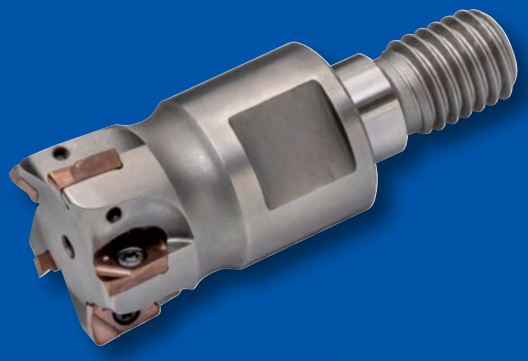
MOLDINO
The Edge To Innovation

ASPV mini type

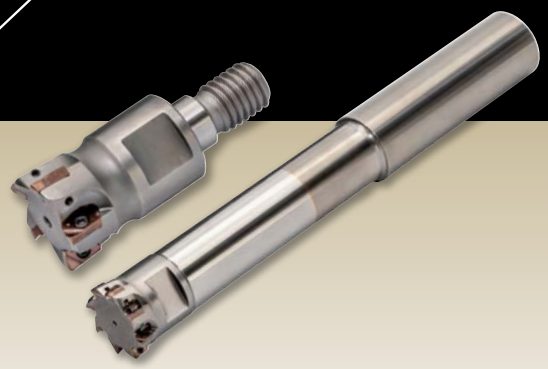
Polish Mill V type ASPVmini



MOLDINO Tool Engineering, Ltd.

New Product News | No.2002E-5 | 2022-11

Obviates the need for reworking on walls and bottom surfaces finishing



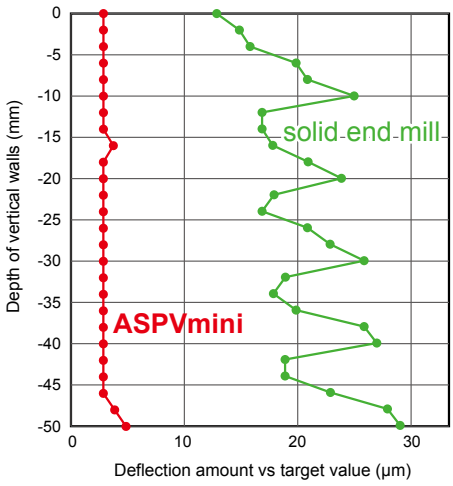
We've added high-precision finishing tools to our small-diameter multi-flute cutting tool series. The free-cutting edge shape solves issues related to vertical wall cutting.

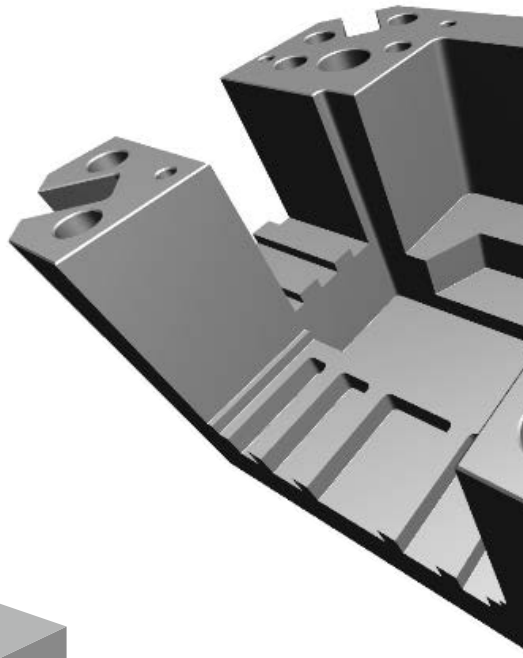
Issue 01

Inability to achieve desired dimensional accuracy with deflected walls. Reworking consumes much time.

Proposed solutions

- Insert shapes with enhanced free-cutting capabilities enable to precisely finish deep vertical walls with extended overhangs.
- ASPVmini decreases wall deflection, reducing the time spent on reworking, additional work and modification issues during the finishing process. (Refer to additional example cases on page 14.)





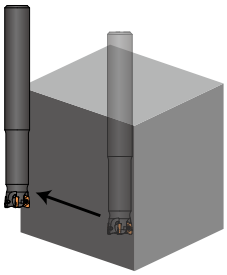
〈**Cutting conditions**〉
Work material : S50C (220HB)
Machine : Vertical type (BT40)

solid end mill

Tool dia. : ϕ20mm
Revolution : 1,432min^{-1}
Feed rate : 572mm/min
Depth of cut : ap=8.0mm
Cutting width : ae=0.2mm
Overhang : OH=100mm (L/D=5)

ASPVmini

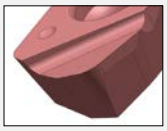
Tool dia. : ϕ20mm
Insert : MPHT040205ZEL-0.5 (TH308)
Revolution : 4,775min^{-1}
Feed rate : 2,387mm/min
Depth of cut : ap=1.0mm
Cutting width : ae=0.2mm
Overhang : OH=100mm (L/D=5)



Contour cutting

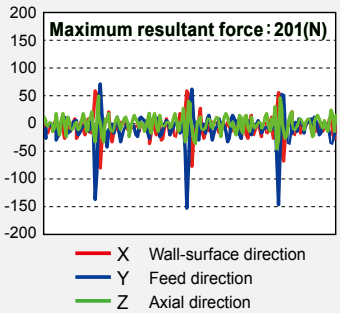
Point! Ground chipbreaker

The ground chipbreaker suppresses cutting forces.



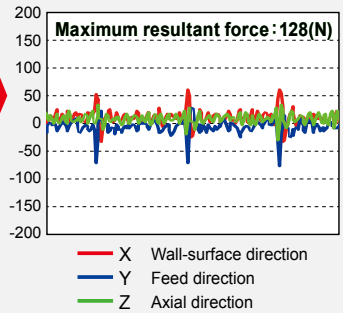
Work material : S50C (220HB)
Cutter : Diameter ϕ20
Insert : MPHT040205ZEL-0.5 (TH308)
Cutting speed : Vc = 300m/min
Feed rate : fz=0.1mm/t
Axial depth of cut : ap=1.0mm
Radial depth of cut : ae=0.2mm

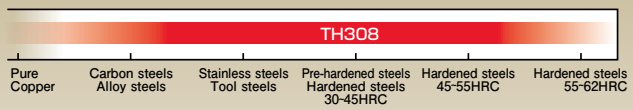
Conventional



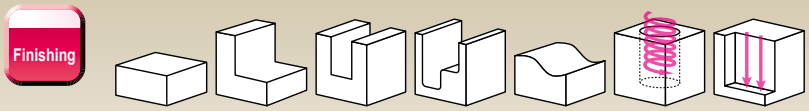
Reduced 36%

ASPVmini





Applications

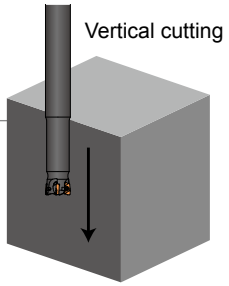


Issue 02

Requires high verticality, even at deep points where the L/D※ is eight or greater.

※L/D:Ratio of tool diameter (D) and tool overhang (L)

Proposed solutions

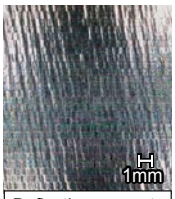


- Vertical cutting improves vertical wall accuracy, even when it's difficult to cut the wall at constant depth due to extremely long overhangs.

〈**Cutting conditions**〉
Work material : Pre-hardened steels（40HRC）
Machine : Vertical type（HSK100）

Depth constant cutting

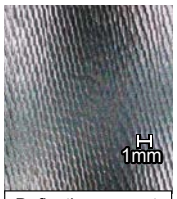
Tool dia. :ϕ11mm
Insert : MPHT040205ZEL-0.5(TH308)
Revolution : 2,893min^{-1}
Feed rate : 463mm/min
Depth of cut : ap=0.5mm
Cutting width : ae=0.1mm
Overhang : OH=90mm（L/D=8.2）
Air-blow



Deflection amount: 21.7μm

Vertical cutting

Tool dia. :ϕ11mm
Insert : MPHT040205ZEL-0.5(TH308)
Revolution : 2,893min^{-1}
Feed rate : 463mm/min
Pick feed : pf=0.2mm
Cutting width : ae=0.1mm
Overhang : OH=90mm（L/D=8.2）
Air-blow



Deflection amount: 8.7μm

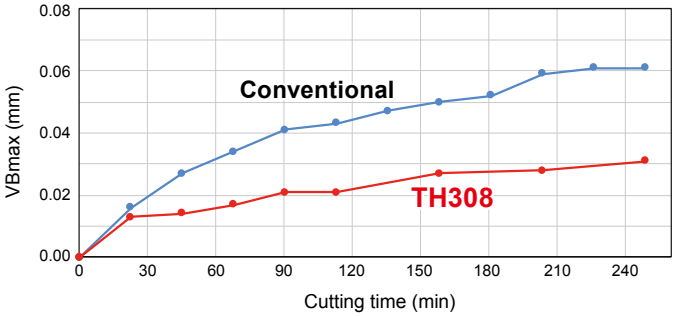
Issue 03

The tool wears due to prolonged finishing, resulting in unstable surface grade or problems with dimensional accuracy.

Proposed solutions

- The ASPVmini inserts use the new grade "TH308" which offers excellent abrasion resistance to maintain high surface grade and accuracy.

Machine : Vertical 3-axis M/C（HSK63）
Work material : Equivalent to SKD61（45HRC）
Tool : Body ASPVM1012R-3-M6
Insert MPHT040205ZEL-0.5
Cutting speed : Vc = 250m/min
Feed rate : fz=0.1mm/t
Axial depth of cut : ap=1.0mm
Radial depth of cut : ae=0.1mm
Air-blow



Steel shank Type

ASPV10○○R-○

Numeric figure in a circle ○.

