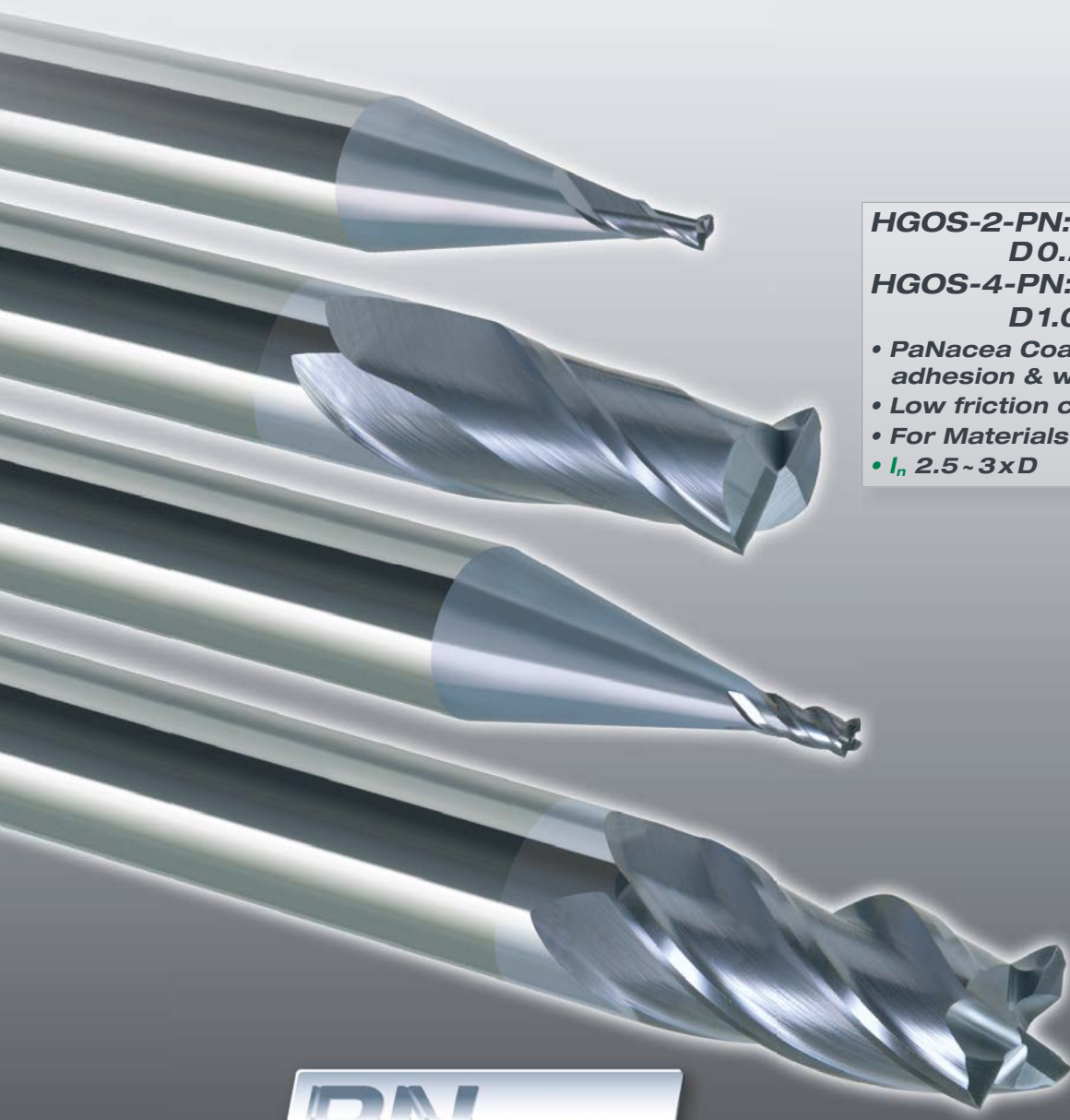


# **GO-Line PaNacea HGOS-PN**

## **Solid Carbide Square Type End Mill**



**HGOS-2-PN:**

**D0.2mm ~ D20mm**

**HGOS-4-PN:**

**D1.0mm ~ D20mm**

- PaNacea Coating for high adhesion & wear resistance
- Low friction coefficient
- For Materials  $\leq 52\text{HRC}$
- $l_n$  2.5 ~ 3xD

**PN**Coating

## HGOS-2-PN | GO-Line PaNacea Square

**V max**  
High Speed

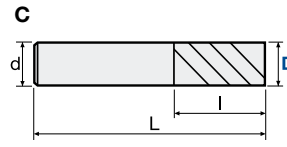
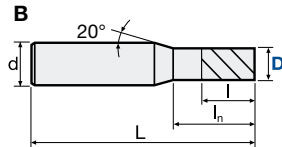
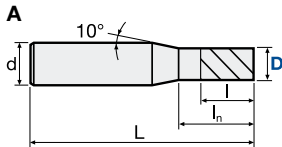
**▽**  
Roughing

