8960	410		1790
∅ 10.0	8760	820	1270	3190	7170		480		1430	
∅ 12.0	7300		1060	290	2650	430		5970	1190	
∅ 16.0	5470	800	280	1990	420	4480	900			

Note:

Down cut is generally recommended.

For easy chip flow, air-cooling rev. minimal quantity lubrication is recommended.

The above cutting parameter are suited for 2-flute endmills (SEE2000NA).

For tools with 4 flutes (SEE4000NA) ap should be ≤ 0.5D.

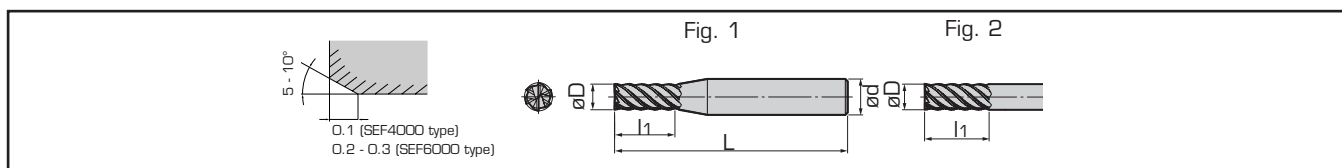
SEF4000F / SEF4000F-L / SEF6000F / SEF6000F-L



Hardened steels
up to 70 HRC

- 45° helix angle
- 4 and 6 flute
- Shoulder milling

øD (mm)	Tolerance (mm)
ø3.0 - ø6.0	-0.010 -0.030
ø6.5 - ø10.5	-0.010 -0.035
ø11.0 - ø16.0	-0.010 -0.040
ø17.0 - ø20.0	-0.015 -0.045



SEF4000F / SEF6000F (Standard)

● Standard stock in Europe ○ Standard stock in Japan

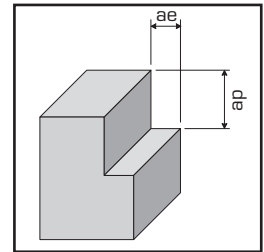
Cat. No.	Stock	No. of teeth	Dimensions (mm)				Fig.	Cat. No.	Stock	No. of teeth	Dimensions (mm)				Fig.
			øD	l1	L	ød					øD	l1	L	ød	
SEF4030F	●	4	3.0	10.0	60	6.0	1	SEF6100F	●	6	10.0	25.0	80	10.0	2
SEF4035F	●		3.5	12.0				SEF6105F	●		10.5	30.0	100	12.0	1
SEF4040F	●		4.0	15.0				SEF6110F	●		11.0				
SEF4045F	●		4.5					SEF6115F	●		11.5				
SEF4050F	●		5.0					SEF6120F	●		12.0				
SEF4055F	●		5.5					SEF6130F	●		13.0	35.0	16.0	1	
SEF6060F	●	6.0	2	SEF6140F	●	14.0									
SEF6065F	●	6.5	20.0	75	8.0	1	SEF6150F	●	15.0						
SEF6070F	●	7.0				2	SEF6160F	●	16.0	40.0	110	2			
SEF6075F	●	7.5				1	SEF6170F	●	17.0						
SEF6080F	●	8.0				2	SEF6180F	●	18.0	45.0	20.0	1			
SEF6085F	●	8.5	25.0	80	10.0	1	SEF6190F	●	19.0						
SEF6090F	●	9.0				2	SEF6200F	●	20.0				2		
SEF6095F	●	9.5													

SEF4000F-L / SEF6000F-L (Long flute type)