Fig.1
(Standard type)

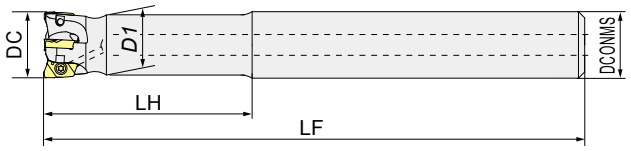
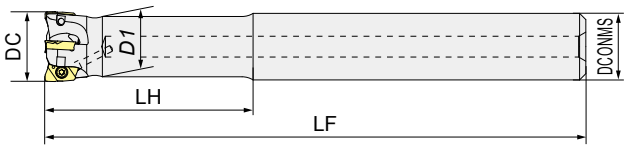


Fig.2
(Undercut type)

※DC > DCONMS

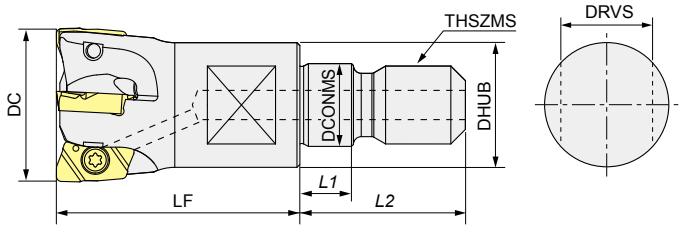


Item code	Stock	No.of flutes	Size (mm)					Shape	Recommended insert
			DC	LF	LH	*D1*	DCONMS		
ASPV1010R-2	●	2	10	100	30	9.4	10	Fig-1 Standard type	MPHT0402○○ZEL(-○○)
ASPV1011R-2	●	2	11	100	30	9.4	10	Fig.2 Undercut type	
ASPV1012R-3	●	3	12	100	40	11.2	12	Fig-1 Standard type	
ASPV1013R-3	●	3	13	100	40	11.2	12	Fig.2 Undercut type	
ASPV1016R-4	●	4	16	130	50	14.5	16	Fig-1 Standard type	
ASPV1017R-4	●	4	17	130	50	14.5	16	Fig.2 Undercut type	
ASPV1020R-5	●	5	20	160	60	18	20	Fig-1 Standard type	
ASPV1021R-5	●	5	21	160	60	18	20	Fig.2 Undercut type	
ASPV1025R-6	●	6	25	180	75	23	25	Fig-1 Standard type	
ASPV1026R-6	●	6	26	180	75	23	25	Fig.2 Undercut type	
ASPV1032R-8	●	8	32	200	100	30	32	Fig-1 Standard type	

Modular Type

ASPVM10○○R-○-M○○

Numeric figure in a circle ○.



Item code	Stock	No.of flutes	Size (mm)								Recommended insert
			DC	LF	DCONMS	THSZMS	DHUB	*L1*	*L2*	DRVS	
ASPVM1010R-2-M6	●	2	10	20	6.5	M6	9.4	5.5	14.5	7	MPHT0402○○ZEL(-○○)
※ASPVM1011R-2-M6	●	2	11	20	6.5	M6	9.8	5.5	14.5	7	
ASPVM1012R-3-M6	●	3	12	20	6.5	M6	9.8	5.5	14.5	7	
※ASPVM1013R-3-M6	●	3	13	20	6.5	M6	9.8	5.5	14.5	7	
ASPVM1016R-4-M8	●	4	16	25	8.5	M8	12.8	5.5	17	10	
※ASPVM1017R-4-M8	●	4	17	25	8.5	M8	12.8	5.5	17	10	
ASPVM1020R-5-M10	●	5	20	30	10.5	M10	17.8	5.5	19	15	
※ASPVM1021R-5-M10	●	5	21	30	10.5	M10	17.8	5.5	19	15	
ASPVM1025R-6-M12	●	6	25	30	12.5	M12	20.8	5.5	22	17	
※ASPVM1026R-6-M12	●	6	26	30	12.5	M12	20.8	5.5	22	17	
ASPVM1032R-8-M16	●	8	32	30	17	M16	28.8	6	23	22	

【Note】 When ※ and carbide shank are used together as a set, there is no interference.
Do not apply lubricants to the threaded section or end surface sections in contact with the dedicated shank/arbor for modular mills.

● : Stocked Items.

インサート Inserts

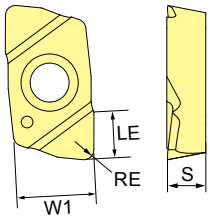


Fig.1

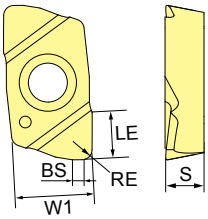


Fig.2

P	Carbon Steels	■
M	SUS, etc.	■
K	Cast irons	■
H	Hardened steels	■

■ : General cutting, First recommendation

Item code	Tolerance class	TH308	Size (mm) W1	BS	S	LE	RE	Shape
MPHT040202ZEL	H	●	4.3	0	2	2.3	0.2	**Fig. 1**
MPHT040202ZEL-0.5		●		0.5				Fig. 2
MPHT040205ZEL		●		0			0.5	Fig. 1
MPHT040205ZEL-0.5		●		0.5				Fig. 2
MPHT040210ZEL		●		0			1	Fig. 1
MPHT040210ZEL-0.5		●		0.5				Fig. 2

Features

Free-cutting chipbreaker

Achieves high-cutting surface grades, even for work materials whose cut surface tends to be cloudy, like carbon steel.
Maintains high dimensional accuracy when cutting, even for tools with long overhangs.

Front cutting edge

This edge is used for bottom surface finishing.
Various shapes with wiper edges are lined up for each R size.
Makes it possible to boost feed rates when finishing bottom surfaces.

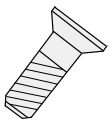
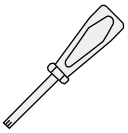
Peripheral cutting edge

Functions as peripheral cutting edge when side cutting.

● Without wiper edge

● With wiper edge

Parts

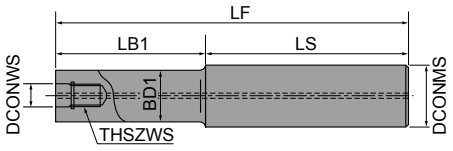
Parts	Clamp screw		Screw Driver	Screw anti-seizure agent
Shape / Cutter body		Fastening torque (N·m)		
ASPV10○○R-○ **ASPVM10○○R-○-M○**	**240-140**	0.5	**104-T6**	**P-37**

The clamp screw is a consumable part. Since replacement life depends on the use environment, it is recommended that it be replaced at an early stage.
As spare parts for the tools, one clamp screw is attached when the tool diameter is 13 mm or smaller, while two clamp screws are attached when the tool diameter is 16 mm or larger.

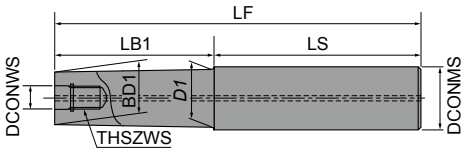
● : Stocked Items.

The Shanks for Modular Mill

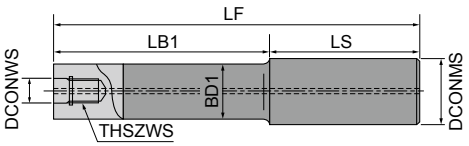
Carbide Shank



A type



B type



C type

Item code	Stock	Size (mm)								Type	Cutter body	With/ without air hole
		DCONWS	THSZWS	LF	LB1	LS	BD1	DCONMS	*D1*			
ASC10-6.5-74-24Z	●	6.5	M6	74	24	50	9.3	10	–	A	ϕ10 (ϕ11) ※3 (ϕ12) ※3 (ϕ13) ※3	○
ASC10-6.5-84-34Z	●			84	34	50						
ASC10-6.5-114-49Z	●			114	49	65						
ASC10-6.5-114-24Z	●				24	90						
ASC12-6.5-74-24Z	●	6.5	M6	74	24	50	11	12	11.5	B	(ϕ10) ※4 (ϕ11) ※4 ϕ12 (ϕ13) ※3	○
ASC12-6.5-94-44Z	●			94	44	50						
ASC12-6.5-129-64Z	●			129	64	65						
ASC12-6.5-129-24Z	●				24	105						
ASC16-8.5-95-30Z	●	8.5	M8	95	30	65	14.5	16	15.5	B	ϕ16 (ϕ17) ※3	○
ASC16-8.5-120-55Z	●			120	55	65						
ASC16-8.5-140-75Z	●			140	75	65						
ASC16-8.5-160-95Z	●			160	95	65						
ASC16-8.5-160-30Z	●			160	30	130						
ASC20-10.5-120-50Z	●	10.5	M10	120	50	70	18.5	20	19.5	B	ϕ20 (ϕ21) ※3	○
ASC20-10.5-170-90Z	●			170	90	80						
ASC20-10.5-220-120Z	●			220	120	100						
ASC20-10.5-270-150Z	●			270	150	120						
ASC20-10.5-220-50Z	●	10.5	M10	220	50	170	18.5	20	19.5	B	ϕ20 (ϕ21) ※3	○
ASC20-10.5-270-50Z	●			270		220						
ASC25-12.5-145-65	●	12.5	M12	145	65	80	23	25	–	C	ϕ25 (ϕ26) ※3	○
ASC25-12.5-215-115	●			215	115	100						
ASC25-12.5-265-145	●			265	145	120						
ASC25-12.5-315-195	●			315	195	120						
ASC25-12.5-265-65	●	12.5	M12	265	65	200	23	25	–	C	ϕ25 (ϕ26) ※3	○
ASC25-12.5-315-65	●			315		250						
ASC32-17-160-80	●	17	M16	160	80	80	28	32	–	C	ϕ32	○
ASC32-17-210-110	●			210	110	100						
ASC32-17-260-140	●			260	140	120						
ASC32-17-310-190	●			310	190	120						
ASC32-17-360-240	●			360	240	120						
ASC32-17-260-80	●	17	M16	260	80	180	28	32	–	C	ϕ32	○
ASC32-17-310-80	●			310		230						
ASC32-17-360-80	●			360		280						

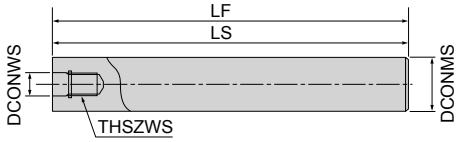
【Note】 ①Commercial milling chucks or shrink-fit holders can be used.
②For ※3, since the cutter diameter is larger than the shank diameter, there is no interference at the shank.
③For ※4, since the cutter diameter is smaller than the shank diameter, interference occurs at the shank.

● : Stocked Items.