**▽▽**  
Semi Finishing

**▽▽▽**  
Finishing

**HRC**  
52

**No. of Teeth**  
2



**Pointed Cutting Edge 90°**  
**Exakte 90°-Schneide**



**Carbide**  
Micro Grain

**PN**  
PaNacea Coating

**Rake Angle**  
Positive

Helix Angle	D Tol. [mm]	d Tol.
30°	D0.2~D0.9: 0/-0.015 D1~D20: 0/-0.020	h5

ID Code	Item Code	Z	D	I	I <sub>n</sub>	L	d	Type
EL066	HGOS-2002-PN	2	0.2	0.4	0.6	40	4	A
EL067	HGOS-2003-PN		0.3	0.6	0.9			
EL068	HGOS-2004-PN		0.4	0.8	1.1			
EL069	HGOS-2005-PN		0.5	1	1.3			
EL070	HGOS-2006-PN		0.6	1.2	1.5			
EL071	HGOS-2007-PN		0.7	1.4	1.7			
EL072	HGOS-2008-PN		0.8	1.6	1.9			
EL073	HGOS-2009-PN		0.9	1.8	2.1			
EL074	HGOS-2010-PN		1	2	2.5			
EL075	HGOS-2015-PN		1.5	3	3.5			
EL076	HGOS-2020-PN		2	6	7			
EL077	HGOS-2025-PN		2.5	8	9			
EL078	HGOS-2030-PN		3	10	11	45	6	B
EL079	HGOS-2035-PN		3.5	11	12			
EL080	HGOS-2040-PN		4	13	14			
EL081	HGOS-2045-PN		4.5	16	17	60	8	C
EL082	HGOS-2050-PN		5	19	20	70		B
EL083	HGOS-2055-PN		5.5	22	-	75		C
EL084	HGOS-2060-PN		6	26	-	80	10	B
EL085	HGOS-2070-PN		7	35	-	100	12	C
EL086	HGOS-2080-PN		8	40	-	110	16	
EL087	HGOS-2090-PN		9			125	20	
EL088	HGOS-2100-PN		10					
EL089	HGOS-2120-PN		12					
EL090	HGOS-2160-PN		16					
EL091	HGOS-2200-PN		20					

Cutting Conditions | Schnittwerte | Condizioni di taglio | Condiciones de Corte | Conditions de coupe | Valores de corte:

D0.2 - D20 : Page 4-5

## HGOS-4-PN | GO-Line PaNacea Square

**V max**  
High Speed

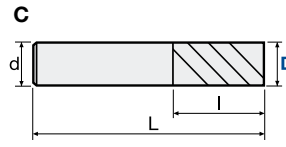
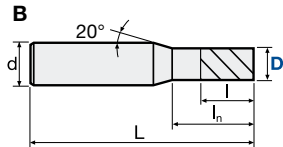
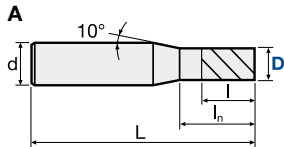
**▽**  
Roughing

**▽▽**  
Semi Finishing

**▽▽▽**  
Finishing

**HRC**  
52

**No. of Teeth**  
4



**Pointed Cutting Edge 90°**  
**Exakte 90°-Schneide**



**Carbide**  
Micro Grain

**PN**  
PaNacea Coating

**Rake Angle**  
Positive

Helix Angle	D Tol. [mm]	d Tol.
30°	0/-0.02	h5

ID Code	Item Code	Z	D	I	I <sub>n</sub>	L	d	Type	
EL092	HGOS-4010-PN	4	1	2.5	3	40	4	A	
EL093	HGOS-4015-PN		1.5	4	4.5				
EL118	HGOS-4020-PN		2	6	7				
EL119	HGOS-4025-PN		2.5	8	9				
EL120	HGOS-4030-PN		3	10	11	45	6	B	
EL121	HGOS-4040-PN		4	12	13				
EL122	HGOS-4050-PN		5	15	16	60	8	C	
EL123	HGOS-4060-PN		6		-				
EL124	HGOS-4080-PN		8	20	75				
EL125	HGOS-4100-PN		10	25	80	10			
EL126	HGOS-4120-PN		12	30	100	12			
EL127	HGOS-4160-PN		16	35	110	16			
EL128	HGOS-4200-PN		20	40	125	20			

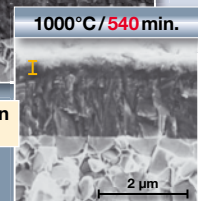
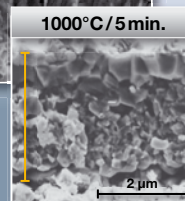
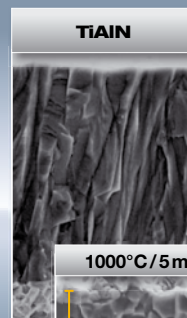
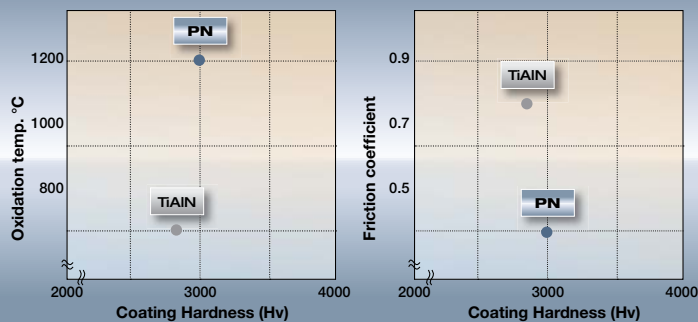
Cutting Conditions | Schnittwerte | Condizioni di taglio | Condiciones de Corte | Conditions de coupe | Valores de corte:

