RAINFORD PRECISION

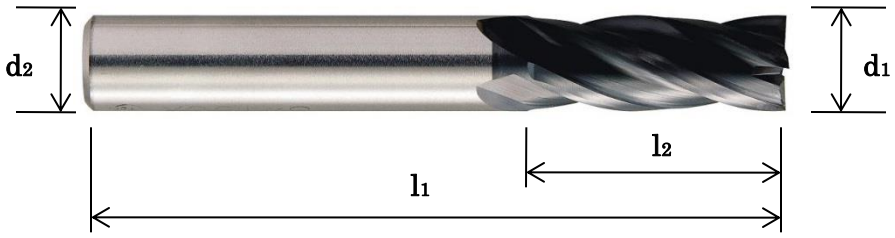
May 2015

SAMURAI Series

4 Flutes Square
4 Flutes Corner Radius
2 ,3 & 4 Flutes Ball

59 Models
Ø1 - Ø12mm

SAMURAI GS - 4 Flutes Square (Ø 1 – Ø 10)



Suitable for the machining of :

Carbon Steel | Stainless Steel | Hardness < 55HRC | Titanium | Copper

Total 8 models

Tool Model	d_1	l_2	l_1	d_2	Price (£)
GS 4010	1	2.5	45	4	16.94
GS 4015	1.5	3.75	45	4	16.94
GS 4020	2	5	45	4	16.94
GS 4030	3	8	45	6	16.94
GS 4040	4	11	45	6	16.94
GS 4060	6	15	60	6	19.78
GS 4080	8	19	60	8	38.50
GS 4100	10	25	70	10	50.14

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SAMURAI GS - Milling conditions

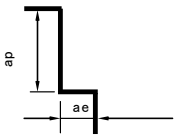
WORK MATERIAL		CARBON STEELS S45C・S50C (~225HB)			ALLOY STEELS SK・SCM・SUS (225~325HB)			PREHARDENED STEELS/HARDENED STEELS NAK・SKD (30~45HRC)			HARDENED STEELS SKD11・61・SKT (45~55HRC)		
Model Number	Outside Diameter (mm)	Speed (min-1)	Velocity (m/min)	Feed (mm/min)	Speed (min-1)	Velocity (m/min)	Feed (mm/min)	Speed (min-1)	Velocity (m/min)	Feed (mm/min)	Speed (min-1)	Velocity (m/min)	Feed (mm/min)
4010	1	20'000	65	240	15'000	45	215	11'000	35	85	7'100	20	40
4015	1.5	13'500		245	10'000		215	8'000		90	5'100		50
4020	2	11'000	70~85	245	8'500	55~65	215	6'400	40~45	90	4'000	25~30	55
4030	3	7'400		370	6'400		260	4'500		105	2'800		65
4040	4	5'900		435	5'000		340	3'500		120	2'150		70
4060	6	4'400		580	3'500		415	2'450		130	1'500		70
4080	8	3'300		550	2'600		415	1'850		125	1'200		70
4100	10	2'600		525	2'100		405	1'450		125	950		65

For high-speed milling

WORK MATERIAL		CARBON STEELS S45C・S50C (~225HB)			ALLOY STEELS SK・SCM・SUS (25~325HB)			PREHARDENED STEELS/HARDENED STEELS NAK・SKD (30~45HRC)			HARDENED STEELS SKD11・61・SKT (45~55HRC)		
Model Number	Outside Diameter (mm)	Speed (min-1)	Velocity (m/min)	Feed (mm/min)	Speed (min-1)	Velocity (m/min)	Feed (mm/min)	Speed (min-1)	Velocity (m/min)	Feed (mm/min)	Speed (min-1)	Velocity (m/min)	Feed (mm/min)
4030	3	30'000	300	1'500	26'500	250	1'075	21'200	200	495	15'800	150	365
4040	4	23'800		1'755	19'800		1'345	15'800		540	11'900		385
4060	6	15'900		2'095	13'200		1'565	10'600		560	7'900		370
4080	8	11'900		1'985	9'900		1'580	7'900		535	5'900		345
4100	10	9'500		1'920	7'900		1'525	6'300		545	4'700		320

Milling Amount for Side Milling

Less than 45HRC	ae=0.05D ap=2.5D
More than 45HRC	ae=0.02D ap=2D



D : Outside Diameter
ap : Axial Depth
ae : Radial Depth

Note
Do not use flammable cutting oils.
Use a machine that has high rigidity and generates a low level of vibration.
Remove chip to prevent heat generation and ignition.

