

NEW



Ball End Mill for Hardened Steel

IX-EPDB-TH3

IX Epoch Deep Ball-TH3



MOLDINO Tool Engineering, Ltd.

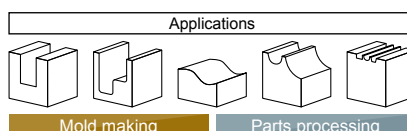
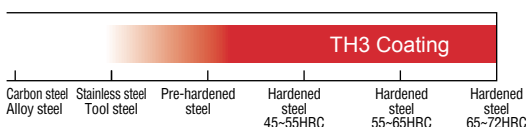
New Product News | No.2503E | 2025-2

"IX" changes the concept of carbide!

IX
Innovation X

Features of IX-EPDB-TH3

- 01** Uses a newly-developed ultra-fine-grain carbide alloy to combine high wear resistance and chipping resistance.
- 02** Uses a TH3 coating designed for machining hardened steel, offering outstanding wear resistance and heat resistance.
- 03** Greatly improves tool life, especially when machining 60HRC class hardened steel.

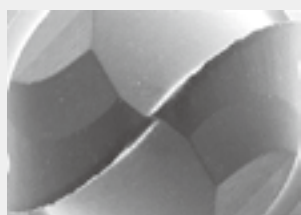
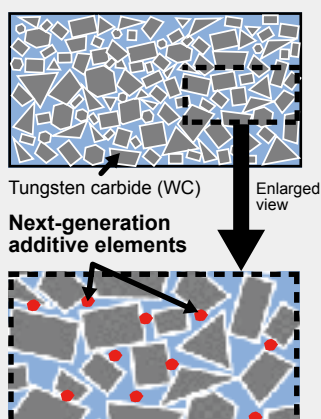


IX-EPDB-TH3
RE0.05~RE1.25 [106 Items]

Features **01** Next-generation carbide alloy for machining hardened steel

- Features refined material structure with approximately 10% greater hardness than conventional materials.
- Incorporates next-generation additive elements to combine high wear resistance (hardness) and chipping resistance (toughness).

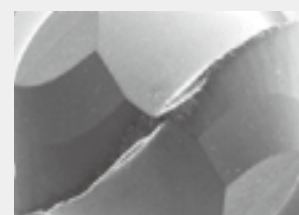
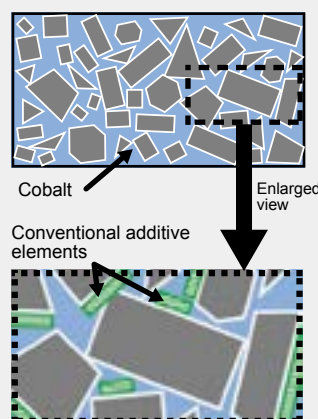
Next-generation carbide alloy



Dramatically reduces chipping.

Next-generation additive elements resist segregating around WC particles.
➔ **Increases carbide toughness.**

Conventional carbide alloy

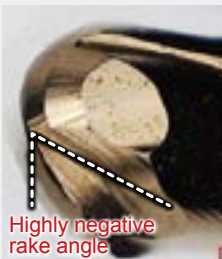
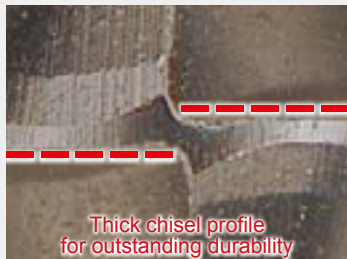


Notable chipping

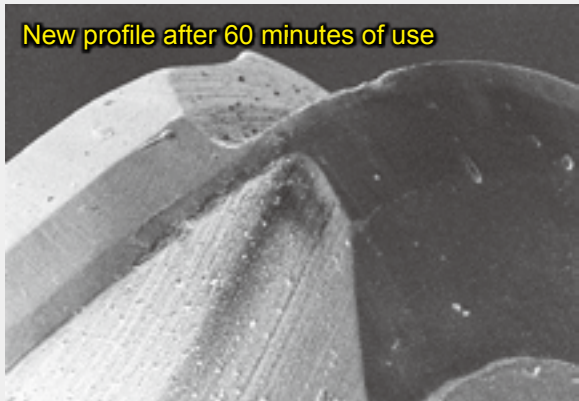
Conventional additive elements segregate around WC particles.
➔ **Reduces carbide toughness.**

Tool : $\phi 2 \times$ Under neck length 4mm Machine : Vertical MC (HSK-E32)
Work material : SLD (60HRC) Coolant : Mist blow Cutting time : 320 min.
Cutting conditions : $n=30,000\text{min}^{-1}$ ($v_c=188\text{m/min}$) $v_f=3,000\text{mm/min}$ ($f_z=0.05\text{mm/t}$) $a_p \times a_e=0.03\text{mm} \times 0.05\text{mm}$

IX-EPDB-TH3



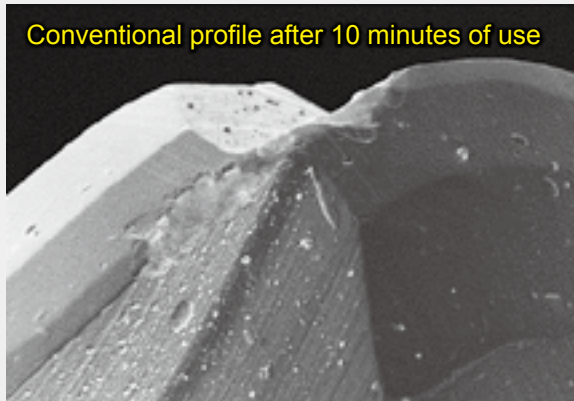
New profile after 60 minutes of use



Conventional



Conventional profile after 10 minutes of use



0.05mm

Tool : $\phi 0.6 \times$ Under neck length 1.5mm Machine : Vertical MC (HSK-E32)

Work material : SLD (60HRC) Coolant : Mist blow

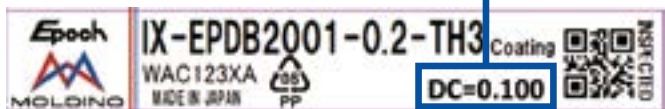
Cutting conditions : $n=40,000\text{min}^{-1}$ ($v_c=75\text{m/min}$) $v_f=800\text{mm/min}$ ($f_z=0.01\text{mm/t}$) $a_p \times a_e = 0.005\text{mm} \times 0.01\text{mm}$

**Effectively reduces chipping common
when machining hardened steel.**

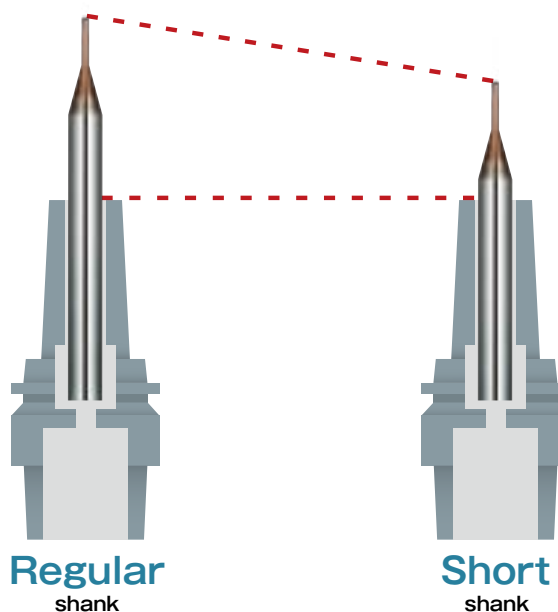
**Allows use of actual size
in CAM**

**without the need
for measurement,
for improved machining
accuracy!**

Actual size indicated here.



