KORLOY
TECH-NEWS

Super Endmill For Ti For HRSA

New

Endmills series for difficult-to-cut materials (Ti and HRSA)

- Machining HRSA and Ti components like engine, turbine and etc. used in aerospace and power generation industries
- Optimal for difficult-to-cut materials machining due to reduced cutting heat and enhanced chip evacuation

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Endmills series for difficult-to-cut materials (Ti and HRSA)

Super Endmill

Using difficult-to-cut materials is getting increased in various industries, aerospace, medical, automobile etc. with demands on high performance and light weight products. According to the change, KORLOY launched Super Endmill For Ti following Super Enmill For HRSA.

With its optimal edge structure for Titanium machining and enlarged chip pocket in flutes design, **Super Endmill For Ti** reduces cutting load and cutting heat and it improves chip evacuation. In addition, applying high toughness substrate and high lubrication coating layer minimizing irregular tool fracture and welding ensure maximized tool life.

Super Endmill For HRSA increases cutting performance and cutting stability applying positive rake angle and irregular flute spacing. Also, the new coating layer with high hardness controls fracture in cutting edge and ensures long tool life for HRSA machining by its increased wear resistance.

Super Endmill For Ti provides the best solution in Titanium alloy and stainless steel cutting, and Super Endmill For HRSA gives the same for HRSA such as Inconel, Hastelloy and Waspaloy.

» Titanium and stainless steel cutting

- Super Endmill For Ti

» Ni based HRSA cutting

- Super Endmill For HRSA

» Improved chip evacuation and long tool life

- Large chip pocket and streamlined flute design
- Sharp cutting edge optimal for difficult-to-cut materials cutting
- High lubrication coating layer and high toughness substrate

Super Endmill For Ti New

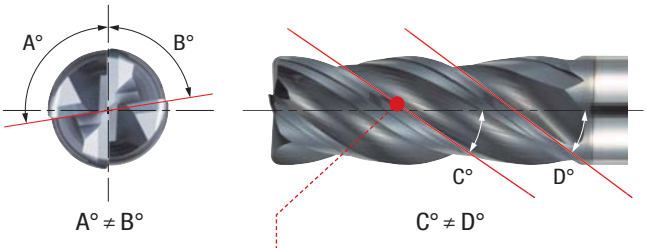
Code system

S	RE	T	4	120	-	080	-	R30
Super Endmill	Type FE: Flat Endmill RE: Radius Endmill BE: Ball Endmill	Workpiece T: Titanium/STS S: Super alloy • Inconel718 • Waspaloy • Hastelloy	No. of flute 4: 4 flutes	Tool diameter 120: Ø12.0 mm		Overall length 080: 80 mm		Corner R R30: 3.0 mm

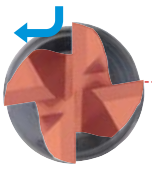
Features

- Endmill for titanium and stainless steel cutting
- **Longer tool life**: high toughness substrate and high lubrication coating layer

SFET (Flat) / SRET (Radius)

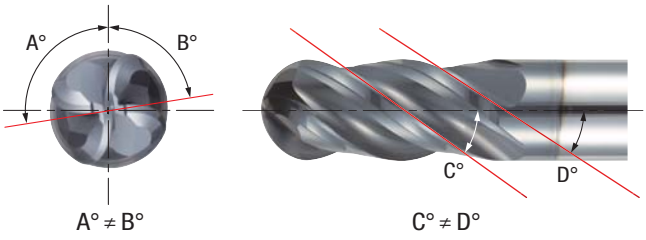


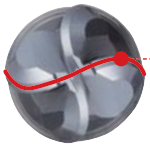
Irregular flute spacing shape
- Reduced chattering and vibration



Large chip pocket and streamlined flute design
- Good chip evacuation

SBET (Ball)

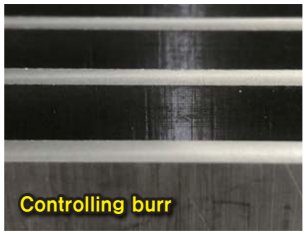




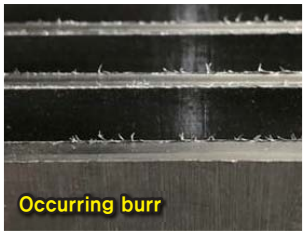
S-curve cutting edge
- Reduced cutting load

High quality surface finish

Workpiece	Titanium alloy (Ti-6Al-4V)
Cutting conditions	vc (m/min) = 65, fz (mm/t) = 0.065 ap (mm) = 12, ae (mm) = 12, wet (emulsion)
Tool	SRET4120-080-R10 (Diameter = Ø12 mm, UL coating)



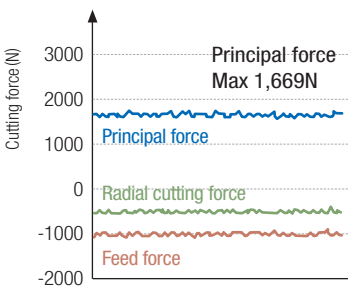
[Super Endmill]



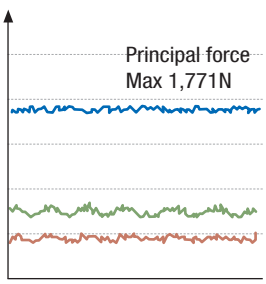
[Competitor]

Reduced chattering and low machinability cutting load

Workpiece	Stainless steel (X5CrNi18-9)
Cutting conditions	vc (m/min) = 60, fz (mm/t) = 0.04 ap (mm) = 12, ae (mm) = 12, wet (emulsion)
Tool	SRET4120-080-R10 (Diameter = Ø12 mm, UL coating)



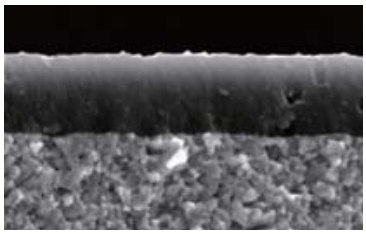
[Super Endmill]



[Competitor]

Grade features

UL coating (Ultra Lubricating coating)



- Enhanced chip control and welding resistance by exclusive lubrication coating technology
- High chipping resistance substrate

[UL coating application range]

◎: Best ○: Very Good △: Good ×: Bad

Workpiece	P			K	M	S		H	N
	Carbon steel	Alloy steel	Pre-hardened steel	Cast iron	Stainless steel	Inconel718, Waspaloy, Hastelloy	Titanium	High hardened alloy	Non-ferrous
UL coating	○	○	△	×	○	×	◎	×	×

Line-up

SFET4000 (Flat)

- 4 flutes and flat 8 designations (∅3~∅20)
- Applying irregular flute spacing shape
- Applying gash land- reducing corner fracture

SRET4000 (Radius)

- 4 flutes and radius 28 designations (∅3~∅20)
- Applying irregular flute spacing shape

SBET2000 (Ball)

