Tooling News No.541

SUMITOMO

CARBIDE - CBN - DIAMOND

Global Support, Global Solutions.

High efficiency shoulder milling cutter

SEC-WaveMill WSE Series

Ideal for high-efficiency machining of titanium alloys, such as aerospace components

A selection of corner radiuses capable of handling large ramping angles

P M K N S H

SUMITOMO ELECTRIC GROUP

■ Features

- Ideal for machining titanium alloys for aerospace
  Designed for machining at large ramping angles, coupled with a selection of corner radiuses, makes it applicable for a variety of applications including titanium structural parts
- Stable and long tool life in machining titanium alloys
  The optimized cutting edge shape together with newly developed ACS2500/ACS3000 grades (for machining exotic alloys) result in excellent wear resistance and fracture resistance
- Optimized cutting edge shape and chip pocket for excellent chip evacuation

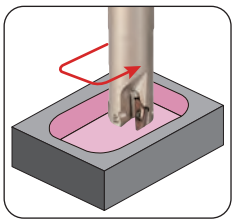
■ Product Range

Number in ●● shows the number of teeth

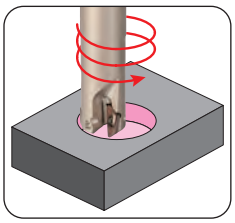
Type	Description	Cat. No.	Dia. (mm)		
			ø32	ø50	ø63
Shell	Standard	**WSE 16000RS○○**		5	6
	Long	**WSE 16000RS○○L**		5	6
Shank	Standard	**WSE 16000E○○**	3		

■ Applicable to various applications!

Groove Expansion



Helical Milling



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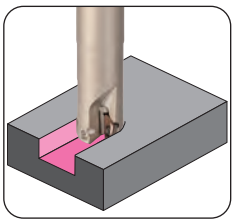
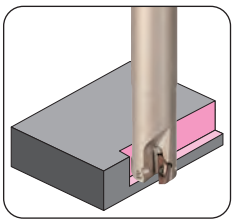
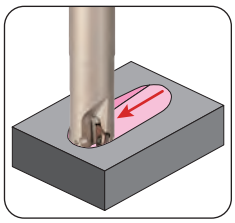


Shoulder Milling

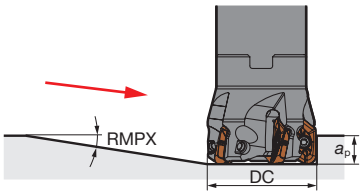


Ramping

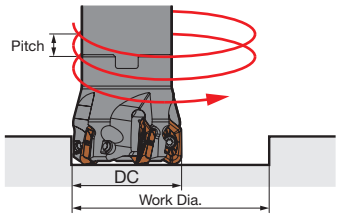


■ Ramping/Helical Milling Upper Limit

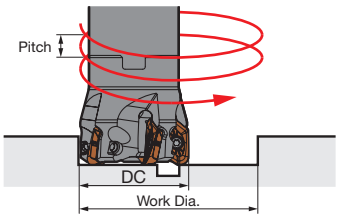
Ramping



Flat bottom machining



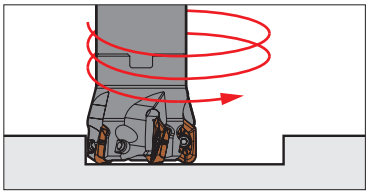
Machining with prepared hole



Dia. DC ø (mm)	Corner Radius RE	Max. Ramping Angle RMPX (°)
32	RE ≥ 5.0	8.4
	RE ≤ 4.0	12.2
50	RE ≥ 5.0	3.6
	RE ≤ 4.0	5.6
63	RE ≥ 5.0	2.5
	RE ≤ 4.0	3.9

Dia. DC ø (mm)	Corner Radius RE	Max. Hole Dia. ø (mm)	Max. Pitch (mm/rev)	Standard Work Dia. ø (mm)	Max. Pitch (mm/rev)	Min. Machining Dia. ø (mm)	Max. Pitch (mm/rev)
32	4.0	55.3	13.0	55.2	13.0	45.9	3.0
	0.8	61.3	13.0	56.3	13.0	45.9	2.9
50	4.0	91.6	11.2	91.6	11.2	81.9	2.8
	0.8	97.3	13.0	92.2	11.0	81.9	2.7
63	4.0	117.6	10.1	117.6	10.1	107.9	2.7
	0.8	123.3	11.7	118.2	9.9	107.9	2.6