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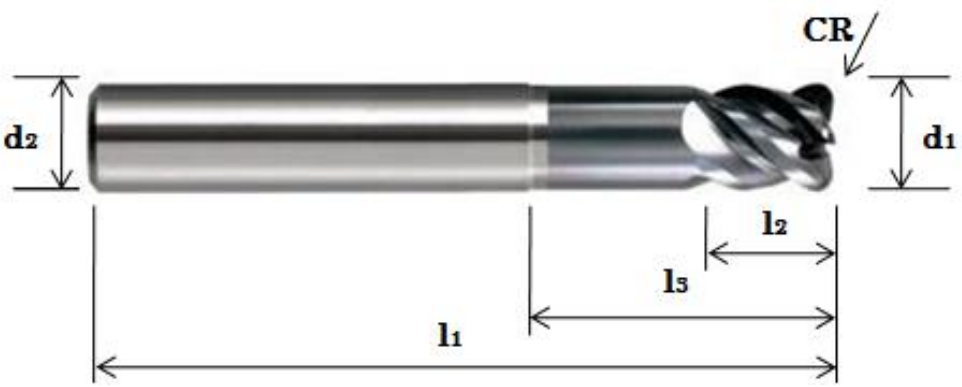
SAMURAI GCR - 4 Flutes Corner Radius (Ø 2– Ø 12)



Suitable for the machining of :

Carbon Steel | Stainless Steel | Hardness < 55HRC | Titanium Inconel

Total 35 models

Tool Model	d_1	CR	l_2	l_3	l_1	d_2	Price (£)
GCR 4020-05-06	2	0.5	2	6	45	4	**39.91**
GCR 4030-05-12	3	0.5	3	12	60	6	**39.91**
GCR 4040-03-08	4	0.3	4	8	50	4	**38.50**
GCR 4040-05-12	4	0.5	4	12	50	6	**39.91**
GCR 4040-05-16	4	0.5	4	16	60	6	**39.91**
GCR 4060-05-18	6	0.5	6	18	60	6	**42.72**
GCR 4060-05-24L	6	0.5	6	24	90	6	**51.19**
GCR 4060-10-18	6	1	6	18	60	6	**42.72**
GCR 4060-10-24L	6	1	6	24	90	6	**51.19**
GCR 4080-05-26	8	0.5	8	26	70	8	**59.31**
GCR 4080-05-32L	8	0.5	8	32	100	8	**71.68**
GCR 4080-10-26	8	1	8	26	70	8	**59.31**
GCR 4080-10-32L	8	1	8	32	100	8	**71.68**
GCR 4080-15-24	8	1.5	8	24	70	8	**59.31**

SAMURAI GCR - 4 Flutes Corner Radius (Ø 2– Ø 12)

Tool Model	d_1	CR	l_2	l_3	l_1	d_2	Price (£)
GCR 4080-15-32L	8	1.5	8	32	100	8	71.68
GCR 4080-20-24	8	2	8	24	70	8	59.31
GCR 4080-20-32L	8	2	8	32	100	8	71.68
GCR 4100-05-30	10	0.5	10	30	80	10	78.39
GCR 4100-05-30L	10	0.5	10	30	120	10	102.41
GCR 4100-10-30	10	1	10	30	80	10	78.39
GCR 4100-10-40L	10	1	10	40	120	10	102.41
GCR 4100-15-30	10	1.5	10	30	80	10	78.39
GCR 4100-15-40L	10	1.5	10	40	120	10	102.41
GCR 4100-20-30	10	2	10	30	80	10	78.39
GCR 4100-20-40L	10	2	10	40	120	10	102.41
GCR 4100-30-30	10	3	10	30	80	10	78.39
GCR 4100-30-40L	10	3	10	40	120	10	102.41
GCR 4120-05-36	12	0.5	12	36	100	12	106.99
GCR 4120-05-48L	12	0.5	12	48	120	12	117.59
GCR 4120-10-36	12	1	12	36	100	12	106.99
GCR 4120-10-48L	12	1	12	48	120	12	117.59
GCR 4120-20-36	12	2	12	36	100	12	106.99
GCR 4120-20-48L	12	2	12	48	120	12	117.59
GCR 4120-30-36	12	3	12	36	100	12	106.99
GCR 4120-30-48L	12	3	12	48	120	12	117.59