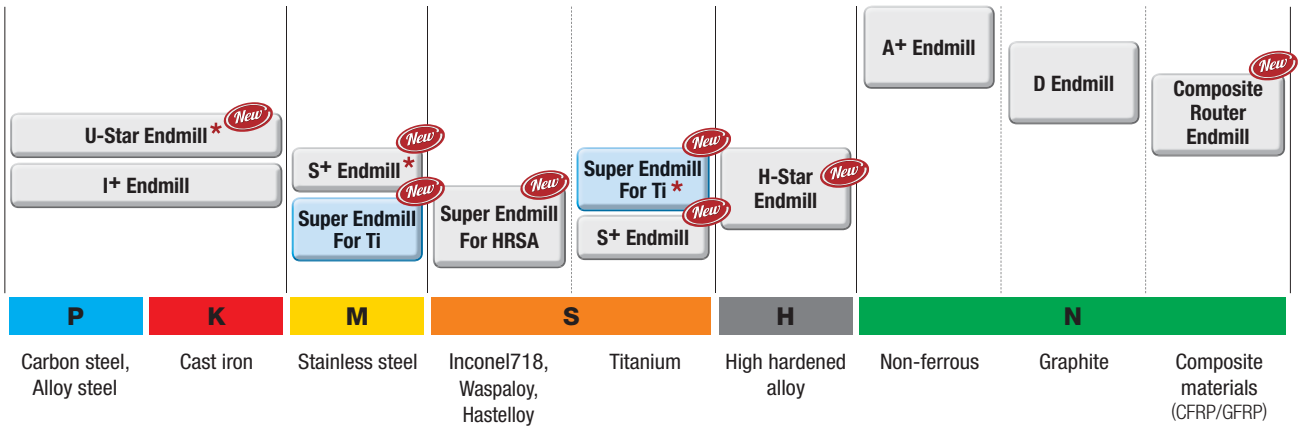
- 2 flutes and ball 15 designations (∅1~∅12)
- S curved design of ball
- Applying gash design for good chip evacuation

SBET4000 (Ball)

- 4 flutes and ball 12 designations (∅4~∅12)
- S curved design of irregular flute spacing
- Applying gash design for good chip evacuation

Tool selection guide

*: 1st recommendation



Recommended cutting conditions _ SFET4000 (Flat) / SRET4000 (Radius)

Workpiece				Brinell hard-ness (HB)	Specific cutting force (N/mm²)	ap (mm)	ae (mm)	Machining	Diameter (mm)	3	4	5	6	8	10	12	16	20
ISO	Workpiece materials	ISO (DIN)	AISI						Cutting length (mm)	8	10	15	15	20	25	30	42	48
P	Carbon steel	(C22) C40 C45	1020 1039 1045	230	400 ~ 600	1.5D	0.1D	Shouldering	vc	100	108	114	114	114	114	114	114	114
									fz	0.020	0.030	0.040	0.050	0.065	0.070	0.080	0.085	0.100
									rpm	10610	8594	7257	6048	4536	3629	3024	2268	1814
									feed	849	1031	1161	1210	1179	1016	968	771	726
						0.5D	1D	Slotting	vc	64	65	68	70	70	70	70	70	70
									fz	0.016	0.022	0.030	0.038	0.046	0.050	0.056	0.060	0.070
									rpm	6791	5173	4329	3714	2785	2228	1857	1393	1114
									feed	435	455	519	564	512	446	416	334	312
	Alloy steel	20NiCrMo2 - - 42CrMo4	8615 4320 4130 4140	280	800 ~ 1000	1.5D	0.1D	Shouldering	vc	141	138	151	151	151	151	151	151	151
									fz	0.021	0.032	0.049	0.069	0.067	0.075	0.078	0.095	0.090
									rpm	15000	11000	9600	8000	6000	4800	4000	3000	2400
									feed	1250	1400	1900	2200	1600	1440	1250	1140	860
						0.5D	1D	Slotting	vc	65	70	71	70	70	69	72	70	69
									fz	0.015	0.022	0.035	0.050	0.060	0.060	0.070	0.070	0.080
									rpm	6900	5600	4500	3700	2800	2200	1900	1400	1100
									feed	410	490	630	740	670	530	530	390	350
M	Ferritic/ martensitic series	X6CrAl13 X6Cr17 X12CrS13 X6CrMo17-1 (X6Cr13) X12Cr13	405 430 416 434 403 410	240	450 540 450	1.5D	0.1D	Shouldering	vc	100	108	114	114	114	114	114	114	114
									fz	0.020	0.030	0.040	0.050	0.065	0.070	0.080	0.085	0.100
									rpm	10610	8594	7257	6048	4536	3629	3024	2268	1814
									feed	849	1031	1161	1210	1179	1016	968	771	726
						0.5D	1D	Slotting	vc	64	65	68	70	70	70	70	70	70
									fz	0.016	0.022	0.030	0.038	0.046	0.050	0.056	0.060	0.070
									rpm	6791	5173	4329	3714	2785	2228	1857	1393	1114
									feed	435	455	519	564	512	446	416	334	312
	Austenite series	X10CrNiS18-9 X5CrNi18-9 X5CrNiMo17-12-2	303 304 316	200	520	1.5D	0.1D	Shouldering	vc	72	76	78	80	80	80	80	80	80
									fz	0.020	0.030	0.040	0.050	0.065	0.070	0.080	0.085	0.100
									rpm	7639	6048	4966	4244	3183	2546	2122	1592	1273
									feed	611	726	795	849	828	713	679	541	509
						0.5D	1D	Slotting	vc	45	46	48	50	50	50	50	50	50
									fz	0.016	0.022	0.030	0.038	0.046	0.050	0.056	0.060	0.070
									rpm	4775	3660	3056	2653	1990	1592	1326	955	796
									feed	306	322	367	403	366	318	297	229	223
S	Ti/ Ti Alloy	Ti6Al4V Ti5Al5V5Mo Ti7Al4Mo	Ti6Al4V Ti5Al5V5Mo Ti7Al4Mo	320	600 ~ 1800	1.5D	0.1D	Shouldering	vc	70	74	75	76	78	78	78	78	78
									fz	0.018	0.027	0.035	0.043	0.054	0.064	0.073	0.080	0.092
									rpm	7427	5889	4775	4032	3104	2483	2069	1552	1241
									feed	535	636	668	693	670	636	604	497	457
						0.5D	1D	Slotting	vc	40	41	43	45	45	45	45	45	45
									fz	0.014	0.020	0.027	0.034	0.040	0.045	0.050	0.054	0.063
									rpm	4244	3263	2737	2387	1790	1432	1194	895	716
									feed	238	261	296	327	286	258	239	193	180

Recommended cutting conditions _ SBET2000 (Ball)