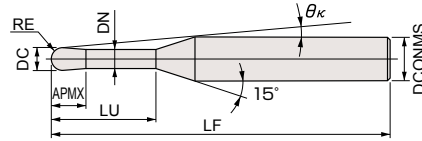
※ Example product label



**Full-length design
that fits shrink-fit holders**

Line Up

2 Flutes



Ball radius	Tolerance on RE
RE ≤ 0.075	±0.002
0.075 < RE ≤ 0.45	±0.003
0.45 < RE	±0.005

IX-EPDB2-TH3



Item code	Stock	Size(mm)							Interference angle (°)	Effective under neck length with respect to draft angle							
		Ball radius	Tool dia.	Under neck length	Flute length	Neck dia.	Overall length	Shank dia.		θκ	0.5°	1°	1.5°	2°	3°		
		RE	DC	LU	APMX	DN	LF	DCONMS									
IX-EPDB2001-0.2-TH3	●	0.05	0.1	0.2	0.08	0.09	35	4	14.66	0.22	0.23	0.23	0.24	0.25			
IX-EPDB2001-0.3-TH3	●			0.3					14.47	0.32	0.33	0.34	0.35	0.38			
IX-EPDB2001-0.4-TH3	●			0.4					14.29	0.43	0.44	0.45	0.47	0.50			
IX-EPDB2001-0.5-TH3	●			0.5					14.11	0.53	0.55	0.56	0.58	0.63			
IX-EPDB20015-0.3-TH3	●	0.075	0.15	0.3	0.12	0.14	35	4	14.51	0.32	0.33	0.34	0.35	0.37			
IX-EPDB20015-0.4-TH3	●			0.4					14.32	0.43	0.44	0.45	0.47	0.50			
IX-EPDB20015-0.5-TH3	●			0.5					14.14	0.53	0.54	0.56	0.58	0.62			
IX-EPDB20015-0.6-TH3	●			0.6					13.97	0.63	0.65	0.67	0.70	0.75			
IX-EPDB20015-0.75-TH3	●			0.75					13.71	0.79	0.81	0.84	0.87	0.93			
IX-EPDB2002-0.3-TH3	●	0.1	0.2	0.3	0.15	0.19	35	4	14.54	0.32	0.33	0.34	0.35	0.37			
IX-EPDB2002-0.4-TH3	●			0.4					14.35	0.42	0.44	0.45	0.46	0.49			
IX-EPDB2002-0.5-TH3	●			0.5					14.17	0.53	0.54	0.56	0.58	0.62			
IX-EPDB2002-0.6-TH3	●			0.6					13.99	0.63	0.65	0.67	0.69	0.74			
IX-EPDB2002-0.75-TH3	●			0.75			13.73		0.79	0.81	0.84	0.86	0.93				
IX-EPDB2002-0.85-TH3	●			0.85			13.57		0.89	0.92	0.95	0.98	1.05				
IX-EPDB2002-1-TH3	●			1						38		13.32	1.04	1.08	1.11	1.15	1.24
IX-EPDB2003-0.5-TH3	●	0.15	0.3	0.5	0.2	0.29	35	4	14.23	0.53	0.54	0.55	0.57	0.60			
IX-EPDB2003-0.6-TH3	●			0.6					14.05	0.63	0.65	0.66	0.68	0.73			
IX-EPDB2003-0.75-TH3	●			0.75					13.78	0.78	0.81	0.83	0.86	0.92			
IX-EPDB2003-1-TH3	●			1			13.35		1.04	1.07	1.11	1.14	1.23				
IX-EPDB2003-1.25-TH3	●			1.25						38		12.95	1.30	1.34	1.39	1.43	1.54
IX-EPDB2003-1.5-TH3	●			1.5			12.58		1.56	1.61	1.66	1.72	1.85				
IX-EPDB2004-0.5-TH3	●	0.2	0.4	0.5	0.25	0.39	35	4	14.30	0.52	0.54	0.55	0.56	0.59			
IX-EPDB2004-0.75-TH3	●			0.75					13.83	0.78	0.80	0.83	0.85	0.90			
IX-EPDB2004-1-TH3	●			1					13.39	1.04	1.07	1.10	1.14	1.21			
IX-EPDB2004-1.2-TH3	●			1.2					13.06	1.25	1.28	1.32	1.37	1.46			
IX-EPDB2004-1.5-TH3	●			1.5			12.59		1.56	1.61	1.66	1.71	1.84				
IX-EPDB2004-1.8-TH3	●			1.8			12.15		1.87	1.93	1.99	2.06	2.21				
IX-EPDB2004-2-TH3	●			2			11.87		2.07	2.14	2.21	2.29	2.46				
IX-EPDB2004-2.5-TH3	●			2.5			11.24		2.59	2.68	2.77	2.86	3.08				
IX-EPDB2004-3-TH3	●			3			10.66		3.11	3.21	3.32	3.44	3.70				
IX-EPDB2004-3.5-TH3	●			3.5			10.15		3.63	3.75	3.87	4.01	4.32				
IX-EPDB2004-4-TH3	●	4	9.67	4.14	4.28	4.43	4.59	4.94									
IX-EPDB2005-0.75-TH3	●	0.25	0.5	0.75	0.3	0.49	35	4	13.88	0.78	0.80	0.82	0.84	0.89			
IX-EPDB2005-1-TH3	●			1					13.42	1.04	1.07	1.10	1.13	1.20			
IX-EPDB2005-1.5-TH3	●			1.5					12.60	1.56	1.60	1.65	1.70	1.82			
IX-EPDB2005-2-TH3	●			2			11.87		2.07	2.14	2.21	2.28	2.45				
IX-EPDB2005-2.5-TH3	●			2.5			11.21		2.59	2.67	2.76	2.85	3.07				
IX-EPDB2005-3-TH3	●			3			10.63		3.11	3.21	3.31	3.43	3.69				
IX-EPDB2005-3.5-TH3	●			3.5			10.10		3.62	3.74	3.87	4.00	4.31				
IX-EPDB2005-4-TH3	●			4			9.62		4.14	4.28	4.42	4.58	4.93				
IX-EPDB2005-5-TH3	●			5						42		8.78	5.17	5.35	5.53	5.73	6.17
IX-EPDB2006-0.75-TH3	●	0.3	0.6	0.75	0.35	0.58	35	4	13.90	0.80	0.82	0.84	0.86	0.90			
IX-EPDB2006-1-TH3	●			1					13.43	1.06	1.08	1.11	1.14	1.21			
IX-EPDB2006-1.5-TH3	●			1.5					12.58	1.57	1.62	1.67	1.72	1.84			
IX-EPDB2006-2-TH3	●			2					11.83	2.09	2.15	2.22	2.29	2.46			
IX-EPDB2006-2.5-TH3	●			2.5			11.16		2.61	2.69	2.78	2.87	3.08				
IX-EPDB2006-3-TH3	●			3			10.57		3.12	3.22	3.33	3.44	3.70				
IX-EPDB2006-3.5-TH3	●			3.5			10.03		3.64	3.76	3.88	4.02	4.32				
IX-EPDB2006-4-TH3	●			4			9.54		4.16	4.29	4.44	4.59	4.94				

● : Stocked items.

