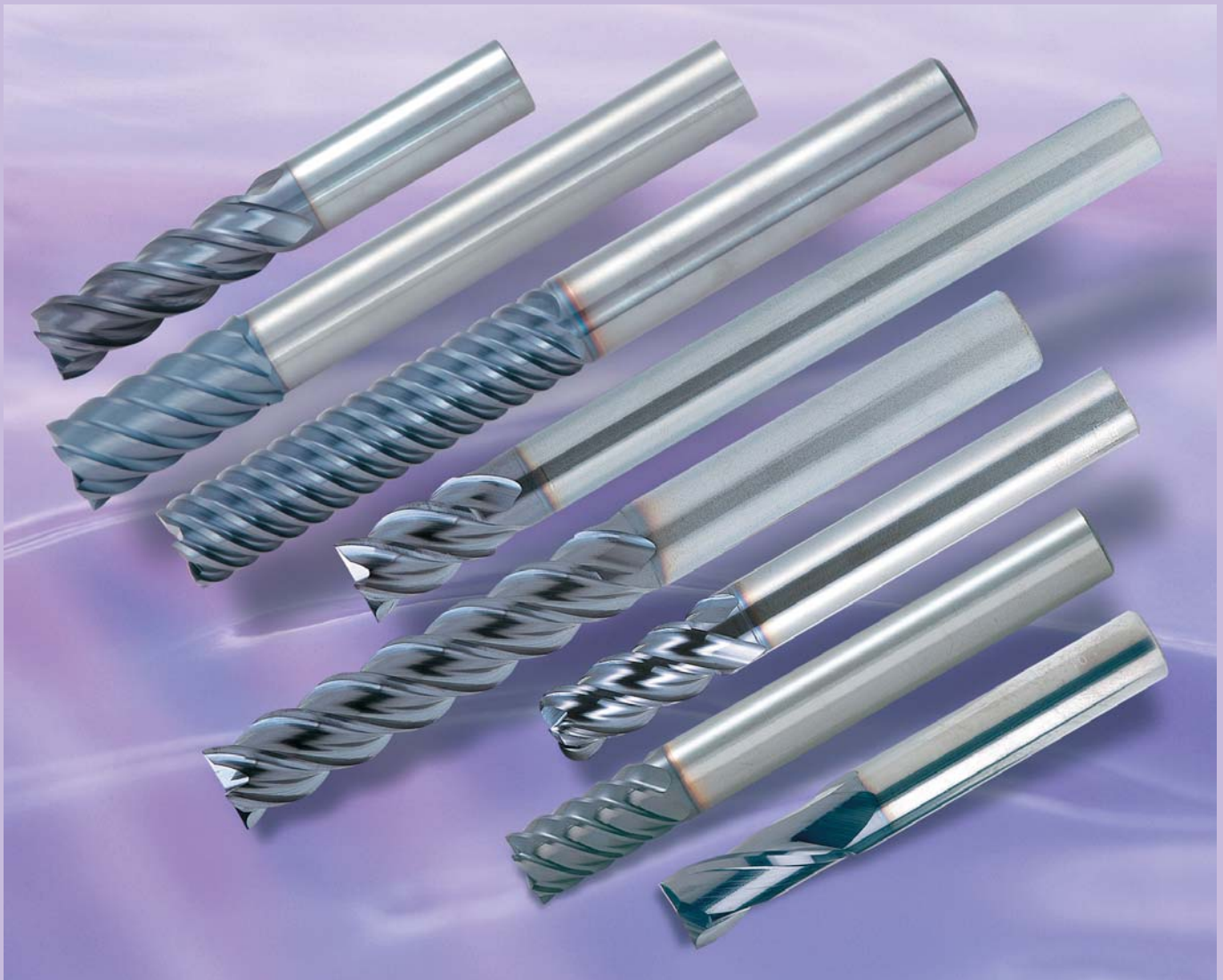











“ Hard Cut End Mills ”



Hard Cut End Mills

“ Hard Cut End Mills ”

■ Hard Cut End Mills Choice

Tool name	One-Cut 70	One-Cut Super R	One-Cut Hard	One-Cut 50		One-Cut Moriba	One-Cut Hard	One-Cut 03			
Type	Square	Radius	Square	Square		Square	Ball		Ball		
Pictures											
Page	283	285	288	290	291	293	297		299	300	301
Cod. No.	DV-SEHH	DV-OCRS	DZ-SEFS	DZ-SEHS	DZ-SEHLS	DZ-SEPL	DV-OCSB		DZ03-OCSB	DZ03-OCSB-LN	DZ03-OCUB
Range of size	ø1~ø32	ø2~ø20	ø3~ø20	ø3~ø32	ø12~ø25	ø16~ø30	ø1~ø25		ø1~ø25	ø1~ø4	ø3~ø10
No. of flute	4-6-8	3	4-6	4-8	6-8	6	2		2	2	2
Length of cut	Regular	Regular	Regular	Regular	Long	Long	Regular		Regular	Regular	Regular
Base Material	Micro Grain		Micro Grain				Micro Grain		Micro Grain		
Coating	DV-Coat (Value coating)		DZ-Coat (TiAlN)				DV-Coat (Value coating)		DZ-Coat (TiAlN)		
Carbon/Alloy steel	☺	☺	☺	☺	☺	☺	☺		☺	☺	☺
Hardened steel up to	~ HRc 50	☺	☺	☺	☺	☺	☺		☺	☺	☺
	~ HRc 65	☺	☺	☺	☺	☺	☺		☺	☺	☺
Stainless steel				☺	☺						
Cast Iron	☺	☺	☺	☺			☺		☺	☺	☺
Aluminium alloys					☺		☺		☺	☺	☺
Copper alloys Graphite							☺		☺	☺	☺
Titanium alloys							☺		☺	☺	☺
Plastics											
Features	For high hardened steel up to 70 HRC. For HSC Helix angle 50° Value Coating	For high hardened steel up to 60 HRC. For HSC Corner Radius Helix angle 50° Value Coating	For machining: High hardened steel Helix angle 50°	For machining: High hardened steel Helix angle 50° With small corner radius	For machining: High hardened steel Helix angle 50° Long shank	For machining: Welded and hardened steel	Regular type Helix angle 30° Up to 65 HRC Value Coating		Regular type Helix angle 30° Up to 65 HRC	Long neck type Helix angle 30° Up to 65 HRC	Slim shank type Helix angle 30° Up to 65 HRC

☺ = Very Good ☺ = OK ☺ = Not recommended

“ Hard Cut End Mills ”

■ **One-Cut70** Square Hard Cut End Mills



“ One-Cut 70 End Mills ”

■ Features



1. Adopting high rigid design and special geometry gives outstanding high precision and high performance on high hardened materials.
2. Achieves to cut smoothly on high hardened materials from semi-finishing to finishing.
3. Adopting the combination of new developed super micro-grain carbide and “VALUE COATING” achieves longer tool life in high speed cutting.

Newly developed "VALUE COATING"

VALUE COATING gives stable and high-performance machining on high hardened materials even with high speed dry condition, due to higher hardness and higher oxidation resistance than the existing DZ coating.

● Characteristic value of various PVD coatings

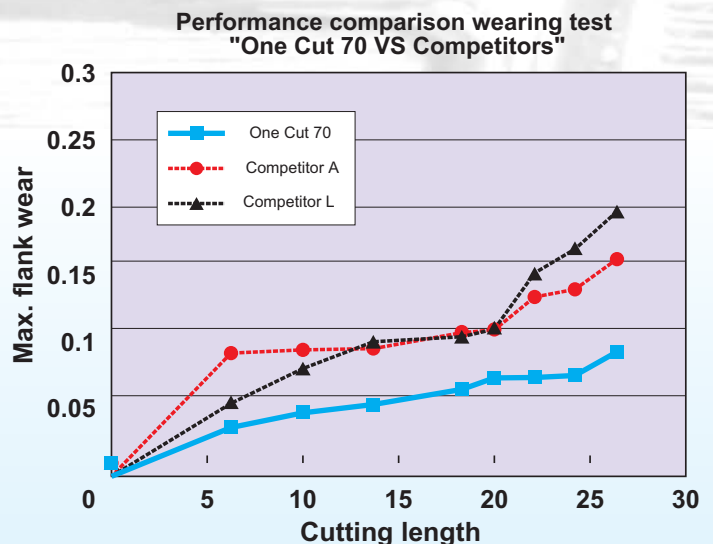
	TiN	TiCN	TiAlN	DV-Coat
Hardness	2,200	2,800	2,900	3,500
Oxidization temperature	400~500	300~400	700~800	1,000
Wear resistance	△	○	○	◎
Thermal resistance	△	×	○	◎

