Tooling by DIJET®

Solid Carbide End Mills

Solid Carbide End Mills - Square

Application	For heat resistant alloy	For hardened steel	For Aluminium			
						
Page	D006	D035	D011	D016	D018	D021
Cat. No.	DV-SCMS	DV-SEHS/H	AL-SEES2	AL-SEEL2	AL-SEEZ3	AL-SEES3-LS
No. of flutes	6~8 flutes	4~8 flutes	2 flutes	2 flutes	3 flutes	3 flutes
Helix angle	45°	50°	45°	45°	45°	45°
Flute length	Regular	Regular	Regular	Long	Regular	Regular
Dia.	φ6~φ16	φ1~φ32	φ0.4~φ30	φ1~φ25	φ3~φ25	φ3~φ22
Coated	DV Coating	DV Coating	Uncoated	Uncoated	Uncoated	Uncoated
Carbon steel Alloy steel	○					
Hardenead steel 45HRC	○	○				
Hardenead steel 50HRC		○				
Hardenead steel 65HRC		◎				
Stainless steel	◎					
Cast iron		○				
Aluminium alloy			◎	◎	◎	◎
Copper alloy			○	○	○	○
Graphite						
Heat resistant alloy Titanium alloy	◎					
Plastic			○			

◎: First choice, Good condition ○: Moderate condition

Solid Carbide End Mills - Square

Application	For Aluminium		General use	For heat resistant alloy
				
Page	D023	D026	D031	D009
Cat. No.	AL-SEES3 -LS-R02	AL-SEES3 -XLS-R02	DV-OCSR	DV-OCSAR4
No. of flutes	3 flutes	3 flutes	3 flutes	4 flutes
Helix angle	45°	45°	50°	42°~45°
Flute length	Regular	Regular	Regular	Regular
Dia.	φ6~φ22	φ6~φ22	φ2~φ20	φ3~φ20
Coated	Uncoated	Uncoated	DV Coating	DV Coating
Carbon steel Alloy steel			○	○
Hardenead steel 45HRC			◎	○
Hardenead steel 50HRC			◎	
Hardenead steel 65HRC			◎	
Stainless steel				◎
Cast iron			○	
Aluminium alloy	◎	◎		
Copper alloy	○			
Graphite				
Heat resistant alloy Titanium alloy				◎
Plastic				

◎: First choice, Good condition ○: Moderate condition

Solid Carbide End Mills - Square

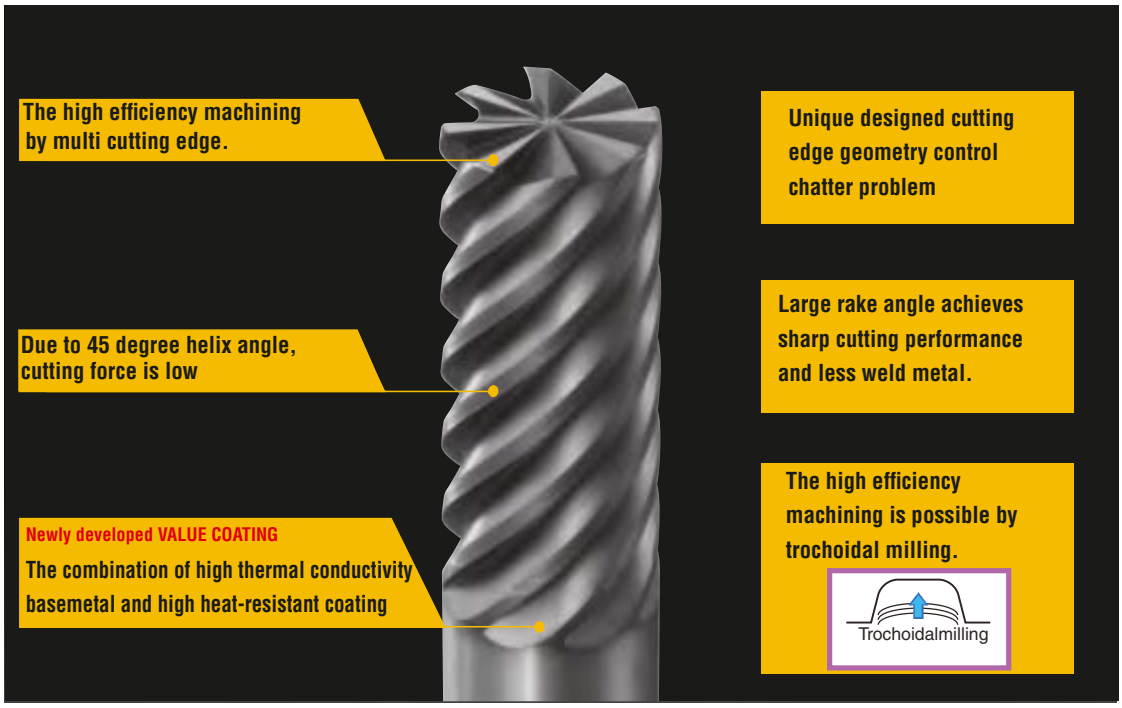
Application	General use		For hardened steel	
				
Page	D046	D047	D044	D041
Cat. No.	DZ03-OCSB	DZ03-OCSB-LN	DV-OCSB	DH-OCHB
No. of flutes	2 flutes	2 flutes	2 flutes	4 flutes
Helix angle	30°	30°	30°	45°
Flute length	Regular	Regular	Regular	Regular
Dia.	φ1~φ25	φ1~φ4	φ1~φ25	φ3~φ12
Coated	DZ Coating (TiAlN)	DZ Coating (TiAlN)	DV Coating	DH Coating
Carbon steel Alloy steel	◎	◎	◎	◎
Hardenead steel 45HRC	◎	◎	◎	◎
Hardenead steel 50HRC	◎	◎	◎	◎
Hardenead steel 65HRC	◎	◎	◎	◎
Stainless steel				
Cast iron	◎	◎	◎	
Aluminium alloy	○	○	○	
Copper alloy	○	○	○	
Graphite			○	
Heat resistant alloy Titanium alloy	○	○	○	
Plastic				

◎: First choice, Good condition ○: Moderate condition

DV-Coated End Mill for Heat Resistant Alloy DV-SCMSTYPE

Aerospace Tooling

Features of DV-SCMS type



■ CUTTING PERFORMANCE

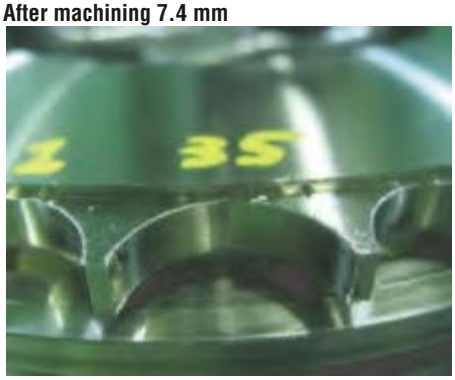
Tool life comparison

Work	Part name	Test piece
	Material	Inco718 Aging
	Hardness	42HRC
Tool	ToolNo.	DV-SCMS8120
	Grade	Value coating
Cutting conditions	Vc,(n)	100 (m/min)
	Vf, (f z)	0.48 (mm/rev),0.06 (mm/t)
	ap (mm)	5 (mm)
	ae (mm)	0.8 (mm)
	Coolant	Wet
	Machine	VerticalMC

Result

DV-SCMS shows no chipping and less wear. Excellent result.

● After machining 7.4 mm

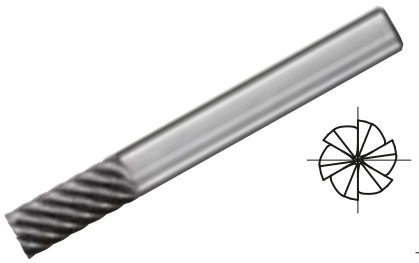


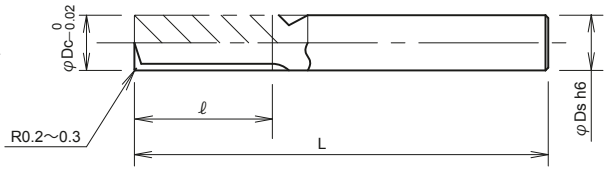
Relief face
Flank wear 0.09 mm

Rake face

DV-Coated End Mill for Heat Resistant Alloy — DV-SCMS TYPE

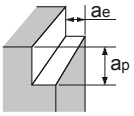
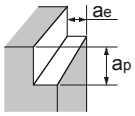
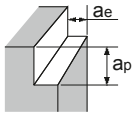
- For heat resistant alloy
- 6,8 flutes, Helix angle45°
- R0.2 Corner radius





Cat.No.	Stock	Dimensions (mm)				
		No.of flutes	φDc	ℓ	L	φDs
DV-SCMS6060	●	6	6	15	50	6
DV-SCMS6080	●	6	8	20	70	8
DV-SCMS6100	●	6	10	25	75	10
DV-SCMS8120	●	8	12	26	100	12
DV-SCMS8160	□	8	16	32	100	16

■ RECOMMENDED CUTTING CONDITIONS

Work Materials	Stainless steel SUS304,1.4301		Titanium alloy Ti-6Al-4V		Heat-resistant alloy Inco718	
Type of Machining	 ap≦1.5Dc ae≦0.1Dc		 ap≦1.5Dc ae≦0.1Dc		 ap≦1.5Dc ae≦0.05Dc	
Tool dia. φDc (mm)	Spindle speed n (min⁻¹)	Feed speed Vf (mm/min)	Spindle speed n (min⁻¹)	Feed speed Vf (mm/min)	Spindle speed n (min⁻¹)	Feed speed Vf (mm/min)
6	8,000	2,100	8,000	2,100	2,100	380
8	6,000	2,100	6,000	2,100	1,600	310
10	4,800	2,100	4,800	2,100	1,300	310
12	4,000	2,100	4,000	2,100	1,100	350
16	3,000	1,700	3,000	1,700	1,700	260

■NOTE

1) Above cutting conditions are for general guidance.
2) The cutting parameters to be adjusted according to machining shape, purpose and rigidity of machine and work clamping.
3) Recommend to use down cutting.
4) Recommend to use wet cutting condition. It is effective to use cutting fluid for heat-resistant alloy.

●: Standard stock items □: Stock in Japan ○: Soon to be deleted

"One-Cut Radius"End Mill for Heat Resistant Alloy DV-OCSARTYPE

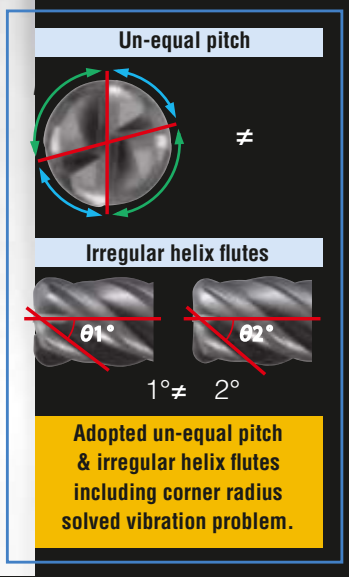
Features of DV-OCSAR type

Adopted un-equal pitch and irregular helix flutes including corner radius solved vibration problems (possible to stable machining for very thin plate)

Adopted positive rake reduced cutting heat top revent welding.

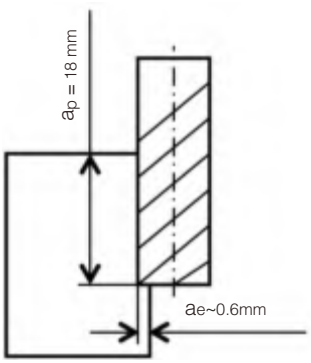
The combination of 42° & 45° helix angle improve reliability and surface roughness

Newly developed VALUECOATING has excellent heat resistance and wear resistance

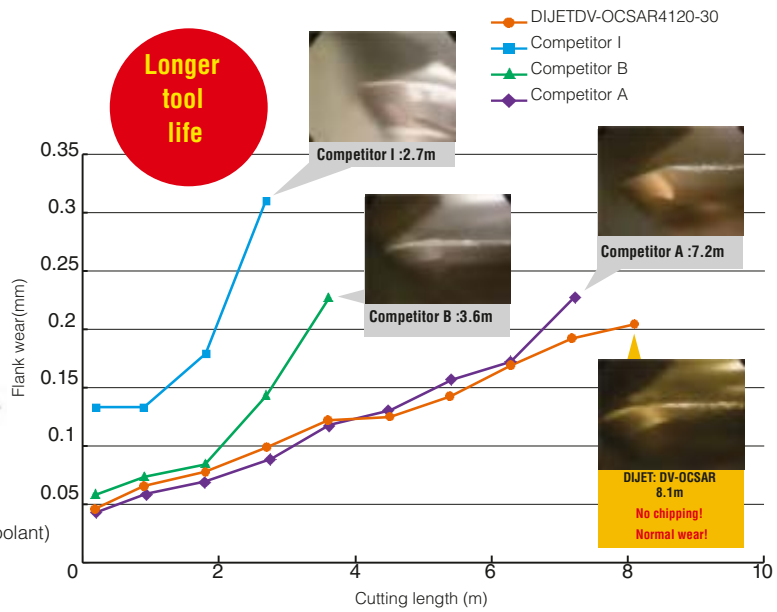


■ CUTTING PERFORMANCE

(1) INCO718

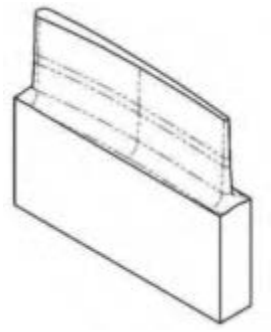


Material: INCO718 (Age hardened)
Tooldia: φ12mm
Vc=50m/min,f=0.20mm/rev,
ap=18mm,ae=0.6mm
Down cut,Water soluble (External coolant)



"One-Cut Radius" End Mill for Heat Resistant Alloy DV-OCSAR TYPE

(2) Stainless steel (SUS304)



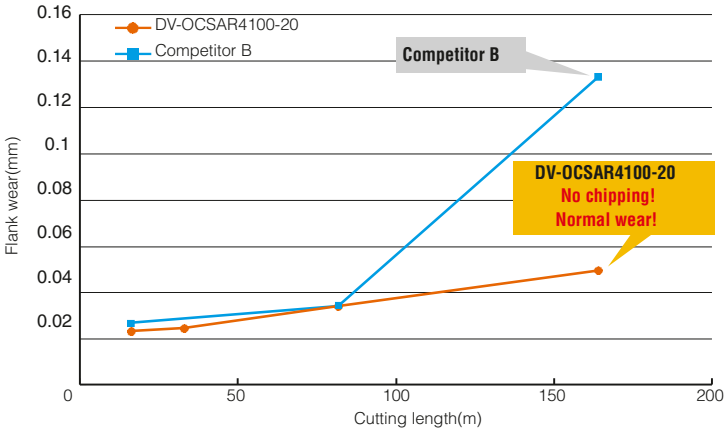
SUS304 very thin plate to be easily chattered

Material: SUS304 (Very thin plate)
Tooldia: φ10mm, Corner radius R2
Vc=100m/min,f=0.28mm/rev
ap=18mm,ae=1.2mm
Down cut
By helical milling:Zdim.0.5mm/rev
⇒Total cutting length per work:16.4m
⇒Total cutting time per work:19min.
Water soluble (External coolant)

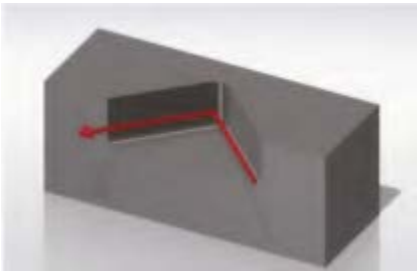
● Work surface

	DV-OCSAR4100-20	Competitor B
Inner R side surface	 No chatter, Stable	 Chattering

● Tool life comparison after machining 164 mm



(3) Titanium alloy (Ti-6Al-4V)



Material:Ti-6Al-4V,
Tool dia.:φ10mm,CornerRadiusR2
Vc=100m/min, f=0.24mm/rev
ap=15mm, ae=0.5mm
Water soluble (External coolant)

Result

DV-OCSAR improved surface roughness than conventional tool.