Workpiece				Brinell hardness (HB)	Specific cutting force (N/mm²)	ap (mm)	ae (mm)	Machining	Diameter (mm)	1	2	3	4	5	6	8	10	12
ISO	Workpiece materials	ISO (DIN)	AISI						Cutting length (mm)	1	2	3	8	12	12	16	20	25
P	Carbon steel	(C22) C40 C45	1020 1039 1045	230	400 ~ 600	≤ 0.1D	≤ 0.1D	Copying	vc	130	130	123	200	200	200	200	200	200
									fz	0.039	0.056	0.080	0.044	0.051	0.050	0.059	0.070	0.085
									rpm	41600	20800	13000	16000	12700	10600	8000	6400	5300
	Alloy steel	20NiCrMo2 - - 42CrMo4	8615 4320 4130 4140	280	800 ~ 1000	≤ 0.1D	≤ 0.1D		feed	1625	1170	1040	1400	1300	1050	950	900	900
M	Ferritic/ martensitic series	X6CrAl13 X6Cr17 X12CrS13 X6CrMo17-1 (X6Cr13) X12Cr13	405 430 416 434 403 410	240	450 540 450	≤ 0.1D	≤ 0.1D	Copying	vc	120	120	113	180	180	180	180	180	180
									fz	0.039	0.056	0.080	0.035	0.039	0.044	0.058	0.068	0.081
									rpm	38400	19200	12000	14400	11520	9600	7200	5760	4800
						≤ 0.1D	≤ 0.1D		feed	3000	2160	1920	1008	897	845	835	783	778
	Austenite series	X10CrNiS18-9 X5CrNi18-9 X5CrNiMo17-12-2	303 304 316	200	520	≤ 0.1D	≤ 0.1D	Copying	vc	100	100	94	150	150	150	150	150	150
									fz	0.039	0.056	0.080	0.035	0.039	0.044	0.058	0.068	0.081
									rpm	32000	16000	10000	12000	9600	8000	6000	4800	4000
									feed	2500	1800	1600	850	750	700	700	650	650
S	Ti/ Ti Alloy	Ti6Al4V Ti5Al5V5Mo Ti7Al4Mo	Ti6Al4V Ti5Al5V5Mo Ti7Al4Mo	320	600 ~ 1800	≤ 0.1D	≤ 0.1D	Copying	vc	100	100	94	150	150	150	150	150	150
									fz	0.039	0.056	0.080	0.035	0.039	0.044	0.058	0.068	0.081
									rpm	32000	16000	10000	12000	9600	8000	6000	4800	4000
									feed	2500	1800	1600	850	750	700	700	650	650

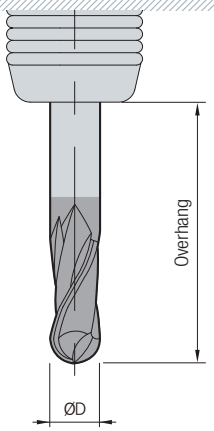
Recommended cutting conditions _ SBET4000 (Ball)

Workpiece				Brinell hardness (HB)	Specific cutting force (N/mm²)	ap (mm)	ae (mm)	Machining	Diameter (mm)	4	5	6	8	10	12
ISO	Workpiece materials	ISO (DIN)	AISI						Cutting length (mm)	8	12	12	16	20	25
P	Carbon steel	(C22) C40 C45	1020 1039 1045	230	400 ~ 600	≤ 0.1D	≤ 0.1D	Copying	vc	200	200	200	200	200	200
									fz	0.044	0.051	0.050	0.059	0.070	0.085
									rpm	16000	12700	10600	8000	6400	5300
	Alloy steel	20NiCrMo2 - - 42CrMo4	8615 4320 4130 4140	280	800 ~ 1000	≤ 0.1D	≤ 0.1D		feed	2800	2600	2100	1900	1800	1800
M	Ferritic/ martensitic series	X6CrAl13 X6Cr17 X12CrS13 X6CrMo17-1 (X6Cr13) X12Cr13	405 430 416 434 403 410	240	450 540 450	≤ 0.1D	≤ 0.1D	Copying	vc	180	180	180	180	180	180
									fz	0.035	0.039	0.044	0.058	0.068	0.081
									rpm	14400	11520	9600	7200	5760	4800
						≤ 0.1D	≤ 0.1D		feed	2040	1800	1680	1680	1560	1560
	Austenite series	X10CrNiS18-9 X5CrNi18-9 X5CrNiMo17-12-2	303 304 316	200	520	≤ 0.1D	≤ 0.1D	Copying	vc	150	150	150	150	150	150
									fz	0.035	0.039	0.044	0.058	0.068	0.081
									rpm	12000	9600	8000	6000	4800	4000
									feed	1700	1500	1400	1400	1300	1300
S	Ti/ Ti Alloy	Ti6Al4V Ti5Al5V5Mo Ti7Al4Mo	Ti6Al4V Ti5Al5V5Mo Ti7Al4Mo	320	600 ~ 1800	≤ 0.1D	≤ 0.1D	Copying	vc	150	150	150	150	150	150
									fz	0.035	0.039	0.044	0.058	0.068	0.081
									rpm	12000	9600	8000	6000	4800	4000
									feed	1700	1500	1400	1400	1300	1300

Product using guide

Cutting condition by overhang

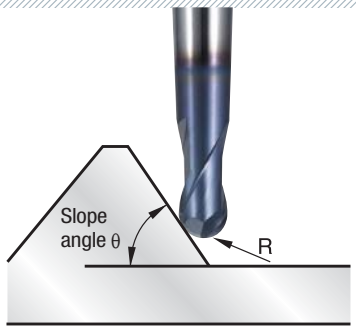
- **For shank taper type, cutting conditions are based on the case of being clamped at neck part**
  - When the overhang is increased by 1D in comparion to the overhang, decrease R.P.M and feed by 10%.
- **In case of the straight type adjust conditions according to the overhang**
  - Ex: When the overhang is 3D and is increased by 1D, decrease R.P.M and feed by 10%.



Cutting speed formulas (Ball Endmills)

- **Effective cutting speed Veff**
  $= (\pi \times Deff \times n)/1000$ $(n = min^{-1})$
- **Effective diameter Deff calculation formula Deff**
  $= (2\sqrt{ap(D-ap)} \times \alpha)$
  D = Ø (Tool diameter), Deff = Efficient diameter
- **Effective cutting speed formulas :** When slope θ is 0°
  $Veff = (\pi \times Deff \times n)/1000$
  Deff = Efficient, diameter Calculate Deff as ap with various Ball Endmills

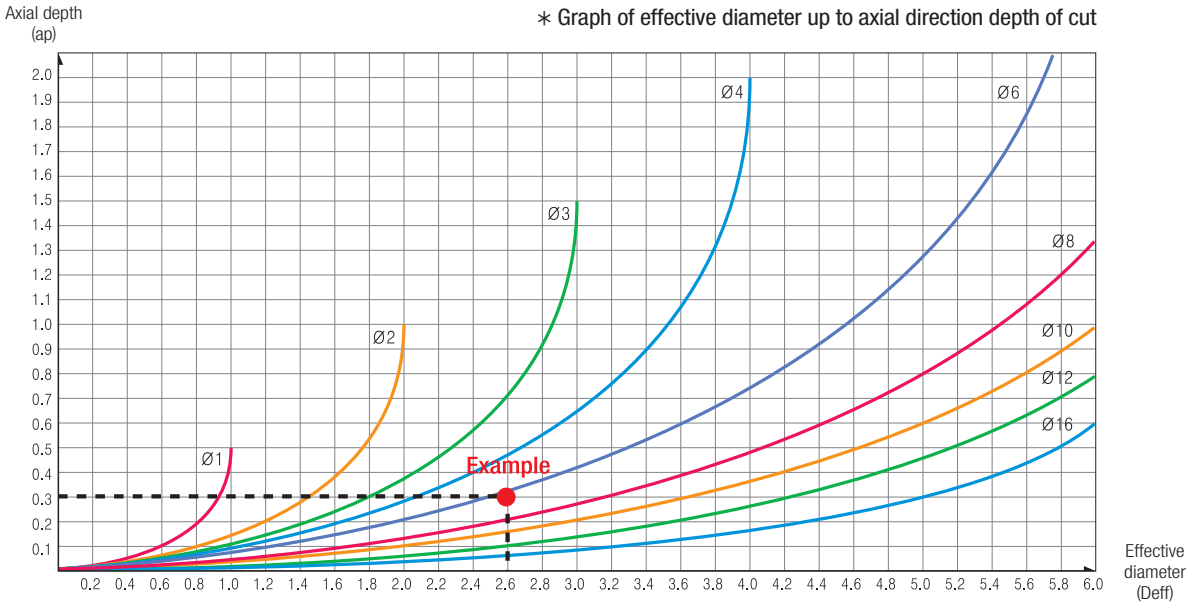
α : α=1 (Slope angle θ=0°)
α=1.2 (Slope angle θ=7°)
α=1.5 (Slope angle θ=15°)
α=1.7 (Slope angle θ=30°)
α=2.17 (Slope angle θ=45°)
α=2.3 (Slope angle θ=60°)