Precautions for Flat Bottom Machining



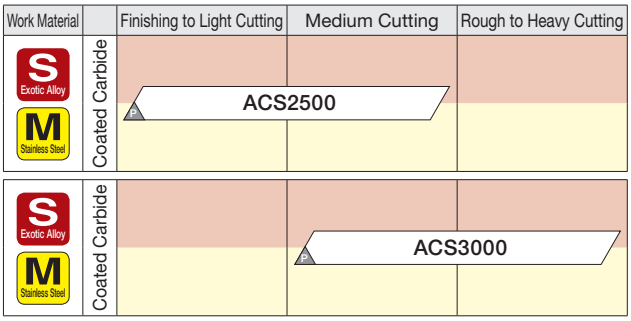
- For flat bottom machining, if the work diameter is smaller than the minimum machining diameter, there will be a centre uncut portion.
- A prepared centre hole should be made.
- Above the maximum machining diameter, this portion can be removed by traverse cutting with the same cutter.

■ Grade Features

Work Material	Grade	Coating Thickness (μm)	Features
S Exotic Alloy / M Stainless Steel	ACS2500	3	Carbide substrate with excellent wear and adhesion resistance, coupled with a chipping resistant coating, provide outstanding performance especially in machining **titanium alloys**
S Exotic Alloy / M Stainless Steel	ACS3000	3	High toughness carbide substrate and a coating with excellent chipping resistance provide outstanding stability when machining **titanium alloys**, **heat-resistant alloys** or **stainless steel**

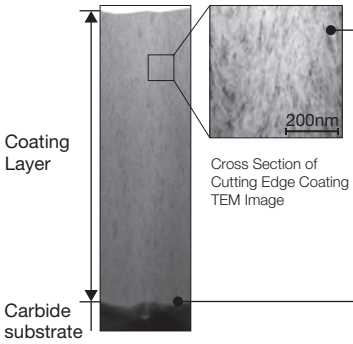
■ Grade Application Range

The newly developed **ACS2500/ACS3000** grades ideal for machining titanium alloys, heat-resistant alloys and stainless steel are now available!



New PVD Coating Features

ABSOTECH **PVD**



Ultra-fine grained B additive
- New AlTiBN coating, with an ultra-fine coating structure, achieves high strength and toughness
- Outstanding chipping resistance and wear resistance

High Adhesion Strength
Significantly improved coating adhesion and more than 2x conventional chipping resistance

■ Chipbreaker Shape

Work Material	M Stainless Steel, S Exotic Alloy
Applications	General-purpose to roughing
Features	Standard
Chipbreaker	E type
Cutting Edge Cross Section	15°

■ Excellent Chip Control

Cutting Conditions	Chip	
v_c = 60m/min f_z = 0.12mm/t a_p = 10mm a_e = 21mm Wet (7MPa) Ramping Angle: 0°	Stable Chip Control WSE Type	Unstable Chips Competitor's Product
v_c = 50m/min f_z = 0.12mm/t a_p = 4mm a_e = 50mm Wet (7MPa) Ramping Angle: 3°	Stable Chip Control WSE Type	Unstable Chips Competitor's Product
v_c = 50m/min f_z = 0.12mm/t a_p = 4mm a_e = 50mm Wet (7MPa) Ramping Angle: 5.5°	Stable Chip Control WSE Type	× Machining Not Possible Competitor's Product

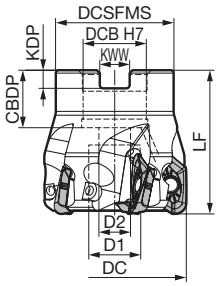
Machine : 5-axis Machine HSK100, Work Material: Ti-6Al-4V
Tool : WSE 16050RS05L (ø50, 5-tooth)
Insert : XOMT160540PEER-E (ACS3000)

WSE 16000RS Type

Rake Angle		
	Radial	-9° to -6°
	Axial	8° to 14°

15mm 90°

Fig 1



■ Body (Shell Type)

Dimensions (mm)

	Cat. No.	Stock	Dia. DC	Boss DCSFMS	Height LF	Hole Dia. DCB	Keyway Width KWW	Keyway Depth KDP	Mounting Depth CBDP	Bolt D1	Bolt D2	Number of Teeth	Weight (kg)	Fig
Metric	**WSE 16050RS05**	●	**50**	41	40(38.5)	**22**	10.4	6.3	20	18	11	5	0.24	1
	16050RS05L	●	**50**	41	50(48.5)	**22**	10.4	6.3	20	18	11	5	0.33	1
	16063RS06	●	**63**	50	40(38.5)	**22**	10.4	6.3	20	18	11	6	0.46	1
	16063RS06L	●	**63**	50	50(48.5)	**22**	10.4	6.3	20	18	11	6	0.61	1

The LF dimensions in parentheses are dimensions using RE = 5.0 or higher inserts. When using RE = 5.0 or higher inserts, the maximum depth of cut is 13mm.
Take note of the cutter mounting size (DCB) when selecting a cutter. Inserts are sold separately.