One cut radius(φ10-R2)
DV-OCSAR4100-20

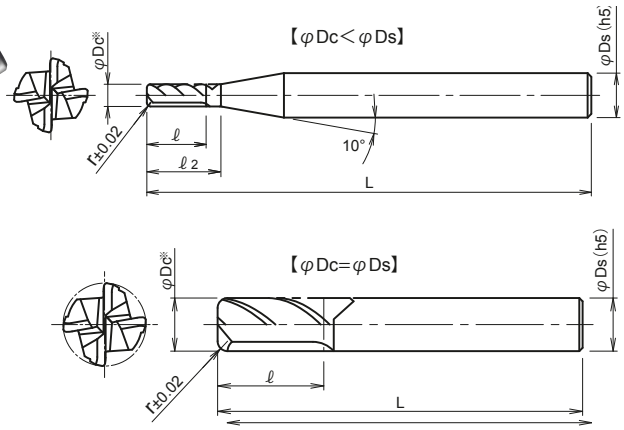
No chatter

DIJET conventional tool(φ10-R2)
Regular helix flutes

Chattering

"One-Cut Radius" End Mill for Heat Resistant Alloy DV-OCSAR TYPE

- For heat resistant alloy
- 4 flutes, Helix angle 42°-45°



Cat.No.	Stock	Dimensions (mm)					
		φDc	r	ℓ	ℓ2	L	φDs
DV-OCSAR4030-05	●	3	0.5	8	10	60	6
DV-OCSAR4040-05	●	4	0.5	11	13	60	6
DV-OCSAR4040-10	□	4	1	11	13	60	6
DV-OCSAR4050-05	●	5	0.5	13	15	60	6
DV-OCSAR4050-10	□	5	1	13	15	60	6
DV-OCSAR4060-05	●	6	0.5	13	–	60	6
DV-OCSAR4060-10	●	6	1	13	–	60	6
DV-OCSAR4080-05	●	8	0.5	19	–	75	8
DV-OCSAR4080-10	●	8	1	19	–	75	8
DV-OCSAR4080-20	●	8	2	19	–	75	8
DV-OCSAR4100-05	●	10	0.5	22	–	80	10
DV-OCSAR4100-10	●	10	1	22	–	80	10
DV-OCSAR4100-20	●	10	2	22	–	80	10
DV-OCSAR4120-05	●	12	0.5	26	–	100	12
DV-OCSAR4120-10	●	12	1	26	–	100	12
DV-OCSAR4120-20	●	12	2	26	–	100	12
DV-OCSAR4120-30	□	12	3	26	–	100	12
DV-OCSAR4160-10	●	16	1	32	–	110	16
DV-OCSAR4160-20	●	16	2	32	–	110	16
DV-OCSAR4160-30	●	16	3	32	–	110	16
DV-OCSAR4200-10	●	20	1	38	–	125	20
DV-OCSAR4200-20	●	20	2	38	–	125	20
DV-OCSAR4200-30	●	20	3	38	–	125	20

TOLERANCE (mm)

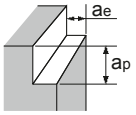
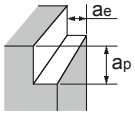
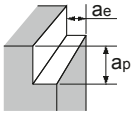
Tool dia. φDc	Tolerance (φDc)
Up to φ6mm	$^{0}_{-0.015}$
Over φ6mm	$^{0}_{-0.02}$

●: Standard stock items □: Stock in Japan ○: Soon to be deleted

"One-Cut Radius" End Mill for Heat Resistant Alloy DV-OCSAR TYPE

■ RECOMMENDED CUTTING CONDITIONS FOR DV-OCSAR TYPE

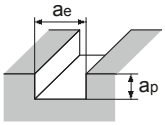
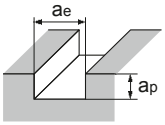
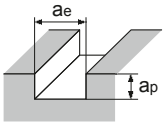
(1) Shoulder Milling

Work Materials	Stainless steel SUS304,1.4301		Titanium alloy Ti-6Al-4V		Heat-resistant alloy Inco718	
Type of Machining	 ap≦1.5Dc ae≦0.1Dc		 ap≦1.5Dc ae≦0.1Dc		 ap≦1.5Dc ae≦0.1Dc	
Tool dia. φDc (mm)	Spindle speed n (min⁻¹)	Feed speed Vf (mm/min)	Spindle speed n (min⁻¹)	Feed speed Vf (mm/min)	Spindle speed n (min⁻¹)	Feed speed Vf (mm/min)
3	11,000	1,200	11,000	1,200	4,200	320
4	8,000	1,200	8,000	1,200	3,200	320
5	6,400	1,200	6,400	1,200	2,500	320
6	5,400	1,200	5,400	1,200	2,100	320
8	4,000	1,200	4,000	1,200	1,600	320
10	3,200	1,300	3,200	1,300	1,300	320
12	2,700	1,300	2,700	1,300	1,100	280
16	2,000	960	2,000	960	800	200
20	1,600	770	1,600	770	640	160

■NOTE

1) Above cutting conditions are for general guidance.
2) The cutting parameters to be adjusted according to machining shape, purpose and rigidity of machine and work clamping
3) Recommend to use down cutting.
4) Recommend to use wet cutting condition. It is effective to use cutting fluid for heat-resistant alloy.

(2) Slotting

Work Materials	Stainless steel SUS304,1.4301		Titanium alloy Ti-6Al-4V		Heat-resistant alloy Inco718	
Type of Machining	 ap≦Dc		 ap≦Dc		 ap≦0.3Dc	
Tooldia. φDc(mm)	Spindle speed n (min⁻¹)	Feed speed Vf (mm/min)	Spindle speed n (min⁻¹)	Feed speed Vf(mm/min)	Spindle speed n (min⁻¹)	Feed speed Vf (mm/min)
3	11,000	670	11,000	670	3,200	160
4	8,000	750	8,000	750	2,400	180
5	6,400	800	6,400	800	1,900	175
6	5,300	740	5,300	740	1,600	180
8	4,000	800	4,000	800	1,200	190
10	3,200	900	3,200	900	950	210
12	2,700	900	2,700	900	800	200
16	2,000	640	2,000	640	600	150
20	1,600	510	1,600	510	480	120

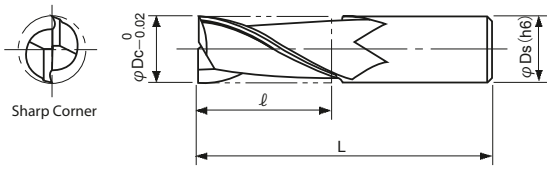
■NOTE

1) Above cutting conditions are for general guidance.
2) The cutting parameters to be adjusted according to machining shape, purpose and rigidity of machine and work clamping
3) Recommend to use wet cutting condition. It is effective to use cutting fluid for heat-resistant alloy.

●: Standard stock items □: Stock in Japan ○: Soon to be deleted

Solid Carbide End Mill for Aluminium — AL-SEES2TYPE

- 2 flutes, Helix angle 45°
- Regular flute length



Cat.No.	Stock	Dimensions (mm)			
		φDc	ℓ	L	φDs
AL-SEES2010	●	1	2.8	40	3
AL-SEES2015	●	1.5	4.4	40	4
AL-SEES2020	●	2	7	40	4
AL-SEES2025	●	2.5	9	40	4
AL-SEES2030	●	3	11	50	6
AL-SEES2035	□	3.5	12	50	6
AL-SEES2040	●	4	14	50	6
AL-SEES2045	●	4.5	16	50	6
AL-SEES2050	●	5	17	55	6
AL-SEES2060	●	6	17	55	6
AL-SEES2070	●	7	22	65	8
AL-SEES2080	●	8	22	65	8
AL-SEES2090	●	9	22	70	10
AL-SEES2100	●	10	28	75	10

Cat.No.	Stock	Dimensions (mm)			
		φDc	ℓ	L	φDs
AL-SEES2120	●	12	28	80	12
AL-SEES2130	□	13	35	85	12
AL-SEES2140	●	14	40	95	16
AL-SEES2150	●	15	40	95	16
AL-SEES2160	●	16	40	95	16
AL-SEES2180	●	18	45	115	20
AL-SEES2200	●	20	45	115	20
AL-SEES2250	●	25	55	130	25

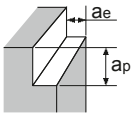
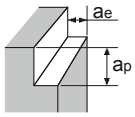
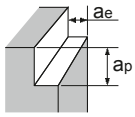
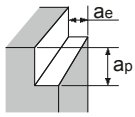
Note) Please refer page D015-D018 for recommended cutting conditions.

●: Standard stock items □: Stock in Japan ○: Soon to be deleted

Solid Carbide End Mill for Aluminium — AL-SEES2TYPE

■ RECOMMENDED CUTTING CONDITIONS FOR AL-SEES2 TYPE

(1) Shoulder Milling

Work Materials	Aluminium alloy (A5052)		Aluminium alloy (A7075)		Cast aluminium alloy (Up to 13% Si)		Copper alloy (C1100)	
Type of Machining	 ap=1.5Dc ae=0.5Dc		 ap=1.5Dc ae=0.5Dc		 ap=1.5Dc ae=0.5Dc		 ap=1.5Dc ae=0.5Dc	
Tool dia. φDc (mm)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)
0.4	32,000	380	32,000	380	32,000	380	32,000	380
0.5	32,000	480	32,000	480	32,000	480	32,000	480
0.75	32,000	700	32,000	700	32,000	700	32,000	700
1	32,000	900	32,000	900	32,000	900	32,000	900
1.5	32,000	1,400	32,000	1,400	32,000	1,400	32,000	1,400
2	32,000	1,900	32,000	1,900	32,000	1,900	25,000	1,500
3	24,000	2,200	22,000	2,000	24,000	2,200	17,000	1,500
4	18,000	2,200	16,000	2,000	18,000	2,200	13,000	1,500
5	15,000	2,200	13,000	2,000	15,000	2,200	10,000	1,500
6	12,000	2,200	10,000	2,000	12,000	2,200	8,500	1,500
8	9,000	1,800	8,000	1,600	9,000	1,800	6,500	1,300
10	7,300	1,800	6,000	1,600	7,300	1,800	5,000	1,300
12	6,000	1,800	5,000	1,600	6,000	1,800	4,000	1,300
16	4,500	1,500	4,000	1,400	4,500	1,500	3,000	1,000
20	3,600	1,500	3,000	1,400	3,600	1,500	2,500	1,000
25	3,000	1,500	2,500	1,400	3,000	1,500	2,000	1,000
30	2,500	1,250	2,100	1,050	2,500	1,250	1,700	850

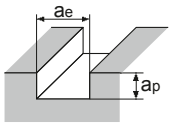
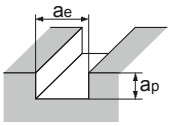
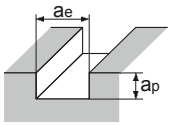
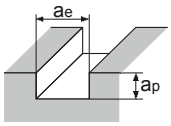
■ NOTE

1) Use water soluble oil.
2) It is important to hold the tool shank at least up to 50-60 mm into any tool holder for rigid holding of the tool.
3) In case of ramping, please reduce the cutting parameters by 30%-60% on above table.
4) If machine does not have enough spindle speed (RPM),it is recommended to reduce feed speed into same proportion.

Solid Carbide End Mill for Aluminium AL-SEES2TYPE

■ RECOMMENDED CUTTING CONDITIONS FOR AL-SEES2 TYPE

(2) Slotting

Work Materials	Aluminium alloy (A5052)		Aluminium alloy (A7075)		Cast aluminium alloy (Up to 13% Si)		Copper alloy (C1100)	
Type of Machining	 ap=Dc ae=Dc		 ap=Dc ae=Dc		 ap=Dc ae=Dc		 ap=Dc ae=Dc	
Tool dia. φDc(mm)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)
0.4	32,000	230	32,000	230	32,000	230	32,000	230
0.5	32,000	290	32,000	290	32,000	290	32,000	290
0.75	32,000	430	32,000	430	32,000	430	32,000	430
1	32,000	570	32,000	570	32,000	570	32,000	570
1.5	32,000	860	32,000	860	32,000	860	29,000	780
2	32,000	1,100	27,000	1,000	32,000	1,100	22,000	800
3	21,000	1,100	18,000	1,000	21,000	1,100	14,000	800
4	16,000	1,100	13,000	1,000	16,000	1,100	11,000	800
5	12,000	1,100	10,000	1,000	12,000	1,100	8,900	800
6	10,000	1,100	9,000	1,000	10,000	1,100	7,400	800
8	8,000	1,100	7,000	1,000	8,000	1,100	5,500	800
10	6,000	1,100	5,500	1,000	6,000	1,100	4,500	800
12	5,000	1,100	4,500	1,000	5,000	1,100	3,700	800
16	4,000	1,000	3,300	800	4,000	1,000	2,700	700
20	3,000	900	2,700	800	3,000	900	2,200	650
25	2,500	900	2,000	700	2,500	900	1,800	650
30	2,000	800	1,800	700	2,000	800	1,500	600

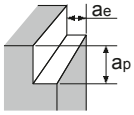
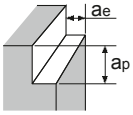
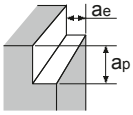
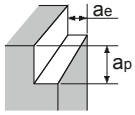
■ NOTE

1) Use water soluble oil.
2) It is important to hold the tool shank at least up to 50-60 mm into any tool holder for rigid holding of the tool.
3) In case of ramping, please reduce the cutting parameters by 30%-60% on above table.
4) If machine does not have enough spindle speed (RPM),it is recommended to reduce feed speed into same proportion.

Solid Carbide End Mill for Aluminium — AL-SEES2TYPE

■ RECOMMENDED CUTTING CONDITIONS FOR AL-SEES2 TYPE

(1) Shoulder Milling / High Speed Machining

Work Materials	Aluminium alloy (A5052)		Aluminium alloy (A7075)		Cast aluminium alloy (Up to 13% Si)		Copper alloy (C1100)	
Type of Machining	 ap=1.5Dc ae=0.3Dc		 ap=1.5Dc ae=0.3Dc		 ap=1.5Dc ae=0.3Dc		 ap=1.5Dc ae=0.3Dc	
Tool dia. φDc (mm)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)
0.4	50,000	600	50,000	600	50,000	600	50,000	600
0.5	50,000	750	50,000	750	50,000	750	50,000	750
0.75	50,000	1,100	50,000	1,100	50,000	1,100	50,000	1,100
1	50,000	1,500	50,000	1,500	50,000	1,500	50,000	1,500
1.5	50,000	2,200	50,000	2,200	50,000	2,200	50,000	2,200
2	50,000	3,000	50,000	3,000	50,000	3,000	50,000	3,000
3	50,000	4,500	45,000	4,000	50,000	4,500	37,000	3,300
4	40,000	4,500	34,000	4,000	40,000	4,500	27,000	3,300
5	32,000	4,500	27,000	4,000	32,000	4,500	22,000	3,300
6	27,000	4,500	22,000	4,000	27,000	4,500	18,000	3,300
8	20,000	4,000	17,000	3,400	20,000	4,000	14,000	2,800
10	16,000	4,000	13,000	3,200	16,000	4,000	11,000	2,800
12	13,000	3,200	11,000	2,800	13,000	3,200	9,000	2,200
16	10,000	3,000	8,500	2,500	10,000	3,000	7,000	2,100
20	8,000	2,400	7,000	2,100	8,000	2,400	5,500	1,700
25	6,500	2,200	5,500	2,000	6,500	2,200	4,500	1,600
30	5,000	1,800	4,500	1,600	5,000	1,800	3,700	1,300

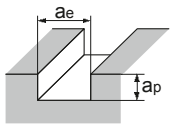
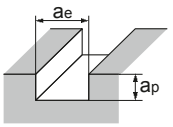
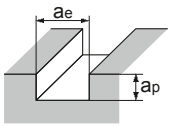
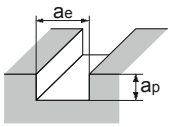
■ NOTE

1) Use water soluble oil.
2) It is important to hold the tool shank at least up to 50-60 mm into any tool holder for rigid holding of the tool.
3) In case of ramping, please reduce the cutting parameters by 30%-60% on above table.
4) If machine does not have enough spindle speed (RPM),it is recommended to reduce feed speed into same proportion.