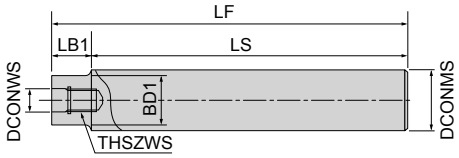
The Shanks for Modular Mill

Steel Shank

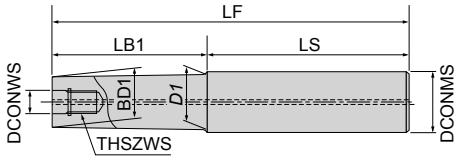
Stated dimensions for L_3, Lf, and L_1 are with ASPV mini attached.



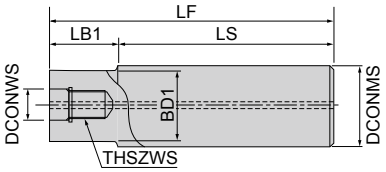
A type



B type



C type (Tapered neck)



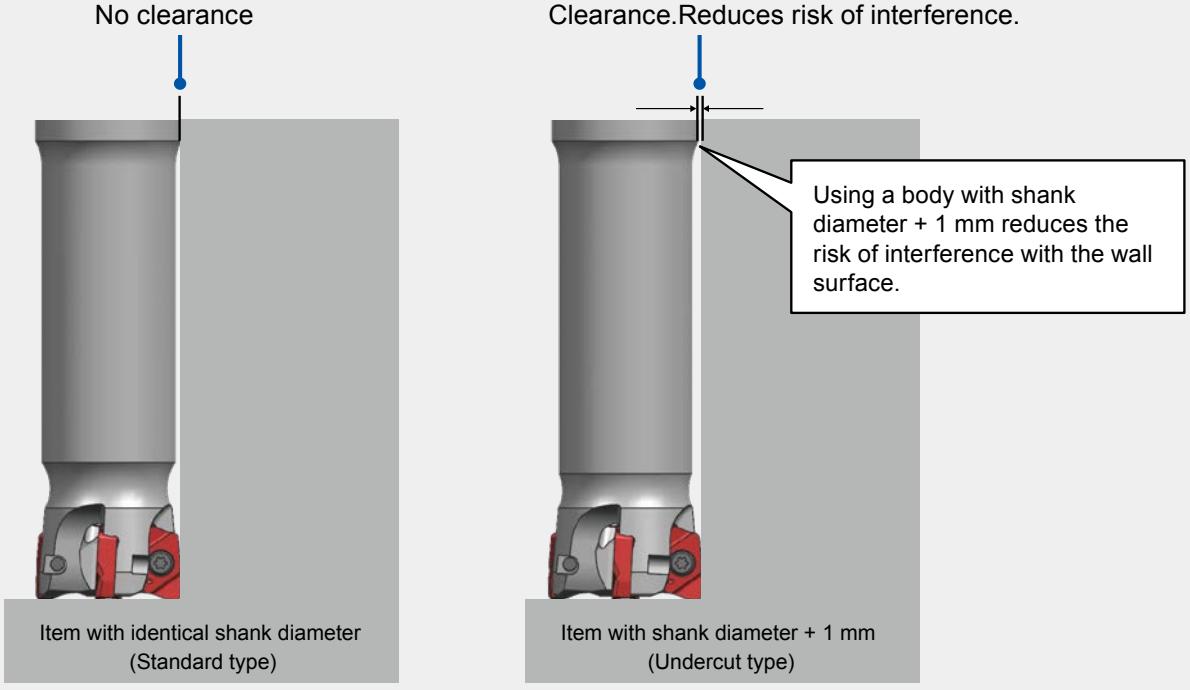
D type

Item code	Stock	Size (mm)								Type	Cutter body	With/ without air hole
		DCONWS	THSZWS	LF	LB1	LS	BD1	DCONMS	*D1*			
AS10-6.5-74-0	●	6.5	M6	74	–	74	–	10	–	A	ϕ10	–
AS12-6.5-84-4	●	6.5	M6	84	4	80	11	12	–	B	ϕ11 ϕ12	–
AS16-8.5-95-15	●	8.5	M8	95	15	80	14.5	16	15.5	C	ϕ16	○
AS20-10.5-100-20	●	10.5	M10	100	20	80	18	20	–	D	ϕ20	○
AS25-12.5-115-35	●	12.5	M12	115	35	80	23	25	–	D	ϕ25	○
AS32-17-110-30	●	17	M16	110	30	80	28	32	–	D	ϕ32	○

【Note】 Commercial milling chucks can be used.

Features

Option to use item with shank diameter + 1 mm

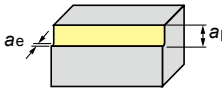


Recommended Cutting Conditions

Side finishing

Work material	Recommended grade	Tool dia.DC	Φ10 (2 Flutes)					Φ11 (2 Flutes)					Φ12 (3 Flutes)					Φ13 (3 Flutes)					Φ16 (4 Flutes)				
		Overhang	<3DC		Modular carbide shank			<3DC		Modular carbide shank			<3DC		Modular carbide shank			<3DC		Modular carbide shank			<3DC		Modular carbide shank		
			General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC
Mild steels (200HB or less)	TH308	*n* (min-1)	12,732	19,099	15,915	12,732	12,732	11,575	17,362	14,469	11,575	11,575	10,610	18,568	15,915	10,610	10,610	9,794	19,588	14,691	9,794	9,794	7,958	15,915	11,937	7,958	7,958
		Vc(m/min)	400	600	500	400	400	400	600	500	400	400	400	700	600	400	400	400	800	600	400	400	400	800	600	400	400
		Vf(mm/min)	2,546	5,730	4,775	3,056	2,546	2,315	5,209	4,341	2,778	2,315	3,183	8,356	7,162	3,820	3,183	2,938	8,815	6,611	3,526	2,938	3,183	9,549	7,162	3,820	3,183
		fz(mm/t)	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1
		*a*p(mm)	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5
		*a*e(mm)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Carbon steels Alloy steels (30HRC or less)	TH308	*n* (min-1)	9,549	19,099	12,732	12,732	9,549	8,681	17,362	11,575	11,575	8,681	7,958	15,915	10,610	10,610	7,958	7,346	14,691	9,794	9,794	7,346	5,968	11,937	7,958	7,958	5,968
		Vc(m/min)	300	600	400	400	300	300	600	400	400	300	300	600	400	400	300	300	600	400	400	300	300	600	400	400	300
		Vf(mm/min)	1,910	5,730	3,820	3,056	1,910	1,736	5,209	3,472	2,778	1,736	2,387	7,162	4,775	3,820	2,387	2,204	6,611	4,407	3,526	2,204	2,387	7,162	4,775	3,820	2,387
		fz(mm/t)	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1
		*a*p(mm)	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5
		*a*e(mm)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Carbon steels Alloy steels (30～45HRC)	TH308	*n* (min-1)	6,366	15,915	11,141	9,549	9,549	5,787	14,469	10,128	8,681	8,681	5,305	13,263	9,284	7,958	7,958	4,897	12,243	8,570	7,346	7,346	3,979	9,947	6,963	5,968	5,968
		Vc(m/min)	200	500	350	300	300	200	500	350	300	300	200	500	350	300	300	200	500	350	300	300	200	500	350	300	300
		Vf(mm/min)	1,273	3,820	2,674	1,910	1,528	1,157	3,472	2,431	1,736	1,389	1,592	4,775	3,342	2,387	1,910	1,469	4,407	3,085	2,204	1,763	1,592	4,775	3,342	2,387	1,910
		fz(mm/t)	0.1	0.12	0.12	0.1	0.08	0.1	0.12	0.12	0.1	0.08	0.1	0.12	0.12	0.1	0.08	0.1	0.12	0.12	0.1	0.08	0.1	0.12	0.12	0.1	0.08
		*a*p(mm)	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5
		*a*e(mm)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Hardened steels (45～55HRC)	TH308	*n* (min-1)	4,775	7,958	5,730	4,775	4,775	4,341	7,234	5,209	4,341	4,341	3,979	6,631	4,775	3,979	3,979	3,673	6,121	4,407	3,673	3,673	2,984	4,974	3,581	2,984	2,984
		Vc(m/min)	150	250	180	150	150	150	250	180	150	150	150	250	180	150	150	150	250	180	150	150	150	250	180	150	150
		Vf(mm/min)	955	1,592	1,146	764	764	868	1,447	1,042	694	694	1,194	1,989	1,432	955	955	1,102	1,836	1,322	881	881	1,194	1,989	1,432	955	955
		fz(mm/t)	0.1	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.08	0.08
		*a*p(mm)	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5
		*a*e(mm)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Hardened steels (55～62HRC)	TH308	*n* (min-1)	4,138	6,366	5,093	4,138	4,138	3,762	5,787	4,630	3,762	3,762	3,448	5,305	4,244	3,448	3,448	3,183	4,897	3,918	3,183	3,183	2,586	3,979	3,183	2,586	2,586
		Vc(m/min)	130	200	160	130	130	130	200	160	130	130	130	200	160	130	130	130	200	160	130	130	130	200	160	130	130
		Vf(mm/min)	828	1,273	1,019	662	414	752	1,157	926	602	376	1,035	1,592	1,273	828	517	955	1,469	1,175	764	477	1,035	1,592	1,273	828	517
		fz(mm/t)	0.1	0.1	0.1	0.08	0.05	0.1	0.1	0.1	0.08	0.05	0.1	0.1	0.1	0.08	0.05	0.1	0.1	0.1	0.08	0.05	0.1	0.1	0.1	0.08	0.05
		*a*p(mm)	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5
		*a*e(mm)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Stainless steels SUS	TH308	*n* (min-1)	9,549	19,099	12,732	12,732	9,549	8,681	17,362	11,575	11,575	8,681	7,958	15,915	10,610	10,610	7,958	7,346	14,691	9,794	9,794	7,346	5,968	11,937	7,958	7,958	5,968
		Vc(m/min)	300	600	400	400	300	300	600	400	400	300	300	600	400	400	300	300	600	400	400	300	300	600	400	400	300
		Vf(mm/min)	1,910	5,730	3,820	3,056	1,910	1,736	5,209	3,472	2,778	1,736	2,387	7,162	4,775	3,820	2,387	2,204	6,611	4,407	3,526	2,204	2,387	7,162	4,775	3,820	2,387
		fz(mm/t)	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1
		*a*p(mm)	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5
		*a*e(mm)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cast irons FC FCD	TH308	*n* (min-1)	9,549	19,099	15,915	12,732	12,732	8,681	17,362	14,469	11,575	11,575	7,958	15,915	13,263	10,610	10,610	7,346	14,691	12,243	9,794	9,794	5,968	11,937	9,947	7,958	7,958
		Vc(m/min)	300	600	500	400	400	300	600	500	400	400	300	600	500	400	400	300	600	500	400	400	300	600	500	400	400
		Vf(mm/min)	1,910	5,730	4,775	3,056	2,546	1,736	5,209	4,341	2,778	2,315	2,387	7,162	5,968	3,820	3,183	2,204	6,611	5,509	3,526	2,938	2,387	7,162	5,968	3,820	3,183
		fz(mm/t)	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1
		*a*p(mm)	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5
		*a*e(mm)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

【Note】
① Use the appropriate coolant for the work material and machining shape.
② These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions.
③ For slotting or ramping, feed rate should be set to 70% as general criteria.
④ Ensure to index the insert at the correct time to ensure safety of the tool-body.
⑤ The evacuation of swarf can cause burns, cuts or damage to the eyes please ensue the correct safety cover is fitted around the machine, and necessary personal protection equipment is worn by the machine operator.
⑥ Due to fire risks do not use neat cutting oil as a coolant.