Cat. No.	Stock	No. of teeth	Dimensions (mm)				Fig.	Cat. No.	Stock	No. of teeth	Dimensions (mm)				Fig.
			øD	l1	L	ød					øD	l1	L	ød	
SEF4030F-L	●	4	3.0	15.0	60	6.0	1	SEF6120F-L	●	6	12.0	55.0	120	12.0	2
SEF4040F-L	●		4.0	20.0	65			SEF6130F-L	●		13.0		125	16.0	1
SEF4050F-L	●		5.0	25.0	70			SEF6140F-L	●		14.0				
SEF6060F-L	●		6.0					2	SEF6150F-L		●	15.0	65.0	135	20.0
SEF6070F-L	●	7.0	35.0	90	8.0	1	SEF6160F-L	●	16.0						
SEF6080F-L	●	8.0				2	SEF6170F-L	●	17.0						
SEF6090F-L	●	9.0				1	SEF6180F-L	●	18.0	75.0	155	2			
SEF6100F-L	●	10.0	2	SEF6190F-L	●	19.0									
SEF6110F-L	●	11.0	1	SEF6200F-L	●	20.0									

Cutting parameter

SEF4000F / SEF6000F



HSC Parameter

Work materials	Alloy steels / Prehardened steels		Hardened steels		Hardened steels	
Hardness	35 - 45HRC		45 - 55HRC		55 - 70HRC	
Vc (m/min)	200 - 250					
Shoulder milling	ap ≤ 1.5D, ae ≤ 0.05D			ap ≤ 1.5D, ae ≤ 0.01D		
Conditions D	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)
∅ 3.0	23890	3830	23890	3380	23890	2880
∅ 4.0	17910	4300	17910	3580	17910	2870
∅ 5.0	14330	4570	14330	3450	14330	
∅ 6.0	11940	7080	11940	4950	11940	4250
∅ 8.0	8960	6990	8960	5370	8960	4300
∅ 10.0	7170	6450	7170	5150	7170	
∅ 12.0	5970	5750	5970	5030	5970	4130
∅ 16.0	4480	4840	4480	4300	4480	4030
∅ 20.0	3580	4300	3580	3850	3580	3580

Conventional Parameter

Work materials	Alloy steels / Prehardened steels		Hardened steels		Hardened steels	
Hardness	35 - 45HRC		45 - 55HRC		55 - 70HRC	
Vc (m/min)	80 - 100				60 - 80	
Shoulder milling	ap ≤ 1.5D, ae ≤ 0.1D			ap ≤ 1.5D, ae ≤ 0.05D		
Conditions D	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)
∅ 3.0	9550	740	9550	570	7430	460
∅ 4.0	7170	720	7170	580	5570	450
∅ 5.0	5730	690	5730		4460	460
∅ 6.0	4780	1160	4780	860	3720	670
∅ 8.0	3580	1080	3580		2790	
∅ 10.0	2870	1030	2870		2230	660
∅ 12.0	2390	1020	2390	850	1860	670
∅ 16.0	1790	900	1790	690	1390	580
∅ 20.0	1430	810	1430	730	1120	530

Note:

Down cut is generally recommended.

For easy chip flow, air-cooling rev. minimal quantity lubrication is recommended.

Above cutting parameter are only suited for standard tools (SEF****F).

For tools with long flutes (SEF****F-L) ap = 3.0D at ae = 100 %, n = 50 % und Vf = 50 %.