Solid Carbide End Mill for Aluminium — AL-SEES2TYPE

■ RECOMMENDED CUTTING CONDITIONS FOR AL-SEES2 TYPE

(2) Slotting/ High Speed Machining

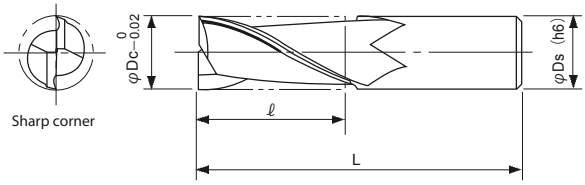
Work Materials	Aluminium alloy (A5052)		Aluminium alloy (A7075)		Cast aluminium alloy (Up to 13% Si)		Copper alloy (C1100)	
Type of Machining	 ap=0.5Dc ae=Dc		 ap=0.5Dc ae=Dc		 ap=0.5Dc ae=Dc		 ap=0.5Dc ae=Dc	
Tool dia. φDc (mm)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)
0.4	50,000	360	50,000	360	50,000	360	50,000	360
0.5	50,000	450	50,000	450	50,000	450	50,000	450
0.75	50,000	670	50,000	670	50,000	670	50,000	670
1	50,000	900	50,000	900	50,000	900	50,000	900
1.5	50,000	1,350	50,000	1,350	50,000	1,350	50,000	1,350
2	50,000	1,800	50,000	1,800	50,000	1,800	48,000	1,700
3	48,000	2,500	40,000	2,100	48,000	2,500	32,000	1,700
4	36,000	2,500	30,000	2,100	36,000	2,500	23,000	1,700
5	28,000	2,500	24,000	2,100	28,000	2,500	19,000	1,700
6	23,000	2,500	20,000	2,100	23,000	2,500	16,000	1,700
8	18,000	2,500	15,000	2,100	18,000	2,500	12,000	1,700
10	14,000	2,500	12,000	2,100	14,000	2,500	9,500	1,700
12	12,000	2,500	10,000	2,100	12,000	2,500	8,000	1,700
16	9,000	2,500	8,000	2,100	9,000	2,500	6,000	1,700
20	7,000	2,100	6,000	1,800	7,000	2,100	4,800	1,400
25	5,700	2,000	4,800	1,700	5,700	2,000	3,800	1,300
30	4,700	1,600	4,000	1,400	4,700	1,600	3,200	1,100

■ NOTE

1) Use water soluble oil.
2) It is important to hold the tool shank at least up to 50-60 mm into any tool holder for rigid holding of the tool.
3) In case of ramping, please reduce the cutting parameters by 30%-60% on above table.
4) If machine does not have enough spindle speed (RPM), it is recommended to reduce feed speed into same proportion.

Solid Carbide End Mill for Aluminium — AL-SEEL2TYPE

- 2 flutes, Helix angle 45°
- Long flute length



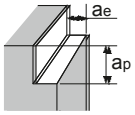
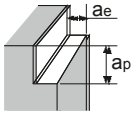
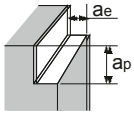
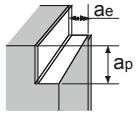
Cat. No.	Stock	Dimensions (mm)			
		φDc	ℓ	L	φDs
AL-SEEL2030	●	**3**	22	65	6
AL-SEEL2040	●	**4**	26	65	6
AL-SEEL2050	●	**5**	32	75	6
AL-SEEL2060	●	**6**	32	75	6
AL-SEEL2070	●	**7**	42	95	8
AL-SEEL2080	●	**8**	42	95	8
AL-SEEL2090	●	**9**	42	110	10
AL-SEEL2100	●	**10**	53	120	10
AL-SEEL2120	●	**12**	53	120	12
AL-SEEL2130	●	**13**	65	130	12
AL-SEEL2140	●	**14**	75	140	16
AL-SEEL2150	●	**15**	75	140	16
AL-SEEL2160	●	**16**	75	140	16
AL-SEEL2180	●	**18**	75	150	20
AL-SEEL2200	●	**20**	75	150	20
AL-SEEL2220	□	**22**	85	160	25
AL-SEEL2250	●	**25**	85	160	25

Note) Please refer page D020 for recommended cutting conditions

Solid Carbide End Mill for Aluminium — AL-SEEL2TYPE

■ RECOMMENDED CUTTING CONDITIONS FOR AL-SEEL2 TYPE

(1) Shoulder Milling

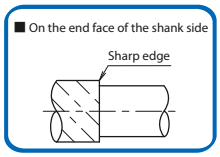
Work Materials	Aluminium alloy (A5052)		Aluminium alloy (A7075)		Cast Aluminium alloy (Up to 13%Si)		Copper alloy (C1100)	
Type of Machining	 ap=1.5Dc ae=0.2Dc		 ap=1.5Dc ae=0.2Dc		 ap=1.5Dc ae=0.2Dc		 ap=1.5Dc ae=0.2Dc	
Tooldia. φDc(mm)	Spindle speed n (min⁻¹)	Feed speed Vf(mm/min)	Spindle speed n(min⁻¹)	Feed speed Vf(mm/min)	Spindle speed n(min⁻¹)	Feed speed Vf(mm/min)	Spindle speed n(min⁻¹)	Feed speed Vf(mm/min)
1	32,000	700	32,000	700	32,000	700	30,000	660
1.5	32,000	1,000	32,000	1,000	32,000	1,000	20,000	660
2	28,000	1,200	23,000	1,000	28,000	1,200	16,000	660
3	19,000	1,200	16,000	1,000	19,000	1,200	10,000	660
4	14,000	1,200	12,000	1,000	14,000	1,200	8,000	660
5	11,000	1,200	9,500	1,000	11,000	1,200	6,000	660
6	9,500	1,200	8,000	1,000	9,500	1,200	5,000	660
8	7,000	1,200	6,000	1,000	7,000	1,200	4,000	660
10	5,700	1,200	4,800	1,000	5,700	1,200	3,200	660
12	4,700	1,200	4,000	1,000	4,700	1,200	2,600	660
16	3,500	1,000	3,000	900	3,500	1,000	2,000	600
20	2,800	800	2,400	700	2,800	800	1,600	500
25	2,300	800	1,900	650	2,300	800	1,300	500

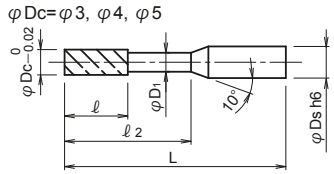
■ NOTE

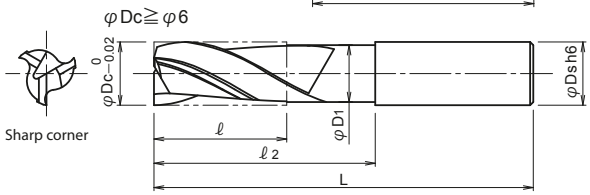
1) Use water soluble oil.
2) It is important to hold the tool shank at least up to 50-60 mm into any tool holder for rigid holding of the tool.
3) In case of ramping,please reduce the cutting parameters by 30-60% on above table. (Not recommended to use)
4) If machine does not have enough spindle speed (RPM), it is recommended to reduce feed speed into same proportion.
5) In case of slotting, please use depth of cut below 0.2D and reduce feed speed by 30-60% on above cutting parameters. (Please try to avoid using this tool for full slotting)

Solid Carbide End Mill for Aluminium — AL-SEEZ3TYPE

- 3 flutes, Helix angle 45°
- Flute length 1.5Dc







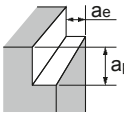
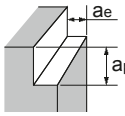
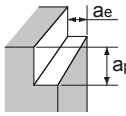
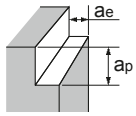
Cat. No.	Stock	Dimensions (mm)					
		φDc	ℓ	ℓ2	L	φD1	φDs
AL-SEEZ3030	●	3	5	9	55	2.8	6
AL-SEEZ3050	●	4	6	12	55	3.8	6
AL-SEEZ3040	●	5	8	15	55	4.8	6
AL-SEEZ3060	●	6	9	18	60	5.8	6
AL-SEEZ3080	●	8	12	24	70	7.8	8
AL-SEEZ3100	●	10	15	30	75	9.8	10
AL-SEEZ3120	●	12	18	36	80	11.7	12
AL-SEEZ3160	●	16	24	48	95	15.7	16
AL-SEEZ3200	●	20	30	60	115	19.7	20
AL-SEEZ3250	●	25	38	75	130	24.7	25

Note) Please refer page D023-D024 for recommended cutting conditions.

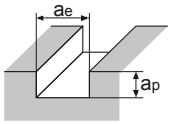
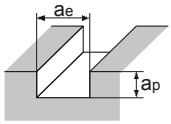
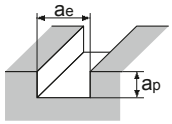
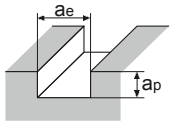
Solid Carbide End Mill for Aluminium — AL-SEEZ3TYPE

■ RECOMMENDED CUTTING CONDITIONS FOR AL-SEEZ3 TYPE

(1) Shoulder Milling

Work Materials	Aluminium alloy (A5052)		Aluminium alloy (A7075)		Cast aluminium alloy (Up to13%Si)		Copper alloy (C1100)	
Type of Machining	 ap=1.5Dc ae=0.3Dc		 ap=1.5Dc ae=0.3Dc		 ap=1.5Dc ae=0.3Dc		 ap=1.5Dc ae=0.3Dc	
Tool dia. φDc(mm)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)
3	24,000	4,800	22,800	4,400	24,000	4,800	17,000	3,400
4	18,000	4,500	16,000	4,000	18,000	4,500	13,000	3,200
5	15,000	4,500	13,000	4,000	15,000	4,500	10,000	3,200
6	12,000	4,200	10,000	3,500	12,000	4,200	8,500	3,000
8	9,000	3,600	8,000	3,200	9,000	3,600	6,500	2,600
10	7,300	3,200	6,000	2,700	7,300	3,200	5,000	2,200
12	6,000	3,000	5,000	2,500	6,000	3,000	4,000	2,000
16	4,500	2,500	4,000	2,200	4,500	2,500	3,000	1,600
20	3,600	2,100	3,000	1,800	3,600	2,100	2,500	1,500
25	3,000	1,800	2,500	1,500	3,000	1,800	2,000	1,200

(2)Slotting

Work Materials	Aluminium alloy (A5052)		Aluminium alloy (A7075)		Cast aluminium alloy (Up to13%Si)		Copper alloy (C1100)	
Type of Machining	 ap=Dc ae=Dc		 ap=Dc ae=Dc		 ap=Dc ae=Dc		 ap=Dc ae=Dc	
Tool dia. φDc(mm)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)
3	21,000	3,100	18,000	2,700	21,000	3,100	14,000	2,100
4	16,000	2,500	13,000	2,000	16,000	2,500	11,000	1,700
5	12,000	2,100	10,000	1,800	12,000	2,100	8,900	1,600
6	10,000	2,000	9,000	1,800	10,000	2,000	7,400	1,500
8	8,000	2,000	7,000	1,750	8,000	2,000	5,500	1,400
10	6,000	1,800	5,500	1,650	6,000	1,800	4,500	1,350
12	5,000	1,800	4,500	1,600	5,000	1,800	3,700	1,300
16	4,000	1,600	3,300	1,300	4,000	1,600	2,700	1,000
20	3,000	1,350	2,700	1,200	3,000	1,350	2,200	1,000
25	2,500	1,100	2,000	900	2,500	1,100	1,800	800

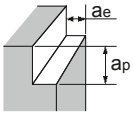
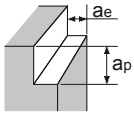
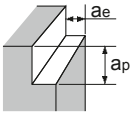
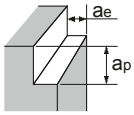
■ NOTE

1) Use water soluble oil.
2) It is important to hold the tool shank at least up to 50-60 mm into any tool holder for rigid holding of the tool.
3) In case of ramping, please reduce the cutting parameters by 30%-60% on above table.
4) If machine does not have enough spindle speed (RPM), it is recommended to reduce feed speed into same proportion.

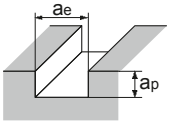
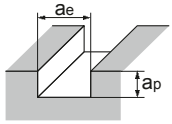
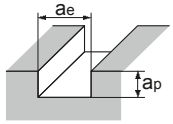
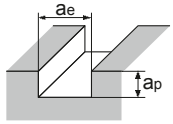
Solid Carbide End Mill for Aluminium — AL-SEEZ3TYPE

■ RECOMMENDED CUTTING CONDITIONS FOR AL-SEEZ3 TYPE

(1) Shoulder Milling / High Speed Machining

Work Materials	Aluminium alloy (A5052)		Aluminium alloy (A7075)		Cast aluminium alloy (Up to13%Si)		Copper alloy (C1100)	
Type of Machining	 ap=1.5Dc ae=0.2Dc		 ap=1.5Dc ae=0.2Dc		 ap=1.5Dc ae=0.2Dc		 ap=1.5Dc ae=0.2Dc	
Tool dia. φDc(mm)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)
3	50,000	9,000	45,000	8,100	50,000	9,000	37,000	6,600
4	40,000	8,000	34,000	6,800	40,000	8,000	27,000	5,400
5	32,000	8,000	27,000	6,800	32,000	8,000	22,000	5,400
6	27,000	6,800	22,000	5,500	27,000	6,800	18,000	4,500
8	20,000	6,000	17,000	5,000	20,000	6,000	14,000	4,200
10	16,000	5,600	13,000	4,500	16,000	5,600	11,000	3,900
12	13,000	5,200	11,000	4,400	13,000	5,200	9,000	3,600
16	10,000	4,500	8,500	3,800	10,000	4,500	7,000	3,100
20	8,000	4,000	7,000	3,500	8,000	4,000	5,500	2,800
25	6,500	3,200	5,500	2,800	6,500	3,200	4,500	2,200

(2) Slotting / High Speed Machining

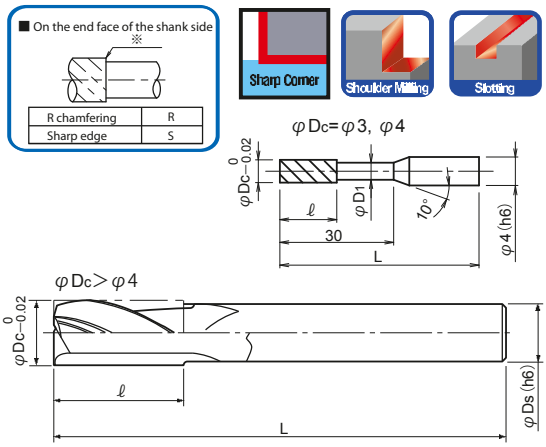
Work Materials	Aluminium alloy (A5052)		Aluminium alloy (A7075)		Cast aluminiumalloy (Up to 13%Si)		Copperalloy (C1100)	
Type of Machining	 ap=0.5Dc ae=Dc		 ap=0.5Dc ae=Dc		 ap=0.5Dc ae=Dc		 ap=0.5Dc ae=Dc	
Tool dia. φDc(mm)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)
3	48,000	5,600	40,000	4,800	48,000	5,600	32,000	3,800
4	36,000	5,600	30,000	4,800	36,000	5,600	23,000	3,800
5	28,000	5,600	24,000	4,800	28,000	5,600	19,000	3,800
6	23,000	5,600	20,000	4,800	23,000	5,600	16,000	3,800
8	18,000	5,000	15,000	4,200	18,000	5,000	12,000	3,300
10	14,000	4,200	12,000	3,600	14,000	4,200	9,500	2,800
12	12,000	3,800	10,000	3,200	12,000	3,800	8,000	2,600
16	9,000	3,100	8,000	2,800	9,000	3,100	6,000	2,100
20	7,000	2,800	6,000	2,400	7,000	2,800	4,800	1,900
25	5,700	2,200	4,800	1,900	5,700	2,200	3,800	1,500

■ NOTE

1) Use water soluble oil.
2) It is important to hold the tool shank at least up to 50-60 mm into any tool holder for rigid holding of the tool.
3) In case of ramping, please reduce the cutting parameters by 30%-60% on above table.
4) If machine does not have enough spindle speed (RPM), it is recommended to reduce feed speed into same proportion.