D1 – D20 : Page 6–7

## PaNacea Coating

high adhesion and wear resistance


### Features PaNacea















Oxidation Layer

## HGOS-2-PN | Recommended Cutting Conditions

### HGOS-2-PN



HGOS-2-PN			D0.2		D0.3		D0.4		D0.5		D0.6		D0.7	
														
I	Copper, Aluminium	$V_e$ (m/min)	38	38	57	57	75	75	94	94	113	113	132	132
		$n$ (min <sup>-1</sup> )	60000	60000	60000	60000	60000	60000	60000	60000	60000	60000	60000	60000
		$f_z$ (mm/tooth)	0.006	0.004	0.008	0.005	0.010	0.006	0.012	0.007	0.013	0.008	0.014	0.009
		$V_f$ (mm/min)	720	430	970	580	1200	720	1380	830	1550	930	1720	1030
		$a_p$ (mm)	0.26	0.10	0.39	0.15	0.52	0.20	0.65	0.25	0.78	0.30	0.91	0.35
		$a_e$ (mm)	0.02	0.20	0.03	0.30	0.04	0.40	0.05	0.50	0.06	0.60	0.07	0.70
II	Carbon steel, Alloy steel Cast iron (180~250HB)	$V_e$ (m/min)	38	38	57	57	75	75	94	94	113	100	132	100
		$n$ (min <sup>-1</sup> )	60000	60000	60000	60000	60000	60000	60000	60000	60000	53100	60000	45500
		$f_z$ (mm/tooth)	0.006	0.004	0.008	0.005	0.010	0.006	0.012	0.007	0.013	0.008	0.014	0.009
		$V_f$ (mm/min)	720	430	970	580	1200	720	1380	830	1550	820	1720	780
		$a_p$ (mm)	0.26	0.10	0.39	0.15	0.52	0.20	0.65	0.25	0.78	0.30	0.91	0.35
		$a_e$ (mm)	0.02	0.20	0.03	0.30	0.04	0.40	0.05	0.50	0.06	0.60	0.07	0.70
III	Stainless steel (20~40HRC)	$V_e$ (m/min)	38	38	57	45	70	45	70	45	70	45	70	45
		$n$ (min <sup>-1</sup> )	60000	60000	60000	47700	55700	35800	44600	28600	37100	23900	31800	20500
		$f_z$ (mm/tooth)	0.005	0.003	0.007	0.004	0.009	0.005	0.010	0.006	0.012	0.007	0.013	0.008
		$V_f$ (mm/min)	650	390	870	420	1000	390	920	360	860	330	820	320
		$a_p$ (mm)	0.20	0.10	0.30	0.15	0.40	0.20	0.50	0.25	0.60	0.30	0.70	0.35
		$a_e$ (mm)	0.02	0.20	0.03	0.30	0.04	0.40	0.05	0.50	0.06	0.60	0.07	0.70
IV	Alloy steel, Tool steel (25~35HRC)	$V_e$ (m/min)	38	38	57	57	75	75	94	80	100	80	100	80
		$n$ (min <sup>-1</sup> )	60000	60000	60000	60000	60000	60000	60000	50900	53100	42400	45500	36400
		$f_z$ (mm/tooth)	0.005	0.003	0.007	0.004	0.009	0.005	0.010	0.006	0.012	0.007	0.013	0.008
		$V_f$ (mm/min)	650	390	870	520	1080	650	1240	630	1230	590	1180	560
		$a_p$ (mm)	0.20	0.10	0.30	0.15	0.40	0.20	0.50	0.25	0.60	0.30	0.70	0.35
		$a_e$ (mm)	0.01	0.20	0.02	0.30	0.03	0.40	0.04	0.50	0.04	0.60	0.05	0.70
V	Alloy steel, Tool steel (35~45HRC)	$V_e$ (m/min)	38	38	57	57	75	60	75	60	75	60	75	60
		$n$ (min <sup>-1</sup> )	60000	60000	60000	60000	59700	47700	47700	38200	39800	31800	34100	27300
		$f_z$ (mm/tooth)	0.005	0.003	0.006	0.004	0.008	0.005	0.009	0.006	0.010	0.006	0.011	0.007
		$V_f$ (mm/min)	580	350	780	470	960	460	880	420	820	390	780	380
		$a_p$ (mm)	0.20	0.06	0.30	0.09	0.40	0.12	0.50	0.15	0.60	0.18	0.70	0.21
		$a_e$ (mm)	0.01	0.20	0.02	0.30	0.02	0.40	0.03	0.50	0.03	0.60	0.04	0.70
VI	Hardened Steel Tool Steels (hot&cold) (45~52HRC)	$V_e$ (m/min)	38	38	57	50	60	50	60	50	60	50	60	50
		$n$ (min <sup>-1</sup> )	60000	60000	60000	53100	47700	39800	38200	31800	31800	26500	27300	22700
		$f_z$ (mm/tooth)	0.004	0.003	0.006	0.003	0.007	0.004	0.008	0.005	0.009	0.005	0.010	0.006
		$V_f$ (mm/min)	500	300	680	360	670	330	620	310	570	290	550	270
		$a_p$ (mm)	0.20	0.04	0.30	0.06	0.40	0.08	0.50	0.10	0.60	0.12	0.70	0.14
		$a_e$ (mm)	0.01	0.20	0.02	0.30	0.02	0.40	0.03	0.50	0.03	0.60	0.04	0.70