■ Cutting performance

Performance (Tool life comparison)

Work	Part name	Test piece
	Material	SKD11
	Hardness	60HRC
Tool	Tool No.	DV-SEHH6080
	Insert No.	Value Coating
Cutting conditions	Cutting speed	150 m/min
	Feed speed	0.18 mm/rev
	(Ap)	10 mm
	(Ae)	0.4 mm
	Coolant	Dry
	Machine	Vertical MC

Result (VB wear)

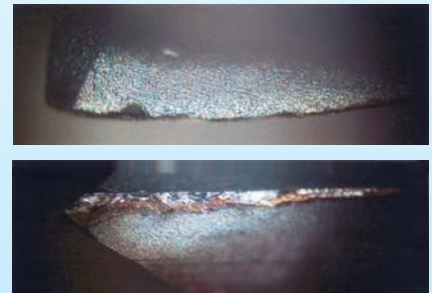
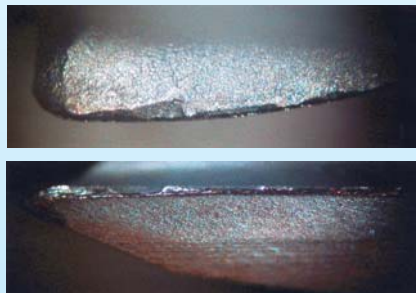
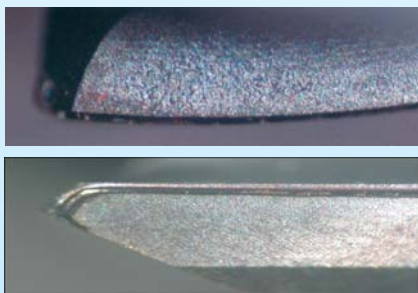


● After 26 min. machining on 60 HRC

One Cut 70

Competitor A

Competitor L



Result: After cutting 26m, One-Cut 70 shows no chipping and less wear than competitor. Excellent result.

“ One-Cut 70 End Mills ”



DV-SEHH (Standard Type)



- For high hardened steel up to 70 HRC
- For high speed machining
- Small corner radius
- Helix angle 50°
- 4-6-8 Flutes
- Regular cutting edge
- Value Coating



Tolerance for ϕD (mm)

ϕD	Tolerance
$\phi 3.0 \sim \phi 6.0$ Up to	0 -0.020
$\phi 7.0 \sim \phi 32.0$ Up to	0 -0.020

Fig. 1 $\phi D < \phi D$

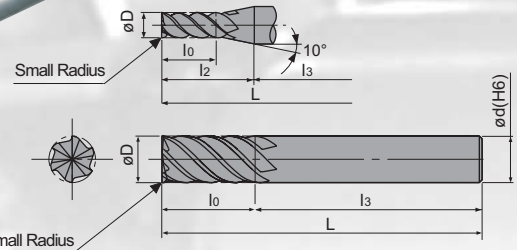
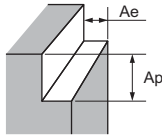
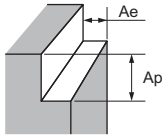
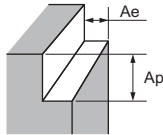
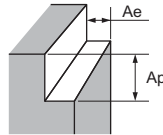


Fig. 2 $\phi D \geq \phi D$

Cat. No.	Stock	Dimensions (mm)							Fig.
		ϕD	l_0	l_2	l_3	L	ϕd	Z	
DV-SEHS4010	●	1.0	3.5	13	47	60	6	4	1
DV-SEHS4015	●	1.5	5	14	46	60	6	4	1
DV-SEHS4020	●	2.0	7	15	45	60	6	4	1
DV-SEHS4025	●	2.5	8	15	45	60	6	4	1
DV-SEHS4030	●	3.0	7	17	43	60	6	4	1
DV-SEHH4030	●	3.0	10	20	40	60	6	4	1
DV-SEHH4035	●	3.5	12	20	40	60	6	4	1
DV-SEHS4040	●	4.0	9	16	44	60	6	4	1
DV-SEHH4040	●	4.0	12	19	41	60	6	4	1
DV-SEHH4045	●	4.5	15	20	40	60	6	4	1
DV-SEHS4050	●	5.0	12	16	44	60	6	4	1
DV-SEHH4050	●	5.0	15	19	41	60	6	4	1
DV-SEHH4055	●	5.5	15	18	42	60	6	4	1
DV-SEHS6060	●	6.0	13	—	47	60	6	6	2
DV-SEHH6060	●	6.0	15	—	45	60	6	6	2
DV-SEHH6065	●	6.5	20	25	50	75	8	6	1
DV-SEHH6070	●	7.0	20	24	51	75	8	6	1
DV-SEHH6075	●	7.5	20	22	53	75	8	6	1
DV-SEHH6080	●	8.0	20	—	55	75	8	6	2
DV-SEHH6085	●	8.5	25	30	50	80	10	6	1
DV-SEHH6090	●	9.0	25	29	51	80	10	6	1
DV-SEHH6095	●	9.5	25	27	53	80	10	6	1
DV-SEHH6100	●	10.0	25	—	55	80	10	6	2
DV-SEHH6105	●	10.5	30	35	65	100	12	6	1
DV-SEHH6110	●	11.0	30	34	66	100	12	6	1
DV-SEHH6115	●	11.5	30	32	68	100	12	6	1
DV-SEHH6120	●	12.0	30	—	70	100	12	6	2
DV-SEHH6130	●	13.0	35	45	60	105	16	6	1
DV-SEHH6140	●	14.0	35	42	63	105	16	6	1
DV-SEHH6150	●	15.0	40	44	66	110	16	6	1
DV-SEHH6160	●	16.0	40	—	70	110	16	6	2
DV-SEHH6170	●	17.0	40	50	70	120	20	6	1
DV-SEHH6180	●	18.0	40	47	73	120	20	6	1
DV-SEHH6190	●	19.0	45	49	76	125	20	6	1
DV-SEHH6200	●	20.0	45	—	80	125	20	6	2
DV-SEHH6220	●	22.0	45	55	80	135	25	6	1
DV-SEHH6240	●	24.0	50	54	86	140	25	6	1
DV-SEHH8250	●	25.0	50	—	90	140	25	8	2
DV-SEHH8260	●	26.0	50	—	90	140	25	8	2
DV-SEHH8280	●	28.0	55	—	90	145	25	8	2
DV-SEHH8300	●	30.0	60	67	98	165	32	8	1
DV-SEHH8320	●	32.0	70	—	105	175	32	8	2

“ One-Cut 70 End Mills ”

■ Recommended cutting conditions for "One-Cut 70" DV-SEHH

Work materials	Tool & die steel, Mold steel (1.2344,1.2379,1.2311,P20) (~45HRC)		Hardened steel (1.2344,1.2379) (45~55HRC)		Hardened steel (1.2344,1.2379) (55~65HRC)		Hardened steel (1.2344,1.2379) (65~70HRC)	
	 $A_p \leq 1.5D$ $A_e \leq 0.05D$		 $A_p \leq 1.5D$ $A_e \leq 0.04D$		 $A_p \leq 1.5D$ $A_e \leq 0.04D$ (MAX. 0.5mm)		 $A_p \leq 1.5D$ $A_e \leq 0.02D$ (MAX. 0.3mm)	
Type of machining								
Tool dia. ϕD (mm)	N (min ⁻¹)	Feed (mm/min)	N (min ⁻¹)	Feed (mm/min)	N (min ⁻¹)	Feed (mm/min)	N (min ⁻¹)	Feed (mm/min)
1	40,000	700	25,000	410	20,000	320	10,000	130
2	34,000	950	15,000	560	12,000	430	6,400	220
3	24,000	1,300	15,000	800	12,000	600	6,000	250
4	18,000	1,800	12,000	1,100	9,500	800	5,100	300
6	12,000	2,200	8,000	1,400	6,500	1,100	3,500	420
8	10,000	2,200	6,000	1,400	5,000	1,100	2,500	420
10	8,000	2,200	5,000	1,400	4,000	1,100	2,000	420
12	6,500	1,900	4,000	1,200	3,300	900	1,700	350
16	5,000	1,480	3,000	930	2,500	700	1,300	260
20	3,800	1,150	2,300	730	2,000	550	1,000	200
25	3,000	920	1,800	580	1,600	450	800	160
30	2,500	680	1,500	430	1,300	330	700	140
32	2,300	550	1,400	350	1,200	300	650	120

- Note: 1. Above cutting conditions are for general guidance.
 2. The figures to be adjusted according to machining shape, purpose and rigidity of machine and work clamping.
 3. Recommend to use down cutting with air blow or mist coolant.