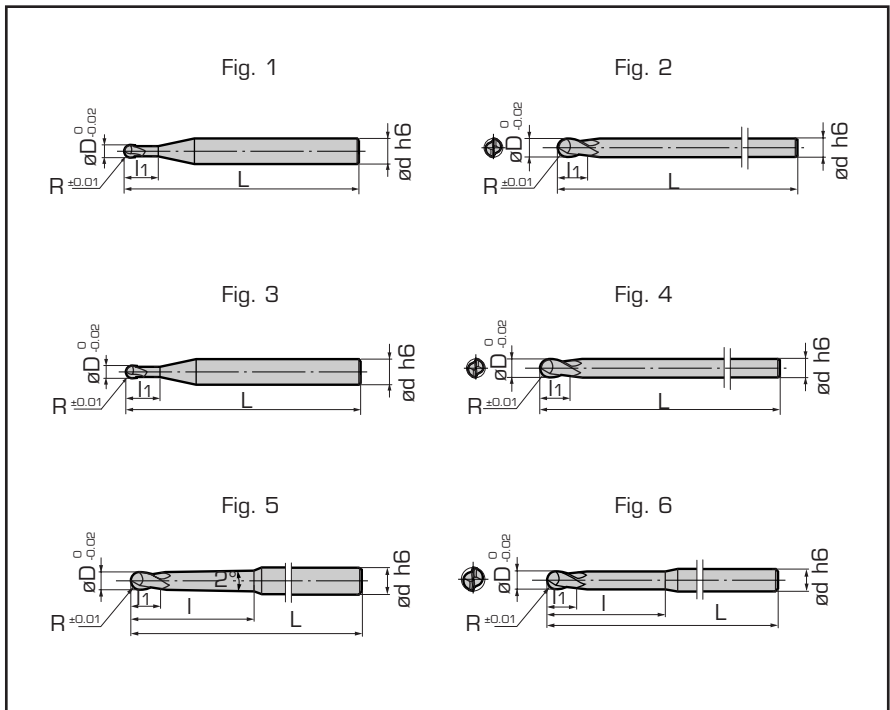
Tool overhang should be as small as possible. Number of revolutions and feed rate should be reduced to minimise vibrations.

SBD2000FN / SBD2000FN-LS / SBD2000FN-NL



- P** Steels
- M** Stainless steels
- K** Cast irons
- S** Heat resistant alloys
- H** Hardened steels

- 15° helix angle (ø1.0 - ø3.0)
- 30° helix angle (ø4.0 - ø20.0)
- 2 flute
- Copy milling / 3D - milling



SBD2000FN (Standard)

● Standard stock in Europe ○ Standard stock in Japan

Cat. No.	Stock	No. of teeth	Dimensions (mm)					Fig.	Cat. No.	Stock	No. of teeth	Dimensions (mm)					Fig.
			øD	R	l1	L	ød					øD	R	l1	L	ød	
SBD2010FN	●	2	1.0	0.5	1.5	50	1	SBD2070FN	●	2	7.0	3.5	11.0	90	1		
SBD2015FN	●		1.5	0.75	2.5			8.0	4.0		12.0	8.0					
SBD2020FN	●		2.0	1.0	3.0	60		SBD2100FN	●		10.0	5.0	15.0	100		2	
SBD2030FN	●		3.0	1.5	4.5			12.0	6.0		18.0	120	12.0				
SBD2040FN	●		4.0	2.0	6.0	70		SBD2160FN	●		16.0	8.0	24.0	125			
SBD2050FN	●		5.0	2.5	7.5			90	SBD2200FN		●	20.0	10.0				30.0
SBD2060FN	●		6.0	3.0	9.0	90		2									

SBD2000FN-LS (Long type)

Cat. No.	Stock	No. of teeth	Dimensions (mm)					Fig.	Cat. No.	Stock	No. of teeth	Dimensions (mm)					Fig.
			øD	R	l1	L	ød					øD	R	l1	L	ød	
SBD2010FN-LS	●	2	1.0	0.5	1.5	80	3	SBD2070FN-LS	●	2	7.0	3.5	11.0	180	3		
SBD2015FN-LS	●		1.5	0.75	2.5			8.0	4.0		12.0	8.0					
SBD2020FN-LS	●		2.0	1.0	3.0	90		SBD2100FN-LS	●		10.0	5.0	15.0	200		4	
SBD2030FN-LS	●		3.0	1.5	4.5			100	6.0		18.0	220	12.0				
SBD2040FN-LS	●		4.0	2.0	6.0	100		SBD2160FN-LS	●		16.0	8.0	24.0	250			
SBD2050FN-LS	●		5.0	2.5	7.5			125	SBD2200FN-LS		●	20.0	10.0				30.0
SBD2060FN-LS	●		6.0	3.0	9.0	150		4									

