MOLDINO
The Edge To Innovation

HGOS-PN / HGOB(LS)-PN

Epoch Panacea series

MOLDINO Tool Engineering, Ltd.
New Product News | No.1222E-13 | 2026-2

PN coating

New coating with amazing adhesion and wear resistance

Features of PN Coating

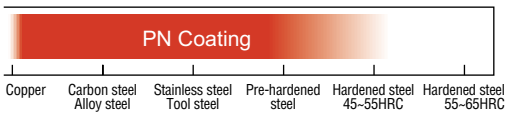
01 A heat-resistant coating material with excellent adhesion to the tool substrate was achieved by optimizing the Al content.

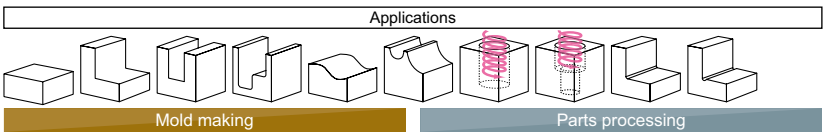
02 Exhibits with good wear resistance due to Si doping to the AlCr coating layer.

03 Exhibits excellent cutting life for cutting materials such as plastic molds, etc. where tool seizure often occurs. (2x the cutting life compared to conventional products.) Provides the long life in cutting processing of materials starting with HPM-MAGIC and including prehardened steel, carbon steel, alloy steel, SUS, SKD61, SKD11, etc.

04 By improving heat resistance, long life are possible for both wet cutting and dry cutting.
Note) This product obtains less electric conductivity. Therefore, Please caution of using electric transmitted measuring systems.

HGOB-PN	RE0.15～RE10	[19 Items]
HGOBLS-PN	RE3～RE10	[8 Items]
HGOS2-PN	φ0.2～φ20	[26 Items]
HGOS4-PN	φ1～φ20	[13Items]

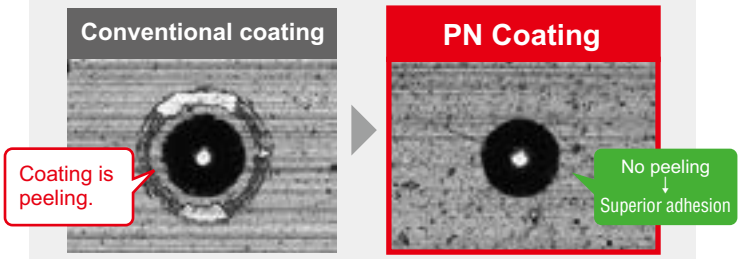




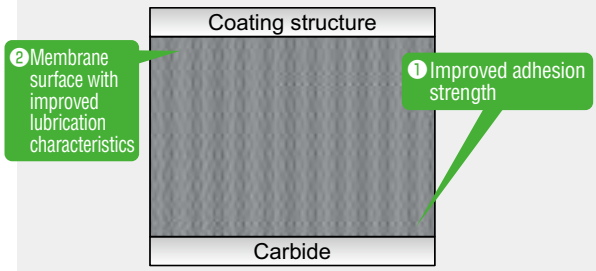
Characteristics

Adhesion of PN Coating

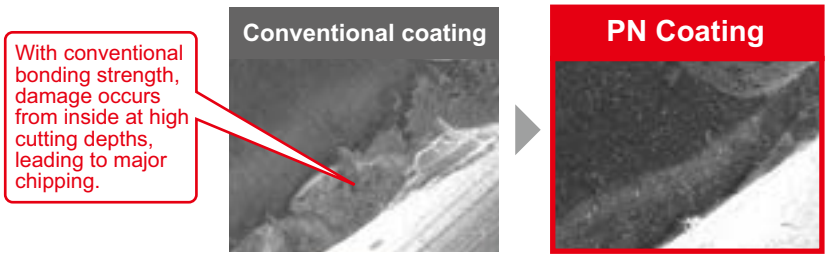
Substrate: Cemented carbide



Cross-sectional structure and characteristics of PN Coating membrane



Coating peeling of PN Coating



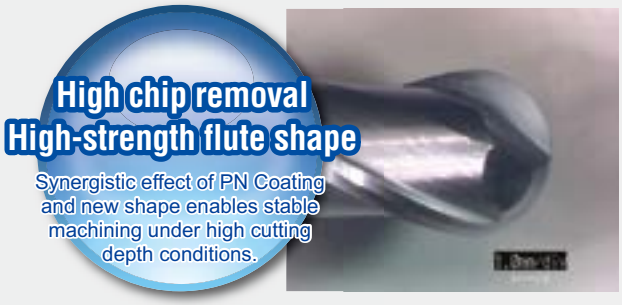
Strengthened bonding structure of PN (Panacea) Coating achieved machining at a higher factor than two the cutting depth.

Epoch Panacea Ball & Epoch Panacea Square

※Panacea: Has the meaning of a cure-all or something that solves all kinds of problems.

Dimensions

Epoch Panacea Ball



Epoch Panacea Square

2-flute, 4-flute square, and 2-flute ball to **handle a wide range of cutting materials.**

Total 66 Items

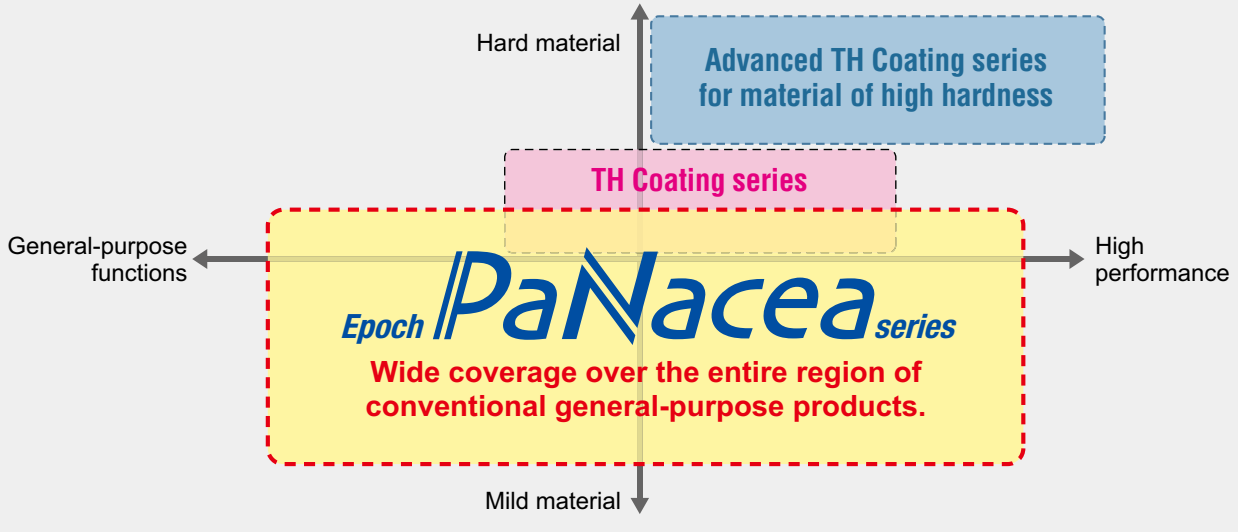
Cutting Area

Newly developed PN Coating enables high-efficiency cutting in a wide variety of materials over a wide range from roughing to finishing.

■ **Panacea series applicable materials table**

Work material	Applicable
Low-carbon steel	◎
Alloy steels	◎
Pre-hardened steels	◎
Hardened steels	○
Stainless steels	◎
Cast iron, Ductile cast iron	◎
Non-ferric Aluminum alloy; Copper	◎

※Excluding high-Si aluminum alloys.



Applicable to machining of plastic injection molds, diecast molds, press dies, or various parts.

※Compared to conventional product.

Ball nose, Regular

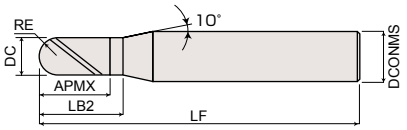
High efficiency cutting with twice as much cutting depth!!