“ One-Cut Super Radius End Mills ”



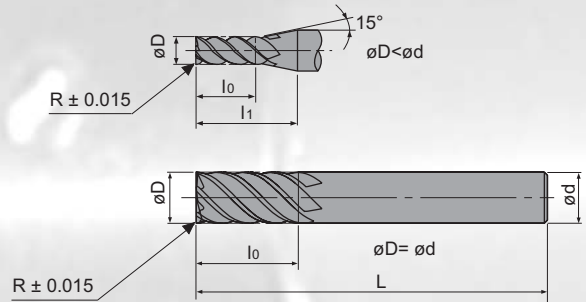
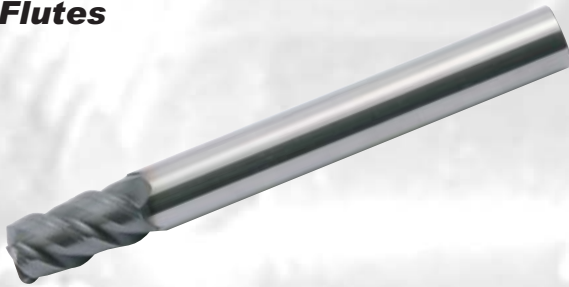
■ DV-OCSR (Standard Type)



■ Tolerance for ϕD (mm)

ϕD	Tolerance
$\phi 2.0 \sim \phi 6.0$ Up to	0 -0.015
$\phi 8.0 \sim \phi 20.0$ Up to	0 -0.015

- For high hardened steel
- From roughing to finishing by one tool
- Corner radius
- High rigid negative positive geometry
- Unique curved rake face
- Helix angle 50°
- 3 Flutes



Cat. No.	Stock	Dimensions (mm)							
		ϕD	R	l_0	l_1	L	ϕd	Z	
DV-OCSR3020-R05	●	2.0	0.5	4	6	70	6	3	
DV-OCSR3030-R08	●	3.0	0.8	6	9	70	6	3	
DV-OCSR3040-R10	●	4.0	1.0	8	12	70	6	3	
DV-OCSR3050-R12	●	5.0	1.2	10	15	70	6	3	
DV-OCSR3060-R15	●	6.0	1.5	12	-	90	6	3	
DV-OCSR3080-R20	●	8.0	2.0	16	-	100	8	3	
DV-OCSR3100-R10	●	10.0	1.0	20	-	110	10	3	
DV-OCSR3100-R20	●	10.0	2.0	20	-	110	10	3	
DV-OCSR3120-R20	●	12.0	2.0	24	-	120	12	3	
DV-OCSR3160-R30	●	16.0	3.0	32	-	160	16	3	
DV-OCSR3160-R30-L	●	16.0	3.0	32	-	185	16	3	
DV-OCSR3200-R30	●	20.0	3.0	40	-	160	20	3	

“ One-Cut Super Radius End Mills ”

■ Recommended cutting conditions for "One-Cut Super Radius"

Work materials	L/D	Tool ø (mm)											
		ø2 × R0.5			ø3 × R0.8			ø4 × R1			ø5 × R1.2		
		Ap (mm)	N (min ⁻¹)	Vf (mm/min)	Ap (mm)	N (min ⁻¹)	Vf (mm/min)	Ap (mm)	N (min ⁻¹)	Vf (mm/min)	Ap (mm)	N (min ⁻¹)	Vf (mm/min)
Carbon steel (S50C,S55C) 250 HB	up to 5D	0.12	15,000	5,100	0.20	10,000	5,100	0.25	7,000	4,800	0.30	5,700	4,800
	6~8D	0.08	7,000	1,900	0.13	5,300	2,700	0.17	3,500	2,300	0.20	2,800	2,300
	9~11D	0.06	5,000	1,000	0.10	3,000	1,500	0.12	2,300	1,500	0.14	1,900	1,600
Mold steel (1.2311,P20) 30-43 HRC	up to 5D	0.12	12,000	4,000	0.20	8,500	4,300	0.25	6,000	4,000	0.30	5,000	4,200
	6~8D	0.08	7,000	1,900	0.13	5,300	2,700	0.17	3,500	2,300	0.20	2,800	2,300
	9~11D	0.06	4,800	980	0.10	3,000	1,500	0.12	2,300	1,500	0.14	1,900	1,600
Tool & die steel (1.2344,1.2379) 255 HB	up to 5D	0.12	12,000	4,000	0.20	8,500	4,300	0.25	6,000	4,000	0.30	5,000	4,200
	6~8D	0.08	7,000	1,900	0.13	5,300	2,700	0.17	3,500	2,300	0.20	2,800	2,300
	9~11D	0.06	4,800	980	0.10	3,000	1,500	0.12	2,300	1,500	0.14	1,900	1,600
Hardened die steel (1.2344,1.2379) 55-60 HRC	up to 5D	0.10	9,600	2,900	0.18	6,300	2,800	0.22	4,700	2,800	0.27	2,200	1,600
	6~8D	0.07	4,800	1,400	0.11	3,000	1,300	0.15	2,300	1,400	0.18	1,900	1,400
	9~11D	0.05	4,000	700	0.09	2,600	1,100	0.10	1,900	1,100	0.12	1,500	1,100
Hardened die steel (1.2344,1.2379) 55-60 HRC	up to 5D	0.10	4,800	1,300	0.16	3,000	1,200	0.20	2,300	1,200	0.24	1,900	1,200
	6~8D	0.06	4,000	980	0.10	2,600	1,000	0.13	1,900	1,000	0.16	1,500	1,000
	9~11D	0.05	3,000	550	0.08	2,000	800	0.10	1,500	800	0.11	1,200	800
Cast iron (GG,GGG) 300 HB	up to 5D	0.13	15,000	5,600	0.22	10,000	5,600	0.27	8,000	5,900	0.33	6,000	5,600
	6~8D	0.09	8,700	1,900	0.14	5,800	3,200	0.16	4,300	3,200	0.22	3,500	3,200
	9~11D	0.07	5,600	1,200	0.11	3,700	2,000	0.13	2,700	2,000	0.15	2,200	2,000

Work materials	L/D	Tool ø (mm)											
		ø6 × R1.5			ø8 × R2			ø10 × R1			ø10 × R2		
		Ap (mm)	N (min ⁻¹)	Vf (mm/min)	Ap (mm)	N (min ⁻¹)	Vf (mm/min)	Ap (mm)	N (min ⁻¹)	Vf (mm/min)	Ap (mm)	N (min ⁻¹)	Vf (mm/min)
Carbon steel (S50C,S55C) 250 HB	up to 5D	0.37	4,800	4,800	0.50	3,500	4,700	0.25	2,800	4,700	0.50	2,800	4,700
	6~8D	0.25	2,300	2,300	0.34	1,700	2,300	0.17	1,400	2,300	0.34	1,400	2,300
	9~11D	0.18	1,500	1,500	0.24	1,100	1,400	0.12	900	1,500	0.24	900	1,500
Mold steel (1.2311,P20) 30-43 HRC	up to 5D	0.37	4,200	4,200	0.50	3,000	4,000	0.25	2,400	4,000	0.50	2,400	4,000
	6~8D	0.25	2,300	2,300	0.34	1,700	2,300	0.17	1,400	2,300	0.34	1,400	2,300
	9~11D	0.18	1,500	1,500	0.24	1,100	1,400	0.12	900	1,500	0.24	900	1,500
Tool & die steel (1.2344,1.2379) 255 HB	up to 5D	0.37	4,200	4,200	0.50	3,000	4,000	0.25	2,400	4,000	0.50	2,400	4,000
	6~8D	0.25	2,300	2,300	0.34	1,700	2,300	0.17	1,400	2,300	0.34	1,400	2,300
	9~11D	0.18	1,500	1,500	0.24	1,100	1,400	0.12	900	1,500	0.24	900	1,500
Hardened die steel (1.2344,1.2379) 55-60 HRC	up to 5D	0.33	1,800	1,600	0.45	1,300	1,500	0.20	1,900	2,900	0.45	1,900	2,900
	6~8D	0.22	1,500	1,300	0.30	1,100	1,300	0.15	900	1,300	0.30	900	1,300
	9~11D	0.16	1,300	1,100	0.20	900	1,100	0.10	700	1,000	0.20	700	1,000
Hardened die steel (1.2344,1.2379) 55-60 HRC	up to 5D	0.30	1,500	1,200	0.40	1,100	1,100	0.20	900	1,200	0.40	900	1,200
	6~8D	0.20	1,300	1,000	0.27	900	900	0.13	700	900	0.27	700	900
	9~11D	0.14	1,000	800	0.19	700	700	0.10	600	800	0.19	600	800
Cast iron (GG,GGG) 300 HB	up to 5D	0.40	5,300	5,900	0.55	3,800	5,600	0.27	3,000	5,600	0.55	3,000	5,600
	6~8D	0.27	2,900	3,200	0.37	2,100	3,100	0.16	1,700	3,100	0.37	1,700	3,100
	9~11D	0.20	1,800	2,000	0.26	1,300	1,900	0.13	1,000	1,800	0.26	1,000	1,800