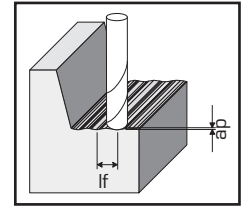
SBD2000FN-NL (Long taper neck type)

Cat. No.	Stock	No. of teeth	Dimensions (mm)						Fig.	Cat. No.	Stock	No. of teeth	Dimensions (mm)						Fig.
			øD	R	l1	l	L	ød					øD	R	l1	l	L	ød	
SBD2030FN-NL	●	2	3.0	1.5	4.5	35.0	5	SBD2070FN-NL	●	2	7.0	3.5	11.0	45.0	125	5			
SBD2040FN-NL	●		4.0	2.0	6.0			100	6.0		8.0	4.0	12.0	55.0			10.0		
SBD2050FN-NL	●		5.0	2.5	7.5	40.0		115	8.0		10.0	5.0	15.0	65.0	140		12.0		
SBD2060FN-NL	●		6.0	3.0	9.0			45.0	115		8.0	12.0	6.0	18.0	75.0		150	16.0	

Cutting parameter

SBD2000FN

Copy milling (Roughing)



Work materials	Carbon steels / Cast irons		Alloy steels / Tool steels / Prehardened steels		Stainless steels		Hardened steels		Hardened steels		Heat resistant alloys (e.g. Inconel, Hastelloy)	
Hardness	≤ 30HRC		≤ 40HRC		-		45 - 55HRC		55 - 70HRC		≤ 45HRC	
Vc (m/min)	200 - 240		150 - 200				130 - 180		100 - 150		60 - 100	
Copy milling	ap ≤ 0.1D, lf ≤ 0.3D											
Conditions D	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)
∅ 1.0	50000	4270	50000	2840	50000	2840	49360	2270	39810	1530	25480	520
∅ 2.0	35030	2120	27870	1680	27870	1680	24680	1470	19900	1200	12740	400
∅ 3.0	23360	1900	18580	1510	18580	1510	16450	1310	13270	1080	8490	350
∅ 4.0	17520	1760	13930	1420	13930	1420	12340	1230	9950	1000	6370	340
∅ 5.0	14010	1710	11150	1330	11150	1330	9870	1200	7960	920	5100	320
∅ 6.0	11680	1670	9290	1270	9290	1270	8230	1110	6640	930	4250	300
∅ 8.0	8760	1430	6970	1130	6970	1130	6170	980	4980	810	3190	260
∅ 10.0	7010	1260	5570	990	5570	990	4940	900	3980	700	2550	240
∅ 12.0	5840	1150	4640	910	4640	910	4110	830	3320	660	2120	220
∅ 16.0	4380	960	3480	780	3480	780	3090	710	2490	560	1590	180
∅ 20.0	3500	780	2790	630	2790	630	2470	550	1990	460	1270	140

Copy milling (Finishing)

Work materials	Carbon steels / Cast irons		Alloy steels / Tool steels / Prehardened steels		Stainless steels		Hardened steels		Hardened steels		Heat resistant alloys (e.g. Inconel, Hastelloy)	
Hardness	≤ 30HRC		≤ 40HRC		-		45 - 55HRC		55 - 70HRC		≤ 45HRC	
Vc (m/min)	150 - 200		130 - 180				100 - 150		80 - 120		50 - 90	
Copy milling	ap ≤ 0.05D, lf ≤ 0.05D											
Conditions D	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)	No. of revolutions n (rpm)	Feed rate Vf (mm/min)
∅ 1.0	50000	2040	50000	1660	50000	1660	47770	1150	38220	970	28660	350
∅ 2.0	31850	1300	28660	1140	28660	1140	23890	970	19110	760	14330	300
∅ 3.0	21230	1180	19110	1050	19110	1050	15920	900	12740	690	9550	270
∅ 4.0	15920	1120	14330	1010	14330	1010	11940	850	9550	650	7170	250
∅ 5.0	12740	1000	11470	920	11470	920	9550	740	7640	620	5730	230
∅ 6.0	10620	940	9550	840	9550	840	7960	720	6370	600	4780	210
∅ 8.0	7960	900	7170	790	7170	790	5970	670	4780	550	3580	200
∅ 10.0	6370	830	5730	750	5730	750	4780	600	3820	500	2870	180
∅ 12.0	5310	770	4780	710	4780	710	3980	600	3190	500	2390	180
∅ 16.0	3980	670	3580	620	3580	620	2990	550	2390	420	1790	150
∅ 20.0	3190	550	2870	490	2870	490	2390	420	1910	320	1430	120