HGOB-PN

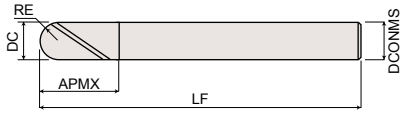
RE accuracy : Right table

Tolerance on shank : h5

A type



B type



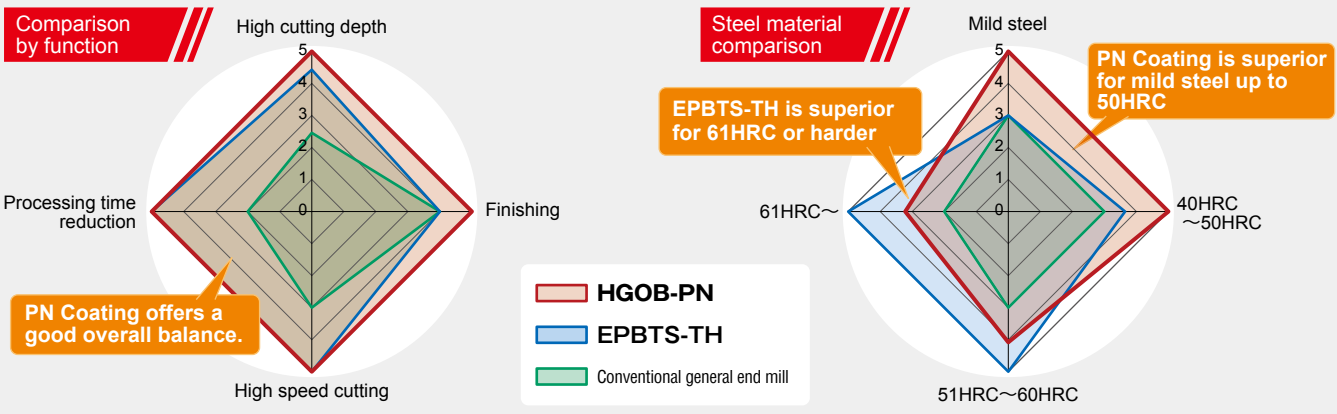
(mm)

Ball radis RE	RE accuracy
0.15~6	±0.005
8~10	±0.01

HGOB2○○○(-○)-PN

Item code	Stock	Size (mm)						No. of flutes	Type
		Ball radius	Tool dia.	Flute length	Under neck length	Overall length	Shank dia.		
		RE	DC	APMX	LB2	LF	DCONMS		
HGOB2003-PN	●	0.15	0.3	0.6	0.9	50	4	2	A
HGOB2004-PN	●	0.2	0.4	0.8	1.1	50	4	2	A
HGOB2005-PN	●	0.25	0.5	1	1.3	50	4	2	A
HGOB2006-PN	●	0.3	0.6	1.2	1.5	50	4	2	A
HGOB2008-PN	●	0.4	0.8	1.6	1.9	50	4	2	A
HGOB2010-PN	●	0.5	1	2.5	3.5	50	4	2	A
HGOB2015-PN	●	0.75	1.5	4	5	50	4	2	A
HGOB2020-PN	●	1	2	5	6	50	6	2	A
HGOB2025-PN	●	1.25	2.5	7	8	50	6	2	A
HGOB2030-PN	●	1.5	3	8	9	70	6	2	A
HGOB2040-4-PN	●	2	4	8	-	70	4	2	B
HGOB2040-PN	●	2	4	8	9	70	6	2	A
HGOB2050-PN	●	2.5	5	10	11	80	6	2	A
HGOB2060-PN	●	3	6	12	-	90	6	2	B
HGOB2080-PN	●	4	8	14	-	100	8	2	B
HGOB2100-PN	●	5	10	18	-	100	10	2	B
HGOB2120-PN	●	6	12	22	-	110	12	2	B
HGOB2160-PN	●	8	16	30	-	140	16	2	B
HGOB2200-PN	●	10	20	38	-	160	20	2	B

Epoch Panacea Ball positioning diagram



●:Stoked items.

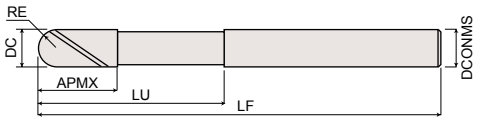
Ball nose, Long shank

HGOBLS-PN

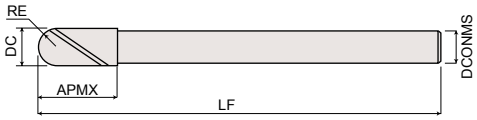
RE accuracy : Right table

Tolerance on shank : h6

A type



B type



(mm)

Ball radis RE	RE accuracy
3~6	±0.015
8~10	±0.02

HGOBLS2○○○(-○○○)-PN

Item code	Stock	Size (mm)						No. of flutes	Type
		Ball radius	Tool dia.	Flute length	Under neck length	Overall length	Shank dia.		
		RE	DC	APMX	LU	LF	DCONMS		
HGOBLS2060-45-PN	●	3	6	9	45	115	6	2	A
HGOBLS2060-75-PN	●	3	6	9	75	150	6	2	A
HGOBLS2080-55-PN	●	4	8	12	55	125	8	2	A
HGOBLS2080-105-PN	●	4	8	12	105	180	8	2	A
HGOBLS2100-PN	●	5	10	15	–	200	9	2	B
HGOBLS2120-PN	●	6	12	18	–	220	11	2	B
HGOBLS2160-PN	●	8	16	24	–	250	14	2	B
HGOBLS2200-PN	●	10	20	30	–	250	18	2	B

Re-grinding compatibility range table

Item code	Product name	Line up tool dia. (mm)	Shape	Re-grinding compatibility range(mm)	
				Outer dia.	End
HGOB-PN	Epoch Panacea Ball	0.3~20		N/A	1~20
HGOBLS-PN	Epoch Panacea Ball -Long Shank	6~20		N/A	6~20
HGOS2-PN	Epoch Panacea Square -2 Flutes	0.2~20		6~20	2~20
HGOS4-PN	Epoch Panacea Square -4 Flutes	1~20		6~20	2~20

【Note】

Contact our sales office regarding whether or not regrinding is possible for tools where Under neck length/Tool diameter is 10DC or greater.

Square, Regular

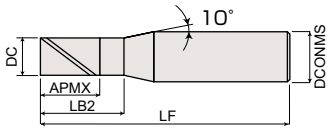
2 Flutes

Tolerance on dia. : Right table Tolerance on shank : h5

4 Flutes

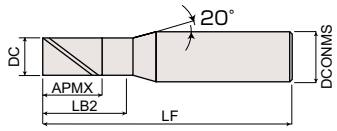
Tolerance on dia. : Right table Tolerance on shank : h5

A type



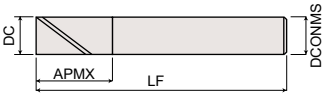
※Without neck escape

B type



※Without neck escape

C type



(mm)

Tool dia.	Dia. tolerance
0.2~0.9	0~−0.015
1~20	0~−0.02

2 flutes HGOS2○○○-PN

Item code	Stock	Size (mm)					No. of flutes	Type
		Tool dia.	Flute length	Under neck length	Overall length	Shank dia.		
		DC	APMX	LB2	LF	DCONMS		
HGOS2002-PN	●	0.2	0.4	0.6	40	4	2	A
HGOS2003-PN	●	0.3	0.6	0.9	40	4	2	A
HGOS2004-PN	●	0.4	0.8	1.1	40	4	2	A
HGOS2005-PN	●	0.5	1	1.3	40	4	2	A
HGOS2006-PN	●	0.6	1.2	1.5	40	4	2	A
HGOS2007-PN	●	0.7	1.4	1.7	40	4	2	A
HGOS2008-PN	●	0.8	1.6	1.9	40	4	2	A
HGOS2009-PN	●	0.9	1.8	2.1	40	4	2	A
HGOS2010-PN	●	1	2	2.5	40	4	2	A
HGOS2015-PN	●	1.5	3	3.5	40	4	2	A
HGOS2020-PN	●	2	6	7	40	4	2	A
HGOS2025-PN	●	2.5	8	9	40	4	2	A
HGOS2030-PN	●	3	8	9	45	6	2	A
HGOS2035-PN	●	3.5	10	11	45	6	2	A
HGOS2040-PN	●	4	11	12	45	6	2	B
HGOS2045-PN	●	4.5	11	12	45	6	2	B
HGOS2050-PN	●	5	13	14	60	6	2	B
HGOS2055-PN	●	5.5	13	14	60	6	2	B
HGOS2060-PN	●	6	13	–	60	6	2	C
HGOS2070-PN	●	7	16	17	70	8	2	B
HGOS2080-PN	●	8	19	–	75	8	2	C
HGOS2090-PN	●	9	19	20	80	10	2	B
HGOS2100-PN	●	10	22	–	80	10	2	C
HGOS2120-PN	●	12	26	–	100	12	2	C
HGOS2160-PN	●	16	35	–	110	16	2	C
HGOS2200-PN	●	20	40	–	125	20	2	C