			D3.5		D4		D4.5		D5		D5.5		D6	
			Side	Slotting	Side	Slotting	Side	Slotting	Side	Slotting	Side	Slotting	Side	Slotting
I	Copper, Aluminium	<b>V<sub>e</sub></b> (m/min)	180	140	180	140	180	140	180	140	180	140	180	140
		<b>n</b> (min <sup>-1</sup> )	16400	12700	14300	11100	12700	9900	11500	8900	10400	8100	9500	7400
		<b>f<sub>z</sub></b> (mm/tooth)	0.044	0.026	0.050	0.030	0.054	0.033	0.059	0.035	0.063	0.038	0.067	0.040
		<b>V<sub>f</sub></b> (mm/min)	1440	670	1430	670	1380	650	1360	630	1320	610	1280	600
		<b>a<sub>p</sub></b> (mm)	4.55	1.75	5.20	2.00	5.85	2.25	6.50	2.50	7.15	2.75	7.80	3.00
		<b>a<sub>e</sub></b> (mm)	0.35	3.50	0.40	4.00	0.45	4.50	0.50	5.00	0.55	5.50	0.60	6.00
II	Carbon steel, Alloy steel Cast iron (180~250HB)	<b>V<sub>e</sub></b> (m/min)	140	100	140	100	140	100	140	100	140	100	140	100
		<b>n</b> (min <sup>-1</sup> )	12700	9100	11100	8000	9900	7100	8900	6400	8100	5800	7400	5300
		<b>f<sub>z</sub></b> (mm/tooth)	0.044	0.026	0.050	0.030	0.054	0.033	0.059	0.035	0.063	0.038	0.067	0.040
		<b>V<sub>f</sub></b> (mm/min)	1110	480	1110	480	1080	460	1050	450	1020	440	990	430
		<b>a<sub>p</sub></b> (mm)	4.55	1.75	5.20	2.00	5.85	2.25	6.50	2.50	7.15	2.75	7.80	3.00
		<b>a<sub>e</sub></b> (mm)	0.35	3.50	0.40	4.00	0.45	4.50	0.50	5.00	0.55	5.50	0.60	6.00
III	Stainless steel (20~40HRC)	<b>V<sub>e</sub></b> (m/min)	70	45	70	45	70	45	70	45	70	45	70	45
		<b>n</b> (min <sup>-1</sup> )	6400	4100	5600	3600	5000	3200	4500	2900	4100	2600	3700	2400
		<b>f<sub>z</sub></b> (mm/tooth)	0.039	0.024	0.045	0.027	0.049	0.029	0.053	0.032	0.057	0.034	0.060	0.036
		<b>V<sub>f</sub></b> (mm/min)	500	190	500	190	490	190	480	180	470	180	450	170
		<b>a<sub>p</sub></b> (mm)	3.50	1.75	4.00	2.00	4.50	2.25	5.00	2.50	5.50	2.75	6.00	3.00
		<b>a<sub>e</sub></b> (mm)	0.35	3.50	0.40	4.00	0.45	4.50	0.50	5.00	0.55	5.50	0.60	6.00
IV	Alloy steel, Tool steel (25~35HRC)	<b>V<sub>e</sub></b> (m/min)	100	80	100	80	100	80	100	80	100	80	100	80
		<b>n</b> (min <sup>-1</sup> )	9100	7300	8000	6400	7100	5700	6400	5100	5800	4600	5300	4200
		<b>f<sub>z</sub></b> (mm/tooth)	0.039	0.024	0.045	0.027	0.049	0.029	0.053	0.032	0.057	0.034	0.060	0.036
		<b>V<sub>f</sub></b> (mm/min)	720	340	720	350	700	340	680	320	660	310	640	300
		<b>a<sub>p</sub></b> (mm)	3.50	1.75	4.00	2.00	4.50	2.25	5.00	2.50	5.50	2.75	6.00	3.00
		<b>a<sub>e</sub></b> (mm)	0.25	3.50	0.28	4.00	0.32	4.50	0.35	5.00	0.39	5.50	0.42	6.00
V	Alloy steel, Tool steel (35~45HRC)	<b>V<sub>e</sub></b> (m/min)	75	60	75	60	75	60	75	60	75	60	75	60
		<b>n</b> (min <sup>-1</sup> )	6800	5500	6000	4800	5300	4200	4800	3800	4300	3500	4000	3200
		<b>f<sub>z</sub></b> (mm/tooth)	0.035	0.021	0.040	0.024	0.044	0.026	0.047	0.028	0.051	0.030	0.054	0.032
		<b>V<sub>f</sub></b> (mm/min)	480	230	480	230	460	220	450	220	440	210	430	210
		<b>a<sub>p</sub></b> (mm)	3.50	1.05	4.00	1.20	4.50	1.35	5.00	1.50	5.50	1.65	6.00	1.80
		<b>a<sub>e</sub></b> (mm)	0.18	3.50	0.20	4.00	0.23	4.50	0.25	5.00	0.28	5.50	0.30	6.00
VI	Hardened Steel Tool Steels (hot&cold) (45~52HRC)	<b>V<sub>e</sub></b> (m/min)	60	50	60	50	60	50	60	50	60	50	60	50
		<b>n</b> (min <sup>-1</sup> )	5500	4500	4800	4000	4200	3500	3800	3200	3500	2900	3200	2700
		<b>f<sub>z</sub></b> (mm/tooth)	0.031	0.018	0.035	0.021	0.038	0.023	0.041	0.025	0.044	0.027	0.047	0.028
		<b>V<sub>f</sub></b> (mm/min)	340	170	340	170	320	160	310	160	310	150	300	150
		<b>a<sub>p</sub></b> (mm)	3.50	0.70	4.00	0.80	4.50	0.90	5.00	1.00	5.50	1.10	6.00	1.20
		<b>a<sub>e</sub></b> (mm)	0.18	3.50	0.20	4.00	0.23	4.50	0.25	5.00	0.28	5.50	0.30	6.00