SAMURAI GCR - Milling conditions

Roughing Parameters

WORK MATERIAL			CARBON STEELS S45C・S55C (~225HB)				ALLOY STEELS SK・SCM・SUS (225~325HB) Note:Use a water soluble if milling stainless steel				PREHARDENED STEELS / HARDENED NAK・HPM・SKD・SKT・STAVAX (30~55HRC) Note:Recommend Using Oil Mist			
Model Number	Outside Diameter (mm)	Corner Radius (CR)	Speed (min-1)	Feed (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Speed (min-1)	Feed (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Speed (min-1)	Feed (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
GCR 4020-05-06	2	R0.5	30000	7200	0.08	0.80	30000	7200	0.04	0.66	24000	7000	0.02	0.59
GCR 4030-05-12	3	R0.5	20000	8400	0.09	1.20	20000	7200	0.04	1.08	16000	7000	0.04	0.88
GCR 4040-03-08	4	R0.3	15000	9600	0.09	1.60	15000	7200	0.05	1.32	12000	7000	0.05	1.17
GCR 4040-05-12		R0.5	15000	9600	0.10	1.60	15000	7200	0.05	1.35	12000	7000	0.05	1.26
GCR 4040-05-16		R0.5	15000	9600	0.10	1.60	15000	7200	0.05	1.35	12000	7000	0.05	1.26
GCR 4060-05-18	6	R0.5	10000	12000	0.14	2.40	10000	7200	0.07	1.98	8000	5250	0.07	1.75
GCR 4060-05-24L		R0.5	10000	12000	0.14	2.40	10000	7200	0.07	1.98	8000	5250	0.07	1.75
GCR 4060-10-18		R1	10000	12000	0.15	2.40	10000	7200	0.07	2.16	8000	5250	0.08	1.75
GCR 4060-10-24L		R1	10000	12000	0.15	2.40	10000	7200	0.07	2.16	8000	5250	0.08	1.75
GCR 4080-05-26	8	R0.5	7500	12000	0.18	2.64	7500	7200	0.08	2.61	6000	4100	0.14	1.76
GCR 4080-05-32L		R0.5	7500	12000	0.18	2.64	7500	7200	0.08	2.61	6000	4100	0.14	1.76
GCR 4080-10-26		R1	7500	12000	0.20	2.72	7500	7200	0.09	2.70	6000	4100	0.16	1.76
GCR 4080-10-32L		R1	7500	12000	0.20	2.72	7500	7200	0.09	2.74	6000	4100	0.16	1.76
GCR 4080-15-24		R1.5	7500	12000	0.22	2.80	7500	7200	0.09	2.74	6000	4100	0.17	1.84
GCR 4080-15-32L		R1.5	7500	12000	0.22	2.80	7500	7200	0.09	2.74	6000	4100	0.17	1.84
GCR 4080-20-24		R2	7500	12000	0.24	2.88	7500	7200	0.10	2.79	6000	4100	0.18	1.96
GCR 4080-20-32L		R2	7500	12000	0.24	2.88	7500	7200	0.10	2.79	6000	4100	0.18	1.96
GCR 4100-05-30	10	R0.5	6000	12000	0.22	3.04	5000	5400	0.14	2.88	4800	4100	0.18	2.03
GCR 4100-05-30L		R0.5	6000	12000	0.22	3.04	5000	5400	0.14	2.88	4800	4100	0.18	2.03
GCS 4100-10-30		R1	6000	12000	0.24	3.28	5000	5400	0.14	2.97	4800	4100	0.19	2.10
GCS 4100-10-40L		R1	6000	12000	0.24	3.28	5000	5400	0.14	2.97	4800	4100	0.19	2.10
GCR 4100-15-30		R1.5	6000	12000	0.25	3.36	5000	5400	0.14	3.01	4800	4100	0.19	2.25
GCR 4100-15-40L		R1.5	6000	12000	0.25	3.36	5000	5400	0.14	3.01	4800	4100	0.19	2.25
GCR 4100-20-30		R2	6000	12000	0.26	3.44	5000	5400	0.14	3.06	4800	4100	0.19	2.35
GCR 4100-20-40L		R2	6000	12000	0.26	3.44	5000	5400	0.14	3.06	4800	4100	0.20	2.35
GCR 4100-30-30		R3	6000	12000	0.27	3.52	5000	5400	0.14	3.08	4800	4100	0.20	2.45
GCR 4100-30-40L		R3	6000	12000	0.27	3.52	5000	5400	0.14	3.08	4800	4100	0.20	2.45
GCR 4120-05-36	12	R0.5	5000	12000	0.26	3.66	3000	4320	0.18	3.15	4000	4100	0.21	2.80
GCR 4120-05-48L		R0.5	5000	12000	0.26	3.66	3000	4320	0.18	3.15	4000	4100	0.21	2.80
GCR 4120-10-36		R1	5000	12000	0.26	3.70	3000	4320	0.18	3.15	4000	4100	0.21	2.80
GCR 4120-10-48L		R1	5000	12000	0.26	3.70	3000	4320	0.18	3.15	4000	4100	0.21	2.80
GCR 4120-20-36		R2	5000	12000	0.28	3.76	3000	4320	0.18	3.15	4000	4100	0.21	2.80
GCR 4120-20-48L		R2	5000	12000	0.28	3.76	3000	4320	0.18	3.15	4000	4100	0.21	2.80
GCR 4120-30-36		R3	5000	12000	0.30	4.00	3000	4320	0.18	3.15	4000	4100	0.21	2.80
GCR 4120-30-48L		R3	5000	12000	0.30	4.00	3000	4320	0.18	3.15	4000	4100	0.21	2.80

D: Outside Diameter
L: Overhand Length

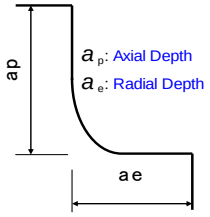
D : Ø3.0

L / D	Speed (min-1	Feed (mm/min)	ap Axial Depth (mm)	ae Radial Depth (mm)
L/D=6	×1	×1	×1	×1
L/D=7	×0.8	×0.8	×0.8	×0.9
L/D=8	×0.7	×0.7	×0.7	×0.9
L/D=9	×0.7	×0.7	×0.6	×0.8
L/D=10	×0.6	×0.6	×0.6	×0.7