4 flutes HGOS4○○○-PN

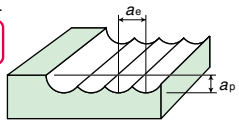
Item code	Stock	Size (mm)					No. of flutes	Type
		Tool dia.	Flute length	Under neck length	Overall length	Shank dia.		
		DC	APMX	LB2	LF	DCONMS		
HGOS4010-PN	●	1	2.5	3	40	4	4	A
HGOS4015-PN	●	1.5	4	4.5	40	4	4	A
HGOS4020-PN	●	2	6	7	40	4	4	A
HGOS4025-PN	●	2.5	8	9	40	4	4	A
HGOS4030-PN	●	3	10	11	45	6	4	A
HGOS4040-PN	●	4	12	13	45	6	4	B
HGOS4050-PN	●	5	15	16	60	6	4	B
HGOS4060-PN	●	6	15	–	60	6	4	C
HGOS4080-PN	●	8	20	–	75	8	4	C
HGOS4100-PN	●	10	25	–	80	10	4	C
HGOS4120-PN	●	12	30	–	100	12	4	C
HGOS4160-PN	●	16	35	–	110	16	4	C
HGOS4200-PN	●	20	40	–	125	20	4	C

● : Stoked items.

Recommended Cutting Conditions

※Compared to conventional product.

High efficiency cutting with twice as much cutting depth!!



Ball nose, Regular　HGOB-PN

Types of finishing	Ball radius RE (mm)	Tool dia. DC (mm)	Flute length APMX (mm)	Copper alloys, Aluminium alloys				Cast irons, Carbon steels (150～200HB) FC250,S50C,S55C				Stainless steels (25～35HRC) SUS304,SUS316			
				Revolution min^{-1}	Feed rate mm/min	ap mm	ae mm	Revolution min^{-1}	Feed rate mm/min	ap mm	ae mm	Revolution min^{-1}	Feed rate mm/min	ap mm	ae mm
Roughing	0.15	0.3	0.6	35,032	2,102	0.039	0.117	31,847	1,911	0.039	0.117	28,662	1,720	0.038	0.112
	0.2	0.4	0.8	35,032	2,102	0.052	0.156	31,847	1,911	0.052	0.156	28,662	1,720	0.050	0.150
	0.25	0.5	1	35,032	2,102	0.065	0.195	31,847	1,911	0.065	0.195	28,662	1,720	0.063	0.187
	0.3	0.6	1.2	29,193	2,335	0.078	0.234	26,539	2,123	0.078	0.234	23,885	1,911	0.075	0.225
	0.4	0.8	1.6	26,274	2,102	0.104	0.312	23,885	1,911	0.104	0.312	21,497	1,720	0.100	0.300
	0.5	1	2.5	28,025	2,803	0.130	0.390	25,478	2,548	0.130	0.390	22,930	2,293	0.125	0.375
	0.75	1.5	4	25,690	3,083	0.195	0.585	23,355	2,803	0.195	0.585	21,019	2,522	0.188	0.562
	1	2	5	24,522	3,433	0.260	0.780	22,293	3,121	0.260	0.780	20,064	2,809	0.250	0.750
	1.25	2.5	7	22,420	3,587	0.325	0.975	20,382	3,261	0.325	0.975	18,344	2,935	0.313	0.937
	1.5	3	8	21,019	3,783	0.390	1.170	19,108	3,439	0.390	1.170	17,197	3,096	0.375	1.125
	2	4	8	20,143	4,029	0.520	1.560	18,312	3,662	0.520	1.560	16,481	3,296	0.500	1.500
			8	20,143	4,834	0.520	1.560	18,312	4,395	0.520	1.560	16,481	3,955	0.500	1.500
	2.5	5	10	18,217	5,101	0.650	1.950	16,561	4,637	0.650	1.950	14,904	4,173	0.625	1.875
	3	6	12	15,764	5,045	0.780	2.340	14,331	4,586	0.780	2.340	12,898	4,127	0.750	2.250
	4	8	14	12,699	4,572	1.040	3.120	11,545	4,156	1.040	3.120	10,390	3,740	1.000	3.000
	5	10	18	10,860	4,344	1.300	3.900	9,873	3,949	1.300	3.900	8,885	3,554	1.250	3.750
	6	12	22	9,634	4,239	1.560	4.680	8,758	3,854	1.560	4.680	7,882	3,468	1.500	4.500
	8	16	30	7,444	3,573	2.080	6.240	6,768	3,248	2.080	6.240	6,091	2,924	2.000	6.000
	10	20	38	5,955	3,097	2.600	7.800	5,414	2,815	2.600	7.800	4,873	2,534	2.500	7.500
Finishing	0.15	0.3	0.6	44,586	1,783	0.015	0.015	37,155	1,486	0.015	0.015	33,439	1,204	0.015	0.015
	0.2	0.4	0.8	42,994	1,720	0.020	0.020	35,828	1,433	0.020	0.020	32,245	1,161	0.020	0.020
	0.25	0.5	1	42,038	1,682	0.025	0.025	35,032	1,401	0.025	0.025	31,529	1,135	0.025	0.025
	0.3	0.6	1.2	35,032	2,102	0.030	0.030	29,193	1,752	0.030	0.030	26,274	1,419	0.030	0.030
	0.4	0.8	1.6	31,051	1,863	0.040	0.040	25,876	1,553	0.040	0.040	23,288	1,258	0.040	0.040
	0.5	1	2.5	30,573	1,834	0.050	0.050	25,478	1,529	0.050	0.050	22,930	1,238	0.050	0.050
	0.75	1.5	4	29,299	1,758	0.075	0.075	24,416	1,465	0.075	0.075	21,975	1,187	0.075	0.075
	1	2	5	29,618	2,369	0.100	0.100	24,682	1,975	0.100	0.100	22,213	1,599	0.100	0.100
	1.25	2.5	7	28,280	2,262	0.125	0.125	23,567	1,885	0.125	0.125	21,210	1,527	0.125	0.125
	1.5	3	8	26,115	2,089	0.150	0.150	21,762	1,741	0.150	0.150	19,586	1,410	0.150	0.150
	2	4	8	24,363	1,949	0.200	0.200	20,303	1,624	0.200	0.200	18,272	1,316	0.200	0.200
			8	24,363	2,436	0.200	0.200	20,303	2,030	0.200	0.200	18,272	1,645	0.200	0.200
	2.5	5	10	22,548	2,255	0.250	0.250	18,790	1,879	0.250	0.250	16,911	1,522	0.250	0.250
	3	6	12	19,427	2,331	0.300	0.300	16,189	1,943	0.300	0.300	14,570	1,574	0.300	0.300
	4	8	14	16,003	1,920	0.400	0.400	13,336	1,600	0.400	0.400	12,002	1,296	0.400	0.400
	5	10	18	14,713	2,060	0.500	0.500	12,261	1,717	0.500	0.500	11,035	1,390	0.500	0.500
	6	12	22	13,535	2,436	0.600	0.600	11,279	2,030	0.600	0.600	10,151	1,645	0.600	0.600
	8	16	30	10,868	2,174	0.800	0.800	9,057	1,811	0.800	0.800	8,151	1,467	0.800	0.800
	10	20	38	7,739	1,548	1.000	1.000	6,449	1,290	1.000	1.000	5,804	1,045	1.000	1.000

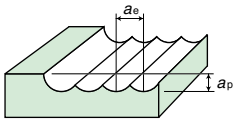
【Note】

① PN Coating is less electro conductive. Therefore, electric transmitted measuring systems may not work.
② Use the appropriate coolant for the work material and machining shape.
③ Use a highly rigid and accurate machine as possible.
④ The pick feed in the table is a general condition; please select the a_e according to the cusp height requested.
⑤ These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions.
⑥ If the rpm available is lower than that recommended please reduce the feed rate to the same ratio.

Recommended Cutting Conditions

※Compared to conventional product.

High efficiency cutting with twice as much cutting depth!!