Solid Carbide End Mill for Aluminium — AL-SEES3-LS TYPE

- 3 flutes, Helix angle 45°
- Long shank type
- Under size neck



Cat. No.	Stock	Dimensions (mm)					※
		φDc	ℓ	L	φD1	φDs	
AL-SEES3030-LS	●	3	5	70	2.8	4	S
AL-SEES3040-LS	●	4	6	70	3.8	4	S
AL-SEES3050-LS	●	5	8	80	–	4	S
AL-SEES3060-LS	●	6	9	80	–	4	R
AL-SEES3060-LS-S5.8	●	6	9	80	–	5.8	S
AL-SEES3070-LS	●	7	10	100	–	6	R
AL-SEES3070-LS-S6.8	●	7	10	100	–	6.8	S
AL-SEES3080-LS	●	8	12	100	–	6	R
AL-SEES3080-LS-S7.8	●	8	12	100	–	7.8	S
AL-SEES3090-LS	□	9	14	120	–	8	R
AL-SEES3090-LS-S8.8	□	9	14	120	–	8.8	S
AL-SEES3100-LS	●	10	15	130	–	8	R
AL-SEES3100-LS-S9.8	●	10	15	130	–	9.8	S
AL-SEES3120-LS	●	12	18	150	–	10	R
AL-SEES3140-LS	●	14	21	160	–	12	R
AL-SEES3160-LS	●	16	24	180	–	14	R
AL-SEES3180-LS	●	18	27	180	–	16	R
AL-SEES3200-LS	●	20	30	200	–	18	R
AL-SEES3220-LS	●	22	33	200	–	20	R

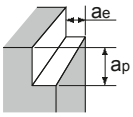
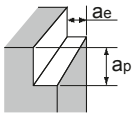
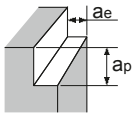
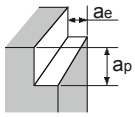
Note) Please refer page D026 for recommended cutting conditions.

●: Standard stock items □: Stock in Japan ○: Soon to be deleted

Solid Carbide End Mill for Aluminium — AL-SEES3-LS TYPE

■ RECOMMENDED CUTTING CONDITIONS FOR AL-SEES3-LS TYPE

(1) Shoulder Milling

Work Materials	Aluminium alloy (A5052)		Aluminium alloy (A7075)		Cast aluminium alloy (Up to 13% Si)		Copper alloy (C1100)	
Type of Machining	 ap=1.5Dc ae=0.05Dc		 ap=1.5Dc ae=0.05Dc		 ap=1.5Dc ae=0.05Dc		 ap=1.5Dc ae=0.05Dc	
Tool dia. φDc (mm)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)
3	19,000	2,200	16,000	1,800	19,000	2,200	10,600	950
4	14,300	1,800	11,900	1,600	14,300	1,800	8,000	880
5	11,400	1,600	10,000	1,400	11,400	1,600	6,400	830
6	9,500	1,400	8,000	1,200	9,500	1,400	5,000	750
8	7,000	1,100	6,000	1,000	7,000	1,100	4,000	650
10	5,700	1,000	4,800	850	5,700	1,000	3,200	570
12	4,700	940	4,000	800	4,700	940	2,600	520
14	4,000	880	3,400	750	4,000	880	2,200	500
16	3,500	800	3,000	700	3,500	800	2,000	450
18	3,200	800	2,600	650	3,200	800	1,800	450
20	2,800	700	2,400	600	2,800	700	1,600	400
22	2,600	650	2,100	520	2,600	650	1,400	350

■NOTE

1) Use water soluble oil.
2) It is important to hold the tool shank at least up to 50-60 mm into any tool holder for rigid holding of the tool.
3) In case of ramping, please reduce the cutting parameters by 30-60% on above table.(Not recommended to use)
4) If machine does not have enough spindle speed (RPM), it is recommended to reduce feed speed into same proportion.
5) In case of slotting, please use depth of cut below 0.2D and reduce feed speed by 30-60% on above cutting parameters. (Please try to avoid using this tool for full slotting)

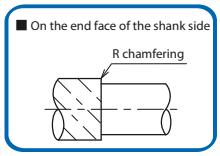
■ REDUCTION RATE FOR AL-SEES3-LS TYPE

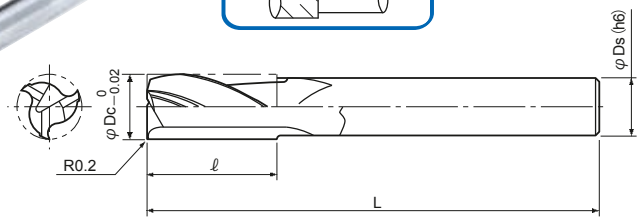
※ In case of lengthening overhung length, the cutting parameters to be adjusted according to the reductionrate.

L / Dc	n (min-1)	Vf (mm/min)	ap	ae
Below 4 Dc	0%	0%	1.5 Dc	0.05 Dc
5~6 Dc	25%	30%	1.2 Dc	0.05 Dc
7~8 Dc	40%	50%	1.0 Dc	0.05 Dc

Solid Carbide End Mill for Aluminium AL-SEES3-LS-R02TYPE

- 3 flutes, Helix angle 45°
- Long shank type
- Under size neck
- R0.2 Corner radius





Cat. No.	Stock	Dimensions (mm)			
		φDc	ℓ	L	φDs
AL-SEES3060-LS-R02	□	**6**	9	80	4
AL-SEES3080-LS-R02	●	**8**	12	100	6
AL-SEES3100-LS-R02	●	**10**	15	130	8
AL-SEES3120-LS-R02	●	**12**	18	150	10
AL-SEES3140-LS-R02	●	**14**	21	160	12
AL-SEES3160-LS-R02	□	**16**	24	180	14
AL-SEES3180-LS-R02	□	**18**	27	180	16
AL-SEES3200-LS-R02	●	**20**	30	200	18
AL-SEES3220-LS-R02	□	**22**	33	200	20

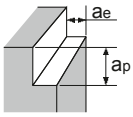
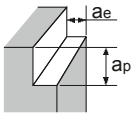
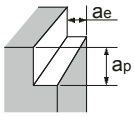
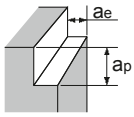
Note) Please refer page D028-D029 for recommended cutting conditions.

●: Standard stock items □: Stock in Japan ○: Soon to be deleted

Solid Carbide End Mill for Aluminium AL-SEES3-LS-R02TYPE

■ RECOMMENDED CUTTING CONDITIONS FOR AL-SEES3-LS-R02 TYPE

(1) Shoulder Milling

Work Materials	Aluminium alloy (A5052)		Aluminium alloy (A7075)		Cast aluminium alloy (Up to 13% Si)		Copper alloy (C1100)	
Type of Machining	 ap=1.5Dc ae=0.05Dc		 ap=1.5Dc ae=0.05Dc		 ap=1.5Dc ae=0.05Dc		 ap=1.5Dc ae=0.05Dc	
Tool dia. φDc (mm)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)
6	10,000	1,500	9,000	1,350	10,000	1,500	7,400	1,100
8	8,000	1,400	7,000	1,250	8,000	1,400	5,500	1,000
10	6,000	1,200	5,500	1,100	6,000	1,200	4,500	900
12	5,000	1,100	4,500	1,000	5,000	1,100	3,700	800
14	4,500	1,000	3,900	900	4,500	1,000	3,200	750
16	4,000	1,000	3,300	800	4,000	1,000	2,700	670
18	3,500	950	3,000	800	3,500	950	2,500	670
20	3,000	900	2,700	800	3,000	900	2,200	670
22	2,900	900	2,500	750	2,900	900	2,000	600

■NOTE

1) Use water soluble oil.
2) It is important to hold the tool shank at least up to 50-60 mm into any tool holder for rigid holding of the tool.
3) In case of ramping, please reduce the cutting parameters by 30-60% on above table.(Not recommended to use)
4) If machine does not have enough spindle speed (RPM), it is recommended to reduce feed speed into same proportion.
5) In case of slotting, please use depth of cut below 0.2D and reduce feed speed by 30-60% on above cutting parameters. (Please try to avoid using this tool for full slotting)

■ REDUCTION RATE FOR AL-SEES3-LS TYPE

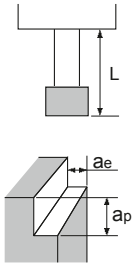
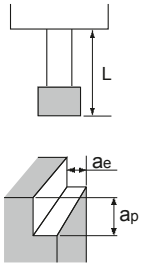
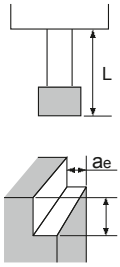
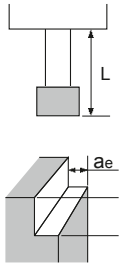
※ In case of lengthening overhung length, the cutting parameters to be adjusted according to the reductionrate.

L / Dc	n (min-1)	Vf (mm/min)	ap	ae
Below 4 Dc	0%	0%	1.5 Dc	0.05 Dc
5~6 Dc	25%	30%	1.2 Dc	0.05 Dc
7~8 Dc	40%	50%	1.0 Dc	0.05 Dc

Solid Carbide End Mill for Aluminium AL-SEES3-LS-R02TYPE

■ RECOMMENDED CUTTING CONDITIONS FOR AL-SEES3-LS-R02 TYPE

(1) Shoulder Milling / High Speed Machining

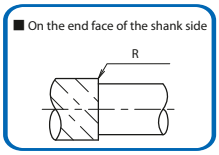
Work Materials	Aluminium alloy (A5052)		Aluminium alloy (A7075)		Cast aluminium alloy (Up to 13% Si)		Copper alloy (C1100)	
Type of Machining	 ap=1.5Dc ae=0.04Dc L≦Dc x 4		 ap=1.5Dc ae=0.04Dc L≦Dc x 4		 ap=1.5Dc ae=0.04Dc L≦Dc x 4		 ap=1.5Dc ae=0.04Dc L≦Dc x 4	
Tool dia. φDc (mm)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)
6	20,000	2,600	17,000	2,200	20,000	2,600	12,000	1,600
8	15,000	2,100	13,000	1,800	15,000	2,100	9,000	1,300
10	12,000	2,000	10,000	1,800	12,000	2,000	7,300	1,200
12	10,000	2,000	9,000	1,800	10,000	2,000	6,000	1,200
14	8,500	1,850	7,500	1,600	8,500	1,850	5,000	1,100
16	7,500	1,650	6,500	1,400	7,500	1,650	4,500	1,000
18	6,500	1,500	6,000	1,400	6,500	1,500	4,000	1,000
20	6,000	1,500	5,000	1,250	6,000	1,500	3,600	900
22	5,500	1,400	4,800	1,200	5,500	1,400	3,300	800

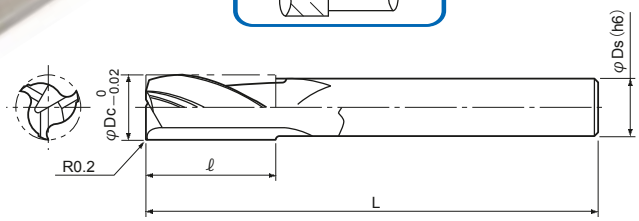
■ NOTE

1) Use water soluble oil.
2) It is important to hold the tool shank at least up to 50-60 mm into any tool holder for rigid holding of the tool.
3) In case of ramping, please reduce the cutting parameters by 30-60% on above table.(Not recommended to use)
4) If machine does not have enough spindle speed (RPM), it is recommended to reduce feed speed into same proportion.
5) In case of slotting, please use depth of cut below 0.2D and reduce feed speed by 30-60% on above cutting parameters. (Please try to avoid using this tool for full slotting)

Solid Carbide End Mill for Aluminium AL-SEES3-XLS-R02TYPE

- 3 flutes, Helix angle 45°
- Extra long shank type
- Under size neck
- R0.2 Corner radius





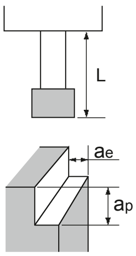
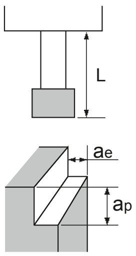
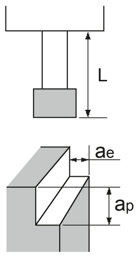
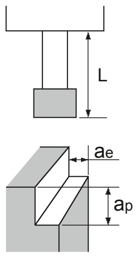
Cat. No.	Stock	Dimensions (mm)			
		φDc	ℓ	L	φDs
AL-SEES3060-XLS-R02	●	**6**	9	100	5
AL-SEES3080-XLS-R02	●	**8**	12	140	7
AL-SEES3100-XLS-R02	●	**10**	15	160	9
AL-SEES3120-XLS-R02	●	**12**	18	180	11
AL-SEES3140-XLS-R02	●	**14**	21	200	13
AL-SEES3160-XLS-R02	●	**16**	24	220	15
AL-SEES3180-XLS-R02	□	**18**	27	240	17
AL-SEES3200-XLS-R02	●	**20**	30	250	18
AL-SEES3220-XLS-R02	●	**22**	33	250	20

Note) Please refer page D031-D032 for recommended cutting conditions

Solid Carbide End Mill for Aluminium AL-SEES3-XLS-R02TYPE

RECOMMENDED CUTTING CONDITIONS FOR AL-SEES3-XLS-R02 TYPE

(1) Shoulder Milling

Work Materials	Aluminium alloy (A5052)		Aluminium alloy (A7075)		Cast aluminium alloy (Up to13% Si)		Copper alloy (C1100)	
Type of Machining	 L = Dc x 4 ae = Dc x 0.25 ap = Dc x 1.5		 L = Dc x 4 ae = Dc x 0.25 ap = Dc x 1.5		 L = Dc x 4 ae = Dc x 0.25 ap = Dc x 1.5		 L = Dc x 4 ae = Dc x 0.25 ap = Dc x 1.5	
Tool dia. φDc (mm)	Spindle speed n (min^{-1})	Feed speed Vf (mm/min)	Spindle speed n (min^{-1})	Feed speed Vf (mm/min)	Spindle speed n (min^{-1})	Feed speed Vf (mm/min)	Spindle speed n (min^{-1})	Feed speed Vf (mm/min)
6	20,000	3,600	20,000	3,400	20,000	3,600	13,500	2,100
8	18,000	3,600	18,000	3,300	18,000	3,600	12,000	2,100
10	14,000	4,200	14,000	4,000	14,000	4,200	9,500	2,400
12	12,000	4,800	10,500	3,800	12,000	4,800	8,000	2,800
14	10,000	4,200	9,000	3,400	10,000	4,200	7,000	2,600
16	9,000	4,000	8,000	3,200	9,000	4,000	6,000	2,400
18	8,000	3,800	7,200	3,100	8,000	3,800	5,400	2,200
20	7,200	3,600	6,500	3,000	7,200	3,600	5,000	2,100
22	6,500	3,400	6,000	2,800	6,500	3,400	4,800	2,100

NOTE

1) Use water soluble oil.
2) It is important to hold the tool shank at least up to 50-60 mm into any tool holder for rigid holding of the tool.
3) In case of ramping, please reduce the cutting parameters by 30-60% on above table.(Not recommended to use)
4) If machine does not have enough spindle speed (RPM), it is recommended to reduce feed speed into same proportion.

REDUCTION RATE FOR AL-SEES3-XLS-R02 TYPE

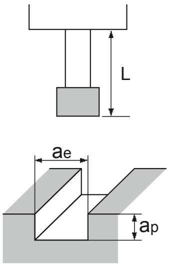
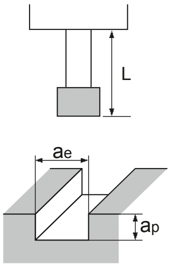
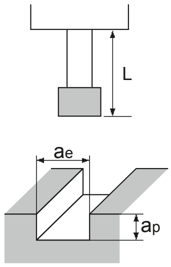
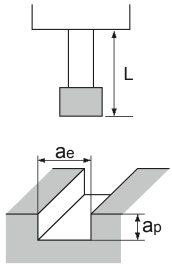
※ In case of lengthening overhung length, the cutting parameters to be adjusted according to the reduction rate.