IX-EPDB2-TH3

Item code	Stock	Size(mm)							Interference angle (°)	Effective under neck length with respect to draft angle				
		Ball radius	Tool dia.	Under neck length	Flute length	Neck dia.	Overall length	Shank dia.						
		RE	DC	LU	APMX	DN	LF	DCONMS		θκ	0.5°	1°	1.5°	2°
IX-EPDB2006-4.5-TH3	●	0.3	0.6	4.5	0.35	0.58	38	4	9.10	4.68	4.83	4.99	5.17	5.56
IX-EPDB2006-5-TH3	●			5			8.70		5.19	5.36	5.55	5.74	6.19	
IX-EPDB2006-5.5-TH3	●			5.5			8.33		5.71	5.90	6.10	6.32	6.81	
IX-EPDB2006-6-TH3	●			6			7.99		6.23	6.43	6.65	6.89	7.43	
IX-EPDB2007-2-TH3	●	0.35	0.7	2	0.4	0.68	38	4	11.82	2.09	2.15	2.22	2.29	2.44
IX-EPDB2007-4-TH3	●			4			9.48		4.16	4.29	4.43	4.59	4.93	
IX-EPDB2008-1-TH3	●	0.4	0.8	1	0.45	0.78	35	4	13.51	1.05	1.08	1.10	1.13	1.19
IX-EPDB2008-1.5-TH3	●			1.5			12.60		1.57	1.61	1.66	1.70	1.81	
IX-EPDB2008-2-TH3	●			2			11.81		2.09	2.15	2.21	2.28	2.43	
IX-EPDB2008-2.5-TH3	●			2.5			11.11		2.60	2.68	2.76	2.85	3.05	
IX-EPDB2008-3-TH3	●			3			10.48		3.12	3.22	3.32	3.43	3.68	
IX-EPDB2008-4-TH3	●			4			9.42		4.15	4.29	4.43	4.58	4.92	
IX-EPDB2008-5-TH3	●			5			8.55		5.19	5.36	5.54	5.73	6.16	
IX-EPDB2008-6-TH3	●			6			7.82		6.22	6.43	6.64	6.88	7.41	
IX-EPDB2008-8-TH3	●			8			6.69		8.29	8.56	8.86	9.18	9.89	
IX-EPDB2009-2-TH3	●	0.45	0.9	2	0.5	0.88	35	4	11.80	2.09	2.14	2.20	2.27	2.42
IX-EPDB2009-4-TH3	●			4			9.35		4.15	4.28	4.42	4.57	4.91	
IX-EPDB2009-6-TH3	●			6			7.74		6.22	6.42	6.64	6.87	7.39	
IX-EPDB2010-1.5-TH3	●	0.5	1	1.5	0.7	0.97	35	4	12.60	1.59	1.62	1.67	1.71	1.81
IX-EPDB2010-2-TH3	●			2			11.75		2.10	2.16	2.22	2.29	2.43	
IX-EPDB2010-2.5-TH3	●			2.5			11.02		2.62	2.69	2.77	2.86	3.05	
IX-EPDB2010-3-TH3	●			3			10.36		3.14	3.23	3.33	3.44	3.68	
IX-EPDB2010-4-TH3	●			4			9.26		4.17	4.30	4.44	4.59	4.92	
IX-EPDB2010-5-TH3	●			5			8.37		5.20	5.37	5.55	5.74	6.16	
IX-EPDB2010-6-TH3	●			6			7.63		6.24	6.44	6.65	6.88	7.41	
IX-EPDB2010-7-TH3	●			7			7.01		7.27	7.51	7.76	8.03	8.65	
IX-EPDB2010-8-TH3	●			8			6.49		8.31	8.58	8.87	9.18	9.89	
IX-EPDB2010-9-TH3	●			9			6.03		9.34	9.65	9.98	10.33	11.13	
IX-EPDB2010-10-TH3	●			10			5.64		10.37	10.72	11.09	11.48	12.38	
IX-EPDB2010-12-TH3	●			12			4.99		12.44	12.86	13.30	13.78	14.86	
IX-EPDB2015-2-TH3	●	0.75	1.5	2	1.25	1.46	35	4	11.64	2.11	2.16	2.21	2.27	2.40
IX-EPDB2015-2.5-TH3	●			2.5			10.78		2.63	2.70	2.77	2.85	3.02	
IX-EPDB2015-3-TH3	●			3			10.04		3.15	3.23	3.32	3.42	3.64	
IX-EPDB2015-4-TH3	●			4			8.82		4.18	4.30	4.43	4.57	4.88	
IX-EPDB2015-5-TH3	●			5			7.87		5.22	5.37	5.54	5.72	6.13	
IX-EPDB2015-6-TH3	●			6			7.10		6.25	6.44	6.65	6.87	7.37	
IX-EPDB2015-8-TH3	●			8			5.93		8.32	8.58	8.86	9.17	9.86	
IX-EPDB2015-10-TH3	●			10			5.09		10.38	10.72	11.08	11.47	12.34	
IX-EPDB2015-12-TH3	●			12			4.46		12.45	12.86	13.30	13.77	14.83	
IX-EPDB2020-2.5-TH3	●	1	2	2.5	1.6	1.95	35	4	10.46	2.64	2.70	2.76	2.83	2.98
IX-EPDB2020-3-TH3	●			3			9.60		3.16	3.23	3.32	3.40	3.60	
IX-EPDB2020-4-TH3	●			4			8.24		4.19	4.30	4.42	4.55	4.85	
IX-EPDB2020-5-TH3	●			5			7.22		5.23	5.37	5.53	5.70	6.09	
IX-EPDB2020-6-TH3	●			6			6.42		6.26	6.44	6.64	6.85	7.33	
IX-EPDB2020-8-TH3	●			8			5.25		8.33	8.58	8.86	9.15	9.82	
IX-EPDB2020-10-TH3	●			10			4.44		10.39	10.72	11.07	11.45	12.31	
IX-EPDB2020-12-TH3	●			12			3.85		12.46	12.86	13.29	13.75	14.79	
IX-EPDB2020-13-TH3	●			13			3.60		13.50	13.93	14.40	14.90	16.04	
IX-EPDB2020-14-TH3	●			14			3.39		14.53	15.00	15.51	16.05	17.28	
IX-EPDB2020-16-TH3	●			16			3.03		16.60	17.14	17.72	18.35	19.76	
IX-EPDB2020-18-TH3	●			18			2.74		18.66	19.28	19.94	20.65	No interference	
IX-EPDB2020-20-TH3	●			20			2.50		20.73	21.42	22.16	22.95	No interference	
IX-EPDB2025-6-TH3	●	1.25	2.5	6	1.9	2.44	38	4	5.54	6.27	6.45	6.64	6.84	7.30
IX-EPDB2025-8-TH3	●			8			4.41		8.34	8.59	8.85	9.14	9.78	
IX-EPDB2025-10-TH3	●			10			3.66		10.41	10.73	11.07	11.44	12.27	
IX-EPDB2025-15-TH3	●			15			2.57		15.57	16.07	16.61	17.19	No interference	