“ One-Cut Super Radius End Mills ”

■ Recommended cutting conditions for "One-Cut Super Radius"

Work materials	L/D	Tool ø (mm)											
		ø12 × R2			ø16 × R3			ø20 × R3					
		Ap (mm)	N (min ⁻¹)	Vf (mm/min)	Ap (mm)	N (min ⁻¹)	Vf (mm/min)	Ap (mm)	N (min ⁻¹)	Vf (mm/min)			
Carbon steel (S50C,S55C) 250 HB	up to 5D	0.50	2,300	4,600	0.75	1,800	4,500	0.80	1,400	3,500			
	6~8D	0.34	1,100	2,200	0.50	900	2,200	0.50	700	1,700			
	9~11D	0.24	700	1,400	0.36	600	1,500	0.36	400	1,000			
Mold steel (1.2311,P20) 30-43 HRC	up to 5D	0.50	2,000	4,000	0.75	1,600	4,000	0.80	1,200	3,000			
	6~8D	0.34	1,100	2,200	0.50	900	2,200	0.50	700	1,700			
	9~11D	0.24	700	1,400	0.36	600	1,500	0.36	400	1,000			
Tool & die steel (1.2344,1.2379) 255 HB	up to 5D	0.50	2,000	4,000	0.75	1,600	4,000	0.80	1,200	3,000			
	6~8D	0.34	1,100	2,200	0.50	900	2,200	0.50	700	1,700			
	9~11D	0.24	700	1,400	0.36	600	1,500	0.36	400	1,000			
Hardened die steel (1.2344,1.2379) 55-60 HRC	up to 5D	0.45	1,500	2,700	0.70	1,200	2,700	0.70	900	2,000			
	6~8D	0.30	700	1,200	0.45	600	1,300	0.45	450	1,000			
	9~11D	0.20	600	1,100	0.30	500	1,100	0.30	380	800			
Hardened die steel (1.2344,1.2379) 55-60 HRC	up to 5D	0.40	700	1,100	0.60	600	1,200	0.60	450	900			
	6~8D	0.27	600	900	0.40	500	1,000	0.40	380	700			
	9~11D	0.19	500	800	0.30	400	800	0.30	300	600			
Cast iron (GG,GGG) 300 HB	up to 5D	0.55	2,500	5,600	0.80	2,000	5,600	0.90	1,500	4,200			
	6~8D	0.37	1,400	3,100	0.55	1,100	3,000	0.55	800	2,200			
	9~11D	0.26	800	1,700	0.40	700	1,900	0.40	500	1,400			

“ Solid One-Cut Hard End Mills ”

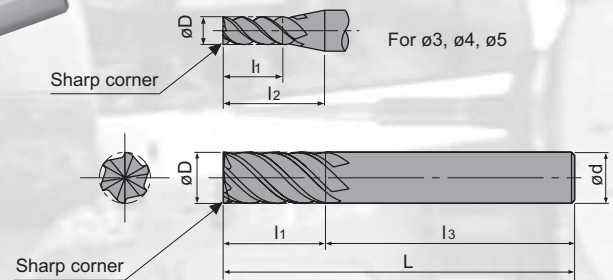


■ DZH-SEFS (Standard Type)

- For high hardened steel up to 65 HRC
- For high speed machining
- Sharp corner
- Helix angle 50°
- 4-6 Flutes
- Regular cutting edge

■ Tolerance for ϕD (mm)

ϕD	Tolerance
$\phi 3.0 \sim \phi 6.0$ Up to	-0.010 -0.028
$\phi 8.0 \sim \phi 20.0$ Up to	-0.013 -0.035

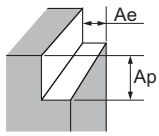
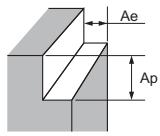
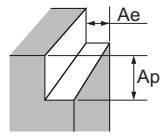
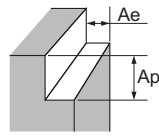
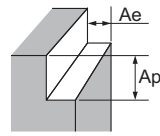


Cat. No.	Stock	Dimensions (mm)							
		ϕD	l_1	l_2	l_3	L	ϕd	Z	
DZH-SEFS4030	●	3.0	6	16	44	60	6	4	
DZH-SEFS4040	●	4.0	8	15	45	60	6	4	
DZH-SEFS4050	●	5.0	10	15	45	60	6	4	
DZH-SEFS6060	●	6.0	12	-	48	60	6	6	
DZH-SEFS6080	●	8.0	16	-	59	75	8	6	
DZH-SEFS6100	●	10.0	20	-	60	80	10	6	
DZH-SEFS6120	●	12.0	24	-	76	100	12	6	
DZH-SEFS6160	●	16.0	32	-	78	110	16	6	
DZH-SEFS6200	●	20.0	40	-	85	125	20	6	

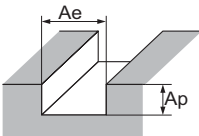
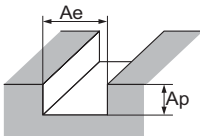
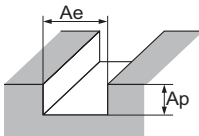
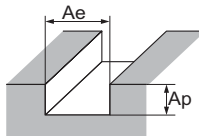
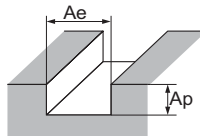
“ Solid One-Cut Hard End Mills ”

■ Recommended cutting conditions for DZ-SEFS

● Shoulder cutting

Work Materials	Hardened die steel (1.2344,1.2379)		Hardened die steel (1.2344,1.2379)		Die steel (1.2344,1.2379)		Low alloy steel (1.7225,1.2311)		Carbon steel Cast iron (C50, GG,GGG)	
Hardness	55 ~ 65HRc		45 ~ 55HRc		30 ~ 45HRc		35 ~ 45HRc		25HRc ≥	
Side Milling										
	Ap ≤ 1.5D Ae ≤ 0.05D		Ap ≤ 1.5D Ae ≤ 0.05D Ae ≤ 0.1D		Ap ≤ 1.5D Ae ≤ 0.1D		Ap ≤ 1.5D Ae ≤ 0.1D		Ap ≤ 1.5D Ae ≤ 0.1D	
Tool øD (mm)	55 ~ 65HRc		45 ~ 55HRc		30 ~ 45HRc		35 ~ 45HRc		25HRc ≥	
	N (min ⁻¹)	Vf (mm/min)	N (min ⁻¹)	Vf (mm/min)	N (min ⁻¹)	Vf (mm/min)	N (min ⁻¹)	Vf (mm/min)	N (min ⁻¹)	Vf (mm/min)
3	3,000	140	4,800	260	5,800	330	6,900	430	10,000	2,800
4	2,400	150	3,600	330	4,400	340	5,200	430	8,000	3,000
5	1,900	150	2,900	370	3,500	530	4,100	920	6,400	2,600
6	1,600	230	2,400	480	2,900	510	3,400	920	5,300	5,000
8	1,200	230	1,800	490	2,200	510	2,600	920	4,000	4,800
10	1,000	230	1,400	440	1,800	510	2,100	950	3,200	4,300
12	800	200	1,200	460	1,500	500	1,700	820	2,600	4,300
16	600	150	900	360	1,100	380	1,300	630	2,000	3,300
20	500	130	700	250	900	330	1,000	500	1,600	2,600

● Slotting

Work Materials	Hardened die steel (1.2344,1.2379)		Hardened die steel (1.2344,1.2379)		Die steel (1.2344,1.2379)		Low alloy steel (1.7225,1.2311)		Carbon steel Cast iron (C50, GG,GGG)	
Hardness	55 ~ 65HRc		45 ~ 55HRc		30 ~ 45HRc		35 ~ 45HRc		25HRc ≥	
Slotting										
	Ap ≤ 0.2D Ae = D		Ap ≤ 0.2D Ae = D		Ap ≤ 0.2D Ae = D		Ap ≤ 0.2D Ae = D		Ap ≤ 0.2D Ae = D	
Tool øD (mm)	55 ~ 65HRc		45 ~ 55HRc		30 ~ 45HRc		35 ~ 45HRc		25HRc ≥	
	N (min ⁻¹)	Vf (mm/min)	N (min ⁻¹)	Vf (mm/min)	N (min ⁻¹)	Vf (mm/min)	N (min ⁻¹)	Vf (mm/min)	N (min ⁻¹)	Vf (mm/min)
3	2,600	95	4,200	170	5,300	400	6,900	580	8,500	950
4	2,000	110	3,200	230	4,000	500	5,200	730	6,400	950
5	1,600	140	2,500	220	3,200	500	4,100	690	5,100	950
6	1,300	200	2,100	370	2,700	940	3,400	990	4,200	1,300
8	1,000	200	1,600	320	2,000	800	2,600	940	3,200	1,200
10	800	200	1,300	310	1,600	640	2,100	780	2,500	930
12	700	190	1,100	290	1,300	500	1,700	710	2,100	920
16	500	140	800	240	1,000	500	1,300	580	1,600	760
20	400	120	600	200	800	400	1,000	500	1,300	750