Ball nose, Regular　HGOB-PN

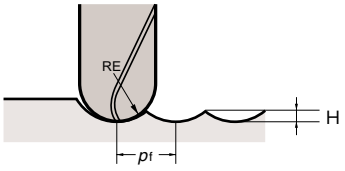
Types of finishing	Ball radius RE (mm)	Tool dia. DC (mm)	Flute length APMX (mm)	Alloy steels (25～35HRC) HPM7,SKD61Ⓐ,SKT4				Pre-hardened steels (35～45HRC) HPM-MAGIC,CENA1,NAK80				Hardened steels (45～52HRC) SKD61Ⓗ,HPM38,DAC-MAGIC			
				Revolution min^{-1}	Feed rate mm/min	ap mm	ae mm	Revolution min^{-1}	Feed rate mm/min	ap mm	ae mm	Revolution min^{-1}	Feed rate mm/min	ap mm	ae mm
Roughing	0.15	0.3	0.6	28,662	1,634	0.036	0.108	25,796	1,393	0.035	0.103	22,930	1,176	0.033	0.099
	0.2	0.4	0.8	28,662	1,634	0.048	0.144	25,796	1,393	0.046	0.138	22,930	1,176	0.044	0.132
	0.25	0.5	1	28,662	1,634	0.060	0.180	25,796	1,393	0.058	0.172	22,930	1,176	0.055	0.165
	0.3	0.6	1.2	23,885	1,815	0.072	0.216	21,497	1,548	0.069	0.207	19,108	1,307	0.066	0.198
	0.4	0.8	1.6	21,497	1,634	0.096	0.288	19,347	1,393	0.092	0.276	17,197	1,176	0.088	0.264
	0.5	1	2.5	22,930	2,178	0.120	0.360	20,637	1,857	0.115	0.345	18,344	1,568	0.110	0.330
	0.75	1.5	4	21,019	2,396	0.180	0.540	18,917	2,043	0.173	0.517	16,815	1,725	0.165	0.495
	1	2	5	20,064	2,668	0.240	0.720	18,057	2,275	0.230	0.690	16,051	1,921	0.220	0.660
	1.25	2.5	7	18,344	2,788	0.300	0.900	16,510	2,377	0.288	0.862	14,675	2,008	0.275	0.825
	1.5	3	8	17,197	2,941	0.360	1.080	15,478	2,507	0.345	1.035	13,758	2,117	0.330	0.990
	2	4	8	16,481	3,131	0.480	1.440	14,833	2,670	0.460	1.380	13,185	2,255	0.440	1.320
			8	16,481	3,758	0.480	1.440	14,833	3,204	0.460	1.380	13,185	2,706	0.440	1.320
	2.5	5	10	14,904	3,965	0.600	1.800	13,414	3,380	0.575	1.725	11,924	2,855	0.550	1.650
	3	6	12	12,898	3,921	0.720	2.160	11,608	3,343	0.690	2.070	10,318	2,823	0.660	1.980
	4	8	14	10,390	3,553	0.960	2.880	9,351	3,030	0.920	2.760	8,312	2,558	0.880	2.640
	5	10	18	8,885	3,376	1.200	3.600	7,997	2,879	1.150	3.450	7,108	2,431	1.100	3.300
	6	12	22	7,882	3,295	1.440	4.320	7,094	2,809	1.380	4.140	6,306	2,372	1.320	3.960
	8	16	30	6,091	2,777	1.920	5.760	5,482	2,368	1.840	5.520	4,873	2,000	1.760	5.280
	10	20	38	4,873	2,407	2.400	7.200	4,385	2,052	2.300	6.900	3,898	1,733	2.200	6.600
Finishing	0.15	0.3	0.6	33,439	1,204	0.012	0.012	30,096	975	0.009	0.009	26,752	770	0.009	0.009
	0.2	0.4	0.8	32,245	1,161	0.016	0.016	29,021	940	0.012	0.012	25,796	743	0.012	0.012
	0.25	0.5	1	31,529	1,135	0.020	0.020	28,376	919	0.015	0.015	25,223	726	0.015	0.015
	0.3	0.6	1.2	26,274	1,419	0.024	0.024	23,646	1,149	0.018	0.018	21,019	908	0.018	0.018
	0.4	0.8	1.6	23,288	1,258	0.032	0.032	20,959	1,019	0.024	0.024	18,631	805	0.024	0.024
	0.5	1	2.5	22,930	1,238	0.040	0.040	20,637	1,003	0.030	0.030	18,344	792	0.030	0.030
	0.75	1.5	4	21,975	1,187	0.060	0.060	19,777	961	0.045	0.045	17,580	759	0.045	0.045
	1	2	5	22,213	1,599	0.080	0.080	19,992	1,295	0.060	0.060	17,771	1,024	0.060	0.060
	1.25	2.5	7	21,210	1,527	0.100	0.100	19,089	1,237	0.075	0.075	16,968	977	0.075	0.075
	1.5	3	8	19,586	1,410	0.120	0.120	17,627	1,142	0.090	0.090	15,669	903	0.090	0.090
	2	4	8	18,272	1,316	0.160	0.160	16,445	1,066	0.120	0.120	14,618	842	0.120	0.120
			8	18,272	1,645	0.160	0.160	16,445	1,332	0.120	0.120	14,618	1,052	0.120	0.120
	2.5	5	10	16,911	1,522	0.200	0.200	15,220	1,233	0.150	0.150	13,529	974	0.150	0.150
	3	6	12	14,570	1,574	0.240	0.240	13,113	1,275	0.180	0.180	11,656	1,007	0.180	0.180
	4	8	14	12,002	1,296	0.320	0.320	10,802	1,050	0.240	0.240	9,602	830	0.240	0.240
	5	10	18	11,035	1,390	0.400	0.400	9,932	1,126	0.300	0.300	8,828	890	0.300	0.300
	6	12	22	10,151	1,645	0.480	0.480	9,136	1,332	0.360	0.360	8,121	1,052	0.360	0.360
	8	16	30	8,151	1,467	0.640	0.640	7,336	1,188	0.480	0.480	6,521	939	0.480	0.480
	10	20	38	5,804	1,045	0.800	0.800	5,224	846	0.600	0.600	4,643	669	0.600	0.600

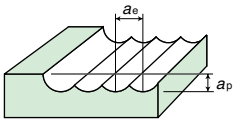
Ball end mill pick feed and theoretical cusp height table (μm)

Ball radius RE (mm)	Pick feed : pf (mm) 0.02	0.03	0.04	0.05	0.075	0.1	0.15	0.2	0.3	0.4	0.5
0.1	0.50	1.13	2.02	3.18	–	–	–	–	–	–	–
0.3	0.17	0.38	0.67	1.04	2.35	4.20	9.53	–	–	–	–
0.5	0.10	0.23	0.40	0.63	1.41	2.51	5.66	10.10	23.03	41.74	66.99
1	0.05	0.11	0.20	0.31	0.70	1.25	2.82	5.01	11.31	20.20	31.75
1.5	0.03	0.08	0.13	0.21	0.47	0.83	1.88	3.34	7.52	13.39	20.98
2	0.03	0.06	0.10	0.16	0.35	0.63	1.41	2.50	5.63	10.03	15.69
2.5	0.02	0.05	0.08	0.13	0.28	0.50	1.13	2.00	4.50	8.01	12.53
3	0.017	0.04	0.07	0.10	0.23	0.42	0.94	1.67	3.75	6.67	10.43
4	0.013	0.03	0.05	0.08	0.18	0.31	0.70	1.25	2.81	5.00	7.82
5	0.010	0.02	0.04	0.06	0.14	0.25	0.56	1.00	2.25	4.00	6.25
6	0.008	0.02	0.03	0.05	0.12	0.21	0.47	0.83	1.88	3.33	5.21