## HGOS-2-PN | Recommended Cutting Conditions

D0.8		D0.9		D1		D1.5		D2		D2.5		D3	
Side	Slotting	Side	Slotting	Side	Slotting	Side	Slotting	Side	Slotting	Side	Slotting	Side	Slotting
151	140	170	140	180	140	180	140	180	140	180	140	180	140
60000	55700	60000	49500	57300	44600	38200	29700	28600	22300	22900	17800	19100	14900
0.015	0.009	0.016	0.010	0.016	0.010	0.022	0.013	0.026	0.016	0.032	0.019	0.038	0.023
1820	1020	1910	950	1830	860	1680	790	1490	700	1470	680	1440	680
1.04	0.40	1.17	0.45	1.30	0.50	1.95	0.75	2.60	1.00	3.25	1.25	3.90	1.50
0.08	0.80	0.09	0.90	0.10	1.00	0.15	1.50	0.20	2.00	0.25	2.50	0.30	3.00
140	100	140	100	140	100	140	100	140	100	140	100	140	100
55700	39800	49500	35400	44600	31800	29700	21200	22300	15900	17800	12700	14900	10600
0.015	0.009	0.016	0.010	0.016	0.010	0.022	0.013	0.026	0.016	0.032	0.019	0.038	0.023
1690	730	1580	680	1430	610	1310	560	1160	500	1140	490	1130	480
1.04	0.40	1.17	0.45	1.30	0.50	1.95	0.75	2.60	1.00	3.25	1.25	3.90	1.50
0.08	0.80	0.09	0.90	0.10	1.00	0.15	1.50	0.20	2.00	0.25	2.50	0.30	3.00
70	45	70	45	70	45	70	45	70	45	70	45	70	45
27900	17900	24800	15900	22300	14300	14900	9500	11100	7200	8900	5700	7400	4800
0.014	0.008	0.014	0.009	0.014	0.009	0.020	0.012	0.023	0.014	0.029	0.017	0.034	0.020
760	290	710	270	640	250	590	230	520	200	510	200	500	200
0.80	0.40	0.90	0.45	1.00	0.50	1.50	0.75	2.00	1.00	2.50	1.25	3.00	1.50
0.08	0.80	0.09	0.90	0.10	1.00	0.15	1.50	0.20	2.00	0.25	2.50	0.30	3.00
100	80	100	80	100	80	100	80	100	80	100	80	100	80
39800	31800	35400	28300	31800	25500	21200	17000	15900	12700	12700	10200	10600	8500
0.014	0.008	0.014	0.009	0.014	0.009	0.020	0.012	0.023	0.014	0.029	0.017	0.034	0.020
1090	520	1020	490	920	440	840	400	740	360	730	350	720	350
0.80	0.40	0.90	0.45	1.00	0.50	1.50	0.75	2.00	1.00	2.50	1.25	3.00	1.50
0.06	0.80	0.06	0.90	0.07	1.00	0.11	1.50	0.14	2.00	0.18	2.50	0.21	3.00
75	60	75	60	75	60	75	60	75	60	75	60	75	60
29800	23900	26500	21200	23900	19100	15900	12700	11900	9500	9500	7600	8000	6400
0.012	0.007	0.013	0.008	0.013	0.008	0.018	0.011	0.021	0.012	0.026	0.015	0.030	0.018
720	350	680	320	610	290	560	270	500	240	490	230	480	230
0.80	0.24	0.90	0.27	1.00	0.30	1.50	0.45	2.00	0.60	2.50	0.75	3.00	0.90
0.04	0.80	0.05	0.90	0.05	1.00	0.08	1.50	0.10	2.00	0.13	2.50	0.15	3.00
60	50	60	50	60	50	60	50	60	50	60	50	60	50
23900	19900	21200	17700	19100	15900	12700	10600	9500	8000	7600	6400	6400	5300
0.011	0.006	0.011	0.007	0.011	0.007	0.015	0.009	0.018	0.011	0.022	0.013	0.026	0.016
510	250	470	240	430	210	390	200	350	170	340	170	340	170
0.80	0.16	0.90	0.18	1.00	0.20	1.50	0.30	2.00	0.40	2.50	0.50	3.00	0.60
0.04	0.80	0.05	0.90	0.05	1.00	0.08	1.50	0.10	2.00	0.13	2.50	0.15	3.00