Recommended Cutting Conditions

High efficiency
cutting condition

High accuracy
cutting condition

Please refer to P.8 about high accuracy cutting conditions

Work material				1		2		3		4		5	
				Pre-hardened steels (35~45HRC)		Hardened steels (45~55HRC)		Hardened steels (55~60HRC)		Hardened steels (60~65HRC)		Hardened steels (65~72HRC)	
Ratio to standard depth of cut				100%		85%		80%		65%		55%	
Ball radius RE (mm)	Tool dia. DC (mm)	Under neck length LU (mm)	a_p (mm)	Revolution n min ⁻¹	Feed rate v_f mm/min	Revolution n min ⁻¹	Feed rate v_f mm/min	Revolution n min ⁻¹	Feed rate v_f mm/min	Revolution n min ⁻¹	Feed rate v_f mm/min	Revolution n min ⁻¹	Feed rate v_f mm/min
0.05	0.1	0.2	0.006	50,000	230	50,000	200	50,000	190	45,000	170	42,500	130
		0.3	0.005	50,000	230	50,000	200	50,000	190	45,000	170	42,500	130
		0.4	0.004	50,000	230	50,000	200	50,000	190	45,000	170	42,500	130
		0.5	0.003	50,000	230	50,000	200	50,000	190	45,000	170	42,500	130
0.075	0.15	0.3	0.009	50,000	280	46,000	230	42,000	180	37,500	160	35,500	120
		0.4	0.008	50,000	280	46,000	230	42,000	180	37,500	160	35,500	120
		0.5	0.008	50,000	280	46,000	230	42,000	180	37,500	160	35,500	120
		0.6	0.007	50,000	280	46,000	230	42,000	180	37,500	160	35,500	120
0.1	0.2	0.75	0.007	50,000	280	46,000	230	42,000	180	37,500	160	35,500	120
		0.3	0.016	50,000	330	45,500	270	42,000	210	37,800	190	35,700	150
		0.4	0.016	50,000	330	45,500	270	42,000	210	37,800	190	35,700	150
		0.5	0.016	50,000	330	45,500	270	42,000	210	37,800	190	35,700	150
0.15	0.3	0.6	0.014	50,000	330	45,500	270	42,000	210	37,800	190	35,700	150
		0.75	0.014	50,000	330	45,500	270	42,000	210	37,800	190	35,700	150
		0.85	0.011	50,000	330	45,500	270	42,000	210	37,800	190	35,700	150
		1	0.011	50,000	330	45,500	270	42,000	210	37,800	190	35,700	150
0.2	0.4	0.5	0.022	50,000	450	45,000	380	42,000	340	37,800	300	35,700	240
		0.6	0.02	50,000	450	45,000	380	42,000	340	37,800	300	35,700	240
		0.75	0.019	50,000	450	45,000	380	42,000	340	37,800	300	35,700	240
		1	0.017	50,000	450	45,000	380	42,000	340	37,800	300	35,700	240
0.25	0.5	1.25	0.015	50,000	450	45,000	380	42,000	340	37,800	300	35,700	240
		1.5	0.013	50,000	450	45,000	380	42,000	340	37,800	300	35,700	240
		0.5	0.034	50,000	770	46,800	660	43,680	610	39,310	550	37,130	430
		0.75	0.034	50,000	770	46,800	660	43,680	610	39,310	550	37,130	430
0.3	0.6	1	0.032	50,000	770	46,800	660	43,680	610	39,310	550	37,130	430
		1.2	0.027	50,000	660	46,800	470	43,680	440	39,310	390	37,130	310
		1.5	0.027	50,000	660	46,800	470	43,680	440	39,310	390	37,130	310
		1.8	0.022	50,000	550	46,800	470	43,680	440	39,310	390	37,130	310
0.35	0.7	2	0.022	50,000	550	46,800	470	43,680	440	39,310	390	37,130	310
		2.5	0.018	36,720	360	35,020	290	33,820	270	32,660	250	30,850	190
		3	0.013	36,720	360	35,020	290	33,820	270	32,660	250	30,850	190
		3.5	0.01	36,720	360	35,020	290	33,820	270	32,660	250	30,850	190
0.4	0.8	4	0.008	36,720	360	35,020	290	33,820	270	32,660	250	30,850	190
		0.75	0.036	50,000	1,190	47,130	1,050	43,930	740	39,820	670	37,560	520
		1	0.036	50,000	1,190	47,130	1,050	43,930	740	39,820	670	37,560	520
		1.5	0.032	50,000	1,190	47,130	1,050	43,930	680	39,820	610	37,560	480
0.4	0.8	2	0.028	50,000	960	47,130	840	43,930	680	39,820	610	37,560	480
		2.5	0.026	45,450	650	42,840	570	39,940	500	36,220	450	34,180	350
		3	0.024	45,450	650	42,840	570	39,940	500	36,220	450	34,180	350
		3.5	0.02	34,970	500	32,950	440	30,730	390	28,540	350	26,290	270
0.4	0.8	4	0.016	34,970	500	32,950	440	30,730	390	28,540	350	26,290	270
		5	0.014	34,970	500	32,950	440	30,730	390	28,540	350	26,290	270
		0.75	0.06	50,000	1,950	48,000	1,730	44,800	1,340	40,320	1,210	38,080	940
		1	0.06	50,000	1,950	48,000	1,730	44,800	1,340	40,320	1,210	38,080	940
0.4	0.8	1.5	0.055	50,000	1,950	48,000	1,730	44,800	1,340	40,320	1,210	38,080	940
		2	0.05	50,000	1,950	48,000	1,730	44,800	1,340	40,320	1,210	38,080	940
		2.5	0.036	50,000	1,560	48,000	1,380	44,800	990	40,320	890	38,080	690
		3	0.033	50,000	1,560	48,000	1,380	44,800	990	40,320	890	38,080	690
0.4	0.8	3.5	0.028	48,960	1,450	43,200	1,180	40,320	840	36,290	760	34,270	590
		4	0.021	48,960	1,450	43,200	1,180	40,320	770	36,290	690	34,270	540
		4.5	0.018	45,900	1,070	40,500	880	37,800	680	34,020	610	32,130	480
		5	0.016	39,780	930	35,100	760	32,760	590	29,480	530	27,850	410
0.4	0.8	5.5	0.014	39,780	930	35,100	760	32,760	590	29,480	530	27,850	410
		6	0.012	39,780	930	35,100	760	32,760	590	29,480	530	27,850	410
		2	0.073	50,000	2,160	48,000	1,930	44,800	1,190	40,320	1,070	38,080	830
		4	0.033	48,960	1,600	47,000	1,320	43,870	850	39,480	760	37,370	590
0.4	0.8	1	0.12	50,000	2,400	48,000	2,210	44,800	1,880	40,320	1,690	38,080	1,320
		1.5	0.12	50,000	2,400	48,000	2,210	44,800	1,880	40,320	1,690	38,080	1,320
		2	0.096	50,000	2,400	48,000	2,210	44,800	1,880	40,320	1,690	38,080	1,320
		2.5	0.088	50,000	2,400	48,000	2,210	44,800	1,880	40,320	1,690	38,080	1,320
0.4	0.8	3	0.08	50,000	2,400	48,000	2,210	44,800	1,880	40,320	1,690	38,080	1,320