L / Dc	n (min^{-1}) Vf (mm/min)	ae
4~5Dc	0%	0.2Dc
5~6Dc	10~20%	0.15Dc
6~7Dc	30~40%	0.1Dc
7~8Dc	40~50%	0.075Dc
8~9Dc	50~60%	0.05Dc
9~10Dc	60~70%	0.025Dc

Solid Carbide End Mill for Aluminium AL-SEES3-XLS-R02 TYPE

■ RECOMMENDED CUTTING CONDITIONS FOR AL-SEES3-XLS-R02 TYPE

(2) Slotting

Work Materials	Aluminium alloy (A5052)		Aluminium alloy (A7075)		Cast aluminium alloy (Up to 13% Si)		Copper alloy (C1100)	
Type of Machining	 L = Dc x 4 ae = Dc ap = Dc x 0.25		 L = Dc x 4 ae = Dc ap = Dc x 0.25		 L = Dc x 4 ae = Dc ap = Dc x 0.25		 L = Dc x 4 ae = Dc ap = Dc x 0.25	
Tool dia. φDc (mm)	Spindle speed n (min^{-1})	Feed speed Vf (mm/min)	Spindle speed n (min^{-1})	Feed speed Vf (mm/min)	Spindle speed n (min^{-1})	Feed speed Vf (mm/min)	Spindle speed n (min^{-1})	Feed speed Vf (mm/min)
6	15,000	5,250	14,000	4,600	15,000	5,250	11,000	3,500
8	12,500	4,150	12,000	3,800	12,500	4,150	9,000	2,700
10	11,000	3,500	10,500	3,500	11,000	3,500	8,000	2,300
12	9,600	3,100	9,000	2,800	9,600	3,100	7,000	2,000
14	8,600	2,750	8,200	2,500	8,600	2,750	6,200	1,800
16	7,800	2,650	7,400	2,400	7,800	2,650	5,600	1,700
18	7,000	2,520	6,700	2,300	7,000	2,520	5,000	1,600
20	6,400	2,560	6,000	2,300	6,400	2,560	4,600	1,600
22	6,000	2,520	5,800	2,300	6,000	2,520	4,400	1,700

■ NOTE

1) Use water soluble oil.
2) It is important to hold the tool shank at least up to 50-60 mm into any tool holder for rigid holding of the tool.
3) In case of ramping, please reduce the cutting parameters by 30-60% on above table.(Not recommended to use)
4) If machine does not have enough spindle speed (RPM), it is recommended to reduce feed speed into same proportion.

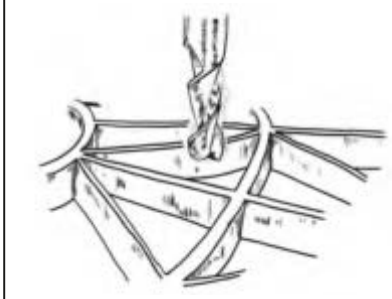
■ REDUCTION RATE FOR AL-SEES3-XLS-R02 TYPE

※ In case of lengthening overhung length, the cutting parameters to be adjusted according to the reduction rate.

L / Dc	n (min^{-1}) Vf (mm/min)		ap
	Below φ10	Over φ10	
4~5Dc	0%	0%	0.2Dc
5~6Dc	40~50%	10~20%	0.1Dc
6~7Dc	50~60%	20~30%	0.05Dc
7~8Dc	60~70%	30~50%	0.05Dc
8~9Dc	70~80%	40~60%	0.025Dc
9~10Dc	70~80%	50~70%	0.025Dc

Solid Carbide End Mill for Aluminium

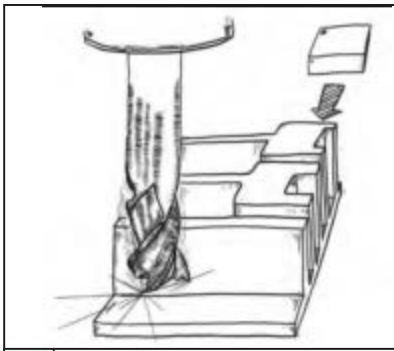
■ CASE STUDIES



Work	Part name	Under plate
	Material	A6061 Aluminium alloy
	Hardness	–
Tool	Tool No.	AL-SEES2100
	Grade	KT9
Cutting conditions	Vc,(n)	25,000 (min^{-1})
	Vf, (f z)	8,000 (mm/min)
	a p(mm)	3 (mm)
	a e(mm)	10 (mm)
	Coolant	Wet cut
	Machine	H.S.C. Vertical MC

Result

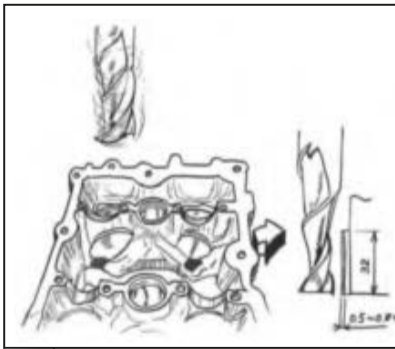
No chattering. Very smooth machining observed on low rigid work piece.



Work	Part name	Aircraft part
	Material	Aluminium alloy
	Hardness	–
Tool	Tool No.	AL-SEES3120-LS
	Grade	KT9
Cutting conditions	Vc,(n)	9,000 (min^{-1})
	Vf, (f z)	4,000 (mm/min)
	a p(mm)	0.5 (mm)
	a e(mm)	12 (mm)
	Coolant	Wet cut
	Machine	H.S.C. Vertical MC

Result

Excellent surface roughness.
Less chattering than competitor's.



Work	Part name	Cylinder head
	Material	Aluminium alloy
	Hardness	–
Tool	Tool No.	AL-SEES2160
	Grade	KT9
Cutting conditions	Vc,(n)	7,500 (min^{-1})
	Vf, (f z)	3,500 (mm/min)
	a p(mm)	32 (mm)
	a e(mm)	0.5!0.8 (mm)
	Coolant	Wet cut
	Machine	H.S.C. Vertical MC

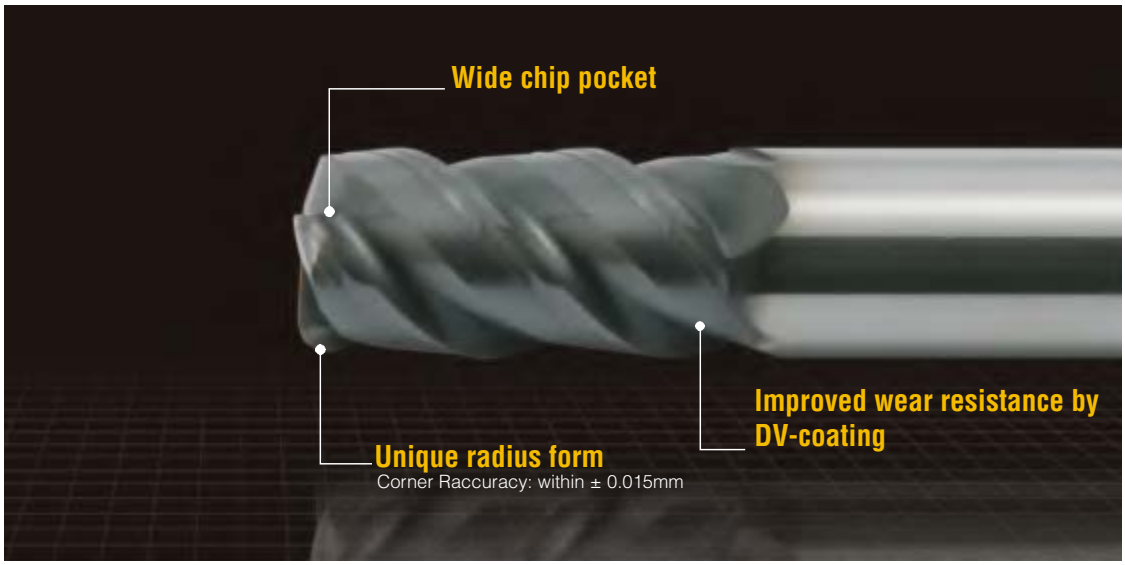
Result

Could finish job by one process integrated roughing and finishing process.
Achieved 10 time longer tool life and better surface roughness than the exisiting.

"One-Cut Super Radius" End Mill DV-OCSR TYPE

From Roughing to Finishing on High Hardened Materials

DV Coating

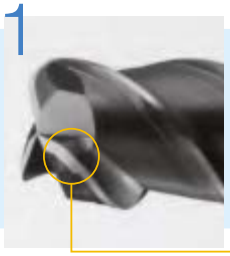


Features

1. Suitable for various materials
2. High speed High feed High accuracy
3. Regular type Long neck type Taper neck type

Unique cutting edge geometry

1



Adapted curve rake face with lead angle on corner edge

- Achieved high feed machining and longer tool life at roughing process of high hardened material by reducing heating due to smooth chip evacuation.

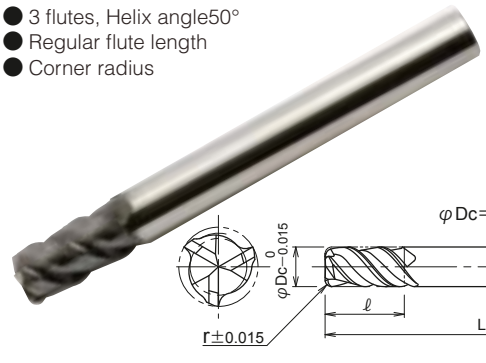
2

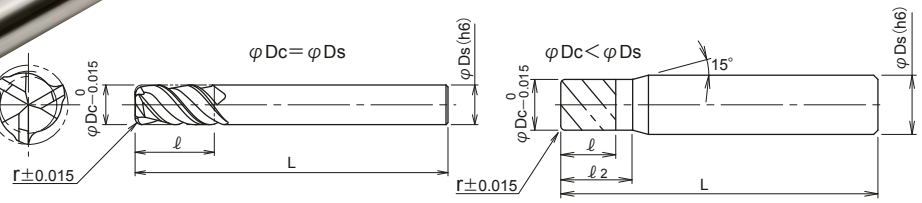
3 flutes with wide chip pocket

- Stable machining is possible at the corner of pocket milling
- High efficient slotting is possible.

"One-Cut Super Radius" End Mill — DV-OCSR TYPE

- 3 flutes, Helix angle50°
- Regular flute length
- Corner radius





Cat. No.	Stock	Dimensions (mm)					
		φDc	r	ℓ	ℓ2	L	φDs
DV-OCSR3020-R05	●	2	0.5	4	6	70	6
DV-OCSR3030-R08	●	3	0.8	6	9	70	6
DV-OCSR3040-R10	●	4	1	8	12	70	6
DV-OCSR3050-R12	●	5	1.2	10	15	70	6
DV-OCSR3060-R15	●	6	1.5	12	–	90	6
DV-OCSR3080-R20	●	8	2	16	–	100	8
DV-OCSR3100-R10	□	10	1	20	–	110	10
DV-OCSR3100-R20	●	10	2	20	–	110	10
DV-OCSR3120-R20	●	12	2	24	–	120	12
DV-OCSR3160-R30	□	16	3	32	–	160	16
DV-OCSR3160-R30-L	□	16	3	32	–	185	16
DV-OCSR3200-R30	□	20	3	40	–	160	20

Note) Please refer page D051-D052 for recommended cutting conditions.

●: Standard stock items □: Stock in Japan ○: Soon to be deleted

"One-Cut Super Radius" End Mill — DV-OCSR TYPE

■ RECOMMENDED CUTTING CONDITIONS FOR DV-OCSR TYPE

Work Materials	L/Dc	Dimensions (mm)											
		φ2×R0.5			φ3×R0.8			φ4×R1			φ5×R1.2		
		ap (mm)	n (mm^{-1})	Vf (mm/min)	ap (mm)	n (mm^{-1})	Vf (mm/min)	ap (mm)	n (mm^{-1})	Vf (mm/min)	ap (mm)	n (mm^{-1})	Vf (mm/min)
Carbon steel S50C, S55C (C50, C55) Below 250HB	Below5 Dc	0.12	15,000	5,100	0.20	10,000	5,100	0.25	7,000	4,800	0.30	5,700	4,800
	6~8 Dc	0.08	7,000	1,900	0.13	5,300	2,700	0.17	3,500	2,300	0.20	2,800	2,300
	9~11Dc	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 HPM7,NAK80,P20 (1.2311) 30-43HRC	Below5 Dc	0.12	12,000	4,000	0.20	8,500	4,300	0.25	6,000	4,000	0.30	5,000	4,200
	6~8 Dc	0.08	7,000	1,900	0.13	5,300	2,700	0.17	3,500	2,300	0.20	2,800	2,300
	9~11Dc	0.06	4,800	980	0.10	3,000	1,500	0.12	2,300	1,500	0.14	1,900	1,600
Die steel SKD61,SKD11 (1.2344,1.2379) Below 255HB	Below5 Dc	0.12	12,000	4,000	0.20	8,500	4,300	0.25	6,000	4,000	0.30	5,000	4,200
	6~8 Dc	0.08	7,000	1,900	0.13	5,300	2,700	0.17	3,500	2,300	0.20	2,800	2,300
	9~11Dc	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 SKD61,DAC,DHA (1.2344,1.2379) 40-50HRC	Below5 Dc	0.10	9,600	2,900	0.18	6,300	2,800	0.22	4,700	2,800	0.27	2,200	1,600
	6~8 Dc	0.07	4,800	1,400	0.11	3,000	1,300	0.15	2,300	1,400	0.18	1,900	1,400
	9~11Dc	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 SKD61,DAC,DHA (1.2344,1.2379) 55-60 HRC	Below5Dc	0.10	4,800	1,300	0.16	3,000	1,200	0.20	2,300	1,200	0.24	1,900	1,200
	6~8 Dc	0.06	4,000	980	0.10	2,600	1,000	0.13	1,900	1,000	0.16	1,500	1,000
	9~11Dc	0.05	3,000	550	0.08	2,000	800	0.10	1,500	800	0.11	1,200	800
Grey & Nodular cast iron FC,FCD(GG,GGG) Below 300HB	Below5 Dc	0.13	15,000	5,600	0.22	10,000	5,600	0.27	8,000	5,900	0.33	6,000	5,600
	6~8 Dc	0.09	8,700	1,900	0.14	5,800	3,200	0.16	4,300	3,200	0.22	3,500	3,200
	9~11Dc	0.07	5,600	1,200	0.11	3,700	2,000	0.13	2,700	2,000	0.15	2,200	2,000

L:Overhung length, Dc:Tool dia, ap: Depth of cut, n: Spindle speed, Vf: Feed speed

Work Materials	L/Dc	Dimensions (mm)											
		φ6×R1.5			φ8×R2			φ10×R1			φ10×R2		
		ap (mm)	n (mm^{-1})	Vf (mm/min)	ap (mm)	n (mm^{-1})	Vf (mm/min)	ap (mm)	n (mm^{-1})	Vf (mm/min)	ap (mm)	n (mm^{-1})	Vf (mm/min)
Carbon steel S50C,S55C (C50,C55) Below 250HB	Below5 Dc	0.37	4,800	4,800	0.50	3,500	4,700	0.25	2,800	4,700	0.50	2,800	4,700
	6~8 Dc	0.25	2,300	2,300	0.34	1,700	2,300	0.17	1,400	2,300	0.34	1,400	2,300
	9~11Dc	0.18	1,500	1,500	0.24	1,100	1,400	0.12	900	1,500	0.24	900	1,500
Mold steel HPM7,NAK80,P20 (1.2311) 30-43 HRC	Below5 Dc	0.37	4,200	4,200	0.50	3,000	4,000	0.25	2,400	4,000	0.50	2,400	4,000
	6~8 Dc	0.25	2,300	2,300	0.34	1,700	2,300	0.17	1,400	2,300	0.34	1,400	2,300
	9~11Dc	0.18	1,500	1,500	0.24	1,100	1,400	0.12	900	1,500	0.24	900	1,500
Die steel SKD61,SKD11 (1.2344,1.2379) Below 255HB	Below5 Dc	0.37	4,200	4,200	0.50	3,000	4,000	0.25	2,400	4,000	0.50	2,400	4,000
	6~8 Dc	0.25	2,300	2,300	0.34	1,700	2,300	0.17	1,400	2,300	0.34	1,400	2,300
	9~11Dc	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 SKD61,DAC,DHA (1.2344,1.2379) 40-50 HRC	Below5 Dc	0.33	1,800	1,600	0.45	1,300	1,500	0.20	1,900	2,900	0.45	1,900	2,900
	6~8 Dc	0.22	1,500	1,300	0.30	1,100	1,300	0.15	900	1,300	0.30	900	1,300
	9~11Dc	0.16	1,300	1,100	0.20	900	1,100	0.10	700	1,000	0.20	700	1,000
Hardened die steel SKD61,DAC,DHA (1.2344,1.2379) 55-60 HRC	Below5 Dc	0.30	1,500	1,200	0.40	1,100	1,100	0.20	900	1,200	0.40	900	1,200
	6~8 Dc	0.20	1,300	1,000	0.27	900	900	0.13	700	900	0.27	700	900
	9~11Dc	0.14	1,000	800	0.19	700	700	0.10	600	800	0.19	600	800
Grey & Nodular cast iron FC,FCD(GG,GGG) Below 300HB	Below5 Dc	0.40	5,300	5,900	0.55	3,800	5,600	0.27	3,000	5,600	0.55	3,000	5,600
	6~8 Dc	0.27	2,900	3,200	0.37	2,100	3,100	0.16	1,700	3,100	0.37	1,700	3,100
	9~11Dc	0.20	1,800	2,000	0.26	1,300	1,900	0.13	1,000	1,800	0.26	1,000	1,800