Ex) Diameter: 6 mm, ap = 0.3 mm, Deff = 2.6 mm, N = 14,000 (min^{-1})
Slope angle 0°: Veff = 113.7 (m/min)
Slope angle 15°: Veff = 113.7 × 1.5 = 170.6 (m/min)

Cutting speed formulas (Ball Endmills, slope angle = 0°)

∗ Graph of effective diameter up to axial direction depth of cut

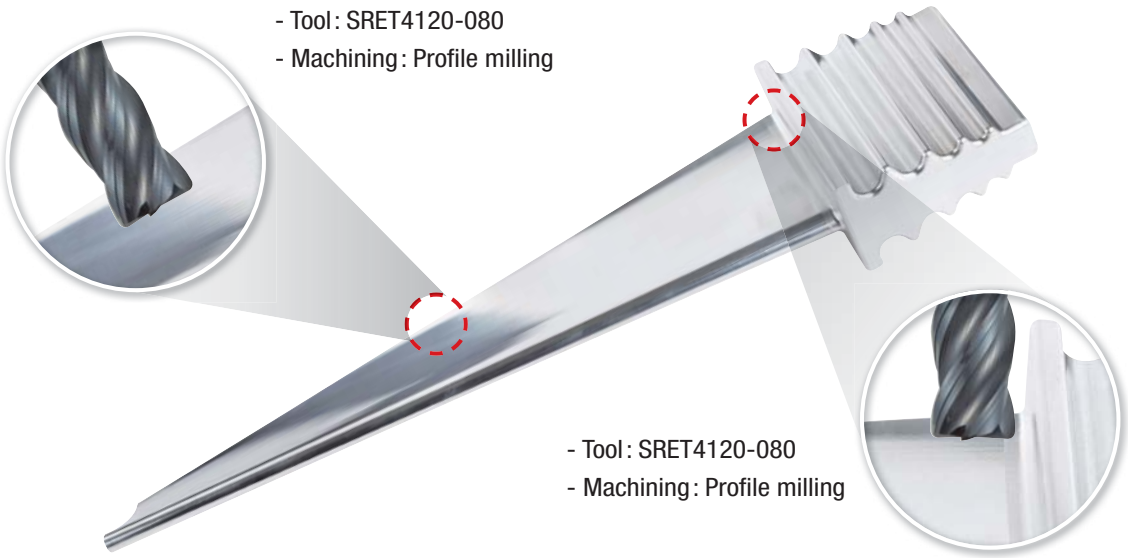


(Graph of effective diameter and axial direction depth of cut of Ball Endmill with high rake angle from 0° to Ø1 ~ Ø16)

Application industries

- **Aerospace/generator industries :** Endmill for parts such as engines and turbines made into difficult-to-cut materials

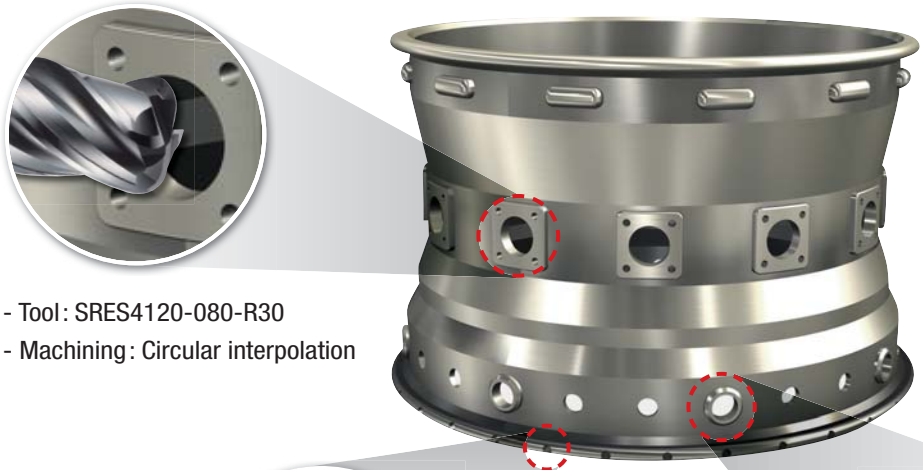
Aerospace engine parts (Turbine blade- Titanium alloy)



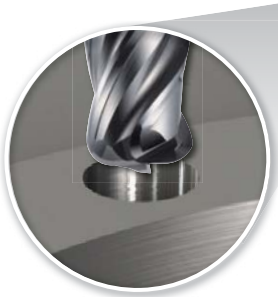
- Tool : SRET4120-080
- Machining : Profile milling

- Tool : SRET4120-080
- Machining : Profile milling

Aerospace engine parts (Turbine case - Ni based HRSA)



- Tool : SRES4120-080-R30
- Machining : Circular interpolation



- Tool : SRES4080-075-R05
- Machining : Internal finishing

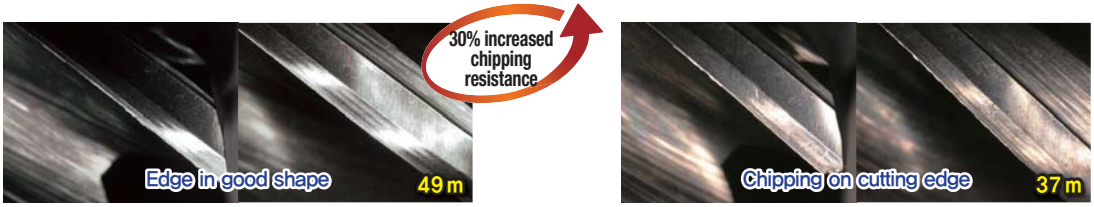
- Tool : SRES4120-080-R30
- Machining : Circular interpolation

Performance evaluation

Titanium alloy (Ti-6AL-4V)

Cutting conditions vc (m/min) = 80, fz (mm/t) = 0.07, ap (mm) = 12, ae (mm) = 2.4, wet (emulsion)

Tool SFET4120-080 (Diameter = Ø12 mm, UL coating)



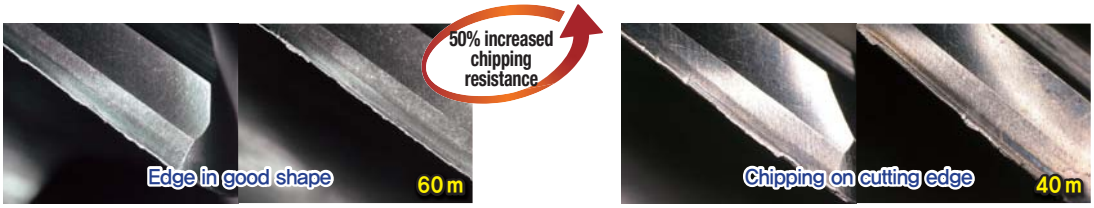
[Super Endmill] [Competitor]