Work material				1		2		3		4		5	
				Pre-hardened steels (35~45HRC)		Hardened steels (45~55HRC)		Hardened steels (55~60HRC)		Hardened steels (60~65HRC)		Hardened steels (65~72HRC)	
Ratio to standard depth of cut				100%		85%		80%		65%		55%	
Ball radius RE (mm)	Tool dia. DC (mm)	Under neck length LU (mm)	a_p (mm)	Revolution n min ⁻¹	Feed rate v_f mm/min	Revolution n min ⁻¹	Feed rate v_f mm/min	Revolution n min ⁻¹	Feed rate v_f mm/min	Revolution n min ⁻¹	Feed rate v_f mm/min	Revolution n min ⁻¹	Feed rate v_f mm/min
0.4	0.8	4	0.063	50,000	2,400	48,000	2,210	44,800	1,880	40,320	1,690	38,080	1,320
		5	0.047	48,960	2,110	43,200	1,770	40,320	1,520	36,290	1,370	34,270	1,070
		6	0.033	42,840	1,730	37,800	1,430	35,280	1,250	31,750	1,120	29,990	870
		8	0.016	35,360	1,020	31,200	840	29,120	730	26,210	660	24,750	510
0.45	0.9	2	0.108	50,000	2,820	45,600	2,410	42,560	2,140	38,300	1,930	36,180	1,500
		4	0.065	48,450	2,370	42,750	1,960	39,900	1,740	35,910	1,560	33,920	1,220
		6	0.044	40,700	1,520	35,910	1,250	33,520	1,110	30,160	1,000	28,490	780
0.5	1	1.5	0.18	45,900	3,100	43,200	2,720	37,800	2,270	34,020	2,040	32,130	1,590
		2	0.16	45,900	3,100	43,200	2,720	37,800	2,270	34,020	2,040	32,130	1,590
		2.5	0.16	45,900	3,100	43,200	2,720	37,800	2,270	34,020	2,040	32,130	1,590
		3	0.16	45,900	3,100	43,200	2,720	37,800	2,270	34,020	2,040	32,130	1,590
		4	0.112	45,900	3,100	43,200	2,720	37,800	2,270	34,020	2,040	32,130	1,590
		5	0.072	39,780	2,600	37,440	2,250	32,760	1,840	29,480	1,650	27,850	1,280
		6	0.048	38,560	2,320	33,690	1,860	29,480	1,380	26,540	1,240	25,060	970
		7	0.048	33,050	1,340	31,590	1,250	27,220	1,060	24,490	960	23,130	740
		8	0.048	33,050	1,340	31,590	1,250	27,220	980	24,490	880	23,130	690
		9	0.036	33,050	1,340	31,590	1,250	27,220	980	24,490	880	23,130	690
		10	0.03	33,050	1,340	31,590	1,250	27,220	980	24,490	880	23,130	690
		12	0.02	24,480	940	21,600	770	20,160	690	18,140	620	17,140	480
0.75	1.5	2	0.192	35,700	3,210	31,500	2,550	29,400	2,210	26,460	1,990	24,990	1,540
		2.5	0.192	35,700	3,210	31,500	2,550	29,400	2,210	26,460	1,990	24,990	1,540
		3	0.192	35,700	3,210	31,500	2,550	29,400	2,210	26,460	1,990	24,990	1,540
		4	0.16	35,700	3,210	31,500	2,550	29,400	2,210	26,460	1,990	24,990	1,540
		5	0.16	35,700	3,210	31,500	2,550	29,400	2,210	26,460	1,990	24,990	1,540
		6	0.16	35,700	3,210	31,500	2,550	29,400	2,210	26,460	1,990	24,990	1,540
		8	0.072	27,850	1,810	24,570	1,430	22,930	1,240	20,640	1,120	19,490	870
		10	0.072	25,700	1,670	22,680	1,320	21,170	1,140	19,050	1,030	17,990	800
1	2	12	0.072	25,700	1,390	22,680	1,100	21,170	950	19,050	860	17,990	670
		2.5	0.32	26,780	3,620	23,630	3,050	22,050	2,650	19,850	2,380	18,740	1,850
		3	0.32	26,780	3,620	23,630	3,050	22,050	2,650	19,850	2,380	18,740	1,850
		4	0.32	26,780	3,620	23,630	3,050	22,050	2,650	19,850	2,380	18,740	1,850
		5	0.32	26,780	3,620	23,630	3,050	22,050	2,650	19,850	2,380	18,740	1,850
		6	0.32	26,780	3,210	23,630	2,690	22,050	2,380	19,850	2,140	18,740	1,670
		8	0.224	26,780	3,210	23,630	2,690	22,050	2,380	19,850	2,140	18,740	1,670
		10	0.168	24,990	2,700	22,050	2,250	19,110	1,470	17,200	1,320	16,240	1,030
		12	0.096	22,490	2,430	19,850	2,020	17,200	1,320	15,480	1,190	14,620	930
		13	0.096	22,490	2,430	19,850	2,020	15,880	1,020	14,290	920	13,500	710
		14	0.096	22,490	2,430	19,850	2,020	15,880	1,020	14,290	920	13,500	710
		16	0.096	20,890	1,350	18,430	1,110	15,880	910	14,290	820	13,500	640
1.25	2.5	18	0.072	20,890	1,350	18,430	1,110	15,880	910	14,290	820	13,500	640
		20	0.06	20,890	1,350	18,430	1,110	15,880	910	14,290	820	13,500	640
		6	0.4	23,590	3,800	20,810	3,090	19,430	2,530	17,480	2,280	16,610	1,820
		8	0.272	23,590	3,800	20,810	3,090	19,430	2,530	17,480	2,280	16,610	1,820
		10	0.272	23,590	3,800	20,810	3,090	19,430	2,530	17,480	2,280	16,610	1,820
		15	0.12	18,400	2,480	16,230	2,020	15,150	1,420	13,640	1,280	12,950	1,020

- ※(1) a_p is shown as the criteria for pre-hardened steel. For other materials, adjust the cutting depth according to the cutting depth factors in the above table.
 ※(2) When performing cutting where cutting chips may cause clogging, such as for rib cutting, blind grooves, etc., the cutting depth setting should be set by multiplying a_p by a cutting depth factor to calculate the cutting depth amount, and this amount should then be reduced to 80% of the calculated value.
 ※(3) Adjust by setting a_e to (3 to 5) × (a_p) × (cutting depth ratio). When performing finishing processing, calculate the theoretical cusp height and set accordingly.