Finishing

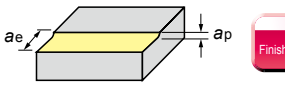
Φ17 (4 Flutes)					Φ20 (5 Flutes)					Φ21 (5 Flutes)					Φ25 (6 Flutes)					Φ26 (6 Flutes)					Φ32 (8 Flutes)					Work material
<3DC		Modular carbide shank			<3DC		Modular carbide shank			<3DC		Modular carbide shank			<3DC		Modular carbide shank			<3DC		Modular carbide shank			<3DC		Modular carbide shank			
General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	
7,490	14,979	11,234	7,490	7,490	6,366	12,732	9,549	6,366	6,366	6,063	12,126	9,095	6,063	6,063	5,093	10,186	7,639	5,093	5,093	4,897	9,794	7,346	4,897	4,897	4,897	9,794	7,346	4,897	4,897	Mild steels (200HB or less)
400	800	600	400	400	400	800	600	400	400	400	800	600	400	400	400	800	600	400	400	400	800	600	400	400	400	800	600	400	400	
2,996	8,988	6,741	3,595	2,996	3,183	9,549	7,162	3,820	3,183	3,032	9,095	6,821	3,638	3,032	3,056	9,167	6,875	3,667	3,056	2,938	8,815	6,611	3,526	2,938	2,938	8,815	6,611	3,526	2,938	
0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	
1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
5,617	11,234	7,490	7,490	5,617	4,775	9,549	6,366	6,366	4,775	4,547	9,095	6,063	6,063	4,547	3,820	7,639	5,093	5,093	3,820	3,673	7,346	4,897	4,897	3,673	2,984	5,968	3,979	3,979	2,984	Carbon steels Alloy steels (30HRC or less)
300	600	400	400	300	300	600	400	400	300	300	600	400	400	300	300	600	400	400	300	300	600	400	400	300	300	600	400	400	300	
2,247	6,741	4,494	3,595	2,247	2,387	7,162	4,775	3,820	2,387	2,274	6,821	4,547	3,638	2,274	2,292	6,875	4,584	3,667	2,292	2,204	6,611	4,407	3,526	2,204	2,387	7,162	4,775	3,820	2,387	
0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	
1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
3,745	9,362	6,553	5,617	5,617	3,183	7,958	5,570	4,775	4,775	3,032	7,579	5,305	4,547	4,547	2,546	6,366	4,456	3,820	3,820	2,449	6,121	4,285	3,673	3,673	1,989	4,974	3,482	2,984	2,984	Carbon steels Alloy steels (30～45HRC)
200	500	350	300	300	200	500	350	300	300	200	500	350	300	300	200	500	350	300	300	200	500	350	300	300	200	500	350	300	300	
1,498	4,494	3,146	2,247	1,798	1,592	4,775	3,342	2,387	1,910	1,516	4,547	3,183	2,274	1,819	1,528	4,584	3,209	2,292	1,833	1,469	4,407	3,085	2,204	1,763	1,592	4,775	3,342	2,387	1,910	
0.1	0.12	0.12	0.1	0.08	0.1	0.12	0.12	0.1	0.08	0.1	0.12	0.12	0.1	0.08	0.1	0.12	0.12	0.1	0.08	0.1	0.12	0.12	0.1	0.08	0.1	0.12	0.12	0.1	0.08	
1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
2,809	4,681	3,370	2,809	2,809	2,387	3,979	2,865	2,387	2,387	2,274	3,789	2,728	2,274	2,274	1,910	3,183	2,292	1,910	1,910	1,836	3,061	2,204	1,836	1,836	1,492	2,487	1,790	1,492	1,492	Hardened steels (45～55HRC)
150	250	180	150	150	150	250	180	150	150	150	250	180	150	150	150	250	180	150	150	150	250	180	150	150	150	250	180	150	150	
1,123	1,872	1,348	899	899	1,194	1,989	1,432	955	955	1,137	1,895	1,364	909	909	1,146	1,910	1,375	917	917	1,102	1,836	1,322	881	881	1,194	1,989	1,432	955	955	
0.1	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.08	0.08	
1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
2,434	3,745	2,996	2,434	2,434	2,069	3,183	2,546	2,069	2,069	1,970	3,032	2,425	1,970	1,970	1,655	2,546	2,037	1,655	1,655	1,592	2,449	1,959	1,592	1,592	1,293	1,989	1,592	1,293	1,293	Hardened steels (55～62HRC)
130	200	160	130	130	130	200	160	130	130	130	200	160	130	130	130	200	160	130	130	130	200	160	130	130	130	200	160	130	130	
974	1,498	1,198	779	487	1,035	1,592	1,273	828	517	985	1,516	1,213	788	493	993	1,528	1,222	795	497	955	1,469	1,175	764	477	1,035	1,592	1,273	828	517	
0.1	0.1	0.1	0.08	0.05	0.1	0.1	0.1	0.08	0.05	0.1	0.1	0.1	0.08	0.05	0.1	0.1	0.1	0.08	0.05	0.1	0.1	0.1	0.08	0.05	0.1	0.1	0.1	0.08	0.05	
1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
5,617	11,234	7,490	7,490	5,617	4,775	9,549	6,366	6,366	4,775	4,547	9,095	6,063	6,063	4,547	3,820	7,639	5,093	5,093	3,820	3,673	7,346	4,897	4,897	3,673	2,984	5,968	3,979	3,979	2,984	Stainless steels SUS
300	600	400	400	300	300	600	400	400	300	300	600	400	400	300	300	600	400	400	300	300	600	400	400	300	300	600	400	400	300	
2,247	6,741	4,494	3,595	2,247	2,387	7,162	4,775	3,820	2,387	2,274	6,821	4,547	3,638	2,274	2,292	6,875	4,584	3,667	2,292	2,204	6,611	4,407	3,526	2,204	2,387	7,162	4,775	3,820	2,387	
0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	
1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
5,617	11,234	9,362	7,490	7,490	4,775	9,549	7,958	6,366	6,366	4,547	9,095	7,579	6,063	6,063	3,820	7,639	6,366	5,093	5,093	3,673	7,346	6,121	4,897	4,897	2,984	5,968	4,974	3,979	3,979	Cast irons FC FCD
300	600	500	400	400	300	600	500	400	400	300	600	500	400	400	300	600	500	400	400	300	600	500	400	400	300	600	500	400	400	
2,247	6,741	5,617	3,595	2,996	2,387	7,162	5,968	3,820	3,183	2,274	6,821	5,684	3,638	3,032	2,292	6,875	5,730	3,667	3,056	2,204	6,611	5,509	3,526	2,938	2,387	7,162	5,968	3,820	3,183	
0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	
1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	1.5	1.5	1	0.7	0.5	
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	