» High quality performance from high toughness substrate and cutting stability

Titanium alloy (Ti-6AL-4V)

Cutting conditions vc (m/min) = 75, fz (mm/t) = 0.065, ap (mm) = 10, ae (mm) = 2, wet (emulsion)

Tool SRET4100-075-R10 (Diameter = Ø10 mm, UL coating)



[Super Endmill] [Competitor]

» High quality performance from high toughness substrate and cutting stability

Titanium alloy (Ti-6AL-4V)

Cutting conditions vc (m/min) = 160, fz (mm/t) = 0.14, ap (mm) = 1.2, ae (mm) = 1.2, wet (emulsion)

Tool SBET4120-100 (Diameter = Ø12 mm, UL coating)

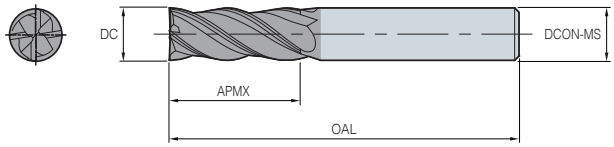
[Super Endmill] [Competitor]

» High quality performance from high toughness substrate and cutting stability

SFET4000 (Flat) New

4 | H·A 35°/38° | h6 shank | UL coating

DC	Tolerance
Ø1 ~ Ø6	0.000 ~ -0.015
Ø6.1 ~ Ø20	0.000 ~ -0.020



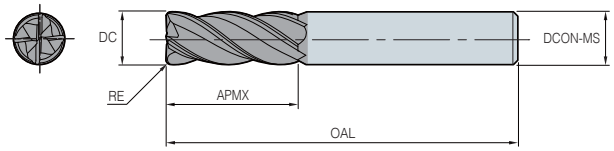
(mm)

Designation		DC	APMX	OAL	DCON-MS
SFET 4	4030-050	3	8	50	6
	4040-050	4	10	50	6
	4050-060	5	15	60	6
	4060-060	6	15	60	6
	4080-070	8	20	70	8
	4100-075	10	25	75	10
	4120-080	12	30	80	12
	4160-100	16	42	100	16
	4200-100	20	48	100	20

SRET4000 (Radius) New

4 | H·A 35°/38° | h6 shank | UL coating | r tolerance ±0.01

DC	Tolerance
Ø1 ~ Ø6	0.000 ~ -0.015
Ø6.1 ~ Ø20	0.000 ~ -0.020



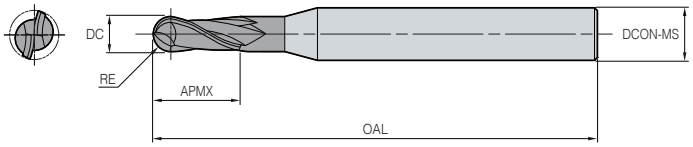
(mm)

Designation		DC	APMX	OAL	DCON-MS	RE
SRET 4	4030-050-R02	3	8	50	6	0.2
	4030-050-R05	3	8	50	6	0.5
	4040-050-R02	4	10	50	6	0.2
	4040-050-R05	4	10	50	6	0.5
	4050-060-R02	5	15	60	6	0.2
	4050-060-R05	5	15	60	6	0.5
	4050-060-R10	5	15	60	6	1.0
	4060-060-R03	6	15	60	6	0.3
	4060-060-R05	6	15	60	6	0.5
	4060-060-R10	6	15	60	6	1.0
	4080-070-R03	8	20	70	8	0.3
	4080-070-R05	8	20	70	8	0.5
	4080-070-R10	8	20	70	8	1.0
	4100-075-R03	10	25	75	10	0.3
	4100-075-R05	10	25	75	10	0.5
	4100-075-R10	10	25	75	10	1.0
	4100-075-R15	10	25	75	10	1.5
	4100-075-R20	10	25	75	10	2.0
	4120-080-R05	12	30	80	12	0.5
	4120-080-R10	12	30	80	12	1.0
	4120-080-R15	12	30	80	12	1.5
	4120-080-R20	12	30	80	12	2.0
	4120-080-R25	12	30	80	12	2.5
	4120-080-R30	12	30	80	12	3.0
	4160-100-R05	16	42	100	16	0.5
	4160-100-R10	16	42	100	16	1.0
	4200-100-R05	20	48	100	20	0.5
	4200-100-R10	20	48	100	20	1.0

SBET2000 (Ball)

2 | H·A 30° | h6 shank | UL coating | r tolerance ±0.01

DC	Tolerance
Ø1 ~ Ø6	0.000 ~ -0.015
Ø6.1 ~ Ø20	0.000 ~ -0.020



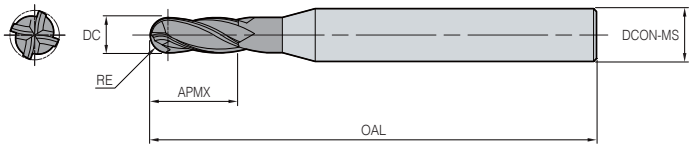
(mm)

Designation		DC	APMX	OAL	DCON-MS	RE
SBET 2	2010-050	1	1	50	6	0.5
	2020-050	2	2	50	6	1.0
	2030-050	3	3	50	6	1.5
	2040-050	4	8	50	6	2.0
	2040-070	4	8	70	6	2.0
	2050-060	5	12	60	6	2.5
	2050-080	5	12	80	6	2.5
	2060-060	6	12	60	6	3.0
	2060-090	6	12	90	6	3.0
	2080-070	8	16	70	8	4.0
	2080-100	8	16	100	8	4.0
	2100-075	10	20	75	10	5.0
	2100-100	10	20	100	10	5.0
	2120-080	12	25	80	12	6.0
	2120-100	12	25	100	12	6.0

SBET4000 (Ball) New

4 | H·A 38°/40° | UL coating | r tolerance ±0.01

DC	Tolerance
Ø1 ~ Ø6	0.000 ~ -0.015
Ø6.1 ~ Ø20	0.000 ~ -0.020



(mm)

Designation		DC	APMX	OAL	DCON-MS	RE
SBET 4	4040-050	4	8	50	6	2.0
	4040-070	4	8	70	6	2.0
	4050-060	5	12	60	6	2.5
	4050-080	5	12	80	6	2.5
	4060-060	6	12	60	6	3.0
	4060-090	6	12	90	6	3.0
	4080-070	8	16	70	8	4.0
	4080-100	8	16	100	8	4.0
	4100-075	10	20	75	10	5.0
	4100-100	10	20	100	10	5.0
	4120-080	12	25	80	12	6.0
	4120-100	12	25	100	12	6.0

Super Endmill For HRSA

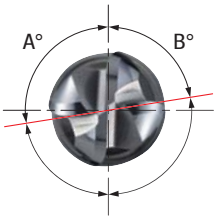
Code system

S	RE	S	4	120	-	080	-	R30
Super Endmill	Type FE: Flat Endmill RE: Radius Endmill BE: Ball Endmill	Workpiece S: Super alloy • Inconel718 • Waspaloy • Hastelloy T: Titanium/STS	No. of flute 4: 4 flutes	Tool diameter 120: Ø12.0 mm		Overall length 080: 80 mm		Corner R R30: 3.0 mm