Cutting depth setting example: When cutting rib groove contours in hardened steel (50HRC) using an IX-EPDB2020-10-TH3 tool:

$$\text{Cutting depth} = 0.168 (a_p) \times 0.85 (\text{cutting depth factor for hardened steel [45-55HRC]}) \times 0.8 (\text{for closed-area cutting}) = 0.11 \text{ mm}$$

[Note]

- Although basically dry (air blow) cutting is recommended, please use appropriate coolant according to the work material and machining shape.
- These Recommended Cutting Conditions indicate only the rule of a thumb for the cutting conditions. In actual machining, the condition should be adjusted according to the machining shape, purpose and the machine type.
- If the rpm of the machine is low, lower the feed rate also to put the rpm and feed rate in the same ratio.

Recommended Cutting Conditions

High efficiency
cutting condition

High accuracy
cutting condition

Please refer to P.6 about high efficiency cutting conditions

Work material				1		2		3		4		5	
				Pre-hardened steels (35~45HRC)		Hardened steels (45~55HRC)		Hardened steels (55~60HRC)		Hardened steels (60~65HRC)		Hardened steels (65~72HRC)	
Ratio to standard depth of cut				100%		85%		80%		65%		55%	
Ball radius RE (mm)	Tool dia. DC (mm)	Under neck length LU (mm)	ap (mm)	Revolution n min ⁻¹	Feed rate vf mm/min	Revolution n min ⁻¹	Feed rate vf mm/min	Revolution n min ⁻¹	Feed rate vf mm/min	Revolution n min ⁻¹	Feed rate vf mm/min	Revolution n min ⁻¹	Feed rate vf mm/min
0.05	0.1	0.2	0.003	50,000	230	50,000	200	50,000	190	45,000	170	42,500	130
		0.3	0.002	50,000	230	50,000	200	50,000	190	45,000	170	42,500	130
		0.4	0.002	50,000	230	50,000	200	50,000	190	45,000	170	42,500	130
		0.5	0.002	50,000	230	50,000	200	50,000	190	45,000	170	42,500	130
0.075	0.15	0.3	0.007	50,000	280	46,000	230	42,000	180	37,500	160	35,500	120
		0.4	0.006	50,000	280	46,000	230	42,000	180	37,500	160	35,500	120
		0.5	0.006	50,000	280	46,000	230	42,000	180	37,500	160	35,500	120
		0.6	0.005	50,000	280	46,000	230	42,000	180	37,500	160	35,500	120
0.1	0.2	0.75	0.005	50,000	280	46,000	230	42,000	180	37,500	160	35,500	120
		0.3	0.012	50,000	330	45,500	270	42,000	210	37,800	190	35,700	150
		0.4	0.012	50,000	330	45,500	270	42,000	210	37,800	190	35,700	150
		0.5	0.012	50,000	330	45,500	270	42,000	210	37,800	190	35,700	150
0.15	0.3	0.6	0.01	50,000	330	45,500	270	42,000	210	37,800	190	35,700	150
		0.75	0.01	50,000	330	45,500	270	42,000	210	37,800	190	35,700	150
		0.85	0.008	50,000	330	45,500	270	42,000	210	37,800	190	35,700	150
		1	0.008	50,000	330	45,500	270	42,000	210	37,800	190	35,700	150
0.2	0.4	0.5	0.016	50,000	450	45,000	380	42,000	340	37,800	300	35,700	240
		0.6	0.015	50,000	450	45,000	380	42,000	340	37,800	300	35,700	240
		0.75	0.014	50,000	450	45,000	380	42,000	340	37,800	300	35,700	240
		1	0.013	50,000	450	45,000	380	42,000	340	37,800	300	35,700	240
0.25	0.5	1.25	0.011	50,000	450	45,000	380	42,000	340	37,800	300	35,700	240
		1.5	0.01	50,000	450	45,000	380	42,000	340	37,800	300	35,700	240
0.3	0.6	0.5	0.024	40,800	450	36,000	360	33,600	340	30,240	300	28,560	240
		0.75	0.024	40,800	450	36,000	360	33,600	340	30,240	300	28,560	240
		1	0.022	40,800	450	36,000	360	33,600	340	30,240	300	28,560	240
		1.2	0.02	40,800	450	36,000	360	33,600	340	30,240	300	28,560	240
0.35	0.7	1.5	0.02	40,800	450	36,000	360	33,600	340	30,240	300	28,560	240
		1.8	0.015	40,800	450	36,000	360	33,600	340	30,240	300	28,560	240
		2	0.015	40,800	450	36,000	360	33,600	340	30,240	300	28,560	240
		2.5	0.013	36,720	360	32,400	290	30,240	270	27,220	250	25,700	190
0.4	0.8	3	0.009	36,720	360	32,400	290	30,240	270	27,220	250	25,700	190
		3.5	0.006	36,720	360	32,400	290	30,240	270	27,220	250	25,700	190
		4	0.004	36,720	360	32,400	290	30,240	270	27,220	250	25,700	190
		0.75	0.025	34,000	610	30,000	540	28,000	480	25,200	430	23,800	330
0.45	0.9	1	0.025	34,000	610	30,000	540	28,000	480	25,200	430	23,800	330
		1.5	0.022	34,000	610	30,000	540	28,000	480	25,200	430	23,800	330
		2	0.02	34,000	610	30,000	540	28,000	480	25,200	430	23,800	330
		2.5	0.018	30,600	500	27,000	440	25,200	390	22,680	350	21,420	270
0.55	1.0	3	0.016	30,600	500	27,000	440	25,200	390	22,680	350	21,420	270
		3.5	0.014	30,600	500	27,000	440	25,200	390	22,680	350	21,420	270
		4	0.011	30,600	500	27,000	440	25,200	390	22,680	350	21,420	270
		5	0.01	30,600	500	27,000	440	25,200	390	22,680	350	21,420	270
0.65	1.2	0.75	0.04	34,000	880	30,000	720	28,000	560	25,200	500	23,800	390
		1	0.04	34,000	880	30,000	720	28,000	560	25,200	500	23,800	390
		1.5	0.038	34,000	880	30,000	720	28,000	560	25,200	500	23,800	390
		2	0.034	34,000	880	30,000	720	28,000	560	25,200	500	23,800	390
0.75	1.5	2.5	0.026	34,000	880	30,000	720	28,000	560	25,200	500	23,800	390
		3	0.024	34,000	880	30,000	720	28,000	560	25,200	500	23,800	390
		3.5	0.02	30,600	760	27,000	620	25,200	480	22,680	430	21,420	340
		4	0.015	30,600	760	27,000	620	25,200	480	22,680	430	21,420	340
0.85	1.8	4.5	0.013	30,600	720	27,000	580	25,200	450	22,680	410	21,420	320
		5	0.011	30,600	720	27,000	580	25,200	450	22,680	410	21,420	320
		5.5	0.01	30,600	720	27,000	580	25,200	450	22,680	410	21,420	320
		6	0.008	30,600	720	27,000	580	25,200	450	22,680	410	21,420	320
0.95	2.0	2	0.049	34,000	980	30,000	810	28,000	660	25,200	590	23,800	460
		4	0.027	30,600	840	27,000	690	25,200	560	22,680	510	21,420	400
1.05	2.5	1	0.08	34,000	1,090	30,000	900	28,000	780	25,200	710	23,800	550
		1.5	0.08	34,000	1,090	30,000	900	28,000	780	25,200	710	23,800	550
		2	0.064	34,000	1,090	30,000	900	28,000	780	25,200	710	23,800	550
		2.5	0.06	34,000	1,090	30,000	900	28,000	780	25,200	710	23,800	550
1.15	3.0	3	0.055	34,000	1,090	30,000	900	28,000	780	25,200	710	23,800	550