D7		D8		D9		D10		D12		D16		D20	
Side	Slotting	Side	Slotting	Side	Slotting	Side	Slotting	Side	Slotting	Side	Slotting	Side	Slotting
180	140	180	140	180	140	180	140	180	140	180	140	180	140
8200	6400	7200	5600	6400	5000	5700	4500	4800	3700	3600	2800	2900	2200
0.076	0.046	0.085	0.051	0.093	0.056	0.100	0.060	0.120	0.072	0.152	0.091	0.180	0.108
1250	590	1220	570	1190	560	1140	540	1150	530	1090	510	1040	480
9.10	3.50	10.40	4.00	11.70	4.50	13.00	5.00	15.60	6.00	20.80	8.00	26.00	10.00
0.70	7.00	0.80	8.00	0.90	9.00	1.00	10.00	1.20	12.00	1.60	16.00	2.00	20.00
140	100	140	100	140	100	140	100	140	100	140	100	140	100
6400	4500	5600	4000	5000	3500	4500	3200	3700	2700	2800	2000	2200	1600
0.076	0.046	0.085	0.051	0.093	0.056	0.100	0.060	0.120	0.072	0.152	0.091	0.180	0.108
980	410	950	410	930	390	900	380	890	390	850	360	790	350
9.10	3.50	10.40	4.00	11.70	4.50	13.00	5.00	15.60	6.00	20.80	8.00	26.00	10.00
0.70	7.00	0.80	8.00	0.90	9.00	1.00	10.00	1.20	12.00	1.60	16.00	2.00	20.00
70	45	70	45	70	45	70	45	70	45	70	45	70	45
3200	2000	2800	1800	2500	1600	2200	1400	1900	1200	1400	900	1100	700
0.069	0.041	0.076	0.046	0.083	0.050	0.090	0.054	0.108	0.065	0.137	0.082	0.162	0.097
440	160	430	160	420	160	400	150	410	160	380	150	360	140
7.00	3.50	8.00	4.00	9.00	4.50	10.00	5.00	12.00	6.00	16.00	8.00	20.00	10.00
0.70	7.00	0.80	8.00	0.90	9.00	1.00	10.00	1.20	12.00	1.60	16.00	2.00	20.00
100	80	100	80	100	80	100	80	100	80	100	80	100	80
4500	3600	4000	3200	3500	2800	3200	2500	2700	2100	2000	1600	1600	1300
0.069	0.041	0.076	0.046	0.083	0.050	0.090	0.054	0.108	0.065	0.137	0.082	0.162	0.097
620	300	610	290	580	280	580	270	580	270	550	260	520	250
7.00	3.50	8.00	4.00	9.00	4.50	10.00	5.00	12.00	6.00	16.00	8.00	20.00	10.00
0.49	7.00	0.56	8.00	0.63	9.00	0.70	10.00	0.84	12.00	1.12	16.00	1.40	20.00
75	60	75	60	75	60	75	60	75	60	75	60	75	60
3400	2700	3000	2400	2700	2100	2400	1900	2000	1600	1500	1200	1200	1000
0.061	0.037	0.068	0.041	0.074	0.044	0.080	0.048	0.096	0.058	0.122	0.073	0.144	0.086
420	200	410	200	400	190	380	180	380	180	360	180	350	170
7.00	2.10	8.00	2.40	9.00	2.70	10.00	3.00	12.00	3.60	16.00	4.80	20.00	6.00
0.35	7.00	0.40	8.00	0.45	9.00	0.50	10.00	0.60	12.00	0.80	16.00	1.00	20.00
60	50	60	50	60	50	60	50	60	50	60	50	60	50
2700	2300	2400	2000	2100	1800	1900	1600	1600	1300	1200	1000	1000	800
0.053	0.032	0.059	0.036	0.065	0.039	0.070	0.042	0.084	0.050	0.106	0.064	0.126	0.076
290	150	280	140	270	140	270	130	270	130	260	130	250	120
7.00	1.40	8.00	1.60	9.00	1.80	10.00	2.00	12.00	2.40	16.00	3.20	20.00	4.00
0.35	7.00	0.40	8.00	0.45	9.00	0.50	10.00	0.60	12.00	0.80	16.00	1.00	20.00