D : Ø4.0 ~ 6.0

L / D	Speed (min^{-1})	Feed (mm/min)	ap Axial Depth (mm)	ae Radial Depth (mm)
L/D=4	×1	×1	×1	×1
L/D=5	×0.9	×0.8	×0.9	×0.9
L/D=6	×0.8	×0.7	×0.8	×0.9
L/D=7	×0.7	×0.6	×0.6	×0.8
L/D=8	×0.5	×0.4	×0.6	×0.7

Roughing Parameter



D : Ø8.0 ~ 12.0

L / D	Speed (min^{-1})	Feed (mm/min)	ap Axial Depth (mm)	ae Radial Depth (mm)
L/D=4	×1	×1	×1	×1
L/D=5	×0.7	×0.6	×0.6	×0.8
L/D=6	×0.5	×0.4	×0.5	×0.7

Note:

Recommend Using Airblow/Water Soluble/Oil Mist.

Use a water soluble if milling stainless steel.Do not use flammable cutting oils.
This table shows standard milling.Adjust it in accordance with milling type, purpose and used instruments in actual milling.
In case of spindle rotation does not reach to target,decrease spindle and feed speed in same ratio.
Use a machine that has high rigidity and generates low level of vibration.
Remove chip to prevent heat generation and ignition by milling processing.
Adjust only spindle speed for finishing process based on overhang length.
Please decrease feed rate rate more than 50% from above table for slot milling.

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SAMURAI GCR - Milling conditions

Finishing Parameters (Flat / Inclined surface)

WORK MATERIAL			CARBON STEELS S45C・S55C (~225HB)				ALLOY STEELS SK・SCM・SUS (225~325HB) Note:Use a water soluble if milling stainless steel				PREHARDENED STEELS / HARDENED NAK・HPM・SKD・SKT・STAVAX (30~55HRC) Note:Recommend Using Oil Mist			
Model Number	Outside Diameter (mm)	Corner Radius (CR)	Speed (min-1)	Feed (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Speed (min-1)	Feed (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)	Speed (min-1)	Feed (mm/min)	a_p Axial Depth (mm)	a_e Radial Depth (mm)
GCR 4020-05-06	2	R0.5	30000	1720	0.10	0.06	30000	1510	0.05	0.05	24000	1070	0.05	0.04
GCR 4030-05-12	3	R0.5	20000	1890	0.10	0.09	20000	1660	0.05	0.08	16000	1160	0.05	0.07
GCR 4040-03-08	4	R0.3	15000	1050	0.10	0.07	15000	910	0.05	0.06	12000	620	0.05	0.05
GCR 4040-05-12		R0.5	15000	1360	0.10	0.09	15000	1180	0.05	0.08	12000	810	0.05	0.07
GCR 4040-05-16		R0.5	15000	1360	0.10	0.09	15000	1180	0.05	0.08	12000	810	0.05	0.07
GCR 4060-05-18	6	R0.5	10000	1150	0.20	0.12	10000	990	0.10	0.10	8000	670	0.10	0.08
GCR 4060-05-24L		R0.5	10000	1150	0.20	0.12	10000	990	0.10	1.00	8000	670	0.10	0.08
GCR 4060-10-18		R1	10000	1630	0.20	0.16	10000	1400	0.10	0.14	8000	950	0.10	0.12
GCR 4060-10-24L		R1	10000	1630	0.20	0.16	10000	1400	0.10	0.14	8000	950	0.10	0.12
GCR 4080-05-26	8	R0.5	7500	990	0.20	0.13	7500	860	0.10	0.11	6000	580	0.10	0.10
GCR 4080-05-32L		R0.5	7500	990	0.20	0.13	7500	860	0.10	0.11	6000	580	0.10	0.10
GCR 4080-10-26		R1	7500	1410	0.20	0.19	7500	1210	0.10	0.16	6000	830	0.10	0.14
GCR 4080-10-32L		R1	7500	1410	0.20	0.19	7500	1210	0.10	0.16	6000	830	0.10	0.14
GCR 4080-15-24		R1.5	7500	1650	0.20	0.23	7500	1530	0.10	0.20	6000	1040	0.10	0.17
GCR 4080-15-32L		R1.5	7500	1650	0.20	0.23	7500	1530	0.10	0.20	6000	1040	0.10	0.17
GCR 4080-20-24		R2	7500	1990	0.20	0.27	7500	1720	0.10	0.23	6000	1170	0.10	0.20
GCR 4080-20-32L		R2	7500	1990	0.20	0.27	7500	1720	0.10	0.23	6000	1170	0.10	0.20
GCR 4100-05-30	10	R0.5	6000	940	0.20	0.16	5000	660	0.10	0.13	4800	520	0.10	0.11
GCR 4100-05-30L		R0.5	6000	940	0.20	0.16	5000	660	0.10	0.13	4800	520	0.10	0.11
GCS 4100-10-30		R1	6000	1330	0.20	0.22	5000	940	0.10	0.19	4800	740	0.10	0.15
GCS 4100-10-40L		R1	6000	1330	0.20	0.22	5000	940	0.10	0.19	4800	740	0.10	0.15
GCR 4100-15-30		R1.5	6000	1580	0.20	0.26	5000	1050	0.10	0.24	4800	960	0.10	0.18
GCR 4100-15-40L		R1.5	6000	1580	0.20	0.26	5000	1050	0.10	0.24	4800	960	0.10	0.18
GCR 4100-20-30		R2	6000	1890	0.20	0.32	5000	1340	0.10	0.27	4800	1050	0.10	0.22
GCR 4100-20-40L		R2	6000	1890	0.20	0.32	5000	1340	0.10	0.27	4800	1050	0.10	0.22
GCR 4100-30-30		R3	6000	2050	0.20	0.35	5000	1560	0.10	0.30	4800	1180	0.10	0.25
GCR 4100-30-40L		R3	6000	2050	0.20	0.35	5000	1560	0.10	0.30	4800	1180	0.10	0.25
GCR 4120-05-36	12	R0.5	5000	1200	0.20	0.32	3000	660	0.10	0.24	4000	690	0.10	0.18
GCR 4120-05-48L		R0.5	5000	1200	0.20	0.32	3000	660	0.10	0.24	4000	690	0.10	0.18
GCR 4120-10-36		R1	5000	1580	0.20	0.33	3000	720	0.10	0.27	4000	820	0.10	0.21
GCR 4120-10-48L		R1	5000	1580	0.20	0.33	3000	720	0.10	0.27	4000	820	0.10	0.21
GCR 4120-20-36		R2	5000	1760	0.20	0.35	3000	870	0.10	0.29	4000	960	0.10	0.24
GCR 4120-20-48L		R2	5000	1760	0.20	0.35	3000	870	0.10	0.29	4000	960	0.10	0.24
GCR 4120-30-36		R3	5000	1950	0.20	0.37	3000	1030	0.10	0.33	4000	1080	0.10	0.27
GCR 4120-30-48L		R3	5000	1950	0.20	0.37	3000	1030	0.10	0.33	4000	1080	0.10	0.27