Work material				1		2		3		4		5	
				Pre-hardened steels (35~45HRC)		Hardened steels (45~55HRC)		Hardened steels (55~60HRC)		Hardened steels (60~65HRC)		Hardened steels (65~72HRC)	
Ratio to standard depth of cut				100%		85%		80%		65%		55%	
Ball radius RE (mm)	Tool dia. DC (mm)	Under neck length LU (mm)	a_p (mm)	Revolution n min ⁻¹	Feed rate v_f mm/min	Revolution n min ⁻¹	Feed rate v_f mm/min	Revolution n min ⁻¹	Feed rate v_f mm/min	Revolution n min ⁻¹	Feed rate v_f mm/min	Revolution n min ⁻¹	Feed rate v_f mm/min
0.4	0.8	4	0.042	34,000	1,090	30,000	900	28,000	780	25,200	710	23,800	550
		5	0.032	30,600	880	27,000	730	25,200	640	22,680	570	21,420	450
		6	0.022	30,600	880	27,000	730	25,200	640	22,680	570	21,420	450
		8	0.011	27,200	780	24,000	650	22,400	560	20,160	510	19,040	400
0.45	0.9	2	0.072	32,300	1,220	28,500	1,000	26,600	890	23,940	800	22,610	620
		4	0.046	32,300	1,220	28,500	1,000	26,600	890	23,940	800	22,610	620
		6	0.034	29,070	980	25,650	810	23,940	720	21,550	650	20,350	510
0.5	1	1.5	0.09	30,600	1,380	27,000	1,130	25,200	1,010	22,680	910	21,420	710
		2	0.08	30,600	1,380	27,000	1,130	25,200	1,010	22,680	910	21,420	710
		2.5	0.08	30,600	1,380	27,000	1,130	25,200	1,010	22,680	910	21,420	710
		3	0.08	30,600	1,380	27,000	1,130	25,200	1,010	22,680	910	21,420	710
		4	0.056	30,600	1,380	27,000	1,130	25,200	1,010	22,680	910	21,420	710
		5	0.048	30,600	1,380	27,000	1,130	25,200	1,010	22,680	910	21,420	710
		6	0.032	27,540	1,120	24,300	920	22,680	820	20,410	730	19,280	570
		7	0.032	27,540	1,120	24,300	920	22,680	820	20,410	730	19,280	570
		8	0.032	27,540	1,120	24,300	920	22,680	820	20,410	730	19,280	570
		9	0.024	27,540	1,120	24,300	920	22,680	820	20,410	730	19,280	570
		10	0.02	27,540	1,120	24,300	920	22,680	820	20,410	730	19,280	570
		12	0.01	24,480	940	21,600	770	20,160	690	18,140	620	17,140	480
0.75	1.5	2	0.096	23,800	1,430	21,000	1,130	19,600	980	17,640	880	16,660	690
		2.5	0.096	23,800	1,430	21,000	1,130	19,600	980	17,640	880	16,660	690
		3	0.096	23,800	1,430	21,000	1,130	19,600	980	17,640	880	16,660	690
		4	0.08	23,800	1,430	21,000	1,130	19,600	980	17,640	880	16,660	690
		5	0.08	23,800	1,430	21,000	1,130	19,600	980	17,640	880	16,660	690
		6	0.08	23,800	1,430	21,000	1,130	19,600	980	17,640	880	16,660	690
		8	0.048	21,420	1,160	18,900	920	17,640	790	15,880	720	14,990	560
		10	0.048	21,420	1,160	18,900	920	17,640	790	15,880	720	14,990	560
1	2	12	0.048	21,420	1,160	18,900	920	17,640	790	15,880	720	14,990	560
		2.5	0.16	17,850	1,610	15,750	1,360	14,700	1,180	13,230	1,060	12,500	820
		3	0.16	17,850	1,610	15,750	1,360	14,700	1,180	13,230	1,060	12,500	820
		4	0.16	17,850	1,610	15,750	1,360	14,700	1,180	13,230	1,060	12,500	820
		5	0.16	17,850	1,610	15,750	1,360	14,700	1,180	13,230	1,060	12,500	820
		6	0.16	17,850	1,430	15,750	1,200	14,700	1,060	13,230	950	12,500	740
		8	0.112	17,850	1,430	15,750	1,200	14,700	1,060	13,230	950	12,500	740
		10	0.112	17,850	1,290	15,750	1,070	14,700	940	13,230	850	12,500	660
		12	0.064	16,070	1,160	14,180	960	13,230	850	11,910	760	11,250	590
		13	0.064	16,070	1,160	14,180	960	13,230	850	11,910	760	11,250	590
		14	0.064	16,070	1,160	14,180	960	13,230	850	11,910	760	11,250	590
		16	0.064	16,070	1,040	14,180	870	13,230	760	11,910	690	11,250	530
1.25	2.5	18	0.048	16,070	1,040	14,180	870	13,230	760	11,910	690	11,250	530
		20	0.04	16,070	1,040	14,180	870	13,230	760	11,910	690	11,250	530
		6	0.2	15,730	1,690	13,880	1,370	12,950	1,130	11,660	1,010	11,070	810
		8	0.136	15,730	1,690	13,880	1,370	12,950	1,130	11,660	1,010	11,070	810
		10	0.136	15,730	1,690	13,880	1,370	12,950	1,130	11,660	1,010	11,070	810
		15	0.08	14,150	1,370	12,490	1,110	11,660	910	10,490	820	9,970	660

※(1) a_p is shown as the criteria for pre-hardened steel. For other materials, adjust the cutting depth according to the cutting depth factors in the above table.

※(2) When performing cutting where cutting chips may cause clogging, such as for rib cutting, blind grooves, etc., the cutting depth setting should be set by multiplying a_p by a cutting depth factor to calculate the cutting depth amount, and this amount should then be reduced to 80% of the calculated value.