## HGOS-4-PN | Recommended Cutting Conditions


### HGOS-4-PN















		D1		D1.5		D2		D2.5		D3		D4		D5	
		Side	Slotting	Side	Slotting	Side	Slotting	Side	Slotting	Side	Slotting	Side	Slotting	Side	Slotting
I	Copper, Aluminium	$V_c$ (m/min)	180	140	180	140	180	140	180	140	180	140	180	140	140
		$n$ (min <sup>-1</sup> )	57300	44600	38200	29700	28600	22300	22900	17800	19100	14900	14300	11100	8900
		$f_z$ (mm/tooth)	0.013	0.006	0.018	0.009	0.021	0.010	0.026	0.013	0.030	0.015	0.040	0.020	0.047
		$V_f$ (mm/min)	2930	1140	2700	1050	2380	930	2340	910	2310	900	2290	890	2170
		$a_p$ (mm)	1.30	0.50	1.95	0.75	2.60	1.00	3.25	1.25	3.90	1.50	5.20	2.00	6.50
II	Carbon steel, Alloy steel Cast iron (180~250HB)	$a_e$ (mm)	0.10	1.00	0.15	1.50	0.20	2.00	0.25	2.50	0.30	3.00	0.40	4.00	0.50
		$V_c$ (m/min)	140	100	140	100	140	100	140	100	140	100	140	100	100
		$n$ (min <sup>-1</sup> )	44600	31800	29700	21200	22300	15900	17800	12700	14900	10600	11100	8000	8900
		$f_z$ (mm/tooth)	0.013	0.006	0.018	0.009	0.021	0.010	0.026	0.013	0.030	0.015	0.040	0.020	0.047
		$V_f$ (mm/min)	2280	810	2100	750	1860	660	1820	650	1800	640	1780	640	1680
III	Stainless steel (20~40HRC)	$a_p$ (mm)	1.30	0.50	1.95	0.75	2.60	1.00	3.25	1.25	3.90	1.50	5.20	2.00	6.50
		$a_e$ (mm)	0.10	1.00	0.15	1.50	0.20	2.00	0.25	2.50	0.30	3.00	0.40	4.00	0.50
		$V_c$ (m/min)	70	45	70	45	70	45	70	45	70	45	70	45	70
		$n$ (min <sup>-1</sup> )	22300	14300	14900	9500	11100	7200	8900	5700	7400	4800	5600	3600	4500
		$f_z$ (mm/tooth)	0.012	0.006	0.016	0.008	0.019	0.009	0.023	0.012	0.027	0.014	0.036	0.018	0.042
IV	Alloy steel, Tool steel (25~35HRC)	$V_f$ (mm/min)	1030	330	950	300	830	270	820	260	810	260	810	260	760
		$a_p$ (mm)	1.00	0.50	1.50	0.75	2.00	1.00	2.50	1.25	3.00	1.50	4.00	2.00	5.00
		$a_e$ (mm)	0.07	1.00	0.11	1.50	0.14	2.00	0.18	2.50	0.21	3.00	0.28	4.00	0.35
		$V_c$ (m/min)	100	80	100	80	100	80	100	80	100	80	100	80	100
		$n$ (min <sup>-1</sup> )	31800	25500	21200	17000	15900	12700	12700	10200	10600	8500	8000	6400	5100
V	Alloy steel, Tool steel (35~45HRC)	$f_z$ (mm/tooth)	0.012	0.006	0.016	0.008	0.019	0.009	0.023	0.012	0.027	0.014	0.036	0.018	0.042
		$V_f$ (mm/min)	1470	590	1350	540	1190	480	1170	470	1150	460	1150	460	1090
		$a_p$ (mm)	1.00	0.50	1.50	0.75	2.00	1.00	2.50	1.25	3.00	1.50	4.00	2.00	5.00
		$a_e$ (mm)	0.05	1.00	0.08	1.50	0.10	2.00	0.13	2.50	0.15	3.00	0.20	4.00	0.25
		$V_c$ (m/min)	75	60	75	60	75	60	75	60	75	60	75	60	75
VI	Hardened Steel Tool Steels (hot&cold) (45~52HRC)	$n$ (min <sup>-1</sup> )	23900	19100	15900	12700	11900	9500	9500	7600	8000	6400	6000	4800	3800
		$f_z$ (mm/tooth)	0.010	0.005	0.014	0.007	0.017	0.008	0.020	0.010	0.024	0.012	0.032	0.016	0.038
		$V_f$ (mm/min)	980	390	900	360	790	320	780	310	770	310	770	310	720
		$a_p$ (mm)	1.00	0.30	1.50	0.45	2.00	0.60	2.50	0.75	3.00	0.90	4.00	1.20	5.00
		$a_e$ (mm)	0.05	1.00	0.08	1.50	0.10	2.00	0.13	2.50	0.15	3.00	0.20	4.00	0.25
		$V_c$ (m/min)	60	50	60	50	60	50	60	50	60	50	60	50	60
		$n$ (min <sup>-1</sup> )	19100	15900	12700	10600	9500	8000	7600	6400	6400	5300	4800	4000	3800
		$f_z$ (mm/tooth)	0.009	0.004	0.012	0.006	0.015	0.007	0.018	0.009	0.021	0.011	0.028	0.014	0.033
		$V_f$ (mm/min)	680	280	630	260	550	230	540	230	540	220	540	220	500
		$a_p$ (mm)	1.00	0.20	1.50	0.30	2.00	0.40	2.50	0.50	3.00	0.60	4.00	0.80	5.00
		$a_e$ (mm)	0.05	1.00	0.08	1.50	0.10	2.00	0.13	2.50	0.15	3.00	0.20	4.00	0.25
		$V_c$ (m/min)	180	140	180	140	180	140	180	140	180	140	180	140	140
		$n$ (min <sup>-1</sup> )	57300	44600	38200	29700	28600	22300	22900	17800	19100	14900	14300	11100	8900
		$f_z$ (mm/tooth)	0.013	0.006	0.018	0.009	0.021	0.010	0.026	0.013	0.030	0.015	0.040	0.020	0.047
		$V_f$ (mm/min)	2930	1140	2700	1050	2380	930	2340	910	2310	900	2290	890	2170
		$a_p$ (mm)	1.30	0.50	1.95	0.75	2.60	1.00	3.25	1.25	3.90	1.50	5.20	2.00	6.50
		$a_e$ (mm)	0.10	1.00	0.15	1.50	0.20	2.00	0.25	2.50	0.30	3.00	0.40	4.00	0.50