D: Outside Diameter
L: Overhand Length

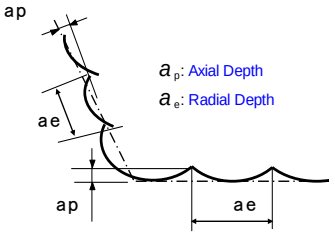
Finishing Parameter (Flat / Inclined surface)

D : Ø3.0

L / D	Speed (min-1	Feed (mm/min)	ap Axial Depth (mm)	ae Radial Depth (mm)
L/D=6	×1	×1	×1	×1
L/D=7	×0.8	×0.8	×0.8	×0.9
L/D=8	×0.7	×0.7	×0.7	×0.9
L/D=9	×0.7	×0.7	×0.6	×0.8
L/D=10	×0.6	×0.6	×0.6	×0.7

D : Ø4.0~6.0

L / D	Speed (min^{-1})	Feed (mm/min)	ap Axial Depth (mm)	ae Radial Depth (mm)
L/D=4	×1	×1	×1	×1
L/D=5	×0.9	×0.8	×0.9	×0.9
L/D=6	×0.8	×0.7	×0.8	×0.9
L/D=7	×0.7	×0.6	×0.6	×0.8
L/D=8	×0.5	×0.4	×0.6	×0.7



D : Ø8.0~12.0

L / D	Speed (min^{-1})	Feed (mm/min)	ap Axial Depth (mm)	ae Radial Depth (mm)
L/D=4	×1	×1	×1	×1
L/D=5	×0.7	×0.6	×0.6	×0.8
L/D=6	×0.5	×0.4	×0.5	×0.7

Note:

Recommend Using Airblow/Water Soluble/Oil Mist.

Use a water soluble if milling stainless steel.Do not use flammable cutting oils.
This table shows standard milling.Adjust it in accordance with milling type, purpose and used instruments in actual milling.
In case of spindle rotation does not reach to target,decrease spindle and feed speed in same ratio.
Use a machine that has high rigidity and generates low level of vibration.
Remove chip to prevent heat generation and ignition by milling processing.
Adjust only spindle speed for finishing process based on overhang length.
Please decrease feed rate rate more than 50% from above table for slot milling.

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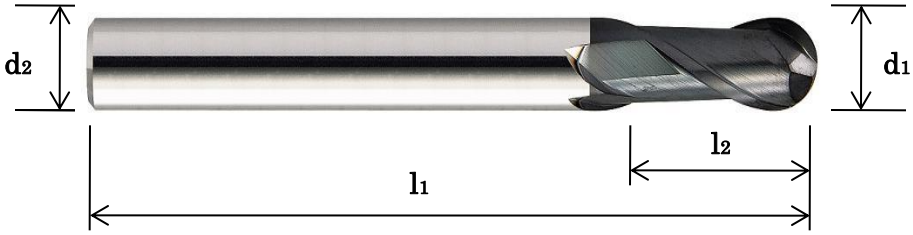
SAMURAI GB - 2 Flutes Ball (Ø1 – Ø10)



UT COAT

30°

Shank Dia 0/-0.005

Suitable for the machining of :