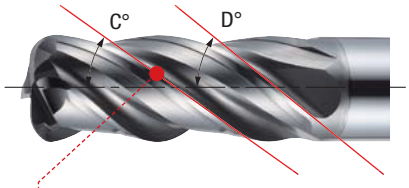
Features

- **Aerospace and generation industries** : Exclusive Endmill series for HRSA workpieces engine, turbine parts and etc.
- **Sharp cutting edge** : Reducing cutting load and suppression of work hardening
- **Longer tool life** : Applying high toughness substrate and new grade with high wear resistance

SRES4000 (Radius)

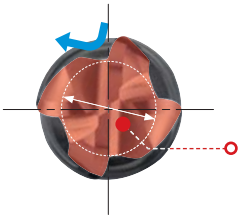


A° ≠ B°



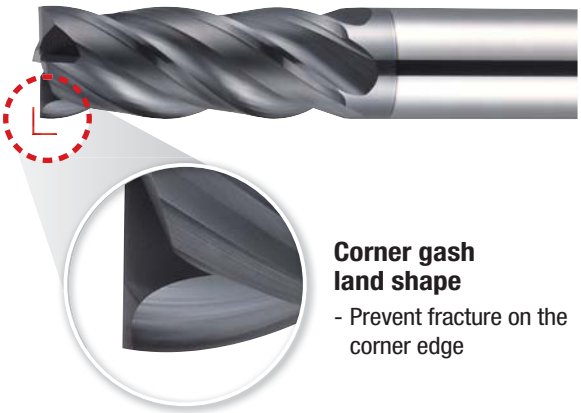
C° ≠ D°

Irregular flute spacing shape
- Reduced chattering and vibration



High rigidity core web design
- Enhancing cutting stability and chip evacuation

SFES4000 (Flat)



Corner gash land shape
- Prevent fracture on the corner edge

Cutting stability

Workpiece	Inconel (Inconel718)
Cutting conditions	vc (m/min) = 60, fz (mm/t) = 0.04
	ap (mm) = 5, ae (mm) = 0.3, wet (emulsion)
Tool	SRES4120-080-R20 (Diameter = Ø12 mm, SL coating)

[Super Endmill]

[Competitor]

High quality surface finish

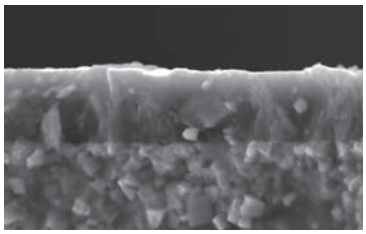
Workpiece	Waspaloy
Cutting conditions	vc (m/min) = 25, fz (mm/t) = 0.025
	ap (mm) = 6, ae (mm) = 12, wet (emulsion)
Tool	SFES4120-080 (Diameter = Ø12 mm, SL coating)

[Super Endmill]

[Competitor]

Grade features

SL coating (Ultra Lubricating coating)



- Applying high lubrication coating and special surface treatment technology
  - Increased welding resistance, chipping resistance and cutting stability by surface treatment technology

[SL coating application range]

◎: Best ○: Very Good △: Good ×: Bad

Workpiece	P			K	M	S		H	N
	Carbon steel	Alloy steel	Pre-hardened steel	Cast iron	Stainless steel	Inconel718, Waspaloy, Hastelloy	Titanium	High hardened alloy	Non-ferrous
SL coating	×	×	×	×	×	◎	×	×	×

Line-up

SFES4000 (Flat)

- 4 flutes and flat 8 designations (∅3~∅20)
- Applying irregular flute spacing shape
- Applying gash land
  : Reducing corner fracture

SRES4000 (Radius)

- 4 flutes and radius 143 designations (∅3~∅20)
- Applying irregular flute spacing shape
- High rigidity core web design
  : Higher cutting stability

Recommended cutting conditions_SFES4000 (Flat) / SRES4000 (Radius)

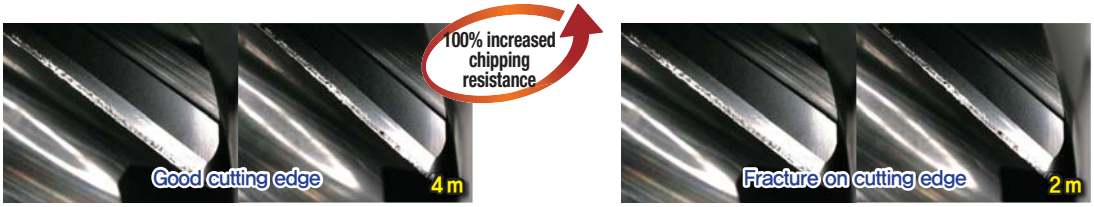
Workpiece				Brinell hardness (HB)	Specific cutting force (N/mm²)	Tensile strength at high temp. (N/mm²)	ap (mm)	ae (mm)	Machining	Diameter (mm)	3	4	5	6	8	10	12	16	20
ISO	Workpiece materials	ISO	AISI							Cutting length (mm)	8	10	15	15	20	25	30	42	48
S	HRSA (Ni series)	Inconel718 Inconel625	Inconel718 Inconel625	250 ~ 320	690 ~ 965	650	1.5D	0.05D	Shouldering	vc	36	38	38	40	40	39	40	38	40
										fz	0.014	0.020	0.025	0.030	0.035	0.043	0.050	0.069	0.079
										rpm	3,800	3,000	2,450	2,100	1,600	1,250	1,050	765	635
										feed	220	240	245	250	225	215	210	210	200
		Waspaloy	Waspaloy	210 ~ 290	1100 ~ 1400	900													
										vc	24	24	24	24	24	24	24	24	24
										fz	0.013	0.018	0.024	0.029	0.041	0.048	0.058	0.058	0.072
		Hastelloy	Hastelloy	170 ~ 240	520 ~ 800	530	0.3D	1D	Slotting	rpm	2,500	1,900	1,500	1,250	945	760	630	475	380
										feed	125	135	145	145	155	145	145	110	110

Performance evaluation

Inconel718 (HRC43-46)

Cutting conditions vc (m/min) = 40, fz (mm/t) = 0.05, ap (mm) = 18, ae (mm) = 0.6, wet (emulsion)

Tool SRES4120-080-R10 (Diameter = Ø12 mm, SL coating)



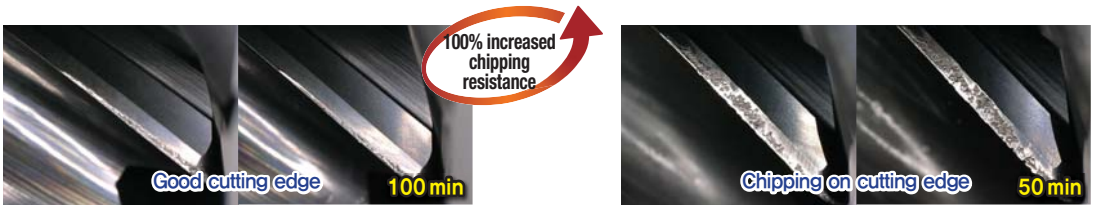
[Super Endmill] [Competitor]

» High quality performance from high toughness substrate and cutting stability

Waspaloy (HRC36-38)