Note:

For easy chip flow, air-cooling rev. minimal quantity lubrication is recommended.

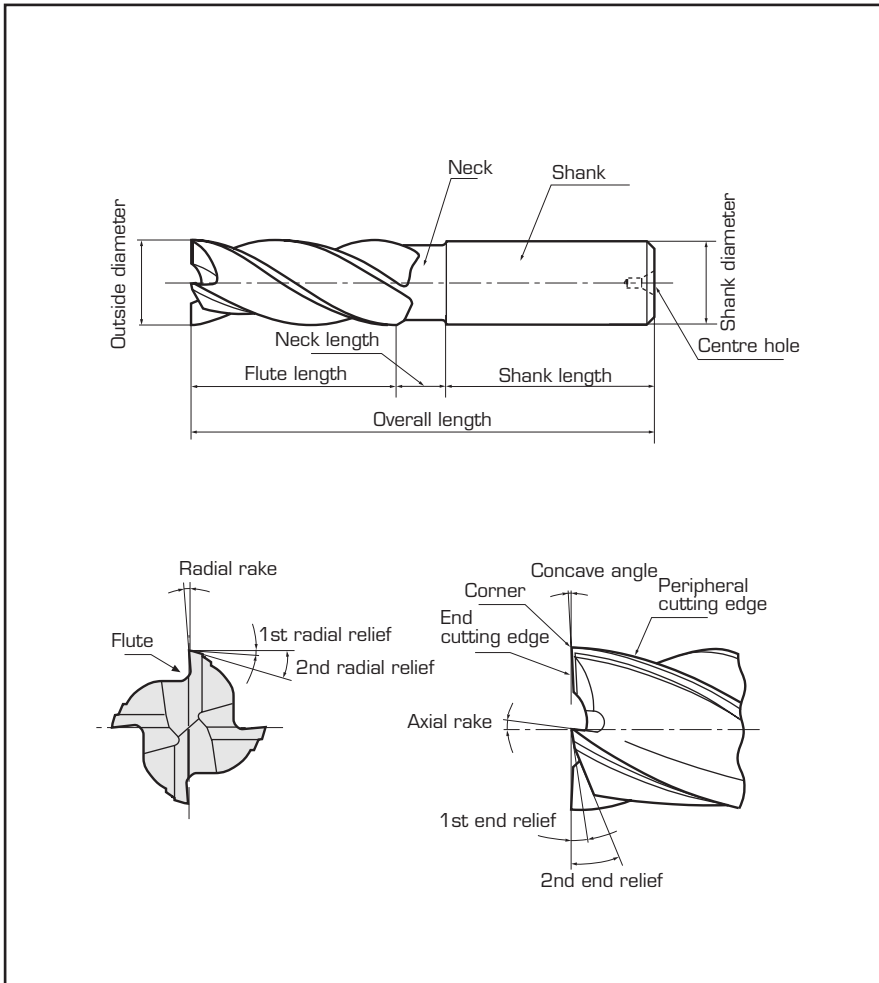
Above cutting parameter are only suited for standard tools (SBD***FN).