Pick feed and cusp height

$H = RE - \sqrt{RE^2 - pf^2/4} \fallingdotseq pf^2/8RE$





Ball nose, Long shank　HGOBLS2-PN

Types of finishing	Ball radius RE (mm)	Tool dia. DC (mm)	Flute length APMX (mm)	Under neck length LB2 (mm)	Work material	Copper alloys Aluminium alloys		Cast Irons Carbon steels (150～220HB) FC250 S50C,S55C		Stainless steels (25～35HRC) SUS304 SUS316		Alloy steels (25～35HRC) HPM7 SKD61Ⓐ,SKT4		Pre-hardened steels (35～45HRC) HPM-MAGIC CENA1,NAK80		Hardened steels (45～52HRC) SKD61Ⓗ,HPM38 DAC-MAGIC	
					Ratio to standard depth of cut	120%		100%		90%		80%		70%		50%	
					Standard depth of cut ap mm	Revolution min-1	Feed rate mm/min	Revolution min-1	Feed rate mm/min	Revolution min-1	Feed rate mm/min	Revolution min-1	Feed rate mm/min	Revolution min-1	Feed rate mm/min	Revolution min-1	Feed rate mm/min
Roughing	3	6	9	45	0.42	9,550	2,670	7,960	2,230	6,630	1,860	6,630	1,860	6,630	1,190	5,300	950
			9	75	0.25	8,350	2,320	6,960	1,940	5,630	1,570	5,630	1,570	5,630	1,010	4,300	770
	4	8	12	55	0.64	7,160	2,290	5,970	1,910	4,980	1,590	4,980	1,590	4,980	1,100	3,980	880
			12	105	0.35	5,960	1,900	4,970	1,590	3,980	1,270	3,980	1,270	3,980	880	2,980	650
	5	10	15	–	1	5,720	2,060	4,770	1,720	3,980	1,430	3,980	1,430	3,980	1,030	3,180	830
	6	12	18	–	1.2	4,770	1,900	3,980	1,590	3,320	1,330	3,320	1,330	3,320	1,000	2,650	800
	8	16	24	–	1.6	3,570	1,600	2,980	1,340	2,490	1,120	2,490	1,120	2,490	850	1,990	680
	10	20	30	–	2	2,860	1,280	2,390	1,070	1,990	900	1,990	900	1,990	680	1,590	540
Finishing	3	6	9	45	0.05~0.1	9,550	1,865	7,960	1,554	7,960	1,102	7,960	1,102	7,960	638	6,630	504
			9	75	0.05~0.1	8,350	1,678	6,960	1,398	6,960	991	6,960	991	6,960	574	5,630	453
	4	8	12	55	0.05~0.1	7,160	1,536	5,970	1,280	5,970	907	5,970	907	5,970	563	4,980	415
			12	105	0.05~0.1	5,960	1,382	4,970	1,152	4,970	816	4,970	816	4,970	507	3,980	374
	5	10	15	–	0.05~0.15	5,720	1,648	4,770	1,374	4,770	973	4,770	973	4,770	563	3,980	445
	6	12	18	–	0.05~0.15	4,770	1,900	3,980	1,590	3,980	1,152	3,980	1,152	3,980	666	3,320	526
	8	16	24	–	0.05~0.2	3,570	1,600	2,980	1,340	2,980	1,027	2,980	1,027	2,980	594	2,490	470
	10	20	30	–	0.05~0.2	2,860	1,238	2,390	1,032	2,390	732	2,390	732	2,390	423	1,990	335

Regarding cutting depth for ball nose, long-shank products

ap

【Roughing】

Overhang ratio	
5D or less	Standard depth of cut×Ratio to standard depth of cut
6D	0.9×Standard depth of cut×Ratio to standard depth of cut
7D	0.8×Standard depth of cut×Ratio to standard depth of cut
8D	0.7×Standard depth of cut×Ratio to standard depth of cut
9D	0.6×Standard depth of cut×Ratio to standard depth of cut
10D	0.5×Standard depth of cut×Ratio to standard depth of cut

【Finishing】

Refer to the values in the table.

ae

【Roughing】

3 times the a_p as general criteria

【Finishing】

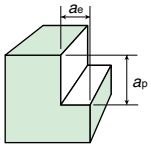
Select the desired value according the theoretical cusp height.

【Note】

① PN Coating is less electro conductive. Therefore, electric transmitted measuring systems may not work.
② Use the appropriate coolant for the work material and machining shape.
③ Use a highly rigid and accurate machine as possible.
④ The pick feed in the table is a general condition; please select the a_e according to the cusp height requested.
⑤ These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions.
⑥ If the rpm available is lower than that recommended please reduce the feed rate to the same ratio.

Recommended Cutting Conditions

HGOS2-PN
HGOS4-PN



Square

Side cutting

Tool dia. DC (mm)	Flute length APMX (mm)	Copper alloys, Aluminium alloys				Cast irons, Carbon steels (150～200HB) FC250,S50C,S55C				Stainless steels (25～35HRC) SUS304,SUS316			
		Revolution min^{-1}	Feed rate mm/min	a_p mm	a_e mm	Revolution min^{-1}	Feed rate mm/min	a_p mm	a_e mm	Revolution min^{-1}	Feed rate mm/min	a_p mm	a_e mm
0.2	0.4	66,879	669	0.300	0.010	55,732	557	0.300	0.010	33,439	301	0.300	0.008
0.3	0.6	44,586	446	0.450	0.015	37,155	372	0.450	0.015	22,293	201	0.450	0.012
0.4	0.8	38,217	382	0.600	0.020	27,866	279	0.600	0.020	16,720	150	0.600	0.016
0.5	1	38,217	382	0.750	0.025	25,478	255	0.750	0.025	15,287	138	0.750	0.020
0.6	1.2	41,401	662	0.900	0.030	26,539	425	0.900	0.030	15,924	229	0.900	0.024
0.7	1.4	35,487	568	1.050	0.035	29,572	473	1.050	0.035	17,743	256	1.050	0.028
0.8	1.6	33,439	535	1.200	0.040	25,876	414	1.200	0.040	15,525	224	1.200	0.032
0.9	1.8	33,970	544	1.350	0.045	24,770	396	1.350	0.045	14,862	214	1.350	0.036
1	2	38,217	764	1.500	0.050	25,478	510	1.500	0.050	15,287	275	1.500	0.040
1.5	3	28,025	561	2.250	0.150	21,231	425	2.250	0.150	12,739	229	2.250	0.135
2	6	21,019	631	3.000	0.200	17,516	525	3.000	0.200	10,510	284	3.000	0.180
2.5	8	16,815	504	3.750	0.250	14,013	420	3.750	0.250	8,408	227	3.750	0.225
3	8	15,287	611	4.500	0.300	11,677	467	4.500	0.300	7,006	252	4.500	0.270
3.5	10	13,103	524	5.250	0.350	10,919	437	5.250	0.350	6,551	236	5.250	0.315
4	11	11,465	573	6.000	0.400	9,554	478	6.000	0.400	5,732	258	6.000	0.360
4.5	11	10,191	510	6.750	0.450	8,493	425	6.750	0.450	5,096	229	6.750	0.405
5	13	9,172	550	7.500	0.500	7,643	459	7.500	0.500	4,586	248	7.500	0.450
5.5	13	8,338	500	8.250	0.550	6,948	417	8.250	0.550	4,169	225	8.250	0.495
6	13	7,643	459	9.000	0.600	6,369	382	9.000	0.600	3,822	206	9.000	0.540
7	16	6,551	459	10.500	0.700	5,460	382	10.500	0.700	3,276	206	10.500	0.630
8	19	5,732	401	12.000	0.800	4,777	334	12.000	0.800	2,866	181	12.000	0.720
9	19	5,096	408	13.500	0.900	4,246	340	13.500	0.900	2,548	183	13.500	0.810
10	22	4,586	459	15.000	1.000	3,822	382	15.000	1.000	2,293	206	15.000	0.900
12	26	3,822	459	18.000	1.200	3,185	382	18.000	1.200	1,911	206	18.000	1.080
16	35	2,866	401	24.000	1.600	2,389	334	24.000	1.600	1,433	181	24.000	1.440
20	40	2,293	367	30.000	2.000	1,911	306	30.000	2.000	1,146	165	30.000	1.800