L:Overhung length, Dc:Tool dia, ap: Depth of cut, n: Spindle speed, Vf: Feed speed

"One-Cut Super Radius" End Mill DV-OCSR TYPE

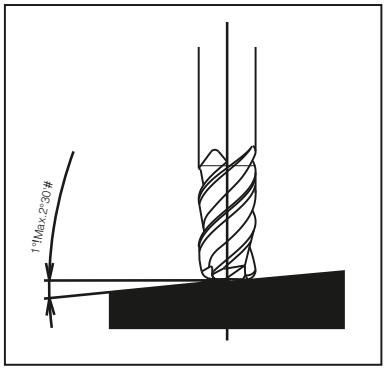
■ RECOMMENDED CUTTING CONDITIONS FOR DV-OCSR TYPE

Work Materials	L/Dc	Dimensions (mm)											
		φ12×R2			φ12×R3			φ16×R3			φ20×R3		
		ap (mm)	n (mm⁻¹)	Vf (mm/min)	ap (mm)	n (mm⁻¹)	Vf (mm/min)	ap (mm)	n (mm⁻¹)	Vf (mm/min)	ap (mm)	n (mm⁻¹)	Vf (mm/min)
Carbon steel S50C,S55C (C50,C55) Below 250HB	Below5 Dc	0.50	2,300	4,600	0.75	2,300	4,600	0.75	1,800	4,500	0.80	1,400	3,500
	6~8 Dc	0.34	1,100	2,200	0.50	1,100	2,200	0.50	900	2,200	0.50	700	1,700
	9~11Dc	0.24	700	1,400	0.36	700	1,400	0.36	600	1,500	0.36	400	1,000
Mold steel HPM7,NAK80,P20 (1.2311) 30-43 HRC	Below5 Dc	0.50	2,000	4,000	0.75	2,000	4,000	0.75	1,600	4,000	0.80	1,200	3,000
	6~8 Dc	0.34	1,100	2,200	0.50	1,100	2,200	0.50	900	2,200	0.50	700	1,700
	9~11Dc	0.24	700	1,400	0.36	700	1,400	0.36	600	1,500	0.36	400	1,000
Die steel SKD61,SKD11 (1.2344,1.2379) Below 255HB	Below5Dc	0.50	2,000	4,000	0.75	2,000	4,000	0.75	1,600	4,000	0.80	1,200	3,000
	6~8 Dc	0.34	1,100	2,200	0.50	1,100	2,200	0.50	900	2,200	0.50	700	1,700
	9~11Dc	0.24	700	1,400	0.36	700	1,400	0.36	600	1,500	0.36	400	1,000
Hardened die steel SKD61,DAC,DHA (1.2344,1.2379) 40-50HRC	Below5 Dc	0.45	1,500	2,700	0.70	1,500	2,700	0.70	1,200	2,700	0.70	900	2,000
	6~8 Dc	0.30	700	1,200	0.45	700	1,200	0.45	600	1,300	0.45	450	1,000
	9~11Dc	0.20	600	1,100	0.30	600	1,100	0.30	500	1,100	0.30	380	800
Hardened die steel SKD61,DAC,DHA (1.2344,1.2379) 55-60 HRC	Below5Dc	0.40	700	1,100	0.60	700	1,100	0.60	600	1,200	0.60	450	900
	6~8 Dc	0.27	600	900	0.40	600	900	0.40	500	1,000	0.40	380	700
	9~11Dc	0.19	500	800	0.30	500	800	0.30	400	800	0.30	300	600
Grey & Nodular cast iron FC,FCD(GG,GGG) Below 300HB	Below5 Dc	0.55	2,500	5,600	0.80	2,500	5,600	0.80	2,000	5,600	0.90	1,500	4,200
	6~8 Dc	0.37	1,400	3,100	0.55	1,400	3,100	0.55	1,100	3,000	0.55	800	2,200
	9~11Dc	0.26	800	1,700	0.40	800	1,700	0.40	700	1,900	0.40	500	1,400

L:Overhung length, Dc:Tool dia, ap: Depth of cut, n: Spindle speed, Vf: Feed speed

■NOTE

1) The cutting parameters to be adjusted according to the machine rigidity or work rigidity.
2) In case chatter occurs, reduce depth of cut or spindle speed with keeping feed per tooth.
3) Use air blow to flush the chips out.
4) In case of requring surface roughness, recommend to reduce feed speed.
5) Ramping angle 1° (Max2°30') is recommended.



"One-Cut70" End Mill — DV-SEH TYPE

One-Cut 70
Up to 70HRC

- Adopting high rigid design and special geometry give outstanding high precision and high performance on high hardened materials.
- Achieves to cut smoothly on high hardened materials from semi-finishing to finishing.
- The combination of new developed super micro-graincarbide and "VALUECOATING" achieves longer tool life in high speed machining.

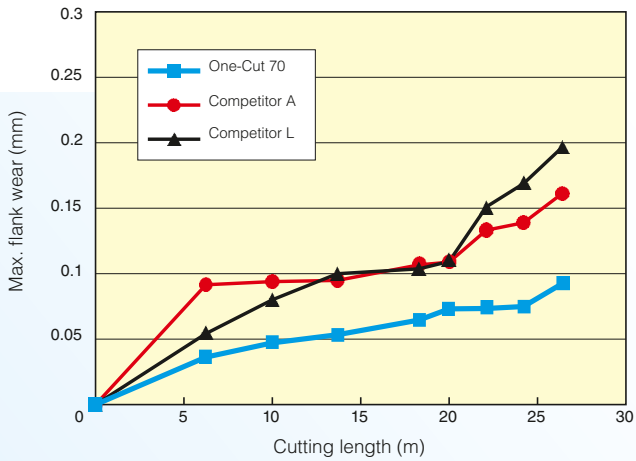
CUTTING PERFORMANCES

PERFORMANCE (Tool life comparison)

Work	Part name	Test piece
	Material	SKD11
	Hardness	60HRC
Tool	Tool No.	DV-SEHH6080
	Grade	Value coating
Cutting conditions	Cutting speed	150 m/min
	Feed rate	0.18 mm/rev
	Depth of cut	10 mm
	Width of cut	0.4 mm
	Coolant	Dry
	Machine	Vertical MC

RESULT (Vbwear)

Wearing test *"One-Cut 70 VS Competitors"*



CONDITION OF CUTTING EDGE AFTER MACHINING 26m

One-Cut 70 | Competitor A | Competitor L

RESULT: **After machining 26m, One-Cut 70 shows no chipping & less wear than competitor. Excellent result.**

"One-Cut70" End Mill

DV-SEHS TYPE
DV-SEHH

- For high hardened materials up to70HRC
- 4,6,8 flutes, Helix angle 50°
- Short & Regular flute length

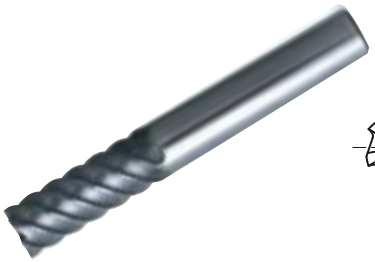
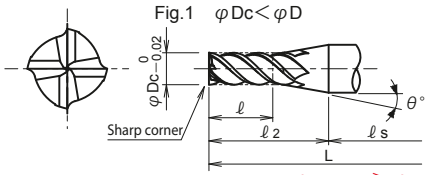
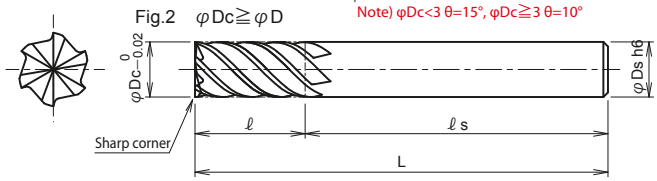


Fig.1 φDc＜φD



Note) φDc<3 θ=15°, φDc≧3 θ=10°

Fig.2 φDc≧φD



DV Coating

Shoulder Milling

Sharp Corner

	Cat. No.	Stock	No. of flutes	Dimensions (mm) φDc	ℓ	ℓ2	ℓs	L	φDs	Fig.
Short	DV-SEHS4010	●	4	**1**	2	12	48	60	6	1
	DV-SEHS4015	●	4	**1.5**	3	12	48	60	6	1
	DV-SEHS4020	●	4	**2**	4	12	48	60	6	1
	DV-SEHS4025	●	4	**2.5**	5	12	48	60	6	1
	DV-SEHS4030	●	4	**3**	7	17	43	60	6	1
	DV-SEHS4040	●	4	**4**	9	16	44	60	6	1
	DV-SEHS4050	●	4	**5**	12	16	44	60	6	1
	DV-SEHS6060	●	6	**6**	13	–	47	60	6	2
Regular	DV-SEHH4010	●	4	**1**	3.5	13	47	60	6	1
	DV-SEHH4015	●	4	**1.5**	5	14	46	60	6	1
	DV-SEHH4020	●	4	**2**	7	15	45	60	6	1
	DV-SEHH4025	□	4	**2.5**	8	15	45	60	6	1
	DV-SEHH4030	●	4	**3**	10	20	40	60	6	1
	DV-SEHH4035	●	4	**3.5**	12	20	40	60	6	1
	DV-SEHH4040	●	4	**4**	12	19	41	60	6	1
	DV-SEHH4045	●	4	**4.5**	15	20	40	60	6	1
	DV-SEHH4050	●	4	**5**	15	19	41	60	6	1
	DV-SEHH4055	□	4	**5.5**	15	18	42	60	6	1
	DV-SEHH6060	●	6	**6**	15	–	45	60	6	2
	DV-SEHH6065	□	6	**6.5**	20	25	50	75	8	1
	DV-SEHH6070	□	6	**7**	20	24	51	75	8	1
	DV-SEHH6075	□	6	**7.5**	20	22	53	75	8	1
	DV-SEHH6080	●	6	**8**	20	–	55	75	8	2
	DV-SEHH6085	□	6	**8.5**	25	30	50	80	10	1
	DV-SEHH6090	□	6	**9**	25	29	51	80	10	1
	DV-SEHH6095	□	6	**9.5**	25	27	53	80	10	1
	DV-SEHH6100	●	6	**10**	25	–	55	80	10	2
	DV-SEHH6105	□	6	**10.5**	30	35	65	100	12	1
	DV-SEHH6110	□	6	**11**	30	34	66	100	12	1
	DV-SEHH6115	□	6	**11.5**	30	32	68	100	12	1
	DV-SEHH6120	●	6	**12**	30	–	70	100	12	2
	DV-SEHH6130	□	6	**13**	35	45	60	105	16	1
	DV-SEHH6140	●	6	**14**	35	42	63	105	16	1
	DV-SEHH6150	●	6	**15**	40	44	66	110	16	1
	DV-SEHH6160	●	6	**16**	40	–	70	110	16	2
	DV-SEHH6170	□	6	**17**	40	50	70	120	20	1

Note) Please refer page D057 for recommended cutting conditions.

●: Standard stock items □: Stock in Japan ○: Soon to be deleted

"One-Cut70" End Mill

DV-SEHS TYPE
DV-SEHH

Fig.1 φDc＜φD

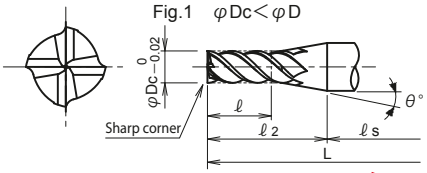
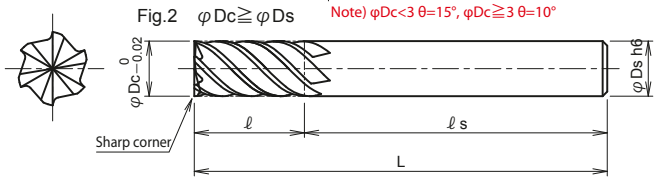


Fig.2 φDc≧φDs Note) φDc<3 θ=15°, φDc≧3 θ=10°

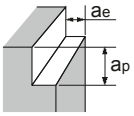
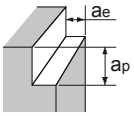
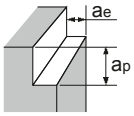
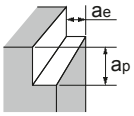


	Cat. No.	Stock	No. of flutes	Dimensions (mm) φDc	ℓ	ℓ2	ℓs	L	φDs	Fig.
Regular	**DV-SEHH6180**	●	6	**18**	40	47	73	120	20	1
	DV-SEHH6190	□	6	**19**	45	49	76	125	20	1
	DV-SEHH6200	●	6	**20**	45	–	80	125	20	2
	DV-SEHH6220	□	6	**22**	45	55	80	135	25	1
	DV-SEHH6240	□	6	**24**	50	54	86	140	25	1
	DV-SEHH8250	□	8	**25**	50	–	90	140	25	2
	DV-SEHH8260	□	8	**26**	50	–	90	140	25	2
	DV-SEHH8280	□	8	**28**	55	–	90	145	25	2
	DV-SEHH8300	□	8	**30**	60	67	98	165	32	1
	DV-SEHH8320	□	8	**32**	70	–	105	175	32	2

Note) Please refer page D057 for recommended cutting conditions.

"One-Cut 70" End Mill DV-SEHS/DV-SEHH TYPE

■ RECOMMENDED CUTTING CONDITIONS FOR DV-SEHS/H

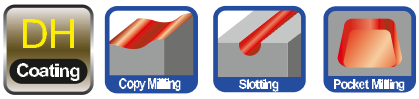
Work Materials	Tool & Die steel•Mold steel SKD, SKH, NAK (1.2344,1.2379,1.2311,P20) Below 45HRC		Hardened die steel SKD, SKT (1.2344,1.2379) 45-55HRC		Hardened die steel SKD, SKH (1.2344,1.2379) 55-65HRC		Hardened die steel SKD, SKH (1.2344,1.2379) 65-70HRC	
Type of Machining	 ap≦1.5Dc ae≦0.05Dc		 ap≦1.5Dc ae≦0.04Dc		 ap≦1.5Dc ae≦0.04Dc (MAX. 0.6mm)		 ap≦1.5Dc ae≦0.02Dc (MAX. 0.4mm)	
Tool dia. φDc (mm)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf(mm/min)
1	40,000	700	25,000	410	20,000	320	10,000	130
2	24,000	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 cutting parameters 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

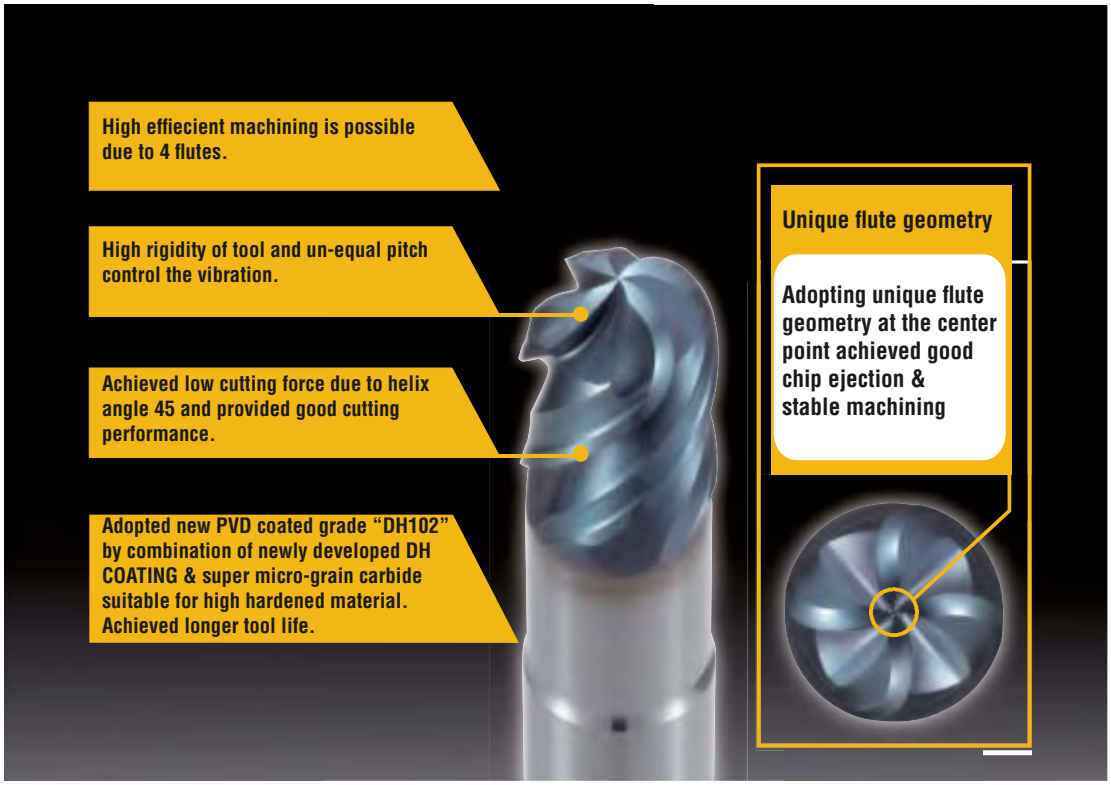
"One-Cut Ball 70" Ball Nose End Mill — DH-OCHB TYPE

- 4 flutes solid carbide ball nose
- end mill for high hardened material up to 70HRC.
- From roughing to finishing.