Cutting conditions vc (m/min) = 30, fz (mm/t) = 0.04, ap (mm) = 6, ae (mm) = 18, Trochoidal cutting, wet (soluble)

Tool SRES4120-080-R10 (Diameter = Ø10 mm, SL coating)



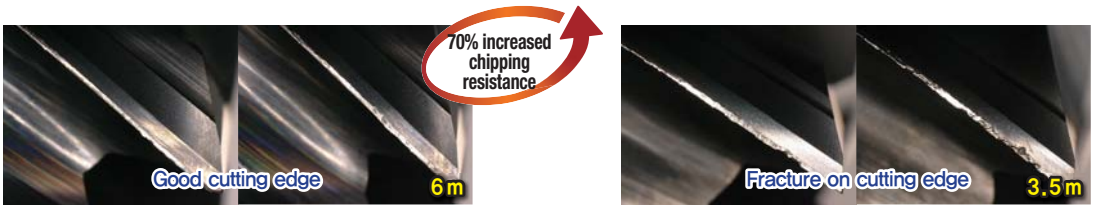
[Super Endmill] [Competitor]

» High quality performance from high toughness substrate and cutting stability

Inconel718 (HRC43-46)

Cutting conditions vc (m/min) = 40, fz (mm/t) = 0.04, ap (mm) = 18, ae (mm) = 0.8, wet (emulsion)

Tool SFES4120-075 (Diameter = Ø12 mm, SL coating)



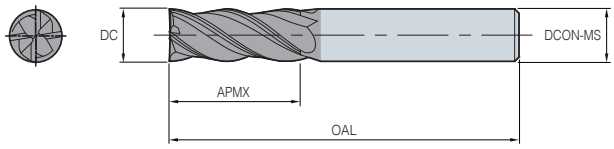
[Super Endmill] [Competitor]

» High quality performance from high toughness substrate and cutting stability

SFES4000 (Flat)

4 | H·A 35°/38° | h6 shank | SL coating

DC	Tolerance
Ø1 ~ Ø6	0.000 ~ -0.015
Ø6.1 ~ Ø20	0.000 ~ -0.020



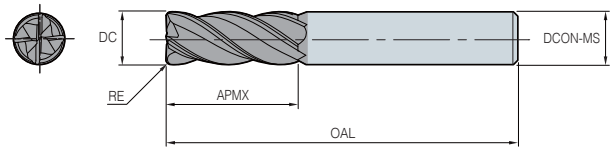
(mm)

Designation		DC	APMX	OAL	DCON-MS
SFES 4	4030-050	3	8	50	6
	4040-050	4	10	50	6
	4050-060	5	15	60	6
	4060-060	6	15	60	6
	4080-070	8	20	70	8
	4100-075	10	25	75	10
	4120-080	12	30	80	12
	4140-100	14	35	90	14
	4160-100	16	42	100	16
	4200-100	20	48	100	20

SRES4000 (Radius)

4 | H·A 35°/38° | h6 shank | SL coating | r tolerance ±0.01

DC	Tolerance
Ø1 ~ Ø6	0.000 ~ -0.015
Ø6.1 ~ Ø20	0.000 ~ -0.020



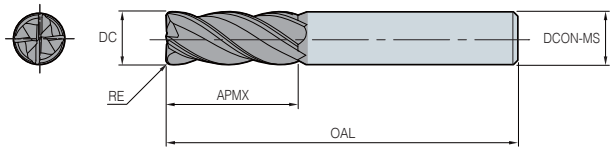
(mm)

Designation		DC	APMX	OAL	DCON-MS	RE
SRES 4	4030-055-R02	3	8	55	6	0.2
	4030-055-R03	3	8	55	6	0.3
	4030-055-R05	3	8	55	6	0.5
	4040-055-R02	4	10	55	6	0.2
	4040-055-R03	4	10	55	6	0.3
	4040-055-R05	4	10	55	6	0.5
	4040-070-R02	4	10	70	6	0.2
	4040-070-R03	4	10	70	6	0.3
	4040-070-R05	4	10	70	6	0.5
	4050-055-R02	5	15	55	6	0.2
	4050-055-R03	5	15	55	6	0.3
	4050-055-R05	5	15	55	6	0.5
	4050-090-R02	5	15	90	6	0.2
	4050-090-R03	5	15	90	6	0.3
	4050-090-R05	5	15	90	6	0.5
	4060-060-R03	6	15	60	6	0.3
	4060-060-R05	6	15	60	6	0.5
	4060-060-R08	6	15	60	6	0.8
	4060-060-R10	6	15	60	6	1.0
	4060-060-R15	6	15	60	6	1.5
	4060-060-R20	6	15	60	6	2.0
	4060-090-R03	6	15	90	6	0.3
	4060-090-R05	6	15	90	6	0.5
	4060-090-R08	6	15	90	6	0.8
	4060-090-R10	6	15	90	6	1.0
	4060-090-R15	6	15	90	6	1.5
	4060-090-R20	6	15	90	6	2.0

SRES4000 (Radius)

4 | H·A 35°/38° | h6 shank | SL coating | r tolerance ±0.01

DC	Tolerance
Ø1 ~ Ø6	0.000 ~ -0.015
Ø6.1 ~ Ø20	0.000 ~ -0.020



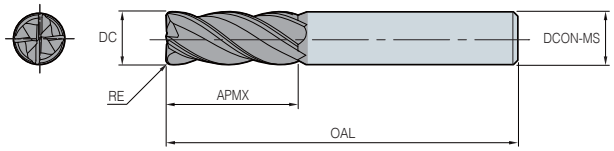
(mm)

Designation		DC	APMX	OAL	DCON-MS	RE
SRES 4	4080-070-R03	8	20	70	8	0.3
	4080-070-R05	8	20	70	8	0.5
	4080-070-R08	8	20	70	8	0.8
	4080-070-R10	8	20	70	8	1.0
	4080-070-R15	8	20	70	8	1.5
	4080-070-R20	8	20	70	8	2.0
	4080-070-R25	8	20	70	8	2.5
	4080-070-R30	8	20	70	8	3.0
	4080-100-R03	8	20	100	8	0.3
	4080-100-R05	8	20	100	8	0.5
	4080-100-R08	8	20	100	8	0.8
	4080-100-R10	8	20	100	8	1.0
	4080-100-R15	8	20	100	8	1.5
	4080-100-R20	8	20	100	8	2.0
	4080-100-R25	8	20	100	8	2.5
	4080-100-R30	8	20	100	8	3.0
	4100-075-R03	10	25	75	10	0.3
	4100-075-R05	10	25	75	10	0.5
	4100-075-R08	10	25	75	10	0.8
	4100-075-R10	10	25	75	10	1.0
	4100-075-R15	10	25	75	10	1.5
	4100-075-R20	10	25	75	10	2.0
	4100-075-R25	10	25	75	10	2.5
	4100-075-R30	10	25	75	10	3.0
	4100-100-R03	10	25	100	10	0.3
	4100-100-R05	10	25	100	10	0.5
	4100-100-R08	10	25	100	10	0.8
	4100-100-R10	10	25	100	10	1.0
	4100-100-R15	10	25	100	10	1.5
	4100-100-R20	10	25	100	10	2.0
	4100-100-R25	10	25	100	10	2.5
	4100-100-R30	10	25	100	10	3.0

SRES4000 (Radius)