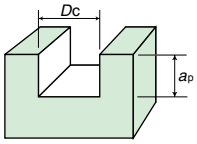
Tool dia. DC (mm)	Flute length APMX (mm)	Alloy steels (25～35HRC) HPM7,SKD61Ⓐ,SKT4				Pre-hardened steels (35～45HRC) HPM-MAGIC,CENA1,NAK80				Hardened steels (45～52HRC) SKD61Ⓗ,HPM38,DAC-MAGIC			
		Revolution min^{-1}	Feed rate mm/min	a_p mm	a_e mm	Revolution min^{-1}	Feed rate mm/min	a_p mm	a_e mm	Revolution min^{-1}	Feed rate mm/min	a_p mm	a_e mm
0.2	0.4	33,439	301	0.300	0.008	26,752	217	0.300	0.006	16,720	105	0.300	0.006
0.3	0.6	22,293	201	0.450	0.012	17,834	144	0.450	0.009	11,146	70	0.450	0.009
0.4	0.8	16,720	150	0.600	0.016	13,376	108	0.600	0.012	8,360	53	0.600	0.012
0.5	1	15,287	138	0.750	0.020	12,229	99	0.750	0.015	7,643	48	0.750	0.015
0.6	1.2	15,924	229	0.900	0.024	12,739	165	0.900	0.018	7,962	80	0.900	0.018
0.7	1.4	17,743	256	1.050	0.028	14,195	184	1.050	0.021	8,872	89	1.050	0.021
0.8	1.6	15,525	224	1.200	0.032	12,420	161	1.200	0.024	7,763	78	1.200	0.024
0.9	1.8	14,862	214	1.350	0.036	11,890	154	1.350	0.027	7,431	75	1.350	0.027
1	2	15,287	275	1.500	0.040	12,229	198	1.500	0.030	7,643	96	1.500	0.030
1.5	3	12,739	229	2.250	0.135	10,191	165	2.250	0.120	6,369	80	2.250	0.045
2	6	10,510	284	3.000	0.180	6,115	149	3.000	0.160	5,732	108	3.000	0.060
2.5	8	8,408	227	3.750	0.225	5,707	139	3.750	0.200	5,350	101	3.750	0.075
3	8	7,006	252	4.500	0.270	5,096	165	4.500	0.240	4,777	120	4.500	0.090
3.5	10	6,551	236	5.250	0.315	4,659	151	5.250	0.280	4,368	110	5.250	0.105
4	11	5,732	258	6.000	0.360	4,331	175	6.000	0.320	4,061	128	6.000	0.120
4.5	11	5,096	229	6.750	0.405	4,076	165	6.750	0.360	3,822	120	6.750	0.135
5	13	4,586	248	7.500	0.450	3,873	188	7.500	0.400	3,631	137	7.500	0.150
5.5	13	4,169	225	8.250	0.495	3,706	180	8.250	0.440	3,474	131	8.250	0.165
6	13	3,822	206	9.000	0.540	3,397	165	9.000	0.480	3,185	120	9.000	0.180
7	16	3,276	206	10.500	0.630	2,912	165	10.500	0.560	2,730	120	10.500	0.210
8	19	2,866	181	12.000	0.720	2,548	144	12.000	0.640	2,389	105	12.000	0.240
9	19	2,548	183	13.500	0.810	2,265	147	13.500	0.720	2,123	107	13.500	0.270
10	22	2,293	206	15.000	0.900	2,038	165	15.000	0.800	1,911	120	15.000	0.300
12	26	1,911	206	18.000	1.080	1,699	165	18.000	0.960	1,592	120	18.000	0.360
16	35	1,433	181	24.000	1.440	1,274	144	24.000	1.280	1,194	105	24.000	0.480
20	40	1,146	165	30.000	1.800	1,019	132	30.000	1.600	955	96	30.000	0.600

【Note】

① PN Coating is less electro conductive. Therefore, electric transmitted measuring systems may not work.
② The cutting conditions given above is applied to 2 flutes type end mills. As for 4 flutes type, increase the feed rate by 1.5 times.
③ Use a highly rigid and accurate machine as possible.
④ Use the appropriate coolant for the work material and machining shape.
⑤ These conditions are for general guidance; in actual machining conditions adjust the parameters according to your actual machine and work-piece conditions.
⑥ If the rpm available is lower than that recommended please reduce the feed rate to the same ratio.

Square

HGOS2-PN



Slotting

Tool dia. DC (mm)	Flute length APMX (mm)	Copper alloys, Aluminium alloys			Cast irons, Carbon steels (150～200HB) FC250,S50C,S55C			Stainless steels (25～35HRC) SUS304,SUS316		
		Revolution min^{-1}	Feed rate mm/min	a_p mm	Revolution min^{-1}	Feed rate mm/min	a_p mm	Revolution min^{-1}	Feed rate mm/min	a_p mm
0.2	0.4	58,678	235	0.01	53,344	213	0.01	37,341	157	0.01
0.3	0.6	39,119	156	0.02	35,563	142	0.02	24,894	120	0.02
0.4	0.8	35,032	140	0.02	26,672	107	0.02	22,293	103	0.02
0.5	1	31,529	126	0.03	25,478	102	0.03	20,064	103	0.03
0.6	1.2	32,113	180	0.03	23,885	191	0.03	20,435	143	0.03
0.7	1.4	30,027	240	0.04	25,023	200	0.04	19,108	161	0.04
0.8	1.6	28,463	228	0.04	23,885	191	0.04	18,113	152	0.04
0.9	1.8	27,247	218	0.05	23,001	184	0.05	17,339	143	0.05
1	2	28,025	215	0.05	22,293	175	0.05	17,834	125	0.05
1.5	3	21,019	210	0.08	16,985	170	0.08	12,739	115	0.08
2	6	15,764	189	0.12	14,331	172	0.12	8,917	96	0.12
2.5	8	12,611	151	0.18	11,465	138	0.18	7,643	83	0.18
3	8	11,677	163	0.30	9,554	134	0.30	6,794	86	0.30
3.5	10	10,009	140	0.35	9,099	127	0.35	6,187	78	0.35
4	11	8,758	140	0.60	7,962	127	0.60	5,732	83	0.60
4.5	11	7,785	125	0.90	7,077	113	0.90	4,034	58	0.90
5	13	7,006	140	1.25	6,369	127	1.25	3,822	69	1.25
5.5	13	6,369	127	1.38	5,790	116	1.38	3,648	66	1.38
6	13	5,839	160	1.80	5,308	150	1.80	3,503	90	1.80
7	16	5,005	200	2.45	4,550	182	2.45	3,139	113	2.45
8	19	4,379	215	3.20	3,981	200	3.20	1,672	125	3.20
9	19	3,892	234	4.05	3,539	212	4.05	1,486	146	4.05
10	22	3,503	210	5.00	3,185	191	5.00	1,338	134	5.00
12	26	2,919	234	6.00	2,654	212	6.00	1,115	103	6.00
16	35	2,189	219	8.00	1,990	199	8.00	975	100	8.00
20	40	1,752	210	10.00	1,592	191	10.00	836	103	10.00

Tool dia. DC (mm)	Flute length APMX (mm)	Alloy steels (25～35HRC) HPM7,SKD61Ⓐ,SKT4			Pre-hardened steels (35～45HRC) HPM-MAGIC,CENA1,NAK80			Hardened steels (45～52HRC) SKD61Ⓗ,HPM38,DAC-MAGIC		
		Revolution min^{-1}	Feed rate mm/min	a_p mm	Revolution min^{-1}	Feed rate mm/min	a_p mm	Revolution min^{-1}	Feed rate mm/min	a_p mm
0.2	0.4	24,005	122	0.01	14,936	56	0.01	8,402	34	0.01
0.3	0.6	16,003	109	0.02	9,958	50	0.01	5,601	30	0.01
0.4	0.8	14,331	103	0.02	8,917	56	0.02	5,016	34	0.02
0.5	1	12,898	93	0.03	8,025	51	0.02	4,514	31	0.02
0.6	1.2	13,137	112	0.03	8,174	51	0.03	4,598	31	0.02
0.7	1.4	12,284	125	0.04	7,643	58	0.03	4,299	35	0.03
0.8	1.6	11,644	119	0.04	7,245	55	0.04	4,075	33	0.03
0.9	1.8	11,146	133	0.05	6,936	61	0.04	3,901	37	0.04
1	2	11,465	125	0.05	7,134	58	0.05	4,013	35	0.04
1.5	3	9,554	114	0.08	5,945	52	0.07	3,344	32	0.06
2	6	7,166	122	0.12	4,459	56	0.11	2,508	34	0.10
2.5	8	5,732	97	0.18	3,567	45	0.16	2,006	27	0.14
3	8	4,777	81	0.30	2,972	37	0.27	1,672	23	0.24
3.5	10	4,095	104	0.35	2,548	48	0.32	1,433	29	0.28
4	11	3,583	91	0.60	2,229	42	0.54	1,254	26	0.49
4.5	11	3,185	92	0.90	1,982	50	0.81	1,115	30	0.73
5	13	2,866	103	1.25	1,783	45	1.13	1,003	27	1.01
5.5	13	2,606	89	1.38	1,621	41	1.24	912	25	1.11
6	13	2,389	105	1.80	1,486	48	1.62	836	30	1.46
7	16	2,047	122	2.45	1,274	56	2.21	717	34	1.98
8	19	1,075	120	3.20	669	54	2.88	376	33	2.59
9	19	955	114	4.05	594	52	3.65	334	32	3.28
10	22	860	117	5.00	535	54	4.50	301	33	4.05
12	26	717	110	6.00	446	51	5.40	251	31	4.86
16	35	627	107	8.00	390	49	7.20	219	30	6.48
20	40	537	100	10.00	334	51	9.00	188	31	8.10

【Note】 The 4 flutes not suitable for slotting.