One-Cut Ball 70
70HRC

"DH COATING" Solid Carbide Ball Nose End Mill for high hardened material up to 70HRC



■ NEWLY DEVELOPED "DH COATING"

DH 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 existing PVD coating.

Characteristic value of various PVD coatings

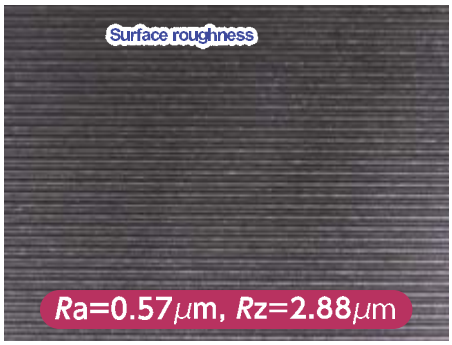
	DH Coat	DV Coat	DZ Coat	DX Coat	JC Coat
Hardness (Hv)	3,500~3,700	3,300~3,500	2,800~2,900	2,500~2,600	2,100~2,200
Oxidation temperature (°C)	1,100~1,200	1,000~1,100	700~800	300~400	400~500
Coefficient of friction	0.5	0.65	0.6	0.45	0.45

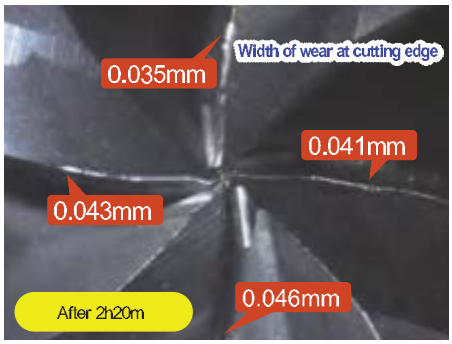
"One-Cut Ball 70" Ball Nose End Mill DH-OCHB TYPE

■ CUTTING PERFORMANCES

1. Tool life test for face milling on 70 HRC

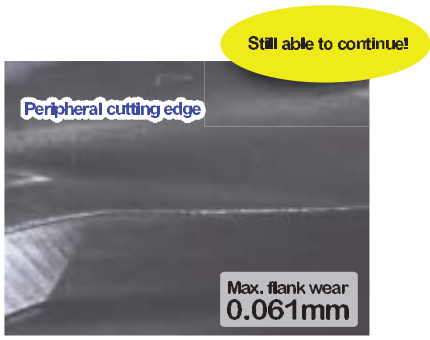
Work: HSS (70HRC)
Tool: DH-OCHB4100(R5)
Spindle speed: n=3,800min^{-1}
Cutting speed: Vc=120m/min
Feed speed: Vf=1,050mm/min
feed per tooth:fz=0.07mm/t
Depth of cut: ap=0.2mm
Pick feed: ae=0.3mm
Coolant: Dry
Machine: Vertival MC

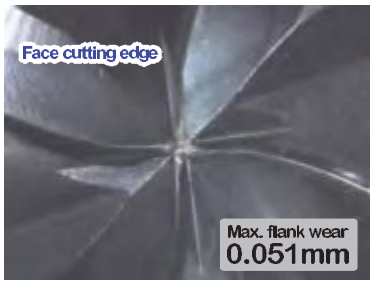




2. High efficient helical milling on high hardened steel

Work: 1.2379 (60HRC)
Tool: DH-OCHB4100(R5)
Spindle speed: n=3,800min^{-1}
Cutting speed: Vc=120m/min
Feed speed: Vf=1,834mm/min
feed: f=0.48mm/rev
Hertical pitch: 0.3mm
Hole size: φ12.6mm
Drilling depth: 6mm(thru.)
Coolant: Air blow
Overhung length: 50mm
Machine: Vertival MC





After 180 holes (cutting length: 1.08m)

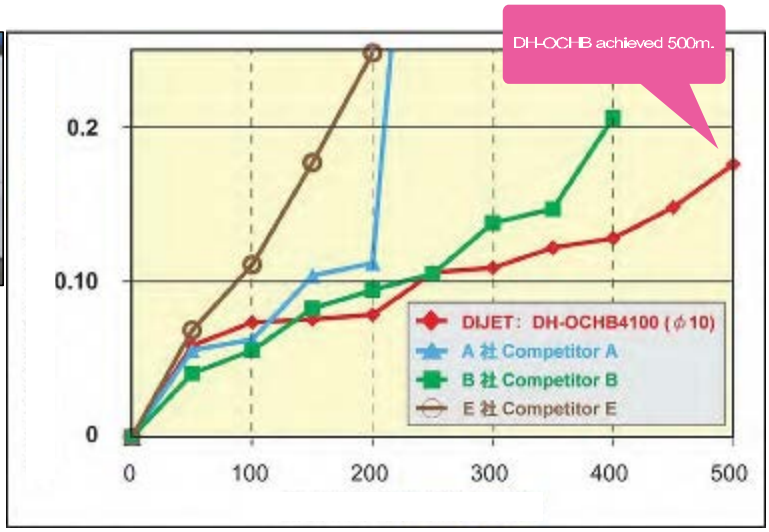
Compared with current drill for high hardened steel, One-Cut Ball 70 achieved good result:
Reduced machining time (60sec. to 15sec./hole).
No cutting fluid necessary.
Intensive tool management can be possibe because of wide applicable hole range by 1 pc.
Longer tool life (tens to over 180 holes).
No workpiece edge chipping, achieved goog hole accuracy.

"One-Cut Ball 70" Ball Nose End Mill — DH-OCHB TYPE

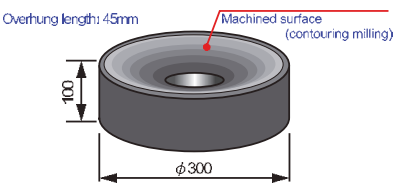
■ CUTTING PERFORMANCES

3. Toollife comparison on 60 HRC

Spindle speed: n=5,100min^{-1}
Cutting speed: Vc=160m/min
Feed speed: Vf=2,040mm/min
feed:f=0.4mm/rev
Pick feed: ae=0.3mm
Overhung length: 50mm
Coolant: Air blow
Machine: Vertival MC



■ CUTTING DATA



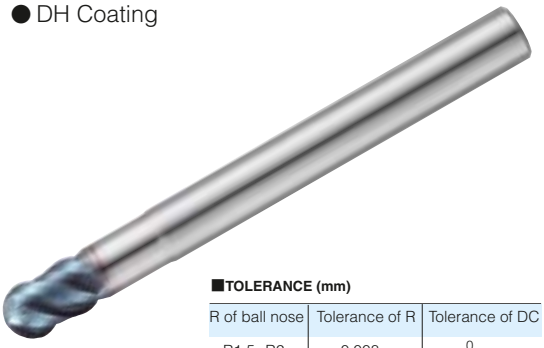
Work	Part name	Forging die
	Material	1.2379, heat-treated
	Hardness	60HRC
Tool	Tool No.	DH-OCHB4080
	Grade	DH-Coated
Cutting conditions	Vc,(n)	n=7,000 (min^{-1}), Vc=175 (m/min)
	Vf	5,000 (mm/min)
	ap (mm)	0.1 (mm)
	ae (mm)	0.3 (mm)
	Coolant	Wet cut
	Machine	Vertical MC

Result

Improved the efficiency by 1.2 times and tool life by 2 times (9 hours) compared with competitor`s 2 flutes solid carbide ball nose end mill. And DH-OCHB is still able to continue

"One-Cut Ball 70" Ball Nose End Mill — DH-OCHB TYPE

- For high hardened steel up to 70 HRC
- 4 flutes, Helix angle 45°
- DH Coating



■TOLERANCE (mm)

R of ball nose	Tolerance of R	Tolerance of DC
R1.5~R2	± 0.008	0 −0.010
R2.5~R6	± 0.008	0 −0.015

Fig.1 φDc<φDs

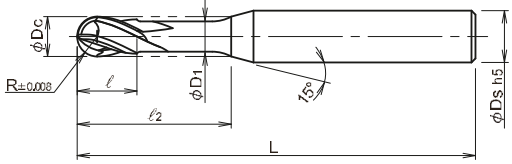
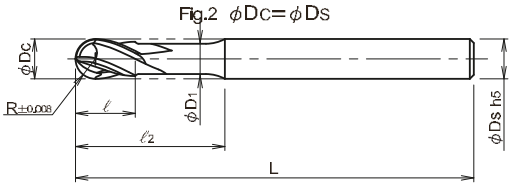


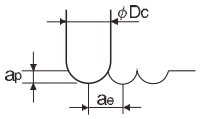
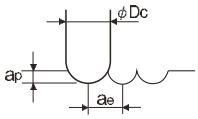
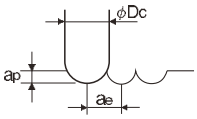
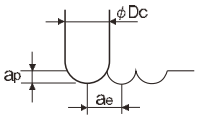
Fig.2 φDc=φDs



Cat. No.	Stock	Dimensions (mm)							
		R	φDc	ℓ	ℓ2	L	φD1	φDs	Fig.
DH-OCHB4030	●	**1.5**	**3**	4.5	9	70	2.9	6	1
DH-OCHB4040	●	**2**	**4**	6	12	70	3.8	6	1
DH-OCHB4050	●	**2.5**	**5**	7.5	15	80	4.8	6	1
DH-OCHB4060	●	**3**	**6**	9	18	90	5.7	6	2
DH-OCHB4080	●	**4**	**8**	12	24	100	7.6	8	2
DH-OCHB4100	●	**5**	**10**	15	30	100	9.5	10	2
DH-OCHB4120	●	**6**	**12**	18	36	110	11.4	12	2

■ RECOMMENDED CUTTING CONDITIONS FOR "ONE-CUT BALL 70"

1. For finishing

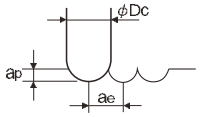
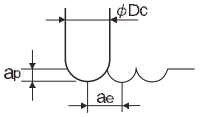
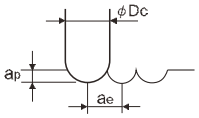
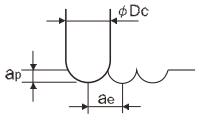
Work Materials	Tool & die steel Mold steel (1.2344, 1.2379, 1.2311, P20,P21) ~45HRC		Hardened steel (1.2344, 1.2379) 45~55HRC		Hardened steel (1.2344, 1.2379) 55~62HRC		Hardened steel (1.2379, HSS) 62~72HRC	
Type of Machining	 ap≦0.03Dc ae≦0.03Dc		 ap≦0.03Dc ae≦0.03Dc		 ap≦0.03Dc ae≦0.03Dc		 ap≦0.03Dc ae≦0.03Dc	
Tool dia. R(mm)	φDc(mm)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)
1.5	**3**	25,500	4,000	21,200	3,000	17,000	2,000	12,700	1,000
2	**4**	19,100	4,000	15,900	3,000	12,700	2,000	9,500	1,000
2.5	**5**	15,300	4,000	12,700	3,000	10,200	2,000	7,600	1,000
3	**6**	12,700	4,000	10,600	3,000	8,500	2,000	6,400	1,000
4	**8**	9,500	4,000	8,000	3,000	6,400	2,000	4,800	1,000
5	**10**	7,600	4,000	6,400	3,000	5,100	2,000	3,800	1,000
6	**12**	6,400	4,000	5,300	3,000	4,200	2,000	3,200	1,000

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

"One-Cut Ball 70" Ball Nose End Mill — DH-OCHB TYPE

■ RECOMMENDED CUTTING CONDITIONS FOR "ONE-CUT BALL 70"

1. For roughing & semi-finishing

Work Materials	Tool & die steel Mold steel (1.2344, 1.2379, 1.2311, P20,P21) ~45HRC			Hardened steel (1.2344, 1.2379) 45~55HRC			Hardened steel (1.2344, 1.2379) 55~62HRC			Hardened steel (1.2379, HSS) 62~72HRC		
Type of Machining	 $a_p \leqq 1.2Dc$ $a_e \leqq 0.2Dc$ example φDc=3 $a_p=2.2, a_e=0.1$ $(a_p \times a_e \leqq 0.22)$			 $a_p \leqq 1.2Dc$ $a_e \leqq 0.2Dc$ example φDc=3 $a_p=2.2, a_e=0.1$ $(a_p \times a_e \leqq 0.22)$			 $a_p \leqq 1.2Dc$ $a_e \leqq 0.2Dc$ example φDc=3 $a_p=1.8, a_e=0.1$ $(a_p \times a_e \leqq 0.18)$			 $a_p \leqq 1.0Dc$ $a_e \leqq 0.1Dc$ example φDc=3 $a_p=1, a_e=0.05$ $(a_p \times a_e \leqq 0.05)$		
Tool dia. R(mm)	Tool dia. φDc(mm)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	ap x ae	Spindle speed n (min-1)	Feed speed Vf (mm/min)	ap x ae	Spindle speed n (min-1)	Feed speed Vf (mm/min)	ap x ae	Spindle speed n (min-1)	Feed speed Vf (mm/min)	ap x ae
1.5	**3**	19,100	3,000	0.22	15,900	2,250	0.22	12,700	1,500	0.18	9,500	750	0.05
2	**4**	14,300	3,000	0.38	11,900	2,250	0.38	9,500	1,500	0.32	7,200	750	0.10
2.5	**5**	11,500	3,000	0.60	9,500	2,250	0.60	7,600	1,500	0.50	5,700	750	0.15
3	**6**	9,500	3,000	0.86	8,000	2,250	0.86	6,400	1,500	0.72	4,800	750	0.22
4	**8**	7,200	3,000	1.54	6,000	2,250	1.54	4,800	1,500	1.28	3,600	750	0.38
5	**10**	5,700	3,000	2.40	4,800	2,250	2.40	3,800	1,500	2.00	2,900	750	0.60
6	**12**	4,800	3,000	3.46	4,000	2,250	3.46	3,200	1,500	2.88	2,400	750	0.86

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

● Attention for helical milling

1) Recommended ramping angle is under 1° (up to 3°).
2) In case of ramping angle under 1°, apply the above table. But, in case of ramping angle over 1°, recommend to reduce Feed speed according to actual machining condition.

"One-Cut Hard" Ball Nose End Mill — DV-OCSB-TYPE

DV Coating

One-Cut Ball Hard

- Adopting high rigid design and unique chip pocket gives outstanding high precision and high performance on high hardened materials for die and mold making.
- Achieves to cut smoothly on high hardened materials from semi-roughing to super-finishing.
- The combination of new developed super micro-grain carbide and "VALUE COATING" achieves longer tool life in high speed machining.