For tools with long flutes (SBD***FN-**) ap = 100 % at ae = 100 %, n = 50 % and Vf = 50 %.

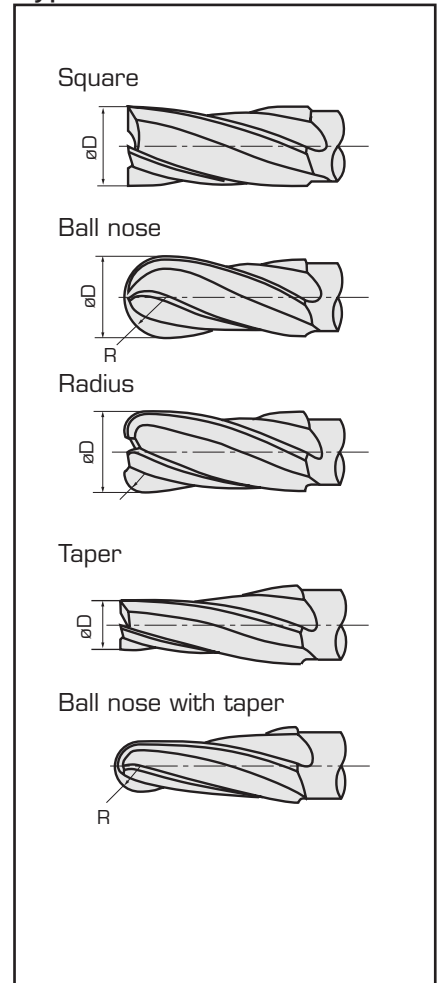
When machining stainless steels and heat resistant alloys coolant (water soluble or water insoluble) should be used.

Tool overhang should be as small as possible. Number of revolutions and feed rate should be reduced to minimise vibrations.