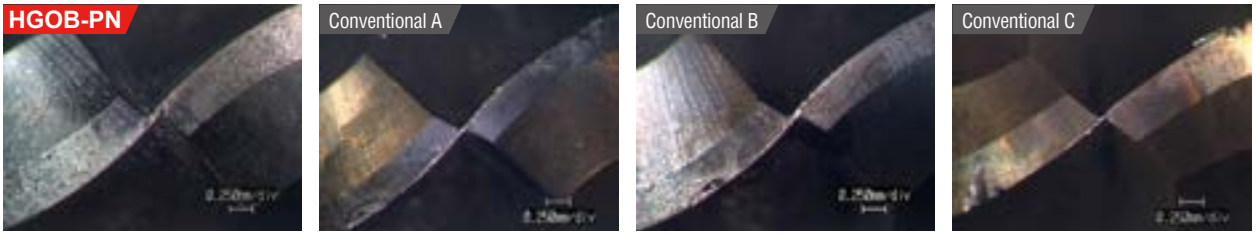
Field data

Enables processing at conditions with high cutting depths! [Pre-hardened steel (40HRC)]

■ Tool: Ball End Mill (RE3×2NT)

Cutting conditions n=16,000min^{-1}, v_c=300m/min, v_f=4,500mm/min、 f_z=0.14mm/t、$a_p \times a_e$= Variable
Dry, Air-blow Work material = Pre-hardened steel (40HRC) Machine =HSK-A63

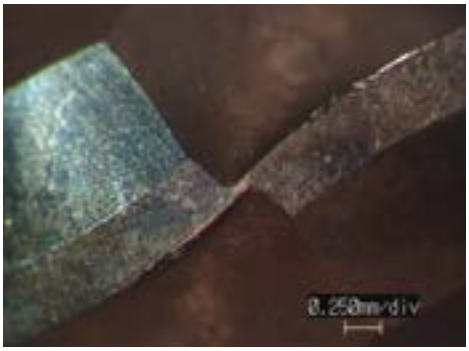
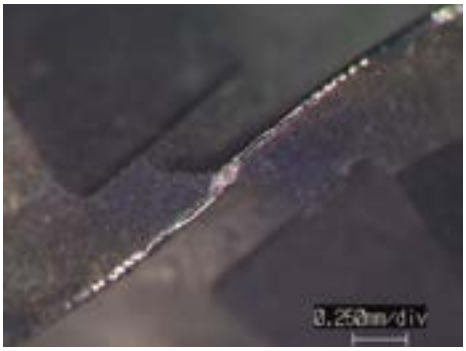
Tool	$a_p \times a_e$ (mm)				
	0.6×1.8	1.2×3.6	1.5×4.5	1.8×4.5	2.1×4.5
HGOB2060-PN	○	○	○	○	○
Conventional A	○	○	chipping		
Conventional B	○	○	○	chipping	
Conventional C	○	chipping			



Processing can be performed without problems even if the cutting depth is increased.

Cutting data when cutting hardened steel with high cutting depth. [HPM38Ⓗ (52HRC)]

■ Tool: Ball End Mill (RE3×2NT)

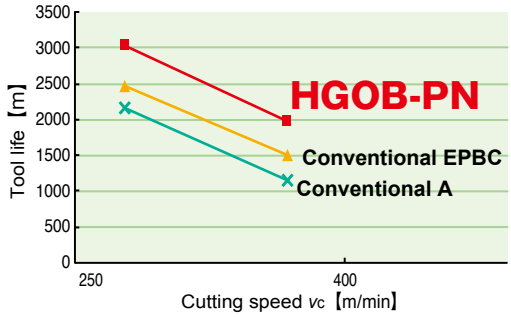
Tool	Epoch Panacea Ball (R3) HGOB2060-PN	Conventional
Cutting conditions	n=10,000min^{-1}, v_c=188m/min v_f=3,000mm/min, f_z=0.15mm/t $a_p \times a_e$=0.6×2.4mm Air blow, Machine：HSK-A63	n=16,000min^{-1}, v_c=300m/min v_f=3,000mm/min, f_z=0.09mm/t $a_p \times a_e$=0.3×1.2mm Air blow, Machine：HSK-A63
Chip removal volume	**4.32cc/min**	1.08cc/min
Cutting time / 1 pocket	33 min.	98 min.
Wear condition		

Cutting at high cutting depth allowed processing time to be reduced by 33%, compared to conventional product.

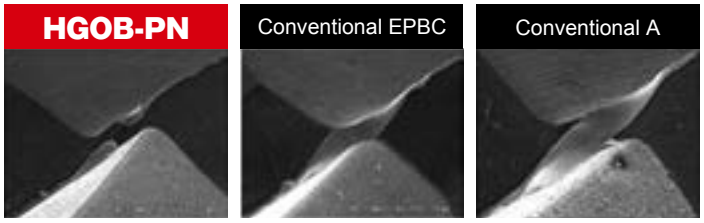
Life comparison when cutting HPM-Magic high-performance plastic mold material

■ Tool: Ball End Mill (RE3×2NT)

Cutting conditions n=15,000、20,000min^{-1}, v_c=282、376m/min、v_f=6,000、8,000mm/min, f_z=0.2mm/t
$a_p \times a_e$=0.4mm×0.2mm Dry, Air-blow Work material =HPM-MAGIC (40HRC)



Cutting conditions n=20,000min^{-1} v_f=8,000mm/min
$a_p \times a_e$=0.4mm×0.2mm Cutting distance L=4,000m

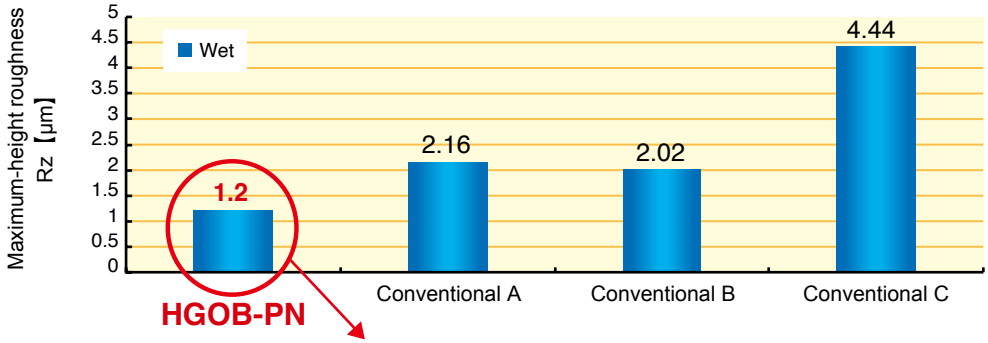


Provides stable machining in all rotation regions.

Comparison of machined surface grade when cutting carbon steel S50CⒶ

■ Tool: Ball End Mill (RE1×2NT)

Cutting conditions n=24,000min^{-1}、 v_c=150m/min、v_f=3,170mm/min、f_z=0.06mm/t、$a_p \times a_e$=0.1mm×0.1mm
Work material =S50CⒶ(200HB) Coolant：Wet

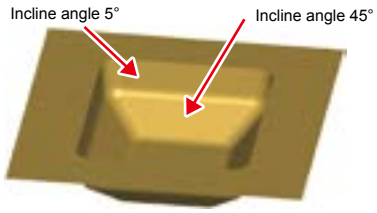


Panacea Ball is superior

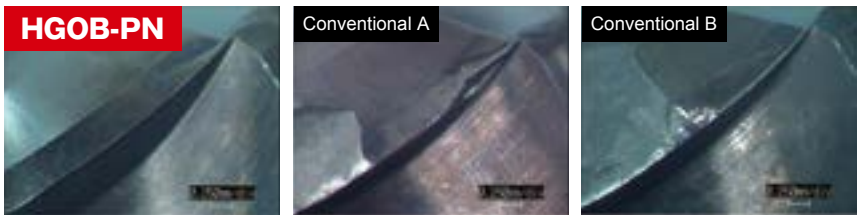
Comparison of chipping damage when cutting hardened steel HPM38Ⓗ

■ Tool: Ball End Mill (RE3×2NT)

Cutting conditions n=19,200min^{-1}、 v_c=361m/min、v_f=3,690mm/min、f_z=0.09mm/t、$a_p \times a_e$=0.72×2.16mm
Work material =HPM38Ⓗ(52HRC) Coolant：Wet
Cutting distance：1 pocketing (Cutting distance 10m)



upper ：35mmx40mm
bottom ：22mmx17mm
depth ：Incline 5°(0～8mm)
Incline 45°(8～14mm)



Panacea Ball showed the best performance in high efficiency cutting.