Carbon Steel | Stainless Steel | Hardness < 55HRC | Titanium | Copper

Total 8 models

Tool Model	d_1	l_2	l_1	d_2	Price (£)
GB 2010	1	2.5	50	4	19.78
GB 2015	1.5	4	50	4	19.78
GB 2020	2	6	50	4	19.78
GB 2030	3	8	70	6	22.62
GB 2040	4	8	70	6	22.62
GB 2060	6	12	70	6	22.62
GB 2080	8	14	80	8	45.56
GB 2100	10	18	90	10	65.32

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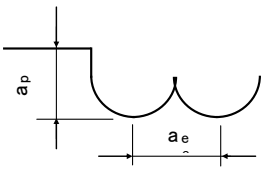
SAMURAI GB 2 Flutes - Milling conditions

WORK MATERIAL			CARBON STEELS S45C・S50C （～225HB）			ALLOY STEELS SK・SCM・SUS （225～325HB）			PREHARDENED STEELS / HARDENED STEELS NAK・SKD （30～45HRC）			HARDENED STEELS SKD11・61・SKT （45～55HRC）		
Model Number	Radius of Ball Nose (mm)	Outside Diameter (mm)	Speed (min-1)	Velocity (m/min)	Feed (mm/min)	Speed (min-1)	Velocity (m/min)	Feed (mm/min)	Speed (min-1)	Velocity (m/min)	Feed (mm/min)	Speed (min-1)	Velocity (m/min)	Feed (mm/min)
2010	R0.5	1	20700	65	970	19100	60	830	17500	55	630	9550	30	310
2020	R1	2	17500		1570	15100		1260	9550		660	5600		310
2030	R1.5	3	11700		1460	10100		1170	6400		620	3700		280
2040	R2	4	8750	110	1140	7550	95	900	4780	60	480	2800	35	230
2060	R3	6	5800		750	5000		600	3200		320	1850		150
2080	R4	8	4400		580	3800		440	2400		230	1400		120
2100	R5	10	3500		440	3000		340	1900		190	1100		90
Milling Amount (mm)		For Roughing	$a_p \leq 0.05D$ $a_e \leq 0.5D$									$a_p \leq 0.04D$ $a_e \leq 0.4D$		
		For Finishing	$a_p \leq 0.04D$ (MAX 0.1) $a_e = F/n$											

For high-speed milling

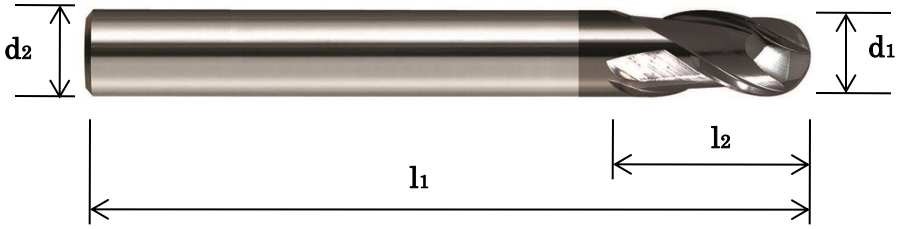
WORK MATERIAL			CARBON STEELS S45C・S50C （～225HB）			ALLOY STEELS SK・SCM・SUS （225～325HB）			PREHARDENED STEELS/ HARDENED STEELS NAK・SKD （30～45HRC）			HARDENED STEELS SKD11・61・SKT （45～55HRC）		
Model Number	Radius of Ball Nose (mm)	Outside Diameter (mm)	Speed (min-1)	Velocity (m/min)	Feed (mm/min)	Speed (min-1)	Velocity (m/min)	Feed (mm/min)	Speed (min-1)	Velocity (m/min)	Feed (mm/min)	Speed (min-1)	Velocity (m/min)	Feed (mm/min)
2020	R1	2	22750		2700	19630	123	2100	12420		1100	7280	46	500
2030	R1.5	3	15210	143	2500	13130	124	2000	8320		1100	4810	45	500
2040	R2	4	11380		2000	3820	123	1500	6210	78	800	3640	46	400
2060	R3	6	7540	142	1300	6500	122	1000	4160		500	2410	45	300
2080	R4	8	5720	144	1000	4940	124	700	3120		400	1820	46	200
2100	R5	10	4550	143	700	3900	122	600	2470		300	1430	45	200
Milling Amount (mm)		For Roughing	$a_p \leq 0.05D$ $a_e \leq 0.5D$									$a_p \leq 0.04D$ $a_e \leq 0.4D$		
		For Finishing	$a_p \leq 0.04D$ (MAX 0.1) $a_e = F/n$											

ap : Axial Depth (mm)
ae : Radial Depth (mm)
D : Outside Diameter (mm)
n : Speed (min-1)
V f : Feed (mm/min)



Note :
Recommend Airblow or Oil Mist.
Do not use flammable cutting oils.
Use a machine that has high rigidity and generates low level of vibration.
Please decrease feed when cutting load changes such as when cutting corner.
Remove chip to prevent heat generation and ignition.