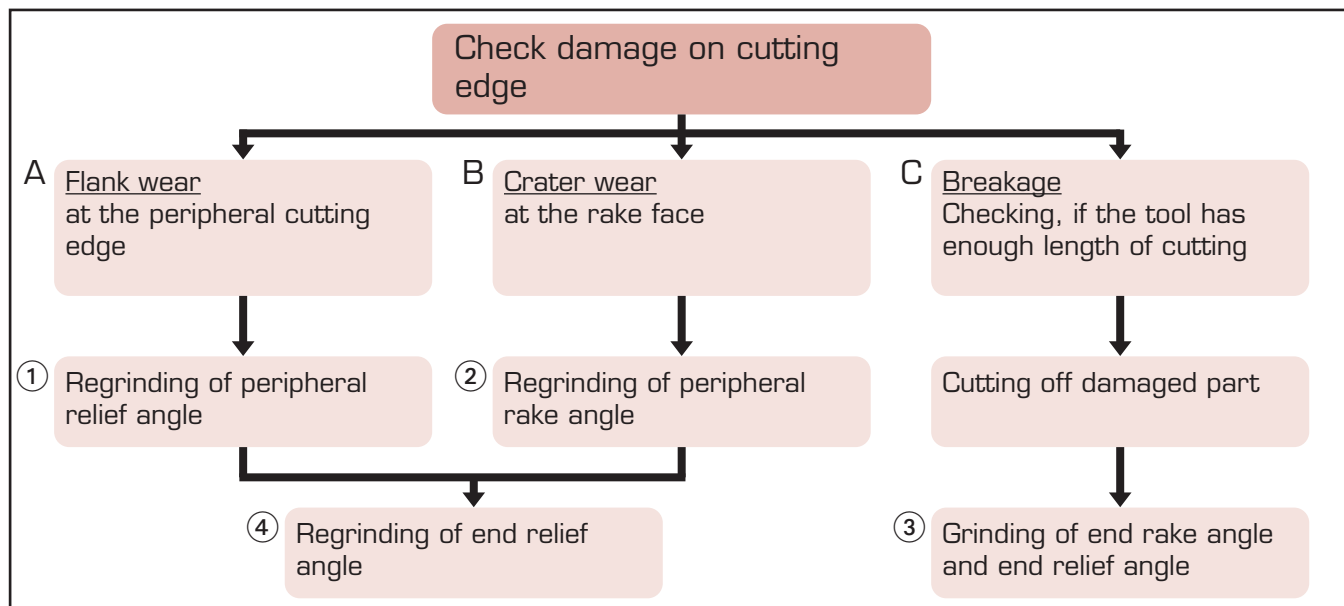
Part details



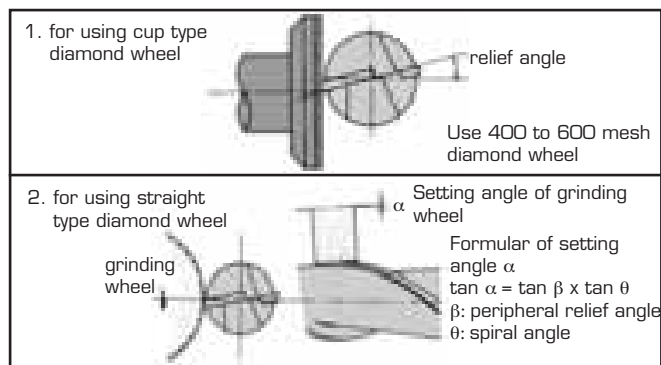
Types



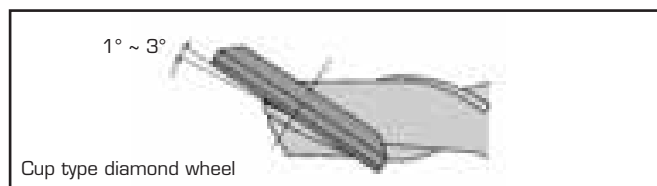
Regrinding procedures of solid carbide endmill



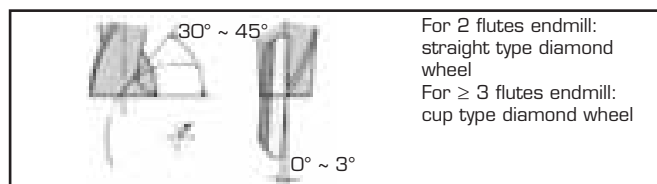
① Regrinding of peripheral relief angle



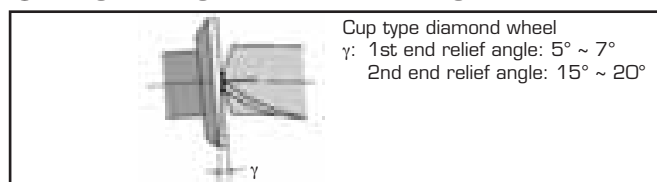
② Regrinding of peripheral rake angle



③ Regrinding of end rake angle (End gash)



④ Regrinding of end relief angle



Notice of regrinding

(1) If, after checking the damage of the cutting edge, the damage is as case "A" or "B" of the flow chart, the tool must be reground.

Too much damage of the cutting edge requires too big stock removal and thus reduces tool life.

(2) Please use diamond grinding wheel.

(3) Peripheral relief angle must be ground between 18° and 10°.

Relief angle of small diameter and for aluminium machining endmill must be big degree.

(4) First check if "C" in flow chart can be adapted for the case of coated endmill or not.

If procedure "C" can be adapted for regrinding, tool life after the grinding would be more improved than new one. The reason is still remaining of coated layer of cutting edge and shorter tool length will keep much higher rigidity of the tool than before regrinding.

(5) Please check run out of peripheral cutting edge, face cutting edge, with Vee block after regrinding.

The value of the run out must be controlled within 0.01 mm.

Notice for regrinding of ball nose endmill

- Regrinding of relief angle only is available. The dimension of nose radius will be smaller after grinding.

- Honing of cutting edge is necessary after regrinding.