■ Identification Code

WSE	16	050	R	S	05	L
Series	Insert Size	Dia.	Feed Direction	Metric Bore	Number of Teeth	Long

■ Parts

Flat Insert Screw		Detachable Wrench		Anti-seizure Cream
		Handle Grip	Bit	
				
BFTX0409IP	**3.0**	HPS1015	TRB15IP	SUMI-P

N·m Recommended Tightening Torque (N·m) ● mark: Standard stocked item

■ Insert

Dimensions (mm)

Grade Classification		Coated Carbide	
Process	High-speed/Light	M S	
	Medium Cutting	M S	M S
	Roughing		M S

Cat. No.	ACS2500	ACS3000	Corner Radius RE	Fig
XOMT 160508PEER-E	●	●	0.8	1
160512PEER-E	●	●	1.2	1
160516PEER-E	●	●	1.6	1
160520PEER-E	●	●	2.0	1
160530PEER-E	●	●	3.0	1
160540PEER-E	●	●	4.0	1
160550PEER-E	●	●	5.0	2
160560PEER-E	●	●	6.0	2
160564PEER-E	●	●	6.35	2

Fig1

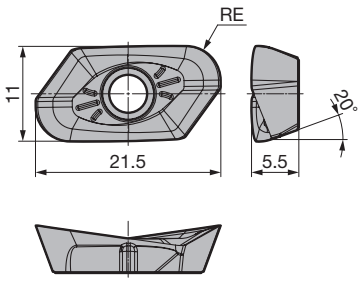
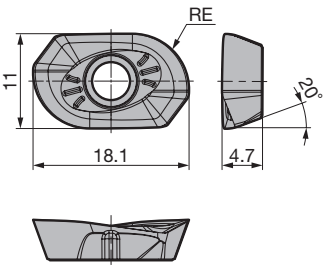
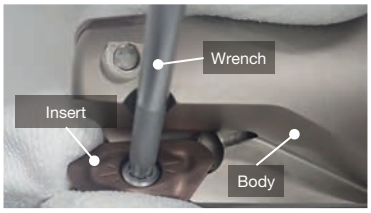


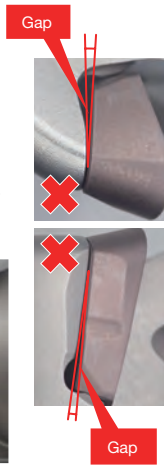
Fig2



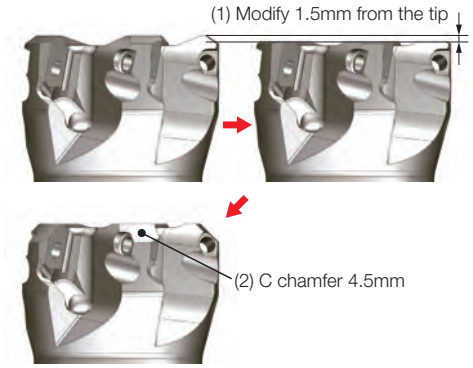
Precautions for Mounting Inserts

(1) Clean the mounting seat surface and contact parts.
(2) While pressing the insert firmly against the seat surface, tighten the screws with the included wrench.
(3) Apply Anti-seizure Cream to the screws and tighten at the recommended torque.
(4) After tightening, check that there are no gaps on the seat surface.





*Modification of the cutter body is required when mounting an insert with corner radius 5.0 or higher.



■ Recommended Cutting Conditions

ISO	Work Material		Hardness	Chipbreaker	Cutting Speed v_c (m/min) Min. - **Optimum** - Max.	Feed Rate f_z (mm/t) Min. - **Optimum** - Max.	Grade
S	Exotic Alloy	Heat-Resistant Alloy	—	E	25 - **35** - 50	0.05 - **0.10** - 0.15	ACS2500/ACS3000
		Ti Alloy	—	E	30 - **60** - 90	0.05 - **0.10** - 0.15	ACS2500/ACS3000
M	Stainless Steel	SUS430 and Others (Martensitic/Ferritic)	200	E	115 - **145** - 175	0.05 - **0.10** - 0.15	ACS2500/ACS3000
		SUS403 and Others (Martensitic/Hardened)	240	E	105 - **130** - 155	0.05 - **0.10** - 0.15	ACS2500/ACS3000
		SUS304, SUS316 (Austenitic)	180	E	125 - **155** - 190	0.05 - **0.10** - 0.15	ACS2500/ACS3000

● The recommended cutting conditions may not be practical depending on the operating conditions (e.g. machine, work material shape, clamping system).
● For groove milling, adjust the feed rate to around 70% of the above values.
Note The cutting conditions above are a guide. Actual conditions will need to be adjusted according to machine rigidity, work clamp rigidity, depth of cut and other factors.