SAMURAI GB - 3 Flutes Ball (Ø2 – Ø6)



Suitable for the machining of :

Carbon Steel | Stainless Steel | Hardness < 55HRC | Titanium | Copper

Total 4 models

Tool Model	d_1	l_2	l_1	d_2	Price (£)
GB 3020	2	3	45	4	46.64
GB 3030	3	4.5	50	6	54.89
GB 3040	4	6	50	6	54.89
GB 3060	6	9	50	6	57.62

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SAMURAI GB 3 Flutes - Milling conditions

Roughing

WORK MATERIAL			COPPER / ALUMINIUM ALLOYS C1100･A5052･A7075 (～225HB)				ALLOY STEELS / HARDENED STEELS S45C･ S50C･SKD･NAK (～45HRC)				HARDENED STEELS STAVAX･SKD61 (45～55HRC)				TITANIUM ALLOYS /STAINLESS STEELS Ti-6Al-4V･SUS			
Model Number	Radius of Ball Nose (mm)	Outside Diameter (mm)	Speed (min-1)	Feed (mm/min)	Ap (mm)	Ae (mm)	Speed (min-1)	Feed (mm/min)	Ap (mm)	Ae (mm)	Speed (min-1)	Feed (mm/min)	Ap (mm)	Ae (mm)	Speed (min-1)	Feed (mm/min)	Ap (mm)	Ae (mm)
3020	R1	2	30000	3200	0.2	0.6	30000	3200	0.2	0.6	30000	2500	0.2	0.6	24000	4000	0.1	0.4
3030	R1.5	3	24000	4000	0.3	0.9	24000	4000	0.3	0.9	21600	2700	0.3	0.9	16000	4000	0.15	0.65
3040	R2	4	18000	4000	0.4	1.2	18000	4000	0.4	1.2	16200	2700	0.4	1.2	12000	4000	0.2	0.85
3060	R3	6	12000	4000	0.6	1.8	12000	4000	0.6	1.8	10800	2700	0.6	1.8	8000	4000	0.3	1.3

Use Table below to adjust the parameters when compensating the extended overhang

WORK MATERIAL	COPPER / ALUMINIUM ALLOYS C1100･A5052･A7075 (～225HB)				ALLOY STEELS / HARDENED STEELS S45C･ S50C･SKD･NAK (～45HRC)				HARDENED STEELS STAVAX･SKD61 (45～55HRC)				TITANIUM ALLOYS /STAINLESS STEELS Ti-6Al-4V･SUS			
Overhang Length	Speed (min-1)	Feed (mm/min)	Ap (mm)	Ae (mm)	Speed (min-1)	Feed (mm/min)	Ap (mm)	Ae (mm)	Speed (min-1)	Feed (mm/min)	Ap (mm)	Ae (mm)	Speed (min-1)	Feed (mm/min)	Ap (mm)	Ae (mm)
~3D	x1	x1~1.5 (*)	x1	x1	x1	x1	x1	x1	x1	x1	x1	x1	x1	x1	x1	x1
4D	x0.9	x0.9~1.2 (*)	x1	x1	x0.9	x0.9	x1	x1	x0.9	x0.9	x1	x1	x0.9	x0.9	x1	x1
5D	x0.75	x0.75	x1	x1	x0.75	x0.75	x0.9	x0.9	x0.75	x0.75	x0.85	x0.9	x0.75	x0.75	x0.95	x0.95
6D	x0.6	x0.6	x1	x1	x0.6	x0.6	x0.85	x0.9	x0.6	x0.6	x0.8	x0.85	x0.6	x0.6	x0.9	x0.9
7D	x0.45	x0.4	x0.95	x0.95	x0.45	x0.4	x0.8	x0.85	x0.45	x0.4	x0.7	x0.8	x0.45	x0.4	x0.85	x0.9
8D	x0.35	x0.3	x0.9	x0.9	x0.35	x0.3	x0.7	x0.8	x0.35	x0.3	x0.6	x0.75	x0.35	x0.3	x0.8	x0.85

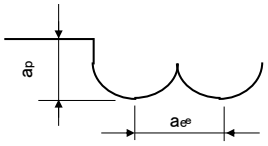
(*) For high effeciency milling, set higher feed rate. For better surface finish and/or longer tool life, reduce the feed rate.

Finishing (Overhand length ~6D)

WORK MATERIAL			COPPER / ALUMINIUM ALLOYS C1100･A5052･A7075 (～225HB)				ALLOY STEELS / HARDENED STEELS S45C･ S50C･SKD･NAK (～45HRC)				HARDENED STEELS STAVAX･SKD61 (45～55HRC)				TITANIUM ALLOYS /STAINLESS STEELS Ti-6Al-4V･SUS			
Model Number	Radius of Ball Nose (mm)	Outside Diameter (mm)	Speed (min-1)	Feed (mm/min)	Ap (mm)	Ae (mm)	Speed (min-1)	Feed (mm/min)	Ap (mm)	Ae (mm)	Speed (min-1)	Feed (mm/min)	Ap (mm)	Ae (mm)	Speed (min-1)	Feed (mm/min)	Ap (mm)	Ae (mm)
3020	R1	2	53000	4000	0.05	0.04	45000	3400	0.05	0.04	36800	2200	0.05	0.04	44200	2700	0.05	0.04
3030	R1.5	3	41200	4200	0.06	0.06	35000	3500	0.06	0.06	28600	2300	0.06	0.06	34400	2800	0.06	0.06
3040	R2	4	29400	4400	0.08	0.08	24000	3700	0.08	0.08	20400	2400	0.08	0.08	24600	3000	0.08	0.08
3060	R3	6	17600	4600	0.1	0.12	14000	3900	0.1	0.12	12300	2600	0.1	0.12	14800	3200	0.1	0.12