Field data

Over-hang limit test on S50C

■ Tool：HGOBLS2060-45-PN（RE3×2 flutes）

Cutting conditions n=5,000min^{-1}、v_c=94m/min、v_f=1,000mm/min、 f_z=0.1mm/t
$a_p \times a_e$=0.6×1.8mm　Dry, Air-blow　Work material =S50CⒶ(200HB)

One surface of work is processed for each over-hang. (Work size: 100 mm × 100 mm)
Evaluation: Wear width of 0.07 or less: ○; 0.0071 to 0.09: △; 0.091 or more: × chipping

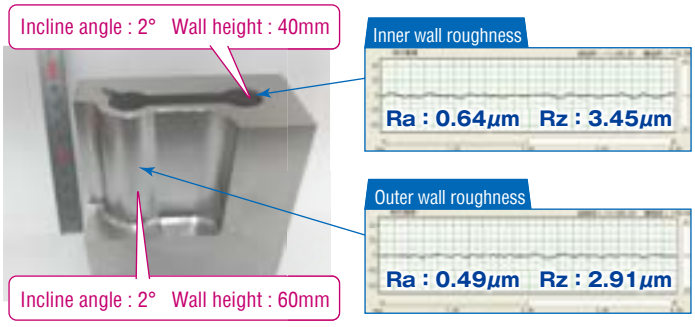
Tool	Overhang OH				
	45mm (About 7DC)	48mm (About 8DC)	54mm (About 9DC)	60mm (About 10DC)	66mm (About 11DC)
HGOBLS-PN	○	○	○	○	○
Conventional A	○	○	○	△	× chipping
Conventional B	○	○	○	△	× chipping

Overhang OH 66mm　Overhang OH 60mm　Overhang OH 60mm

High-strength flute shape provides stable wear conditions even at long over-hang lengths.

Cutting data for direct cutting of hardened steel. [DAC-MAGICⒽ(43HRC)]

Processed site	Cutting process	Tool	Mill dia.	Revolution min^{-1} (Cutting speed)	Feed rate mm/min (Feed/tooth)	Depth of cut mm $a_p \times a_e$	Coolnat	Cutting depth mm	Length m
Outer wall	Roughing	HGOB2100-PN	φ10	7000 (220)	2400 (0.17)	1×2	DRY	45	17
	Semi-roughing	HGOBLS2100-PN	φ10	3000 (94)	840 (0.14)	0.5×1	DRY	60	18
	Finishing	HGOBLS2060-45-PN	φ6	2000 (37)	200 (0.05)	0.0014 (Cusp height)	WET	60	18
Pocket wall	Roughing	HGOB2060-PN	φ6	4200 (80)	760 (0.09)	0.25×0.5	WET	40	58
	Semi-roughing	HGOB2040-4-PN	φ4	4000 (50)	400 (0.05)	0.2×0.4	DRY	30	4
	Finishing	HGOB2040-4-PN	φ4	3000 (37)	300 (0.05)	0.0014 (Cusp height)	WET	30	2.5



Stable cut surface grade even in a range of deep cutting!!

Question and Answer

Frequently Asked Questions

Q1 What should I do to perform high-performance processing?

A1 In order to increase performance, it is necessary to increase the cutting chip removal amount per unit time. To do that, it is necessary to increase the feed rate v_f or the cutting amount a_p or a_e.With the HGOB-PN, because it has a high-strength ball flute shape, it can perform stable cutting even at high cutting depths, so high-performance processing by using high cutting depths is recommended.
Particularly when processing small-sized molds, even if the feed rate is set faster in the program settings, in actuality because acceleration to the feed rate is needed, the higher feed rate cannot be achieved and in some cases there is no effect on performance. In such cases, processing methods with a high cutting depth directly improve performance.

Q2 Since processing with high cutting depths increases cusp height, doesn't it affect later processes?

A2 Processing with a large XY pick certainly increases cusp height. Since leaving that condition alone would affect later processes, for example when performing cutting for contour processing, setting the tool path for the final depth or wall to make the XY pick smaller will reduce the effects.

Q3 Is it possible to perform high-cutting-depth processing in any environment?

A3 For an environment in which high-cutting-depth processing is possible, it is necessary that the main shaft rigidity is strong (BT50, etc. main shaft) enough and the holder has sufficient holding force (by using a milling holder, etc.). In addition, it is ideal if the tool chucking condition is good and further, the workpiece is firmly secured using a vise, etc.
If the main shaft rigidity is low or a holder with weak holding force is used, the cutting depth amount percentage should be adjusted.

Q4 If I can't set the cutting depth larger, how can I perform high-performance processing?

A4 If the machine allows it, processing can be performed by increasing the feed rate. When the cutting depth is small, the per-flute feed rate can be increased due to superior chip removal characteristics.

Q5 Which is better: Dry or wet coolant?

A5 PN Coating itself can be used with either ways. PN Coating is a coating with excellent adhesion strength on carbide base materials. In wet environments, normally coating peeling on the tool rake face occurs, and tool damage proceeds from the peeled area, but this problem is less likely to occur with PN Coating. In addition, PN Coating itself has high oxidation resistance, so that sufficiently stable processing can be performed even in dry environments.
For general hardened materials (40HRC or higher), dry processing is recommended.
Further, for viscous materials with which welding is likely to progress, wet processing is recommended.
If you want to improve the grade of the processed surface, wet processing is recommended to reduce scratching of the surface by cutting chips.

Q6 What cutting materials is PN Coating suitable for?

A6 The applicable range is from mild steel to hardnesses of around 50HRC. PN Coating has a high oxidation resistance temperature of 1200°C. Because of this, direct cutting of hardened materials is possible.
Further, because the membrane adhesion strength is high, it is a strong coating when used in wet processing environments.
For processing materials such as copper electrodes, carbon steel, etc. with which welding is likely to occur or wet processing is common, stable cutting without peeling of the coating can be performed.
If you want to perform stable processing of materials with hardnesses of 52HRC or higher in the high-hardness region, please use an Epoch TH Hard Ball Strong EPBTS-TH tool.

Q7 Although cutting of non-ferrous metals is possible, is it good for aluminum processing?

A7 Compared to conventional end mills, good results can be achieved even when processing aluminum.
However, the HGO○-PN series being introduced here would not be our first recommendation. For processing aluminum, the SD Coating series is our first recommendation.

MOLDINO

The Edge To Innovation

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

1. Cautions regarding handling

(1) When removing the tool from its case (packaging), be careful that the tool does not pop out or is dropped. Be particularly careful regarding contact with the tool flutes.
(2) When handling tools with sharp cutting flutes, be careful not to touch the cutting flutes directly with your bare hands.

2. Cautions regarding mounting

(1) Before use, check the outside appearance of the tool for scratches, cracks, etc. and that it is firmly mounted in the collet chuck, etc.
(2) If abnormal chattering, etc. occurs during use, stop the machine immediately and remove the cause of the chattering.

3. Cautions during use

(1) Before use, confirm the dimensions and direction of rotation of the tool and milling work material.
(2) The numerical values in the standard cutting conditions table should be used as criteria when starting new work. The cutting conditions should be adjusted as appropriate when the cutting depth is large, the rigidity of the machine being used is low, or according to the conditions of the work material.
(3) Cutting tools are made of a hard material. During use, they may break and fly off. In addition, cutting chips may also fly off. Since there is a danger of injury to workers, fire, or eye damage from such flying pieces, a safety cover should be attached when work is performed and safety equipment such as safety goggles should be worn to create a safe environment for work.
(4) There is a risk of fire or inflammation due to sparks, heat due to breakage, and cutting chips. Do not use where there is a risk of fire or explosion. **Please caution of fire while using oil base coolant, fire prevention is necessary.**
(5) Do not use the tool for any purpose other than that for which it is intended.

4. Cautions regarding regrinding

(1) If regrinding is not performed at the proper time, there is a risk of the tool breaking. Replace the tool with one in good condition, or perform regrinding.
(2) Grinding dust will be created when regrinding a tool. When regrinding, be sure to attach a safety cover over the work area and wear safety clothes such as safety goggles, etc.
(3) This product contains the specified chemical substance cobalt and its inorganic compounds. When performing regrinding or similar processing, be sure to handle the processing in accordance with the local laws and regulations regarding prevention of hazards due to specified chemical substances.

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