● mark: Standard stocked item

WSE 16000E Type

Rake Angle		
	Radial	-9°
	Axial	8°

15mm 90°

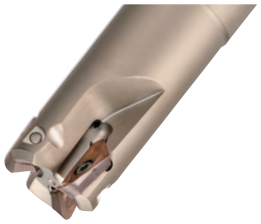
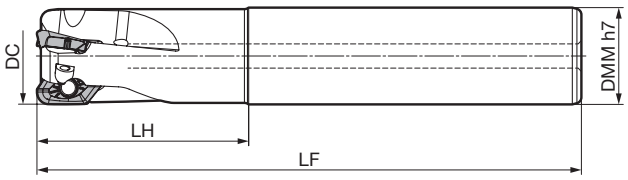


Fig 1



■ Body (Shank Type)

Dimensions (mm)

Cat. No.	Stock	Dia. DC	Shank DMM	Head LH	Overall Length LF	Number of Teeth	Weight (kg)	Fig
WSE 16032E03	●	**32**	32	60(58.4)	170(168.4)	3	0.90	1

The LH and LF dimensions in parentheses are dimensions using RE = 5.0 or higher inserts. When using RE = 5.0 or higher inserts, the maximum depth of cut is 13mm.
Inserts are sold separately.

■ Identification Code

WSE	16	032	E	03
Series	Insert Size	Dia.	Shank Type	Number of Teeth

■ Parts

Flat Insert Screw		Wrench	Anti-seizure Cream
			
BFTX0409IP	3.0	TRDR15IP	SUMI-P

N·m Recommended Tightening Torque (N·m) ● mark: Standard stocked item

■ Insert

Dimensions (mm)

Grade Classification		Coated Carbide	
Process	High-speed/Light	M S	
	Medium Cutting	M S	M S
	Roughing		M S

Cat. No.	ACS2500	ACS3000	Corner Radius RE	Fig
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160512PEER-E	●	●	1.2	1
160516PEER-E	●	●	1.6	1
160520PEER-E	●	●	2.0	1
160530PEER-E	●	●	3.0	1
160540PEER-E	●	●	4.0	1
160550PEER-E	●	●	5.0	2
160560PEER-E	●	●	6.0	2
160564PEER-E	●	●	6.35	2

Fig1

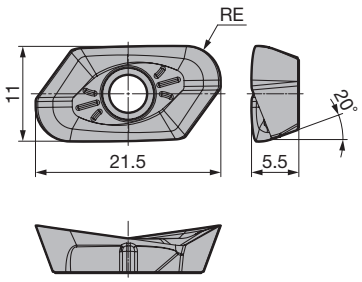
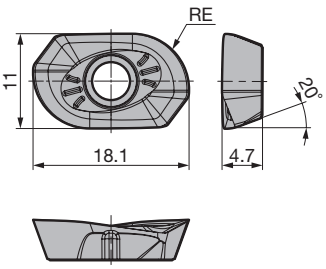


Fig2



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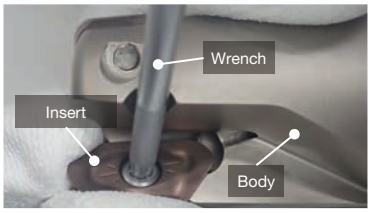

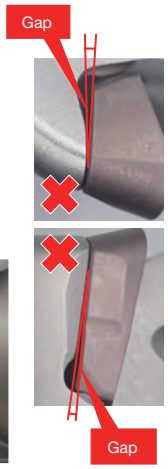

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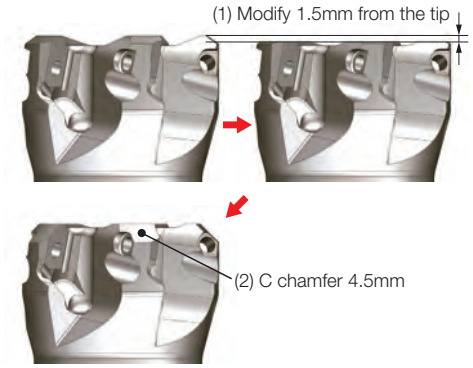