Recommended Cutting Conditions

Bottom finishing

Work material	Recommended grade	Tool dia.DC	Φ10 (2 Flutes)					Φ11 (2 Flutes)					Φ12 (3 Flutes)					Φ13 (3 Flutes)					Φ16 (4 Flutes)				
		Overhang	<3DC		Modular carbide shank			<3DC		Modular carbide shank			<3DC		Modular carbide shank			<3DC		Modular carbide shank			<3DC		Modular carbide shank		
			General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC
Mild steels (200HB or less)	TH308	*n* (min-1)	4,775	9,549	6,366	4,775	4,138	4,341	8,681	5,787	4,341	3,762	3,979	7,958	5,305	3,979	3,448	3,673	7,346	4,897	3,673	3,183	2,984	5,968	3,979	2,984	2,586
		Vc(m/min)	150	300	200	150	130	150	300	200	150	130	150	300	200	150	130	150	300	200	150	130	150	300	200	150	130
		Vf(mm/min)	955	2,865	1,910	1,146	828	868	2,604	1,736	1,042	752	1,194	3,581	2,387	1,432	1,035	1,102	3,306	2,204	1,322	955	1,194	3,581	2,387	1,432	1,035
		fz(mm/t)	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1
		*a*p(mm)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
		*a*e(mm)	5-10	5-10	5-10	5-10	5-10	5.5-11	5.5-11	5.5-11	5.5-11	5.5-11	6-12	6-12	6-12	6-12	6-12	6.5-13	6.5-13	6.5-13	6.5-13	6.5-13	8-16	8-16	8-16	8-16	8-16
Carbon steels Alloy steels (30HRC or less)	TH308	*n* (min-1)	4,775	7,958	5,730	4,138	3,183	4,341	7,234	5,209	3,762	2,894	3,979	6,631	4,775	3,448	2,653	3,673	6,121	4,407	3,183	2,449	2,984	4,974	3,581	2,586	1,989
		Vc(m/min)	150	250	180	130	100	150	250	180	130	100	150	250	180	130	100	150	250	180	130	100	150	250	180	130	100
		Vf(mm/min)	955	2,387	1,719	993	637	868	2,170	1,563	903	579	1,194	2,984	2,149	1,241	796	1,102	2,755	1,983	1,146	735	1,194	2,984	2,149	1,241	796
		fz(mm/t)	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1
		*a*p(mm)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
		*a*e(mm)	5-10	5-10	5-10	5-10	5-10	5.5-11	5.5-11	5.5-11	5.5-11	5.5-11	6-12	6-12	6-12	6-12	6-12	6.5-13	6.5-13	6.5-13	6.5-13	6.5-13	8-16	8-16	8-16	8-16	8-16
Carbon steels Alloy steels (30～45HRC)	TH308	*n* (min-1)	4,138	6,366	5,093	4,138	2,865	3,762	5,787	4,630	3,762	2,604	3,448	5,305	4,244	3,448	2,387	3,183	4,897	3,918	3,183	2,204	2,586	3,979	3,183	2,586	1,790
		Vc(m/min)	130	200	160	130	90	130	200	160	130	90	130	200	160	130	90	130	200	160	130	90	130	200	160	130	90
		Vf(mm/min)	828	1,528	1,222	828	458	752	1,389	1,111	752	417	1,035	1,910	1,528	1,035	573	955	1,763	1,410	955	529	1,035	1,910	1,528	1,035	573
		fz(mm/t)	0.1	0.12	0.12	0.1	0.08	0.1	0.12	0.12	0.1	0.08	0.1	0.12	0.12	0.1	0.08	0.1	0.12	0.12	0.1	0.08	0.1	0.12	0.12	0.1	0.08
		*a*p(mm)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
		*a*e(mm)	5-10	5-10	5-10	5-10	5-10	5.5-11	5.5-11	5.5-11	5.5-11	5.5-11	6-12	6-12	6-12	6-12	6-12	6.5-13	6.5-13	6.5-13	6.5-13	6.5-13	8-16	8-16	8-16	8-16	8-16
Hardened steels (45～55HRC)	TH308	*n* (min-1)	2,546	3,820	3,183	2,546	2,546	2,315	3,472	2,894	2,315	2,315	2,122	3,183	2,653	2,122	2,122	1,959	2,938	2,449	1,959	1,959	1,592	2,387	1,989	1,592	1,592
		Vc(m/min)	80	120	100	80	80	80	120	100	80	80	80	120	100	80	80	80	120	100	80	80	80	120	100	80	80
		Vf(mm/min)	509	764	637	407	407	463	694	579	370	370	637	955	796	509	509	588	881	735	470	470	637	955	796	509	509
		fz(mm/t)	0.1	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.08	0.08
		*a*p(mm)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
		*a*e(mm)	5-10	5-10	5-10	5-10	5-10	5.5-11	5.5-11	5.5-11	5.5-11	5.5-11	6-12	6-12	6-12	6-12	6-12	6.5-13	6.5-13	6.5-13	6.5-13	6.5-13	8-16	8-16	8-16	8-16	8-16
Hardened steels (55～62HRC)	TH308	*n* (min-1)	1,592	3,183	2,228	1,592	1,592	1,447	2,894	2,026	1,447	1,447	1,326	2,653	1,857	1,326	1,326	1,224	2,449	1,714	1,224	1,224	995	1,989	1,393	995	995
		Vc(m/min)	50	100	70	50	50	50	100	70	50	50	50	100	70	50	50	50	100	70	50	50	50	100	70	50	50
		Vf(mm/min)	318	637	446	255	159	289	579	405	231	145	398	796	557	318	199	367	735	514	294	184	398	796	557	318	199
		fz(mm/t)	0.1	0.1	0.1	0.08	0.05	0.1	0.1	0.1	0.08	0.05	0.1	0.1	0.1	0.08	0.05	0.1	0.1	0.1	0.08	0.05	0.1	0.1	0.1	0.08	0.05
		*a*p(mm)	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
		*a*e(mm)	5-10	5-10	5-10	5-10	5-10	5.5-11	5.5-11	5.5-11	5.5-11	5.5-11	6-12	6-12	6-12	6-12	6-12	6.5-13	6.5-13	6.5-13	6.5-13	6.5-13	8-16	8-16	8-16	8-16	8-16
Stainless steels SUS	TH308	*n* (min-1)	4,775	7,958	5,730	4,138	3,183	4,341	7,234	5,209	3,762	2,894	3,979	6,631	4,775	3,448	2,653	3,673	6,121	4,407	3,183	2,449	2,984	4,974	3,581	2,586	1,989
		Vc(m/min)	150	250	180	130	100	150	250	180	130	100	150	250	180	130	100	150	250	180	130	100	150	250	180	130	100
		Vf(mm/min)	955	2,387	1,719	993	637	868	2,170	1,563	903	579	1,194	2,984	2,149	1,241	796	1,102	2,755	1,983	1,146	735	1,194	2,984	2,149	1,241	796
		fz(mm/t)	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1
		*a*p(mm)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
		*a*e(mm)	5-10	5-10	5-10	5-10	5-10	5.5-11	5.5-11	5.5-11	5.5-11	5.5-11	6-12	6-12	6-12	6-12	6-12	6.5-13	6.5-13	6.5-13	6.5-13	6.5-13	8-16	8-16	8-16	8-16	8-16
Cast irons FC FCD	TH308	*n* (min-1)	4,775	7,958	6,366	4,775	4,138	4,341	7,234	5,787	4,341	3,762	3,979	6,631	5,305	3,979	3,448	3,673	6,121	4,897	3,673	3,183	2,984	4,974	3,979	2,984	2,586
		Vc(m/min)	150	250	200	150	130	150	250	200	150	130	150	250	200	150	130	150	250	200	150	130	150	250	200	150	130
		Vf(mm/min)	955	2,387	1,910	1,146	828	868	2,170	1,736	1,042	752	1,194	2,984	2,387	1,432	1,035	1,102	2,755	2,204	1,322	955	1,194	2,984	2,387	1,432	1,035
		fz(mm/t)	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1
		*a*p(mm)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
		*a*e(mm)	5-10	5-10	5-10	5-10	5-10	5.5-11	5.5-11	5.5-11	5.5-11	5.5-11	6-12	6-12	6-12	6-12	6-12	6.5-13	6.5-13	6.5-13	6.5-13	6.5-13	8-16	8-16	8-16	8-16	8-16

【Note】
① Use the appropriate coolant for the work material and machining shape.
② These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions.
③ For slotting or ramping, feed rate should be set to 70% as general criteria.
④ Ensure to index the insert at the correct time to ensure safety of the tool-body.
⑤ The evacuation of swarf can cause burns, cuts or damage to the eyes please ensue the correct safety cover is fitted around the machine, and necessary personal protection equipment is worn by the machine operator.
⑥ Due to fire risks do not use neat cutting oil as a coolant.