“ One-Cut 50 End Mills ”

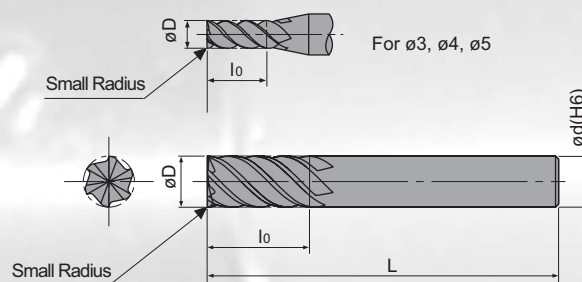


■ DZ-SEHS (Standard Type)

- For high hardened steel up to 65 HRC
- For high speed machining
- Small corner radius
- Helix angle 50°
- 4-8 Flutes
- Regular cutting edge

■ Tolerance for ϕD (mm)

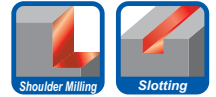
ϕD	Tolerance
$\phi 3.0 \sim \phi 6.0$ Up to	-0.010 -0.028
$\phi 7.0 \sim \phi 32.0$ Up to	-0.013 -0.035



Cat. No.	Stock	Dimensions (mm)						
		ϕD	l_0	L	ϕd	Z		
DZ-SEHS4030	●	3.0	10	60	6	4		
DZ-SEHS4040	●	4.0	12	60	6	4		
DZ-SEHS4050	●	5.0	15	60	6	4		
DZ-SEHS6060	●	6.0	15	60	6	6		
DZ-SEHS6070	●	7.0	20	75	8	6		
DZ-SEHS6080	●	8.0	20	75	8	6		
DZ-SEHS6090	●	9.0	25	80	10	6		
DZ-SEHS6100	●	10.0	25	80	10	6		
DZ-SEHS6120	●	12.0	30	100	12	6		
DZ-SEHS6140	●	14.0	35	105	16	6		
DZ-SEHS6160	●	16.0	40	110	16	6		
DZ-SEHS6180	●	18.0	40	120	20	6		
DZ-SEHS6200	●	20.0	45	125	20	6		
DZ-SEHS6220	●	22.0	45	135	20	6		
DZ-SEHS6240	●	24.0	50	140	25	6		
DZ-SEHS8250	●	25.0	50	140	25	8		
DZ-SEHS8260	●	26.0	50	140	25	8		
DZ-SEHS8280	●	28.0	55	145	25	8		
DZ-SEHS8300	●	30.0	60	165	32	8		
DZ-SEHS8320	●	32.0	70	170	32	8		

● Stock in Japan

“ One-Cut 50 End Mills ”

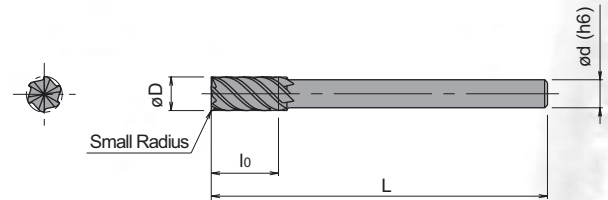
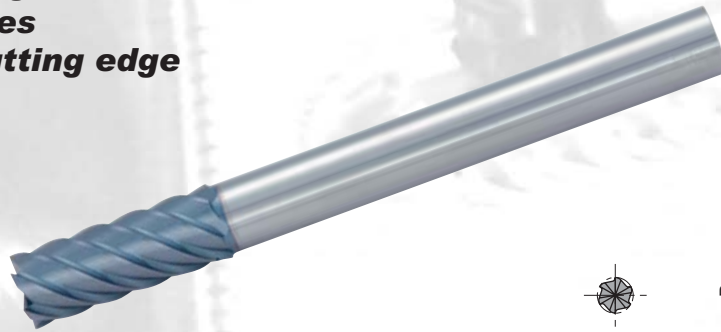


■ DZ-SEHLS (Long Shank Type)

- For high hardened steel up to 65 HRC
- For high speed machining
- Small corner radius
- Helix angle 50°
- 6-8 Flutes
- Long cutting edge

■ Tolerance for øD (mm)

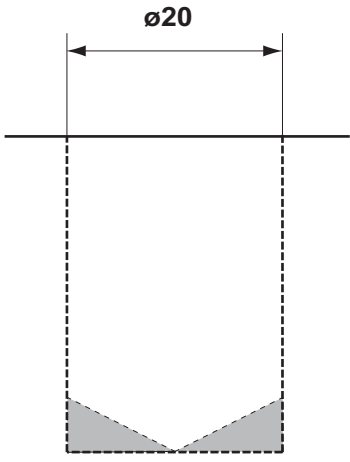
øD	Tolerance
ø3.0 ~ ø6.0 Up to	-0.010 -0.028
ø7.0 ~ ø25.0 Up to	-0.013 -0.035



Cat. No.	Stock	Dimensions (mm)						
		øD	lo	L	ød	Z		
DZ-SEHLS6120-S10	●	12.0	30	125	10	6		
DZ-SEHLS6160-S12	●	16.0	40	140	12	6		
DZ-SEHLS6160-S14	●	16.0	40	140	14	6		
DZ-SEHLS6180-S16	●	18.0	40	150	16	6		
DZ-SEHLS6200-S16	●	20.0	45	160	16	6		
DZ-SEHLS6200-S18	●	20.0	45	160	18	6		
DZ-SEHLS6220-S20	●	22.0	45	170	20	6		
DZ-SEHLS8250-S20	●	25.0	50	180	20	8		

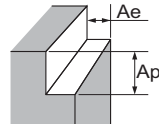
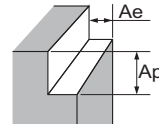
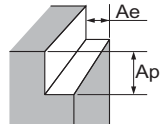
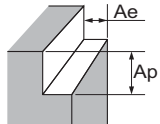
“ One-Cut 50 End Mills ”

■ Cutting data

Spot facing on high-hardened steel		Work	Part Name	Stamping die
			Material	RC55
			Hardness	55 ~ 57HRC
		Tool	Tool No.	DZ-SEHS6200
Coating	DZ (TiAlN)			
Result A lot of corners chipping are occurring on competitor's hard cut end mills. One-cut 50 didn't show any chipping.		Cutting Conditions	Vc	160 (min ⁻¹) 10 (m/min)
			Vf	8 (mm/min)
			Ap	6 (mm)
			Ae	
			Coolant	Wet cut
		Machine	Vertical MC	

■ Recommended cutting conditions for DZ-SEH

● Shoulder cutting

Work Materials	Hardened die steel (1.2344, 1.2379) 55 ~ 65HRC		Hardened die steel (1.2344, 1.2379) 45 ~ 55HRC		Mold steel (P20, 1.2311) 280 ~ 400HB		Stainless steel (1.4301, 1.4401) 35 ~ 45HRC	
	 Ap=1.5D Ae ≤ 0.05D		 Ap=1.5D Ae ≤ 0.05D		 Ap=1.5D Ae ≤ 0.1D		 Ap=1.5D Ae ≤ 0.1D	
Tool øD (mm)	N (min ⁻¹)	Vf (mm/min)	N (min ⁻¹)	Vf (mm/min)	N (min ⁻¹)	Vf (mm/min)	N (min ⁻¹)	Vf (mm/min)
3	2,120	130	8,490	610	10,600	850	10,600	780
4	1,590	130	6,370	580	7,960	870	7,960	780
5	1,270	130	5,090	610	6,370	870	6,370	780
6	1,060	170	4,240	880	5,310	1,140	5,310	1,020
8	795	145	3,180	800	3,980	970	3,980	870
10	640	160	2,550	700	3,180	1,060	3,180	950
12	530	160	2,120	640	2,650	1,070	2,650	960
16	400	140	1,590	550	1,990	930	1,990	840
20	320	110	1,270	460	1,590	730	1,590	660
25	255	120	1,020	470	1,270	800	1,270	720
30	210	100	850	400	1,060	670	1,060	610