■ Recommended Cutting Conditions

ISO	Work Material		Hardness	Chipbreaker	Cutting Speed v_c (m/min) Min. - **Optimum** - Max.	Feed Rate f_z (mm/t) Min. - **Optimum** - Max.	Grade
S	Exotic Alloy	Heat-Resistant Alloy	—	E	25 - **35** - 50	0.05 - **0.10** - 0.15	ACS2500/ACS3000
		Ti Alloy	—	E	30 - **60** - 90	0.05 - **0.10** - 0.15	ACS2500/ACS3000
M	Stainless Steel	SUS430 and Others (Martensitic/Ferritic)	200	E	115 - **145** - 175	0.05 - **0.10** - 0.15	ACS2500/ACS3000
		SUS403 and Others (Martensitic/Hardened)	240	E	105 - **130** - 155	0.05 - **0.10** - 0.15	ACS2500/ACS3000
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● The recommended cutting conditions may not be practical depending on the operating conditions (e.g. machine, work material shape, clamping system).
● For groove milling, adjust the feed rate to around 70% of the above values.
Note The cutting conditions above are a guide. Actual conditions will need to be adjusted according to machine rigidity, work clamp rigidity, depth of cut and other factors.

● mark: Standard stocked item

■ Application Examples

Titanium Alloy Ti-6Al-4V Aerospace Component		Sumitomo	Competitor's Product
	Tool	WSE16050RS05L	Single-Sided, 2 Corners
	Grade	ACS3000	—
	Insert	XOMT160540PEER-E	—
	Cutter Dia. (mm)	50	50
	Number of Teeth	5	5
	v_c (m/min)	50	50
	v_f (mm/min)	191	191
	f_z (mm/t)	0.12	0.12
	a_p (mm)	4	4
	a_e (mm)	10	10
	Coolant	Wet	Wet
	Results	Although cutting edge chipping resulted in an unstable tool life, WSE Type suppresses fractures for double the tool life of competitor's product	

Titanium Alloy Ti-6Al-4V Aerospace Component		Sumitomo		Competitor's Product
	Tool	WSE16050RS05L		Single-Sided, 2 Corners
	Grade	ACS3000		—
	Insert	XOMT160540PEER-E		—
	Cutter Dia. (mm)	50	50	50
	Number of Teeth	5	5	5
	v_c (m/min)	75	50	75
	v_f (mm/min)	287	287	287
	f_z (mm/t)	0.12	0.18	0.12
	a_p (mm)	10	10	10
	a_e (mm)	25	25	25
	Coolant	Wet		Wet
	Results	Tool life was similar to competitor's under the same cutting conditions, but with the change of cutting conditions, tool life was doubled with the same efficiency		

Titanium Alloy Ti-6Al-4V Aerospace Component		Sumitomo	Competitor's Product
Vertical Machining Centre BT50	Tool	WSE16050RS05L	Single-Sided, 2 Corners
	Grade	ACS3000	—
	Insert	XOMT160520PEER-E	—
	Cutter Dia. (mm)	50	50
	Number of Teeth	5	5
	v_c (m/min)	32	32
	v_f (mm/min)	102	102
	f_z (mm/t)	0.1	0.1
	a_p (mm)	3 to 10	3 to 10
	a_e (mm)	35 to 50	35 to 50
	Coolant	Wet	Wet
	Results	Sudden fractures suppressed for a stable tool life	

Sumitomo Electric Cutting Tools Official Apps for iOS/Android

Cutting calculation App

SumiTool Calculator

Download on the App Store

GET IT ON Google Play

Grade & chipbreaker comparison App

SumiTool Converter

Download on the App Store

GET IT ON Google Play

< SAFETY NOTES >

- Very hot or lengthy chips may be discharged while the machine is in operation. Therefore, machine guards, safety goggles or other protective covers must be used. Fire safety precautions must also be considered.
- Please handle with care as this product has sharp edges.
- Improper cutting conditions or mis-handling of the tool may result in breakages or projectiles. Therefore, please use the tool within its recommended conditions.
- When using non-water soluble cutting oil, precautions against fire must be taken and please ensure that a fire extinguisher is placed near the machine.

Sumitomo Electric Industries, Ltd.

Hardmetal Division

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https://www.sumitool.com/global

(2021.10) I GR/AK