Finishing

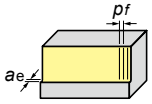
Φ17 (4 Flutes)					Φ20 (5 Flutes)					Φ21 (5 Flutes)					Φ25 (6 Flutes)					Φ26 (6 Flutes)					Φ32 (8 Flutes)					Work material
<3DC		Modular carbide shank			<3DC		Modular carbide shank			<3DC		Modular carbide shank			<3DC		Modular carbide shank			<3DC		Modular carbide shank			<3DC		Modular carbide shank			
General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	
2,809	5,617	3,745	2,809	2,434	2,387	4,775	3,183	2,387	2,069	2,274	4,547	3,032	2,274	1,970	1,910	3,820	2,546	1,910	1,655	1,836	3,673	2,449	1,836	1,592	1,836	3,673	2,449	1,836	1,592	Mild steels (200HB or less)
150	300	200	150	130	150	300	200	150	130	150	300	200	150	130	150	300	200	150	130	150	300	200	150	130	150	300	200	150	130	
1,123	3,370	2,247	1,348	974	1,194	3,581	2,387	1,432	1,035	1,137	3,410	2,274	1,364	985	1,146	3,438	2,292	1,375	993	1,102	3,306	2,204	1,322	955	1,102	3,306	2,204	1,322	955	
0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	
0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	
8.5-17	8.5-17	8.5-17	8.5-17	8.5-17	10-20	10-20	10-20	10-20	10-20	10.5-21	10.5-21	10.5-21	10.5-21	10.5-21	12.5-25	12.5-25	12.5-25	12.5-25	12.5-25	13-26	13-26	13-26	13-26	13-26	16-32	16-32	16-32	16-32	16-32	
2,809	4,681	3,370	2,434	1,872	2,387	3,979	2,865	2,069	1,592	2,274	3,789	2,728	1,970	1,516	1,910	3,183	2,292	1,655	1,273	1,836	3,061	2,204	1,592	1,224	1,492	2,487	1,790	1,293	995	Carbon steels Alloy steels (30HRC or less)
150	250	180	130	100	150	250	180	130	100	150	250	180	130	100	150	250	180	130	100	150	250	180	130	100	150	250	180	130	100	
1,123	2,809	2,022	1,168	749	1,194	2,984	2,149	1,241	796	1,137	2,842	2,046	1,182	758	1,146	2,865	2,063	1,192	764	1,102	2,755	1,983	1,146	735	1,194	2,984	2,149	1,241	796	
0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	
0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	
8.5-17	8.5-17	8.5-17	8.5-17	8.5-17	10-20	10-20	10-20	10-20	10-20	10.5-21	10.5-21	10.5-21	10.5-21	10.5-21	12.5-25	12.5-25	12.5-25	12.5-25	12.5-25	13-26	13-26	13-26	13-26	13-26	16-32	16-32	16-32	16-32	16-32	
2,434	3,745	2,996	2,434	1,685	2,069	3,183	2,546	2,069	1,432	1,970	3,032	2,425	1,970	1,364	1,655	2,546	2,037	1,655	1,146	1,592	2,449	1,959	1,592	1,102	1,293	1,989	1,592	1,293	895	Carbon steels Alloy steels (30～45HRC)
130	200	160	130	90	130	200	160	130	90	130	200	160	130	90	130	200	160	130	90	130	200	160	130	90	130	200	160	130	90	
974	1,798	1,438	974	539	1,035	1,910	1,528	1,035	573	985	1,819	1,455	985	546	993	1,833	1,467	993	550	955	1,763	1,410	955	529	1,035	1,910	1,528	1,035	573	
0.1	0.12	0.12	0.1	0.08	0.1	0.12	0.12	0.1	0.08	0.1	0.12	0.12	0.1	0.08	0.1	0.12	0.12	0.1	0.08	0.1	0.12	0.12	0.1	0.08	0.1	0.12	0.12	0.1	0.08	
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
8.5-17	8.5-17	8.5-17	8.5-17	8.5-17	10-20	10-20	10-20	10-20	10-20	10.5-21	10.5-21	10.5-21	10.5-21	10.5-21	12.5-25	12.5-25	12.5-25	12.5-25	12.5-25	13-26	13-26	13-26	13-26	13-26	16-32	16-32	16-32	16-32	16-32	
1,498	2,247	1,872	1,498	1,498	1,273	1,910	1,592	1,273	1,273	1,213	1,819	1,516	1,213	1,213	1,019	1,528	1,273	1,019	1,019	979	1,469	1,224	979	979	796	1,194	995	796	796	Hardened steels (45～55HRC)
80	120	100	80	80	80	120	100	80	80	80	120	100	80	80	80	120	100	80	80	80	120	100	80	80	80	120	100	80	80	
599	899	749	479	479	637	955	796	509	509	606	909	758	485	485	611	917	764	489	489	588	881	735	470	470	637	955	796	509	509	
0.1	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.08	0.08	
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
8.5-17	8.5-17	8.5-17	8.5-17	8.5-17	10-20	10-20	10-20	10-20	10-20	10.5-21	10.5-21	10.5-21	10.5-21	10.5-21	12.5-25	12.5-25	12.5-25	12.5-25	12.5-25	13-26	13-26	13-26	13-26	13-26	16-32	16-32	16-32	16-32	16-32	
936	1,872	1,311	936	936	796	1,592	1,114	796	796	758	1,516	1,061	758	758	637	1,273	891	637	637	612	1,224	857	612	612	497	995	696	497	497	Hardened steels (55～62HRC)
50	100	70	50	50	50	100	70	50	50	50	100	70	50	50	50	100	70	50	50	50	100	70	50	50	50	100	70	50	50	
374	749	524	300	187	398	796	557	318	199	379	758	531	303	189	382	764	535	306	191	367	735	514	294	184	398	796	557	318	199	
0.1	0.1	0.1	0.08	0.05	0.1	0.1	0.1	0.08	0.05	0.1	0.1	0.1	0.08	0.05	0.1	0.1	0.1	0.08	0.05	0.1	0.1	0.1	0.08	0.05	0.1	0.1	0.1	0.08	0.05	
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
8.5-17	8.5-17	8.5-17	8.5-17	8.5-17	10-20	10-20	10-20	10-20	10-20	10.5-21	10.5-21	10.5-21	10.5-21	10.5-21	12.5-25	12.5-25	12.5-25	12.5-25	12.5-25	13-26	13-26	13-26	13-26	13-26	16-32	16-32	16-32	16-32	16-32	
2,809	4,681	3,370	2,434	1,872	2,387	3,979	2,865	2,069	1,592	2,274	3,789	2,728	1,970	1,516	1,910	3,183	2,292	1,655	1,273	1,836	3,061	2,204	1,592	1,224	1,492	2,487	1,790	1,293	995	Stainless steels SUS
150	250	180	130	100	150	250	180	130	100	150	250	180	130	100	150	250	180	130	100	150	250	180	130	100	150	250	180	130	100	
1,123	2,809	2,022	1,168	749	1,194	2,984	2,149	1,241	796	1,137	2,842	2,046	1,182	758	1,146	2,865	2,063	1,192	764	1,102	2,755	1,983	1,146	735	1,194	2,984	2,149	1,241	796	
0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	
0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	
8.5-17	8.5-17	8.5-17	8.5-17	8.5-17	10-20	10-20	10-20	10-20	10-20	10.5-21	10.5-21	10.5-21	10.5-21	10.5-21	12.5-25	12.5-25	12.5-25	12.5-25	12.5-25	13-26	13-26	13-26	13-26	13-26	16-32	16-32	16-32	16-32	16-32	
2,809	4,681	3,745	2,809	2,434	2,387	3,979	3,183	2,387	2,069	2,274	3,789	3,032	2,274	1,970	1,910	3,183	2,546	1,910	1,655	1,836	3,061	2,449	1,836	1,592	1,492	2,487	1,989	1,492	1,293	Cast irons FC FCD
150	250	200	150	130	150	250	200	150	130	150	250	200	150	130	150	250	200	150	130	150	250	200	150	130	150	250	200	150	130	
1,123	2,809	2,247	1,348	974	1,194	2,984	2,387	1,432	1,035	1,137	2,842	2,274	1,364	985	1,146	2,865	2,292	1,375	993	1,102	2,755	2,204	1,322	955	1,194	2,984	2,387	1,432	1,035	
0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	
0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	
8.5-17	8.5-17	8.5-17	8.5-17	8.5-17	10-20	10-20	10-20	10-20	10-20	10.5-21	10.5-21	10.5-21	10.5-21	10.5-21	12.5-25	12.5-25	12.5-25	12.5-25	12.5-25	13-26	13-26	13-26	13-26	13-26	16-32	16-32	16-32	16-32	16-32	

Recommended Cutting Conditions

Vertical cutting (※ Use only in pushing-down direction.)

Work material	Recommended grade	Tool dia.DC	Φ10 (2 Flutes)					Φ11 (2 Flutes)					Φ12 (3 Flutes)					Φ13 (3 Flutes)					Φ16 (4 Flutes)				
		Overhang	<3DC		Modular carbide shank			<3DC		Modular carbide shank			<3DC		Modular carbide shank			<3DC		Modular carbide shank			<3DC		Modular carbide shank		
			General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC
Mild steels (200HB or less)	TH308	*n* (min-1)	9,549	19,099	12,732	12,732	9,549	8,681	17,362	11,575	11,575	8,681	7,958	15,915	10,610	10,610	7,958	7,346	14,691	9,794	9,794	7,346	5,968	11,937	7,958	7,958	5,968
		Vc(m/min)	300	600	400	400	300	300	600	400	400	300	300	600	400	400	300	300	600	400	400	300	300	600	400	400	300
		Vf(mm/min)	2,483	7,639	3,820	3,310	1,910	2,257	6,945	3,472	3,009	1,736	3,104	9,549	4,775	4,138	2,387	2,865	8,815	4,407	3,820	2,204	3,104	9,549	4,775	4,138	2,387
		fz(mm/t)	0.13	0.2	0.15	0.13	0.1	0.13	0.2	0.15	0.13	0.1	0.13	0.2	0.15	0.13	0.1	0.13	0.2	0.15	0.13	0.1	0.13	0.2	0.15	0.13	0.1
		pf(mm)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
		ae(mm)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Carbon steels Alloy steels (30HRC or less)	TH308	*n* (min-1)	7,958	14,324	9,549	9,549	7,958	7,234	13,022	8,681	8,681	7,234	6,631	11,937	7,958	7,958	6,631	6,121	11,018	7,346	7,346	6,121	4,974	8,952	5,968	5,968	4,974
		Vc(m/min)	250	450	300	300	250	250	450	300	300	250	250	450	300	300	250	250	450	300	300	250	250	450	300	300	250
		Vf(mm/min)	2,069	5,730	2,865	2,483	1,592	1,881	5,209	2,604	2,257	1,447	2,586	7,162	3,581	3,104	1,989	2,387	6,611	3,306	2,865	1,836	2,586	7,162	3,581	3,104	1,989
		fz(mm/t)	0.13	0.2	0.15	0.13	0.1	0.13	0.2	0.15	0.13	0.1	0.13	0.2	0.15	0.13	0.1	0.13	0.2	0.15	0.13	0.1	0.13	0.2	0.15	0.13	0.1
		pf(mm)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
		ae(mm)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Carbon steels Alloy steels (30～45HRC)	TH308	*n* (min-1)	5,730	11,141	7,958	6,366	5,730	5,209	10,128	7,234	5,787	5,209	4,775	9,284	6,631	5,305	4,775	4,407	8,570	6,121	4,897	4,407	3,581	6,963	4,974	3,979	3,581
		Vc(m/min)	180	350	250	200	180	180	350	250	200	180	180	350	250	200	180	180	350	250	200	180	180	350	250	200	180
		Vf(mm/min)	1,146	2,674	1,910	1,273	917	1,042	2,431	1,736	1,157	833	1,432	3,342	2,387	1,592	1,146	1,322	3,085	2,204	1,469	1,058	1,432	3,342	2,387	1,592	1,146
		fz(mm/t)	0.1	0.12	0.12	0.1	0.08	0.1	0.12	0.12	0.1	0.08	0.1	0.12	0.12	0.1	0.08	0.1	0.12	0.12	0.1	0.08	0.1	0.12	0.12	0.1	0.08
		pf(mm)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
		ae(mm)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Hardened steels (45～55HRC)	TH308	*n* (min-1)	3,820	6,366	5,730	4,775	3,820	3,472	5,787	5,209	4,341	3,472	3,183	5,305	4,775	3,979	3,183	2,938	4,897	4,407	3,673	2,938	2,387	3,979	3,581	2,984	2,387
		Vc(m/min)	120	200	180	150	120	120	200	180	150	120	120	200	180	150	120	120	200	180	150	120	120	200	180	150	120
		Vf(mm/min)	764	1,273	1,146	764	611	694	1,157	1,042	694	556	955	1,592	1,432	955	764	881	1,469	1,322	881	705	955	1,592	1,432	955	764
		fz(mm/t)	0.1	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.08	0.08
		pf(mm)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
		ae(mm)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Hardened steels (55～62HRC)	TH308	*n* (min-1)	3,183	5,730	4,775	3,820	3,183	2,894	5,209	4,341	3,472	2,894	2,653	4,775	3,979	3,183	2,653	2,449	4,407	3,673	2,938	2,449	1,989	3,581	2,984	2,387	1,989
		Vc(m/min)	100	180	150	120	100	100	180	150	120	100	100	180	150	120	100	100	180	150	120	100	100	180	150	120	100
		Vf(mm/min)	637	1,146	955	611	318	579	1,042	868	556	289	796	1,432	1,194	764	398	735	1,322	1,102	705	367	796	1,432	1,194	764	398
		fz(mm/t)	0.1	0.1	0.1	0.08	0.05	0.1	0.1	0.1	0.08	0.05	0.1	0.1	0.1	0.08	0.05	0.1	0.1	0.1	0.08	0.05	0.1	0.1	0.1	0.08	0.05
		pf(mm)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
		ae(mm)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Stainless steels SUS	TH308	*n* (min-1)	7,958	14,324	9,549	9,549	7,958	7,234	13,022	8,681	8,681	7,234	6,631	11,937	7,958	7,958	6,631	6,121	11,018	7,346	7,346	6,121	4,974	8,952	5,968	5,968	4,974
		Vc(m/min)	250	450	300	300	250	250	450	300	300	250	250	450	300	300	250	250	450	300	300	250	250	450	300	300	250
		Vf(mm/min)	1,592	4,297	2,865	2,292	1,592	1,447	3,907	2,604	2,083	1,447	1,989	5,371	3,581	2,865	1,989	1,836	4,958	3,306	2,644	1,836	1,989	5,371	3,581	2,865	1,989
		fz(mm/t)	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1
		pf(mm)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
		ae(mm)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cast irons FC FCD	TH308	*n* (min-1)	7,958	14,324	12,732	11,141	9,549	7,234	13,022	11,575	10,128	8,681	6,631	11,937	10,610	9,284	7,958	6,121	11,018	9,794	8,570	7,346	4,974	8,952	7,958	6,963	5,968
		Vc(m/min)	250	450	400	350	300	250	450	400	350	300	250	450	400	350	300	250	450	400	350	300	250	450	400	350	300
		Vf(mm/min)	1,592	4,297	3,820	2,674	1,910	1,447	3,907	3,472	2,431	1,736	1,989	5,371	4,775	3,342	2,387	1,836	4,958	4,407	3,085	2,204	1,989	5,371	4,775	3,342	2,387
		fz(mm/t)	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1
		pf(mm)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
		ae(mm)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2