“ One-Cut Moriba End Mills ”

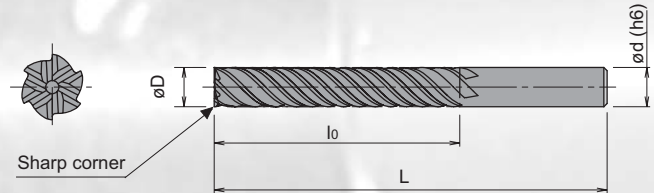


■ DZ-SEPL (Long Type)

- For machining welded and high hardened steel
- Sharp corner
- Helix angle 60°
- 6 Flutes
- Long cutting edge

■ Tolerance for $\varnothing D$ (mm)

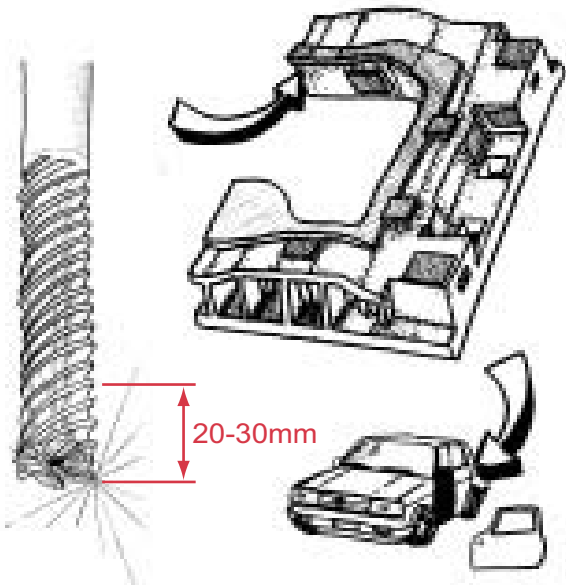
$\varnothing D$	Tolerance
$\varnothing 16.0 \sim \varnothing 20.0$ Up to	-0.013 -0.035
$\varnothing 25.0 \sim \varnothing 30$ Up to	-0.013 -0.035



Cat. No.	Stock	Dimensions (mm)						
		$\varnothing D$	lo	L	$\varnothing d$	Z		
DZ-SEPL6160	●	16.0	70	150	16	6		
DZ-SEPL6200	●	20.0	100	180	20	6		
DZ-SEPL6250	●	25.0	100	180	25	6		
DZ-SEPL6300	●	30.0	110	200	32	6		

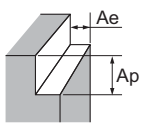
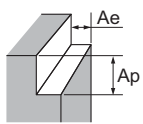
“ One-Cut Moriba End Mills ”

■ Cutting data

Cutting edge of shearing die 		Work	Part Name	Shearing die
			Material	Welded part
Result No chatter. Good surface finish. One-Cut Moriba got better result against competitors.		Tool	Hardness	50 HRc
			Tool No.	DZ-SEPL6200
		Cutting Conditions	Coating	DZ (TiAlN)
			Vc	Roughing: 12.5 m/min Finishing: 19 m/min
			Vf	R: 20 - 30 mm/min F: 50 - 100 mm/min
			Ap	20 ~ 30 (mm)
			Ae	R: 2 mm F: 0.2 - 0.3 mm
			Coolant	Dry cut
			Machine	Vertical MC

■ Recommended cutting conditions for DZ-SEPL

● Shoulder cutting

Work Materials	Hardness 45 - 65 HRc			
Side Milling  $Ap = 1.5D$ $Ae = 0.1D$	 $Ap = 1.5D$ $Ae = 0.01D$			
	Roughing		Finishing	
Tool ϕD (mm)	N (min⁻¹)	Vf (mm/min)	N (min⁻¹)	Vf (mm/min)
16	300	35	400	100
20	240	20	320	90
25	190	30	250	80
30	160	35	210	70

“ Hard Cut End Mills ”

■ *Ball Nose Hard Cut End Mills*



“ One-Cut Ball Hard ”

■ Features



One-Cut Ball Hard

1. Adopting high rigid design and special geometry gives outstanding high precision and high performance on high hardened materials.
2. Achieves to cut smoothly on high hardened materials from semi-finishing to finishing.
3. Adopting the combination of new developed super micro-grain carbide and “VALUE COATING” achieves longer tool life in high speed cutting.

Newly developed “VALUE COATING”

VALUE COATING gives stable and high-performance machining on high hardened materials even with high speed dry condition, due to higher hardness and higher oxidation resistance than the existing DZ coating.

● Characteristic value of various PVD coatings

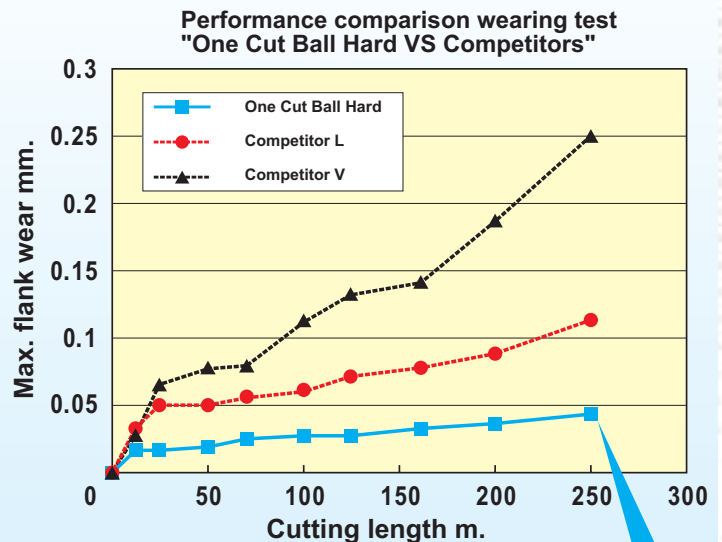
	TiN	TiCN	TiAlN	DV-Coat
Hardness	2,200	2,800	2,900	3,500
Oxidization temperature	400~500	300~400	700~800	1,000
Wear resistance	△	○	○	◎
Thermal resistance	△	×	○	◎

■ Cutting performance

Performance (Tool life comparison)

Material	Wavy shaped test piece (1.2379, D2)
Hardness	60HRC
Tool	Tool No. DV-OCSB2100
	Coating: Value Coating
Cutting conditions	Cutting speed : 200m/min
	Feed speed : 0.24mm/rev
	Ap : 0.1mm
	Ae : 0.2mm
	Coolant Dry cut
	Machine Vertical MC

Result (VB wear)



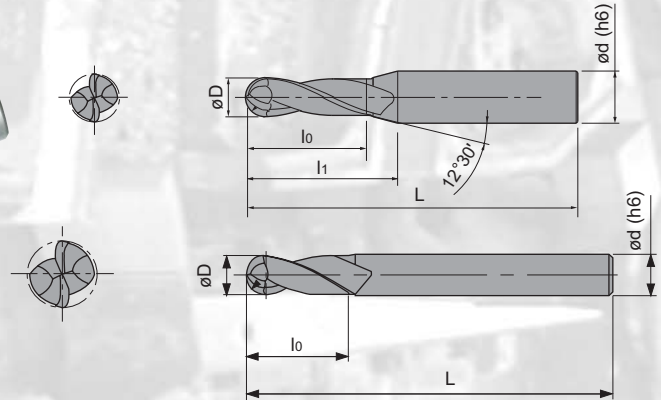
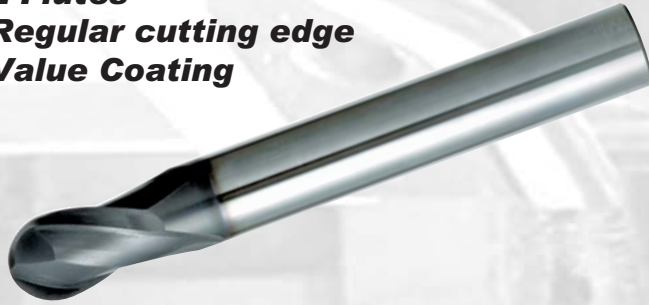
Result: Excellent surface finish. After cutting 250m, maximum flank wear was below 0.05mm. Still able to continue.