If overhang exceeds 6D, fine adjustments are recommended.

ap : Axial Depth (mm)
ae : Radial Depth (mm)
D : Outside Diameter (mm)
n : Speed (min-1)
V f : Feed (mm/min)



Note :
Recommend Airblow or Oil Mist.
Do not use flammable cutting oils.
Use a machine that has high rigidity and generates low level of vibration.
Please decrease feed when cutting load changes such as when cutting corner.
Remove chip to prevent heat generation and ignition.

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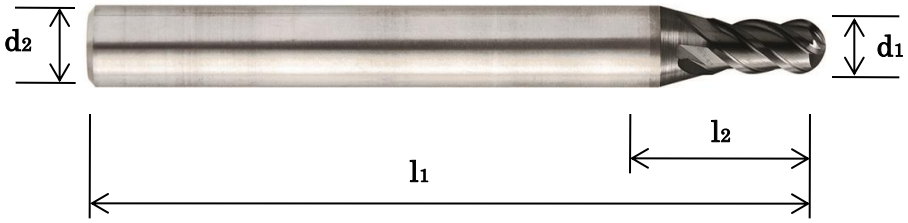
SAMURAI GB - 4 Flutes Ball (Ø2 – Ø6)



Suitable for the machining of :

Carbon Steel | Stainless Steel | Hardness < 55HRC

Total 4 models

Tool Model	d_1	l_2	l_1	d_2	Price (£)
GB 4020	2	3	40	4	46.64
GB 4030	3	4.5	40	4	46.64
GB 4040	4	6	45	6	43.89
GB 4060	6	9	50	6	49.41

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SAMURAI GB 4 Flutes - Milling conditions

Roughing

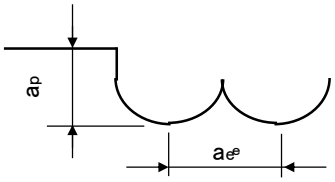
WORK MATERIAL			ALLOY STEELS / PREHARDENED STEELS S45C・S50C・SKD・NAK (～45HRC)				HARDENED STEELS STAVAX・SKD61 (45～55HRC)				STAINLESS STEELS SUS			
Model Number	Radius of Ball Nose (mm)	Outside Diameter (mm)	Speed (min-1)	Feed (mm/min)	Ap (mm)	Ae (mm)	Speed (min-1)	Feed (mm/min)	Ap (mm)	Ae (mm)	Speed (min-1)	Feed (mm/min)	Ap (mm)	Ae (mm)
4020	R1	2	20000	1700	0.5	0.8	16000	1500	0.6	0.9	17000	1400	0.1	0.4
4030	R1.5	3	16000	1800	0.6	0.9	10500	1500	0.9	1.35	12000	1400	0.2	0.8
4040	R2	4	15000	1900	0.4	0.8	9000	3000	0.7	1.4	8500	1500	0.2	0.8
4060	R3	6	9000	2000	0.5	1	8000	3500	0.6	1.8	6000	1600	0.3	1.3

Finishing

WORK MATERIAL			ALLOY STEELS / PREHARDENED STEELS S45C・S50C・SKD・NAK (～45HRC)				HARDENED STEELS STAVAX・SKD61 (45～55HRC)				STAINLESS STEELS SUS			
Model Number	Radius of Ball Nose (mm)	Outside Diameter (mm)	Speed (min-1)	Feed (mm/min)	Ap (mm)	Ae (mm)	Speed (min-1)	Feed (mm/min)	Ap (mm)	Ae (mm)	Speed (min-1)	Feed (mm/min)	Ap (mm)	Ae (mm)
4020	R1	2	26000	2000	0.02	0.06	26000	2000	0.02	0.06	26000	2000	0.02	0.06
4030	R1.5	3	25000	1800	0.03	0.07	25000	1800	0.03	0.07	25000	1800	0.03	0.07
4040	R2	4	22500	1500	0.04	0.08	22500	1500	0.04	0.08	22500	1500	0.04	0.08
4060	R3	6	15000	1000	0.06	0.12	15000	1000	0.06	0.12	15000	1000	0.06	0.12

If overhang exceeds 6D, fine adjustments are recommended.

ap : Axial Depth (mm)
ae : Radial Depth (mm)
D : Outside Diameter (mm)
n : Speed (min-1)
V f : Feed (mm/min)



Note :
Recommend Airblow or Oil Mist.
Do not use flammable cutting oils.
Use a machine that has high rigidity and generates low level of vibration.
Please decrease feed when cutting load changes such as when cutting corner.
Remove chip to prevent heat generation and ignition.

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