【Note】
① Use the appropriate coolant for the work material and machining shape.
② These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions.
③ Ensure to index the insert at the correct time to ensure safety of the tool-body.
④ The evacuation of swarf can cause burns, cuts or damage to the eyes please ensue the correct safety cover is fitted around the machine, and necessary personal protection equipment is worn by the machine operator.
⑤ Due to fire risks do not use neat cutting oil as a coolant.



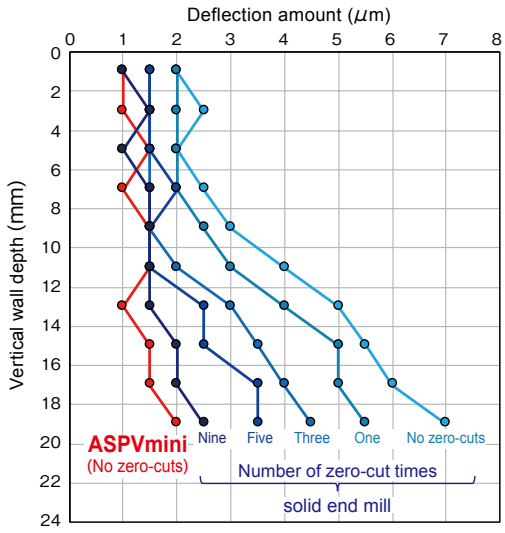
Finishing

Φ17 (4 Flutes)					Φ20 (5 Flutes)					Φ21 (5 Flutes)					Φ25 (6 Flutes)					Φ26 (6 Flutes)					Φ32 (8 Flutes)					Work material
<3DC		Modular carbide shank			<3DC		Modular carbide shank			<3DC		Modular carbide shank			<3DC		Modular carbide shank			<3DC		Modular carbide shank			<3DC		Modular carbide shank			
General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	General purpose	High-speed cutting	3DC -5DC	5DC -7DC	>7DC	
5,617	11,234	7,490	7,490	5,617	4,775	9,549	6,366	6,366	4,775	4,547	9,095	6,063	6,063	4,547	3,820	7,639	5,093	5,093	3,820	3,673	7,346	4,897	4,897	3,673	3,673	7,346	4,897	4,897	3,673	Mild steels (200HB or less)
300	600	400	400	300	300	600	400	400	300	300	600	400	400	300	300	600	400	400	300	300	600	400	400	300	300	600	400	400	300	
2,921	8,988	4,494	3,895	2,247	3,104	9,549	4,775	4,138	2,387	2,956	9,095	4,547	3,941	2,274	2,979	9,167	4,584	3,973	2,292	2,865	8,815	4,407	3,820	2,204	2,865	8,815	4,407	3,820	2,204	
0.13	0.2	0.15	0.13	0.1	0.13	0.2	0.15	0.13	0.1	0.13	0.2	0.15	0.13	0.1	0.13	0.2	0.15	0.13	0.1	0.13	0.2	0.15	0.13	0.1	0.13	0.2	0.15	0.13	0.1	
0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
4,681	8,426	5,617	5,617	4,681	3,979	7,162	4,775	4,775	3,979	3,789	6,821	4,547	4,547	3,789	3,183	5,730	3,820	3,820	3,183	3,061	5,509	3,673	3,673	3,061	2,487	4,476	2,984	2,984	2,487	Carbon steels Alloy steels (30HRC or less)
250	450	300	300	250	250	450	300	300	250	250	450	300	300	250	250	450	300	300	250	250	450	300	300	250	250	450	300	300	250	
2,434	6,741	3,370	2,921	1,872	2,586	7,162	3,581	3,104	1,989	2,463	6,821	3,410	2,956	1,895	2,483	6,875	3,438	2,979	1,910	2,387	6,611	3,306	2,865	1,836	2,586	7,162	3,581	3,104	1,989	
0.13	0.2	0.15	0.13	0.1	0.13	0.2	0.15	0.13	0.1	0.13	0.2	0.15	0.13	0.1	0.13	0.2	0.15	0.13	0.1	0.13	0.2	0.15	0.13	0.1	0.13	0.2	0.15	0.13	0.1	
0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
3,370	6,553	4,681	3,745	3,370	2,865	5,570	3,979	3,183	2,865	2,728	5,305	3,789	3,032	2,728	2,292	4,456	3,183	2,546	2,292	2,204	4,285	3,061	2,449	2,204	1,790	3,482	2,487	1,989	1,790	Carbon steels Alloy steels (30～45HRC)
180	350	250	200	180	180	350	250	200	180	180	350	250	200	180	180	350	250	200	180	180	350	250	200	180	180	350	250	200	180	
1,348	3,146	2,247	1,498	1,079	1,432	3,342	2,387	1,592	1,146	1,364	3,183	2,274	1,516	1,091	1,375	3,209	2,292	1,528	1,100	1,322	3,085	2,204	1,469	1,058	1,432	3,342	2,387	1,592	1,146	
0.1	0.12	0.12	0.1	0.08	0.1	0.12	0.12	0.1	0.08	0.1	0.12	0.12	0.1	0.08	0.1	0.12	0.12	0.1	0.08	0.1	0.12	0.12	0.1	0.08	0.1	0.12	0.12	0.1	0.08	
0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
2,247	3,745	3,370	2,809	2,247	1,910	3,183	2,865	2,387	1,910	1,819	3,032	2,728	2,274	1,819	1,528	2,546	2,292	1,910	1,528	1,469	2,449	2,204	1,836	1,469	1,194	1,989	1,790	1,492	1,194	Hardened steels (45～55HRC)
120	200	180	150	120	120	200	180	150	120	120	200	180	150	120	120	200	180	150	120	120	200	180	150	120	120	200	180	150	120	
899	1,498	1,348	899	719	955	1,592	1,432	955	764	909	1,516	1,364	909	728	917	1,528	1,375	917	733	881	1,469	1,322	881	705	955	1,592	1,432	955	764	
0.1	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.08	0.08	
0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
1,872	3,370	2,809	2,247	1,872	1,592	2,865	2,387	1,910	1,592	1,516	2,728	2,274	1,819	1,516	1,273	2,292	1,910	1,528	1,273	1,224	2,204	1,836	1,469	1,224	995	1,790	1,492	1,194	995	Hardened steels (55～62HRC)
100	180	150	120	100	100	180	150	120	100	100	180	150	120	100	100	180	150	120	100	100	180	150	120	100	100	180	150	120	100	
749	1,348	1,123	719	374	796	1,432	1,194	764	398	758	1,364	1,137	728	379	764	1,375	1,146	733	382	735	1,322	1,102	705	367	796	1,432	1,194	764	398	
0.1	0.1	0.1	0.08	0.05	0.1	0.1	0.1	0.08	0.05	0.1	0.1	0.1	0.08	0.05	0.1	0.1	0.1	0.08	0.05	0.1	0.1	0.1	0.08	0.05	0.1	0.1	0.1	0.08	0.05	
0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
4,681	8,426	5,617	5,617	4,681	3,979	7,162	4,775	4,775	3,979	3,789	6,821	4,547	4,547	3,789	3,183	5,730	3,820	3,820	3,183	3,061	5,509	3,673	3,673	3,061	2,487	4,476	2,984	2,984	2,487	Stainless steels SUS
250	450	300	300	250	250	450	300	300	250	250	450	300	300	250	250	450	300	300	250	250	450	300	300	250	250	450	300	300	250	
1,872	5,056	3,370	2,696	1,872	1,989	5,371	3,581	2,865	1,989	1,895	5,116	3,410	2,728	1,895	1,910	5,157	3,438	2,750	1,910	1,836	4,958	3,306	2,644	1,836	1,989	5,371	3,581	2,865	1,989	
0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	
0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
4,681	8,426	7,490	6,553	5,617	3,979	7,162	6,366	5,570	4,775	3,789	6,821	6,063	5,305	4,547	3,183	5,730	5,093	4,456	3,820	3,061	5,509	4,897	4,285	3,673	2,487	4,476	3,979	3,482	2,984	Cast irons FC FCD
250	450	400	350	300	250	450	400	350	300	250	450	400	350	300	250	450	400	350	300	250	450	400	350	300	250	450	400	350	300	
1,872	5,056	4,494	3,146	2,247	1,989	5,371	4,775	3,342	2,387	1,895	5,116	4,547	3,183	2,274	1,910	5,157	4,584	3,209	2,292	1,836	4,958	4,407	3,085	2,204	1,989	5,371	4,775	3,342	2,387	
0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	0.1	0.15	0.15	0.12	0.1	
0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	
<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	