4 | H·A 35°/38° | h6 shank | SL coating | r tolerance ±0.01

DC	Tolerance
Ø1 ~ Ø6	0.000 ~ -0.015
Ø6.1 ~ Ø20	0.000 ~ -0.020



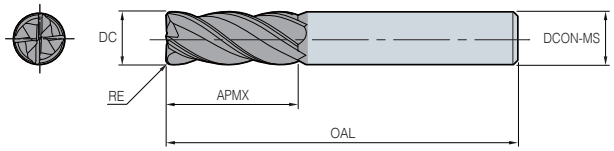
(mm)

Designation		DC	APMX	OAL	DCON-MS	RE
SRES 4	4120-080-R05	12	30	80	12	0.5
	4120-080-R08	12	30	80	12	0.8
	4120-080-R10	12	30	80	12	1.0
	4120-080-R15	12	30	80	12	1.5
	4120-080-R20	12	30	80	12	2.0
	4120-080-R25	12	30	80	12	2.5
	4120-080-R30	12	30	80	12	3.0
	4120-080-R35	12	30	80	12	3.5
	4120-080-R40	12	30	80	12	4.0
	4120-110-R05	12	30	110	12	0.5
	4120-110-R08	12	30	110	12	0.8
	4120-110-R10	12	30	110	12	1.0
	4120-110-R15	12	30	110	12	1.5
	4120-110-R20	12	30	110	12	2.0
	4120-110-R25	12	30	110	12	2.5
	4120-110-R30	12	30	110	12	3.0
	4120-110-R35	12	30	110	12	3.5
	4120-110-R40	12	30	110	12	4.0
	4140-090-R05	14	35	90	14	0.5
	4140-090-R08	14	35	90	14	0.8
	4140-090-R10	14	35	90	14	1.0
	4140-090-R15	14	35	90	14	1.5
	4140-090-R20	14	35	90	14	2.0
	4140-090-R30	14	35	90	14	3.0
	4140-150-R05	14	35	150	14	0.5
	4140-150-R08	14	35	150	14	0.8
	4140-150-R10	14	35	150	14	1.0
	4140-150-R15	14	35	150	14	1.5
	4140-150-R20	14	35	150	14	2.0
	4140-150-R30	14	35	150	14	3.0

SRES4000 (Radius)

4 | H·A 35°/38° | h6 shank | SL coating | r tolerance ±0.01

DC	Tolerance
Ø1 ~ Ø6	0.000 ~ -0.015
Ø6.1 ~ Ø20	0.000 ~ -0.020



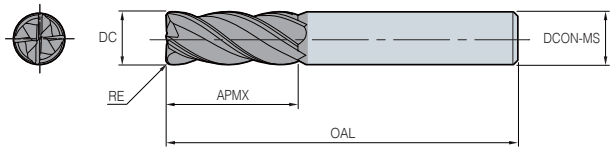
(mm)

Designation		DC	APMX	OAL	DCON-MS	RE
SRES 4	4160-100-R05	16	42	100	16	0.5
	4160-100-R08	16	42	100	16	0.8
	4160-100-R10	16	42	100	16	1.0
	4160-100-R15	16	42	100	16	1.5
	4160-100-R20	16	42	100	16	2.0
	4160-100-R25	16	42	100	16	2.5
	4160-100-R30	16	42	100	16	3.0
	4160-100-R35	16	42	100	16	3.5
	4160-100-R40	16	42	100	16	4.0
	4160-100-R50	16	42	100	16	5.0
	4160-100-R60	16	42	100	16	6.0
	4160-150-R05	16	42	150	16	0.5
	4160-150-R08	16	42	150	16	0.8
	4160-150-R10	16	42	150	16	1.0
	4160-150-R15	16	42	150	16	1.5
	4160-150-R20	16	42	150	16	2.0
	4160-150-R25	16	42	150	16	2.5
	4160-150-R30	16	42	150	16	3.0
	4160-150-R35	16	42	150	16	3.5
	4160-150-R40	16	42	150	16	4.0
	4160-150-R50	16	42	150	16	5.0
	4160-150-R60	16	42	150	16	6.0
	4180-100-R05	18	45	100	20	0.5
	4180-100-R08	18	45	100	20	0.8
	4180-100-R10	18	45	100	20	1.0
	4180-100-R15	18	45	100	20	1.5
	4180-100-R20	18	45	100	20	2.0
	4180-100-R30	18	45	100	20	3.0
	4180-150-R05	18	45	150	20	0.5
	4180-150-R08	18	45	150	20	0.8
	4180-150-R10	18	45	150	20	1.0
	4180-150-R15	18	45	150	20	1.5
	4180-150-R20	18	45	150	20	2.0
	4180-150-R30	18	45	150	20	3.0

SRES4000 (Radius)

4 | H·A 35°/38° | h6 shank | SL coating | r tolerance ±0.01

DC	Tolerance
Ø1 ~ Ø6	0.000 ~ -0.015
Ø6.1 ~ Ø20	0.000 ~ -0.020

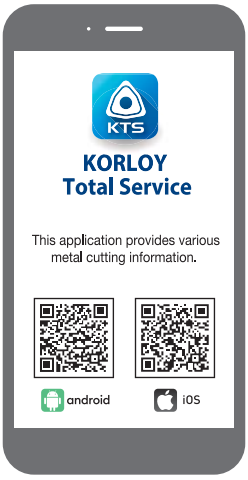


(mm)

Designation		DC	APMX	OAL	DCON-MS	RE
SRES 4	4200-100-R05	20	48	100	20	0.5
	4200-100-R10	20	48	100	20	1.0
	4200-100-R15	20	48	100	20	1.5
	4200-100-R20	20	48	100	20	2.0
	4200-100-R25	20	48	100	20	2.5
	4200-100-R30	20	48	100	20	3.0
	4200-100-R35	20	48	100	20	3.5
	4200-100-R40	20	48	100	20	4.0
	4200-100-R50	20	48	100	20	5.0
	4200-100-R60	20	48	100	20	6.0
	4200-150-R05	20	48	150	20	0.5
	4200-150-R10	20	48	150	20	1.0
	4200-150-R15	20	48	150	20	1.5
	4200-150-R20	20	48	150	20	2.0
	4200-150-R25	20	48	150	20	2.5
	4200-150-R30	20	48	150	20	3.0
	4200-150-R35	20	48	150	20	3.5
	4200-150-R40	20	48	150	20	4.0
	4200-150-R50	20	48	150	20	5.0
	4200-150-R60	20	48	150	20	6.0

⚠ For the safe metalcutting

- Use safety supplies such as protective gloves to prevent possible injury while touching the edge of tools.
- Use safety glasess or safety cover to hedge possible dangers. Inappropriate usage or excessive cutting condition may lead tool's breakage or even the fragment's scattering.
- Clamp the workpiece tightly enough to prevent its movement while its machining.
- Properly manage the tool change phase because the inordinately used tool can be easily broken under the excessive cutting load or severe wear, and it may threat the operator's safety.
- Use safety cover because chips evacuated during cutting are hot and sharp and may cause burns and cuts. To remove chips safely, stop machining, put on protective gloves, and use a hook or other tools.
- Prepare for fire prevention measures as the use of the non-water soluble cutting oil may cause fire.
- Use safety cover and other safety supplies because the spare parts or the inserts can be pulled out due to centrifugal force while high speed machining.



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