“ One-Cut Ball Hard ”



■ DV-OCSB (Regular Type)

- For high hardened steel up to 65HRC
- Ball Nose
- Helix angle 30°
- 2 Flutes
- Regular cutting edge
- Value Coating



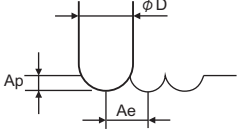
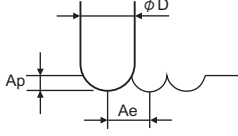
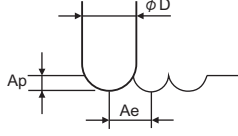
■ Tolerance for øD (mm)

R	Tolerance for R	Tolerance for øD
0.5 ~ 6.0	± 0.005	0.000 -0.020
8.0 ~ 12.5	±0.01	0.000 -0.020

Cat. No.	Stock	Dimensions (mm)						
		R	øD	lo	l1	L	ød	Z
DV-OCSB2010	●	0.5	1.0	1.5	3	50	4	2
DV-OCSB2015	●	0.75	1.5	2.25	4.5	50	4	2
DV-OCSB2020	●	1.0	2.0	3	5.5	50	6	2
DV-OCSB2025	●	1.25	2.5	3.75	6.5	50	6	2
DV-OCSB2030	●	1.5	3	4.5	8	60	6	2
DV-OCSB2030-8T	●	1.5	3	8	10	60	6	2
DV-OCSB2035	●	1.75	3.5	5.25	9.5	60	6	2
DV-OCSB2040S4	●	2	4	6	—	70	4	2
DV-OCSB2040	●	2	4	6	10.5	70	6	2
DV-OCSB2040-8T	●	2	4	8	10.5	70	6	2
DV-OCSB2050	●	2.5	5	7.5	12.5	80	6	2
DV-OCSB2050-10T	●	2.5	5	10	12.5	80	6	2
DV-OCSB2060	●	3	6	9	—	90	6	2
DV-OCSB2060-12T	●	3	6	12	—	90	6	2
DV-OCSB2060-L120	●	3	6	9	—	120	6	2
DV-OCSB2080	●	4	8	12	—	100	8	2
DV-OCSB2080-14T	●	4	8	14	—	100	8	2
DV-OCSB2080-L120	●	4	8	12	—	120	8	2
DV-OCSB2100	●	5	10	15	—	100	10	2
DV-OCSB2100-18T	●	5	10	18	—	100	10	2
DV-OCSB2100-L140	●	5	10	15	—	140	10	2
DV-OCSB2120	●	6	12	18	—	110	12	2
DV-OCSB2120-22T	●	6	12	22	—	110	12	2
DV-OCSB2120-L140	●	6	12	18	—	140	12	2
DV-OCSB2160-30T-L140	●	8	16	30	—	140	16	2
DV-OCSB2160-L140	●	8	16	24	—	140	16	2
DV-OCSB2160	●	8	16	24	—	160	16	2
DV-OCSB2160-L180	●	8	16	24	—	180	16	2
DV-OCSB2200-L140	●	10	20	30	—	140	20	2
DV-OCSB2200-L160	●	10	20	30	—	160	20	2
DV-OCSB2200	●	10	20	30	—	180	20	2
DV-OCSB2250	●	12.5	25	38	—	180	25	2

“ One-Cut Ball Hard ”

■ Recommended cutting conditions for "One - Cut Ball Hard"

Work materials		Tool & die steel, Mold steel (1.2344, 1.2379, 1.2311, P20) (~45HRC)		Hardened steel (1.2344, 1.2379) (45~55HRC)		Hardened steel (1.2344, 1.2379) (55~65HRC)	
Type of machining		 $A_p \leq 0.1D$ $A_e \leq 0.3D$		 $A_p \leq 0.5D$ $A_e \leq 0.1D$		 $A_p \leq 0.3D$ $A_e \leq 0.02D$	
Tool dia.		N (min ⁻¹)	Feed (mm/min)	N (min ⁻¹)	Feed (mm/min)	N (min ⁻¹)	Feed (mm/min)
R (mm)	ϕD (mm)						
0.5	1	32,000	1,600	25,000	1,300	22,000	1,100
1	2	28,000	1,700	22,000	1,400	20,000	1,200
1.5	3	24,000	1,800	21,000	1,500	18,000	1,300
2	4	20,000	2,000	18,000	1,600	14,000	1,400
3	6	16,000	2,200	13,000	1,800	10,000	1,500
4	8	12,000	2,300	10,000	2,000	8,000	1,500
5	10	10,000	2,200	8,000	1,800	6,000	1,400
6	12	8,000	2,000	6,500	1,700	5,000	1,200
8	16	6,000	1,800	5,000	1,500	4,000	1,000
10	20	5,000	1,500	4,000	1,200	3,000	800
12.5	25	4,000	1,200	4,000	1,000	2,000	600

Note: The figures to be adjusted according to the machine rigidity or work rigidity.

“ One-Cut 03 Ball Nose End Mills ”

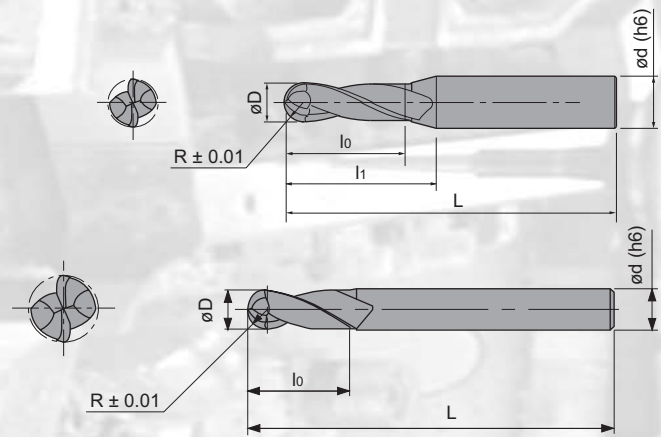
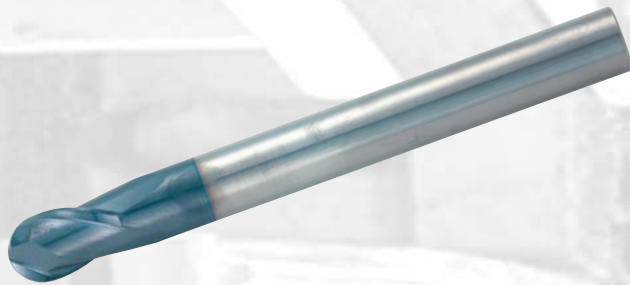


■ DZ03-OCSB (Regular Type)

- For high hardened steel up to 65HRC
- Ball Nose
- Helix angle 30°
- 2 Flutes
- Regular cutting edge

■ Tolerance for ϕD (mm)

ϕD	Tolerance
$\phi 1.0 \sim \phi 6.0$ Up to	0.000 -0.020
$\phi 8.0 \sim \phi 25.0$ Up to	0.000 -0.020



Cat. No.	Stock	Dimensions (mm)							
		R	ϕD	l_0	l_1	L	ϕd	Z	
DZ03-OCSB2010	●	0.5	1.0	1.5	3	50	4	2	
DZ03-OCSB2015	●	0.75	1.5	2.25	4.5	50	4	2	
DZ03-OCSB2020	●	1.0	2.0	3	5.5	50	6	2	
DZ03-OCSB2025	●	1.25	2.5	3.75	6.5	50	6	2	
DZ03-OCSB2030	●	1.5	3.0	4.5	8	60	6	2	
DZ03-OCSB2035	●	1.75	3.5	5.25	9.5	60	6	2	
DZ03-OCSB2040	●	2.0	4.0	6	10.5	70	6	2	
DZ03-OCSB2050	●	2.5	5.0	7.5	12.5	80	6	2	
DZ03-OCSB2060	●	3.0	6.0	9	-	90	6	2	
DZ03-OCSB2060-L120	●	3.0	6.0	9	-	120	6	2	
DZ03-OCSB2080	●	4.0	8.0	12	-	100	8	2	
DZ03-OCSB2080-L120	●	4.0	8.0	12	-	120	8	2	
DZ03-OCSB2100	●	5.0	10.0	15	-	100	10	2	
DZ03-OCSB2100-L140	●	5.0	10.0	15	-	140	10	2	
DZ03-OCSB2120	●	6.0	12.0	18	-	110	12	2	
DZ03-OCSB2120-L140	●	6.0	12.0	18	-	140	12	2	
DZ03-OCSB2160	●	8.0	16.0	24	-	160	16	2	
DZ03-OCSB2160-L180	●	8.0	16.0	24	-	180	16	2	
DZ03-OCSB2200-L140	●	10.0	20.0	30	-	140	20	2	
DZ03-OCSB2200-L160	●	10.0	20.0	30	-	160	20	2	
DZ03-OCSB2200	●	10.0	20.0	30	-	180	20	2	
DZ03-OCSB2250	●	12.5	25.0	38	-	180	25	2	

Hard Cut End Mills

“ One-Cut 03 Ball Nose End Mills ”