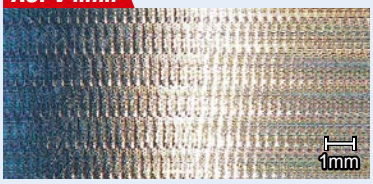
Field data

Comparison of deflection amount vs vertical walls

01 Comparing the deflection amounts of processed vertical walls to results with solid end mill



ASPV mini



Shiny surface

Conventional (solid end mill)

Worn / Cloudy surface

Cutting conditions

Work material : S50C (220HB)
Machine : Vertical type (BT40)

ASPV mini

Cutter : ASPVM1012R-3-M6 (φ12-3NT)
Shank : ASC12-6.5-74-24Z
Insert : MPHT040205ZEL-0.5 (TH308)
Cutting speed : *Vc* = 300m/min
Revolution : *n* = 7,958min^{-1}
Feed rate : *fz*=0.1mm/t
Feed rate : *Vf* = 2,387mm/min
Axial depth of cut (*ap*) =1.0mm
Radial depth of cut (*ae*) =0.1mm
Overhang : 50mm (L/D=4.2)
Coolant : Air-blow

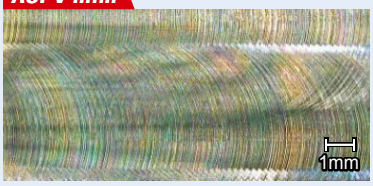
Conventional (solid end mill)

Cutter : solid、φ12-4NT、Corner R0.5
Cutting speed : *Vc* = 90m/min
Revolution : *n* = 2,400min^{-1}
Feed rate : *fz*=0.1mm/t
Feed rate : *Vf* = 1,000mm/min
Axial depth of cut (*ap*) =20mm
Radial depth of cut (*ae*) =0.1mm
Overhang : 50mm (L/D=4.2)
Coolant : Air-blow

Comparison of finished bottom surfaces

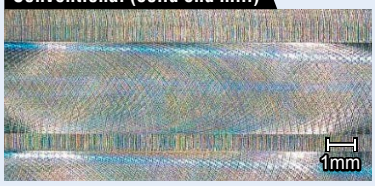
01 Comparing the roughness of finished bottom surfaces with results for solid end mill

ASPV mini



Feed direction roughness：Ra=0.07μm
Radial roughness：Ra=0.07μm

Conventional (solid end mill)



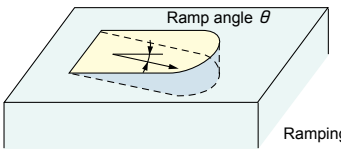
Feed direction roughness：Ra=0.49μm
Radial roughness：Ra=0.52μm

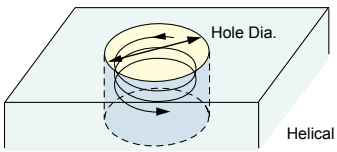
Cutting conditions

Work material : Pre-hardened steels (40HRC)
Machine : Vertical 3-axis M/C (HSK63)
Tool : ASPVM1012R-3-M6 (φ12-3NT, CR=R0.5, TH308)
Solid end mill (φ12-4NT, CR=R0.5)
Cutting speed : *Vc* = 200m/min
Feed rate : *fz*=0.1mm/t
Axial depth of cut (*ap*) =0.1mm
Radial depth of cut (*ae*) =6.0mm
Overhang : 50mm (L/D=4.2)
Coolant : Air-blow

Ramp Angle / Hole Dia.

Regarding ramping and helical milling diameter.

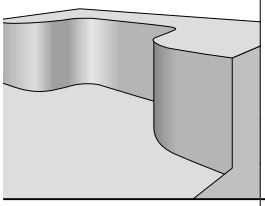
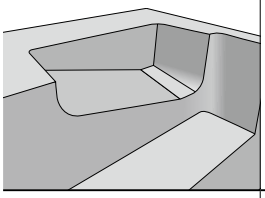
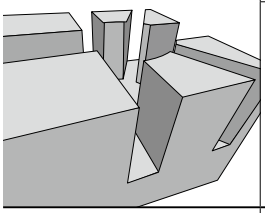
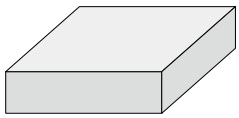




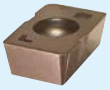
Tool Dia.(mm)	10	11	12	13	16	17	20	21	25	26	32
Maximum Ramping angle θ	0.5 ° or less										
Hole Dia.(mm)	13～19	15～21	17～23	19～25	25～31	27～33	33～39	35～41	43～49	45～51	57～63

Field data

Field Data

Cutting examples	Cutting conditions		Result
Plastic mold Finishing mold base 	Tool：ASPVM1016R-4-M8、ASC16-8.5-160-95Z Work material：SCM440（32HRC） Insert：MPHT040202ZEL（Equivalent to TH308） Overhang：120mm（L/D=7.5） Machine：Vertical type (HSK63)		Produces reference surfaces with a single cut and without zero cuts, reducing the time required for modification and additional cutting.
	■side wall Cutting speed：*Vc*=300m/min Revolution：*n*=6,000min^{-1} Feed speed：*Vf*=2,150mm/min Feed rate：*fz*=0.1mm/t Cutting depth：*ap*=0.8mm Radial depth of cut：*ae*=0.05mm Coolant：Air-blow	**■Bottom surface** Cutting speed：*Vc*=200m/min Revolution：*n*=4,000min^{-1} Feed speed：*Vf*=1,600mm/min Feed rate：*fz*=0.1mm/t Cutting depth：*ap*=0.05mm Radial depth of cut：*ae*=8.0mm Coolant：Air-blow	
Die-casting mold Finishing design sections 	Tool：ASPVM1012R-3-M6、ASC12-6.5-74-24Z Work material：SKD61（46HRC） Insert：MPHT040210ZEL-0.5（Equivalent to TH308） Overhang：50mm（L/D=4.2） Machine：Vertical type (HSK63)		Maintains high surface grade and dimensional accuracy throughout the cutting process. Can be used as an integrated tool for both design and structural sections.
	■side wall Cutting speed：*Vc*=260m/min Revolution：*n*=7,000min^{-1} Feed speed：*Vf*=2,000mm/min Feed rate：*fz*=0.1mm/t Cutting depth：*ap*=0.1mm Radial depth of cut：*ae*=0.1mm Coolant：Air-blow	**■Bottom surface** Cutting speed：*Vc*=110m/min Revolution：*n*=2,900min^{-1} Feed speed：*Vf*=870mm/min Feed rate：*fz*=0.1mm/t Cutting depth：*ap*=0.1mm Radial depth of cut：*ae*=7.0mm Coolant：Air-blow	
Mold components Finishing reference surfaces 	Tool：ASPVM1016R-4-M8、ASC16-8.5-160-95Z Work material：SCM440（32HRC） Insert：MPHT040205ZEL（Equivalent to TH308） Overhang：125mm（L/D=7.8） Machine：Vertical type (HSK63)		Allows reference surface finishing at twice the feed rate of conventional tools. Achieves good dimensional accuracy without need for reworking, reducing cutting times to half or less compared to conventional tools.
	■side wall Cutting speed：*Vc*=300m/min Revolution：*n*=6,000min^{-1} Feed speed：*Vf*=2,400mm/min Feed rate：*fz*=0.1mm/t Cutting depth：*ap*=0.4mm Radial depth of cut：*ae*=0.05mm Coolant：Air-blow		
Plate finishing 	Tool：ASPVM1012R-3-M6、ASC12-6.5-74-24Z Work material：S50C（220HB） Insert：MPHT040205ZEL（TH308） Overhang：50mm（L/D=4.2） Machine：Vertical type（BT50）		Produces equivalent cutting surface grades at more than twice the feed rate of conventional cermet. Longer tool life for higher efficiency and lower tool costs.
	■Bottom surface Cutting speed：*Vc*=300m/min Revolution：*n*=7,958min^{-1} Feed speed：*Vf*=1,194mm/min Feed rate：*fz*=0.05mm/t Cutting depth：*ap*=0.03mm Radial depth of cut：*ae*=9.6mm Coolant：Emulsion oil		

Lineup of our tools for finishing structural sections

Type	Feature			Body		Insert		Tool description
	Tolerance class	Efficiency	Economical	Tool dia.	Flutes	Corner R	No. of corners	
ARPF 	◎			ϕ6~32	2	R0.3~3.0	1	High-precision radius finishing tool with unique clamping mechanism and helical cutting edge
ASPVmini 	○	◎	◎	ϕ10~32	2~8	R0.2~1.0	2	Compact tool characterized by free-cutting with ground chipbreaker and high efficiency based on multi-flute specification
ASPV 	○	○	◎	ϕ16~63	2~8	R0.2~2.0	2	Multi-function/multi-flute specification tool designed for finishing structural sections

MOLDINO

The Edge To Innovation

The diagrams and table data are examples of test results, and are not guaranteed values.
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⚠ Attentions on Safety

1. Attentions regarding handling

(1) When removing the tool from the case (package), be careful not to drop it on your foot or drop it onto the tips of your bare fingers.
(2) When actually setting the inserts, be careful not to touch the cutting flute directly with your bare hands.

2. Attentions regarding mounting

(1) When preparing for use, be sure that the inserts are firmly mounted in place and that they are firmly mounted on the arbor, etc.
(2) If abnormal chattering occurs during use, stop the machine immediately and remove the cause of the chattering.

3. Attentions during use

(1) Before use, confirm the dimensions and direction of rotation of the tool and milling work material.
(2) The numerical values in the standard cutting conditions table should be used as criteria when starting new work. The cutting conditions should be adjusted as appropriate when the cutting depth is large, the rigidity of the machine being used is low, or according to the conditions of the work material.
(3) The inserts are made of a hard material. During use, they may break and fly off. In addition, cutting chips may also fly off. Since there is a danger of injury to workers, fire, or eye damage from such flying pieces, a safety cover should be installed and safety equipment such as safety glasses should be worn to create a safe environment for work.
・Do not use where there is a risk of fire or explosion.
・Do not use non-water-soluble cutting oils. Such oils may result in fire.
(4) Do not use the tool for any purpose other than that for which it is intended, and do not modify it.

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