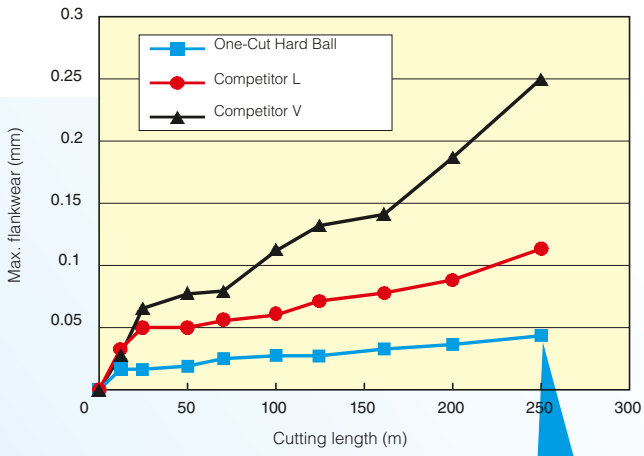
■ CUTTING PERFORMANCES

PERFORMANCE (Tool life comparison)

Work Material	Wave shaped test piece (SKD11,1.2379,D2)
Hardness	60HRC
Tool	DV-OCSB2100 Value coating
Cutting conditions	Cutting speed : 200m min Feedrate : 0.24mm/ rev Depth of cut : 0.1mm Pick feed : 0.2mm Coolant : Dry Machine : Vertical MC

RESULT (VB wear)

Wearing test "One-Cut Ball Hard VS Competitors"



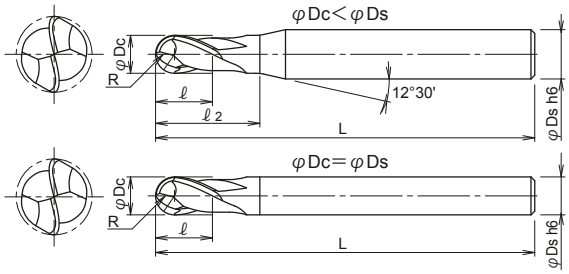
RESULT: **Exellent surface roughness. After machining 250m, maximum flank wear was below 0.05mm. Still able to continue.**

"One-Cut Hard" Ball Nose End Mill — DV-OCSB TYPE

- 2flutes, Helix angle 30°
- Flute length 1.5Dc

■TOLERANCE (mm)

Radius of ball nose R	Tolerance of R	Tolerance of φDc
0.5~1.25	±0.005	0 −0.01
1.5~6	±0.005	0 −0.02
8~12.5	±0.01	0 −0.02



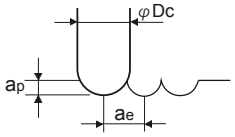
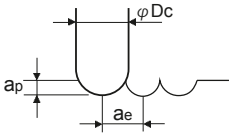
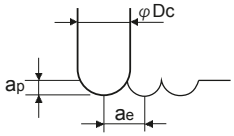
Cat. No.	Stock	Dimensions (mm)					
		R	φDc	ℓ	ℓ2	L	φDs
DV-OCSB2010	●	0.5	**1**	1.5	3	50	4
DV-OCSB2010-2.5T	□	0.5	**1**	2.5	4.5	50	4
DV-OCSB2012	□	0.6	**1.2**	1.8	3.5	50	4
DV-OCSB2014	□	0.7	**1.4**	2.1	4	50	4
DV-OCSB2015	●	0.75	**1.5**	2.25	4.5	50	4
DV-OCSB2016	□	0.8	**1.6**	2.4	4.5	50	4
DV-OCSB2018	□	0.9	**1.8**	2.7	5	50	4
DV-OCSB2020	●	1	**2**	3	5.5	50	6
DV-OCSB2020-5T	●	1	**2**	5	7	50	6
DV-OCSB2025	●	1.25	**2.5**	3.75	6.5	50	6
DV-OCSB2030	●	1.5	**3**	4.5	8	60	6
DV-OCSB2030-8T	●	1.5	**3**	8	10	60	6
DV-OCSB2035	□	1.75	**3.5**	5.25	9.5	60	6
DV-OCSB2040S4	●	2	**4**	6	–	70	4
DV-OCSB2040	●	2	**4**	6	10.5	70	6
DV-OCSB2040-8T	●	2	**4**	8	10.5	70	6
DV-OCSB2050	●	2.5	**5**	7.5	12.5	80	6
DV-OCSB2050-10T	●	2.5	**5**	10	12.5	80	6
DV-OCSB2060	●	3	**6**	9	–	90	6
DV-OCSB2060-12T	●	3	**6**	12	–	90	6
DV-OCSB2060-L120	●	3	**6**	9	–	120	6
DV-OCSB2080	●	4	**8**	12	–	100	8
DV-OCSB2080-14T	●	4	**8**	14	–	100	8
DV-OCSB2080-L120	●	4	**8**	12	–	120	8
DV-OCSB2100	●	5	**10**	15	–	100	10
DV-OCSB2100-18T	●	5	**10**	18	–	100	10
DV-OCSB2100-L140	●	5	**10**	15	–	140	10
DV-OCSB2120	●	6	**12**	18	–	110	12
DV-OCSB2120-22T	●	6	**12**	22	–	110	12
DV-OCSB2120-L140	●	6	**12**	18	–	140	12
DV-OCSB2160-30T-L140	●	8	**16**	30	–	140	16
DV-OCSB2160-L140	□	8	**16**	24	–	140	16
DV-OCSB2160	●	8	**16**	24	–	160	16
DV-OCSB2160-L180	□	8	**16**	24	–	180	16
DV-OCSB2200-L140	□	10	**20**	30	–	140	20
DV-OCSB2200-L160	□	10	**20**	30	–	160	20
DV-OCSB2200	□	10	**20**	30	–	180	20
DV-OCSB2250	□	12.5	**25**	38	–	180	25

Note) Please refer page D065 for recommended cutting conditions.

●: Standard stock items □: Stock in Japan ○: Soon to be deleted

"One-Cut Hard" Ball Nose End Mill — DV-OCSB TYPE

■ RECOMMENDED CUTTING CONDITIONS FOR DV-OCSB TYPE

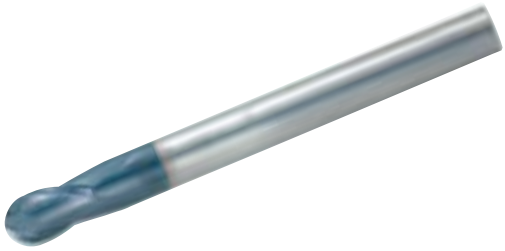
Work Materials	Tool & Die steel・Mold steel SKD, SKH, NAK Below 45HRC		Tool & Die steel・Mold steel SKD, SKT 45~50HRC		Tool & Die steel・Mold steel SKD, SKT 45~65HRC	
Type of Machining	 ap≦0.1Dc ae≦0.3Dc		 ap≦0.05Dc (MAX 0.5mm) ae≦0.1Dc		 ap≦0.03Dc (MAX 0.3mm) ae≦0.05Dc	
Tool dia. R (mm)	Tool dia. φDc (mm)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)
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

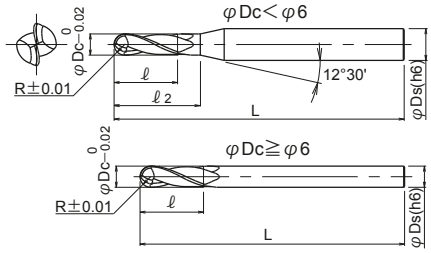
■NOTE

1) The above cutting conditions are for general guidance.
2) The cutting parameters to be adjusted according to machining shape, purpose and rigidity of machine and work clamping.

"One-Cut 03" Ball Nose End Mill — DZ03-OCSB TYPE

- 2 flutes, Helix angle 30°
- Flute length 1.5Dc





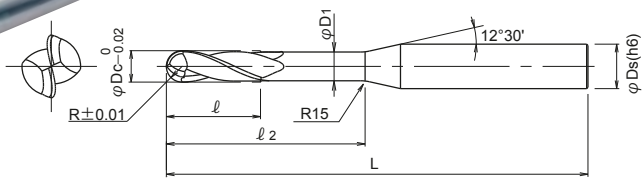
Cat. No.	Stock	Dimensions (mm)					
		R	φDc	ℓ	ℓ2	L	φDs
DZ03-OCSB2010	●	0.5	**1**	1.5	3	50	4
DZ03-OCSB2012	□	0.6	**1.2**	1.8	3.5	50	4
DZ03-OCSB2014	□	0.7	**1.4**	2.1	4	50	4
DZ03-OCSB2015	●	0.75	**1.5**	2.25	4.5	50	4
DZ03-OCSB2016	□	0.8	**1.6**	2.4	4.5	50	4
DZ03-OCSB2018	□	0.9	**1.8**	2.7	5	50	4
DZ03-OCSB2020	●	1	**2**	3	5.5	50	6
DZ03-OCSB2025	●	1.25	**2.5**	3.75	6.5	50	6
DZ03-OCSB2030	●	1.5	**3**	4.5	8	60	6
DZ03-OCSB2035	□	1.75	**3.5**	5.25	9.5	60	6
DZ03-OCSB2040S4	●	2	**4**	6	–	70	4
DZ03-OCSB2040	●	2	**4**	6	10.5	70	6
DZ03-OCSB2050	●	2.5	**5**	7.5	12.5	80	6
DZ03-OCSB2060	●	3	**6**	9	–	90	6
DZ03-OCSB2060-L120	●	3	**6**	9	–	120	6
DZ03-OCSB2080	●	4	**8**	12	–	100	8
DZ03-OCSB2080-L120	●	4	**8**	12	–	120	8
DZ03-OCSB2100	●	5	**10**	15	–	100	10
DZ03-OCSB2100-L140	●	5	**10**	15	–	140	10
DZ03-OCSB2120	●	6	**12**	18	–	110	12
DZ03-OCSB2120-L140	□	6	**12**	18	–	140	12
DZ03-OCSB2160-L140	□	8	**16**	24	–	140	16
DZ03-OCSB2160	●	8	**16**	24	–	160	16
DZ03-OCSB2160-L180	□	8	**16**	24	–	180	16
DZ03-OCSB2200-L140	□	10	**20**	30	–	140	20
DZ03-OCSB2200-L160	□	10	**20**	30	–	160	20
DZ03-OCSB2200	□	10	**20**	30	–	180	20
DZ03-OCSB2250	□	12.5	**25**	38	–	180	25

Note) Please refer page D068 for recommended cutting conditions.

●: Standard stock items □: Stock in Japan ○: Soon to be deleted

"One-Cut 03" Ball Nose End Mill — DZ03-OCSB-LN TYPE

- 2 flutes, Helix angle 30°
- Flute length 1Dc
- Long neck type



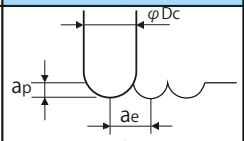
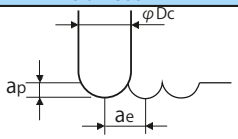
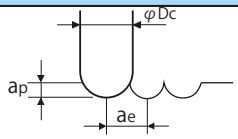
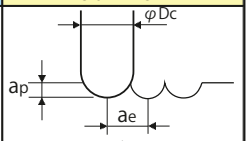
Cat. No.	Stock	Dimensions (mm)						
		R	φDc	ℓ	ℓ2	L	φD1	φDs
DZ03-OCSB2010-6LN	●	0.5	**1**	1	6	60	0.95	4
DZ03-OCSB2010-11LN	●	0.5	**1**	1	11	60	0.95	4
DZ03-OCSB2010-17LN	●	0.5	**1**	1	17	60	0.95	4
DZ03-OCSB2010-21LN	●	0.5	**1**	1	21	60	0.95	4
DZ03-OCSB2015-6LN	□	0.75	**1.5**	1.5	6	60	1.45	4
DZ03-OCSB2015-11LN	□	0.75	**1.5**	1.5	11	60	1.45	4
DZ03-OCSB2015-17LN	□	0.75	**1.5**	1.5	17	60	1.45	4
DZ03-OCSB2015-21LN	□	0.75	**1.5**	1.5	21	60	1.45	4
DZ03-OCSB2020S4-6LN	□	1	**2**	2	6	60	1.95	4
DZ03-OCSB2020S4-9LN	●	1	**2**	2	9	60	1.95	4
DZ03-OCSB2020-9LN	●	1	**2**	2	9	60	1.95	6
DZ03-OCSB2020S4-11LN	●	1	**2**	2	11	60	1.95	4
DZ03-OCSB2020-11LN	●	1	**2**	2	11	60	1.95	6
DZ03-OCSB2020S4-17LN	●	1	**2**	2	17	60	1.95	4
DZ03-OCSB2020-17LN	●	1	**2**	2	17	60	1.95	6
DZ03-OCSB2020S4-21LN	●	1	**2**	2	21	60	1.95	4
DZ03-OCSB2020-21LN	●	1	**2**	2	21	60	1.95	6
DZ03-OCSB2025S4-11LN	□	1.25	**2.5**	2.5	11	60	2.45	4
DZ03-OCSB2025S4-17LN	●	1.25	**2.5**	2.5	17	60	2.45	4
DZ03-OCSB2025S4-21LN	●	1.25	**2.5**	2.5	21	60	2.45	4
DZ03-OCSB2030-9LN	●	1.5	**3**	3	9	60	2.95	6
DZ03-OCSB2030-17LN	●	1.5	**3**	3	17	60	2.95	6
DZ03-OCSB2030-21LN	●	1.5	**3**	3	21	60	2.95	6
DZ03-OCSB2040-13LN	●	2	**4**	4	13	70	3.95	6
DZ03-OCSB2040-17LN	●	2	**4**	4	17	70	3.95	6
DZ03-OCSB2040-21LN	●	2	**4**	4	21	70	3.95	6

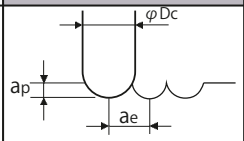
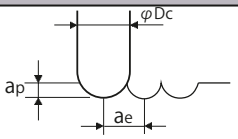
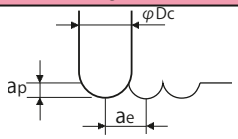
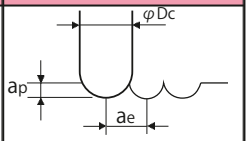
Note) Please refer page D068 for recommended cutting conditions.

●: Standard stock items □: Stock in Japan ○: Soon to be deleted

"One-Cut 03" Ball Nose End Mill — DZ03-OCSB/ DZ03-OCSB-LN TYPE

■ RECOMMENDED CUTTING CONDITIONS FOR DZ03-OCSB/DZ03-OCSB-LN/ TYPE

Work Materials	Carbon steel S55C 180~280HB		Tool & Die steel SKD, SNCM Below 300HB		Mold steel NAK55, NAK80 35~45HRC		Stainless steel SUS420J2 Below 270HB	
Type of Machining	 ap≦0.3Dc ae≦0.5Dc		 ap≦0.3Dc ae≦0.5Dc		 ap≦0.3Dc ae≦0.5Dc		 ap≦0.3Dc ae≦0.5Dc	
Tool dia. R (mm)	φDc (mm)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindl speed n (min-1)	Feed speed Vf (mm/min)
0.5	1	50,000	2,500	45,000	2,200	38,000	1,900	38,000	1,900
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 SKD, SKT 45~52HRC		Hardened die steel SKD, SKT 55~60HRC		Grey cast iron FC250 Tensile strength 350 N/mm²		Nodular cast iron FCD450, FCD550 Tensile strength below 550N/mm²	
Type of Machining	 ap≦0.3Dc ae≦0.5Dc		 ap≦0.3Dc ae≦0.5Dc		 ap≦0.3Dc ae≦0.5Dc		 ap≦0.3Dc ae≦0.5Dc	
Tool dia. R (mm)	φDc (mm)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindle speed n (min-1)	Feed speed Vf (mm/min)	Spindl speed n (min-1)	Feed speed Vf (mm/min)
0.5	1	31,000	1,200	25,000	750	60,000	4,800	54,000	4,300
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

■NOTE

The cutting parameters to be adjusted according to machine rigidity or work rigidity.