## HGOS-4-PN | Recommended Cutting Conditions

### HGOS-4-PN



		D6		D8		D10		D12		D16		D20	
													
		Side	Slotting	Side	Slotting	Side	Slotting	Side	Slotting	Side	Slotting	Side	Slotting
I	Copper, Aluminium	$V_c$ (m/min)	180	140	180	140	180	140	180	140	180	140	180
		$n$ (min <sup>-1</sup> )	9500	7400	7200	5600	5700	4500	4800	3700	3600	2800	2900
		$f_z$ (mm/tooth)	0.054	0.027	0.068	0.034	0.080	0.040	0.096	0.048	0.122	0.061	0.144
		$V_f$ (mm/min)	2040	800	1950	760	1820	720	1840	710	1750	680	1670
		$a_p$ (mm)	7.80	3.00	10.40	4.00	13.00	5.00	15.60	6.00	20.80	8.00	26.00
		$a_e$ (mm)	0.60	6.00	0.80	8.00	1.00	10.00	1.20	12.00	1.60	16.00	2.00
II	Carbon steel, Alloy steel Cast iron (180~250HB)	$V_c$ (m/min)	140	100	140	100	140	100	140	100	140	100	140
		$n$ (min <sup>-1</sup> )	7400	5300	5600	4000	4500	3200	3700	2700	2800	2000	2200
		$f_z$ (mm/tooth)	0.054	0.027	0.068	0.034	0.080	0.040	0.096	0.048	0.122	0.061	0.144
		$V_f$ (mm/min)	1590	570	1520	540	1440	510	1420	520	1360	490	1270
		$a_p$ (mm)	7.80	3.00	10.40	4.00	13.00	5.00	15.60	6.00	20.80	8.00	26.00
		$a_e$ (mm)	0.60	6.00	0.80	8.00	1.00	10.00	1.20	12.00	1.60	16.00	2.00
III	Stainless steel (20~40HRC)	$V_c$ (m/min)	70	45	70	45	70	45	70	45	70	45	70
		$n$ (min <sup>-1</sup> )	3700	2400	2800	1800	2200	1400	1900	1200	1400	900	1100
		$f_z$ (mm/tooth)	0.048	0.024	0.061	0.031	0.072	0.036	0.086	0.043	0.109	0.055	0.130
		$V_f$ (mm/min)	720	230	680	220	630	200	660	210	610	200	570
		$a_p$ (mm)	6.00	3.00	8.00	4.00	10.00	5.00	12.00	6.00	16.00	8.00	20.00
		$a_e$ (mm)	0.60	6.00	0.80	8.00	1.00	10.00	1.20	12.00	1.60	16.00	2.00
IV	Alloy steel, Tool steel (25~35HRC)	$V_c$ (m/min)	100	80	100	80	100	80	100	80	100	80	100
		$n$ (min <sup>-1</sup> )	5300	4200	4000	3200	3200	2500	2700	2100	2000	1600	1300
		$f_z$ (mm/tooth)	0.048	0.024	0.061	0.031	0.072	0.036	0.086	0.043	0.109	0.055	0.130
		$V_f$ (mm/min)	1030	410	980	390	920	360	930	360	880	350	830
		$a_p$ (mm)	6.00	3.00	8.00	4.00	10.00	5.00	12.00	6.00	16.00	8.00	20.00
		$a_e$ (mm)	0.42	6.00	0.56	8.00	0.70	10.00	0.84	12.00	1.12	16.00	1.40
V	Alloy steel, Tool steel (35~45HRC)	$V_c$ (m/min)	75	60	75	60	75	60	75	60	75	60	75
		$n$ (min <sup>-1</sup> )	4000	3200	3000	2400	2400	1900	2000	1600	1500	1200	1000
		$f_z$ (mm/tooth)	0.043	0.022	0.054	0.027	0.064	0.032	0.077	0.038	0.097	0.049	0.115
		$V_f$ (mm/min)	690	280	650	260	610	240	610	250	580	230	550
		$a_p$ (mm)	6.00	1.80	8.00	2.40	10.00	3.00	12.00	3.60	16.00	4.80	20.00
		$a_e$ (mm)	0.30	6.00	0.40	8.00	0.50	10.00	0.60	12.00	0.80	16.00	1.00
VI	Hardened Steel Tool Steels (hot&cold) (45~52HRC)	$V_c$ (m/min)	60	50	60	50	60	50	60	50	60	50	60
		$n$ (min <sup>-1</sup> )	3200	2700	2400	2000	1900	1600	1600	1300	1200	1000	800
		$f_z$ (mm/tooth)	0.038	0.019	0.047	0.024	0.056	0.028	0.067	0.034	0.085	0.043	0.101
		$V_f$ (mm/min)	480	200	460	190	430	180	430	170	410	170	400
		$a_p$ (mm)	6.00	1.20	8.00	1.60	10.00	2.00	12.00	2.40	16.00	3.20	20.00
		$a_e$ (mm)	0.30	6.00	0.40	8.00	0.50	10.00	0.60	12.00	0.80	16.00	1.00

**Always up to date: Please check our P50 QuickFinder**



### **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) When preparing for use, be sure that the inserts are firmly mounted in place and that they are firmly mounted on the arbor, etc.
- (3) 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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**Specifications for the products listed in this catalog are subject to change without notice due to replacement or modification.**

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