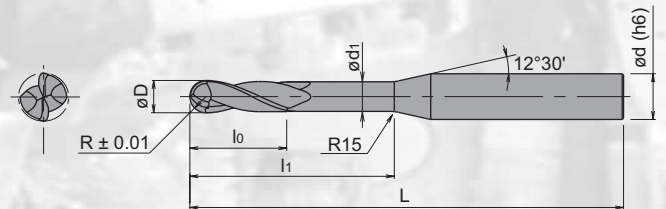
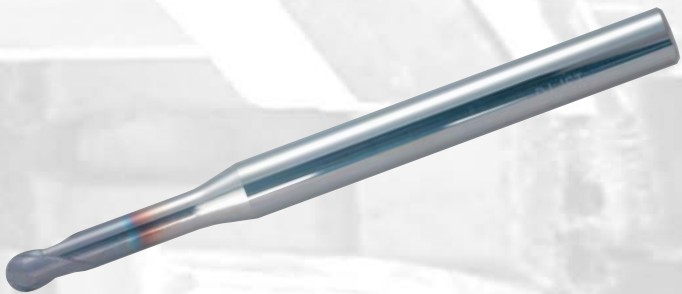


■ DZ03-OCSB-LN (Long neck Type)

- For high hardened steel up to 65HRC
- Ball Nose
- Helix angle 30°
- 2 Flutes
- Regular cutting edge

■ Tolerance for ϕD (mm)

ϕD	Tolerance
$\phi 1.0 \sim \phi 2.0$ Up to	0.000 -0.020
$\phi 3.0 \sim \phi 4.0$ Up to	0.000 -0.020



Cat. No.	Stock	Dimensions (mm)							
		R	ϕD	l_0	l_1	L	ϕd_1	ϕd	Z
DZ03-OCSB2010-6LN	●	0.5	1.0	1	6	60	0.95	4	2
DZ03-OCSB2010-11LN	●	0.5	1.0	1	11	60	0.95	4	2
DZ03-OCSB2010-17LN	●	0.5	1.0	1	17	60	0.95	4	2
DZ03-OCSB2010-21LN	●	0.5	1.0	1	21	60	0.95	4	2
DZ03-OCSB2020-9LN	●	1.0	2.0	2	9	60	1.95	6	2
DZ03-OCSB2020-11LN	●	1.0	2.0	2	11	60	1.95	6	2
DZ03-OCSB2020-17LN	●	1.0	2.0	2	17	60	1.95	6	2
DZ03-OCSB2020-21LN	●	1.0	2.0	2	21	60	1.95	6	2
DZ03-OCSB2030-9LN	●	1.5	3.0	3	9	60	2.95	6	2
DZ03-OCSB2030-17LN	●	1.5	3.0	3	17	60	2.95	6	2
DZ03-OCSB2030-21LN	●	1.5	3.0	3	21	60	2.95	6	2
DZ03-OCSB2040-13LN	●	2.0	4.0	4	13	70	3.95	6	2
DZ03-OCSB2040-17LN	●	2.0	4.0	4	17	70	3.95	6	2
DZ03-OCSB2040-21LN	●	2.0	4.0	4	21	70	3.95	6	2

“ One-Cut 03 Ball Nose End Mills ”

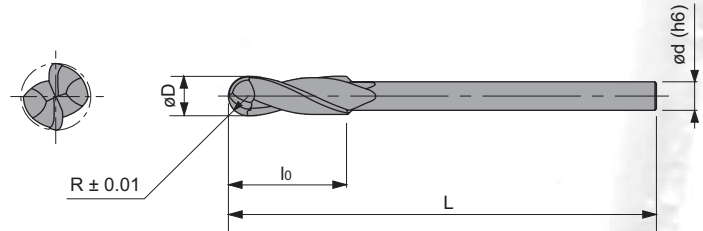
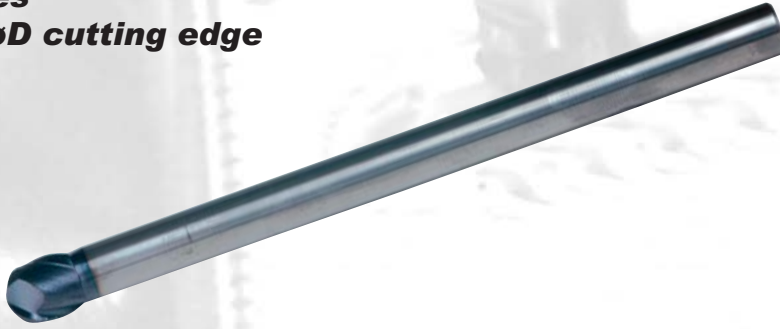


■ DZ03-OCUB (Long Type)

- For high hardened steel up to 65HRC
- Ball Nose
- Helix angle 30°
- 2 Flutes
- 1.5 x ϕD cutting edge

■ Tolerance for ϕD (mm)

ϕD	Tolerance
$\phi 6.0 \sim \phi 10.0$ Up to	0.000 -0.020
$\phi 11.0 \sim \phi 20.0$ Up to	0.000 -0.020



Cat. No.	Stock	Dimensions (mm)							
		R	ϕD	l_0	L	ϕd	Z		
DZ03-OCUB2060	●	3	6.0	9	120	5	2		
DZ03-OCUB2070	●	3.5	7.0	10.5	120	6	2		
DZ03-OCUB2080	●	4	8.0	12	120	7	2		
DZ03-OCUB2090	●	4.5	9.0	13.5	120	8	2		
DZ03-OCUB2100	●	5	10.0	15	140	9	2		
DZ03-OCUB2110	●	5.5	11.0	16.5	140	10	2		
DZ03-OCUB2120	●	6	12.0	18	140	11	2		
DZ03-OCUB2160	●	8	16.0	24	180	15	2		
DZ03-OCUB2200	●	10	20.0	30	180	18	2		

“ One-Cut 03 Ball Nose End Mills ”

■ Recommended cutting conditions for DZ03-OCSB / DZ03-OCUB

Work Materials	Carbon steel (C55) 180 ~ 280HB		Tool & Die (1.2344,1.2379) ~280HB		Mold steel (P20,1.2311) 35 ~ 45Hrc		Stainless steel (1.4301,1.4401) ~270HB		
	Operation		Operation		Operation		Operation		
Tool R (mm) øD (mm)	N (min ⁻¹)	Vf (mm/min)	N (min ⁻¹)	Vf (mm/min)	N (min ⁻¹)	Vf (mm/min)	N (min ⁻¹)	Vf (mm/min)	
	0.5	1	50,000	2,500	45,000	2,200	38,000	1,900	38,000
1	2	25,000	2,000	22,000	1,700	19,000	1,500	19,000	1,500
1.5	3	17,000	1,700	15,000	1,500	12,700	1,270	12,700	1,270
2	4	12,700	1,600	11,000	1,100	9,500	950	9,500	950
3	6	8,500	1,600	7,400	900	6,400	800	6,400	800
4	8	6,400	1,600	5,600	900	4,800	670	4,800	800
5	10	5,000	1,500	4,500	900	3,800	650	3,800	750
6	12	4,200	1,400	3,700	850	3,200	640	3,200	750
8	16	3,200	1,300	2,800	840	2,400	620	2,400	700
10	20	2,500	1,250	2,200	800	1,900	600	1,900	700
12.5	25	2,000	1,200	1,800	800	1,500	600	1,500	650

Work Materials	Hardened die steel (1.2344,1.2379) 45 ~ 52Hrc		Hardened die steel (1.2344,1.2379) 55 ~ 60Hrc		Cast Iron (GG25) ~ 350 N/mm ²		Nodular cast iron (GGG) ~550 N/mm ²		
	Operation		Operation		Operation		Operation		
Tool R (mm) øD (mm)	N (min ⁻¹)	Vf (mm/min)	N (min ⁻¹)	Vf (mm/min)	N (min ⁻¹)	Vf (mm/min)	N (min ⁻¹)	Vf (mm/min)	
	0.5	1	31,000	1,200	25,000	750	60,000	4,800	54,000
1	2	16,000	950	12,000	600	40,000	4,800	27,000	3,200
1.5	3	10,000	600	8,500	430	26,000	4,100	18,000	2,700
2	4	8,000	500	6,300	320	20,000	3,400	13,000	2,000
3	6	5,300	370	4,200	250	13,000	2,500	9,000	1,700
4	8	4,000	320	3,200	250	9,900	2,500	6,700	1,700
5	10	3,200	320	2,500	220	8,000	2,400	5,400	1,600
6	12	2,700	300	2,100	210	6,600	2,200	4,500	1,500
8	16	2,000	260	1,600	200	5,000	2,100	3,400	1,400
10	20	1,600	260	1,200	200	4,000	2,000	2,700	1,300
12.5	25	1,300	270	1,000	200	3,200	1,900	2,100	1,300

“ One-Cut 03 Ball Nose End Mills ”

■ **Note**