※(3) Adjust by setting a_e to (3 to 5) × (a_p) × (cutting depth ratio). When performing finishing processing, calculate the theoretical cusp height and set accordingly.

Cutting depth setting example: When cutting rib groove contours in hardened steel (50HRC) using an IX-EPDB2020-10-TH3 tool:

Cutting depth = 0.112 (a_p) × 0.85 (cutting depth factor for hardened steel [45~55HRC]) × 0.8 (for closed-area cutting) = 0.076 mm

[Note]

① Although basically dry (air blow) cutting is recommended, please use appropriate coolant according to the work material and machining shape.

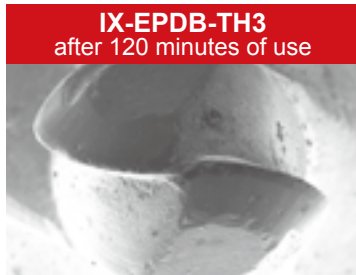
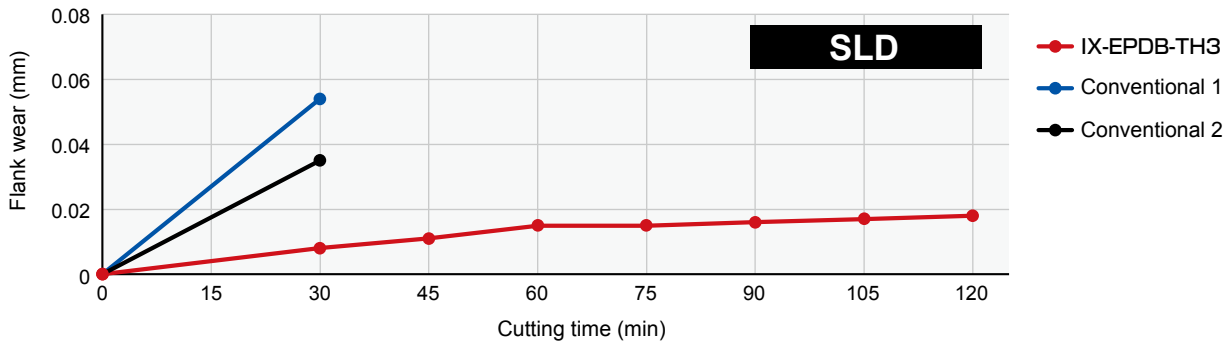
② These Recommended Cutting Conditions indicate only the rule of a thumb for the cutting conditions. In actual machining, the condition should be adjusted according to the machining shape, purpose and the machine type.

③ If the rpm of the machine is low, lower the feed rate also to put the rpm and feed rate in the same ratio.

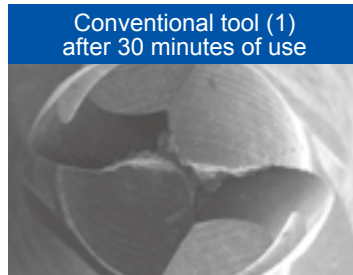


Comparison to conventional carbide tools

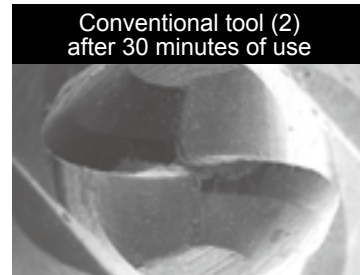
Tool : IX-EPDB2003-0.5-TH3 ($\phi 0.3$ Under neck length 0.5mm) Machine : Vertical MC (HSK-E25)
 Work material : SLD(60HRC) VANADIS23(64HRC)
 Cutting conditions : $n=40,000\text{min}^{-1}$ ($v_c=38\text{m/min}$) $v_f=320\text{mm/min}$ ($f_z=0.004\text{mm/t}$)
 $a_p \times a_e = 0.01\text{mm} \times 0.01\text{mm}$ Coolant : Mist blow



Normal wear allowing continued use

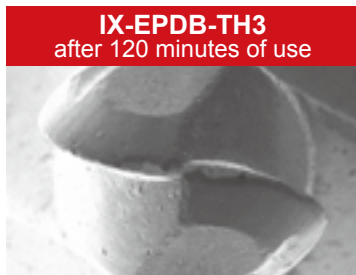
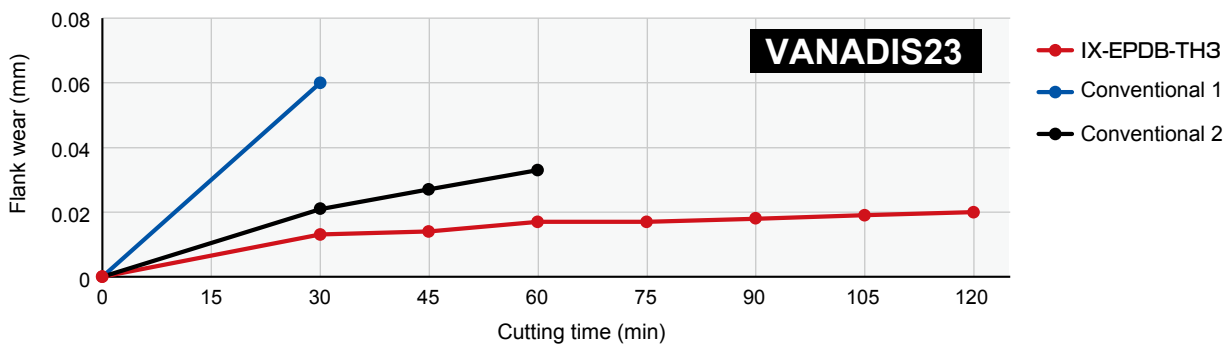


Excessive wear + chipping

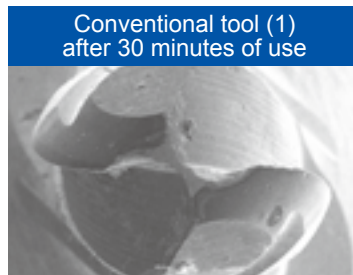


Excessive wear + chipping

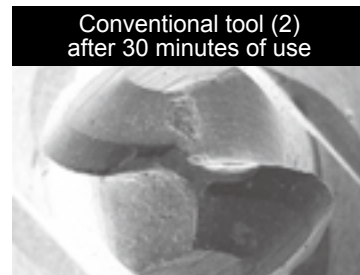
0.1mm



Normal wear allowing continued use



Excessive wear + chipping



Excessive wear + chipping

0.1mm

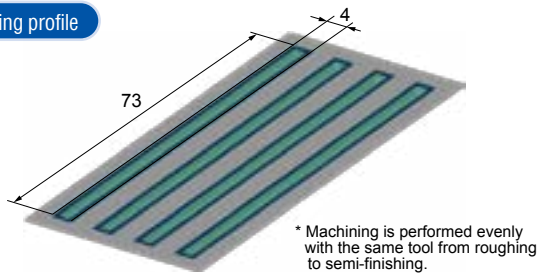
IX-EPDB-TH3 combines high wear resistance and chipping resistance to greatly improve tool life when machining hardened steel.



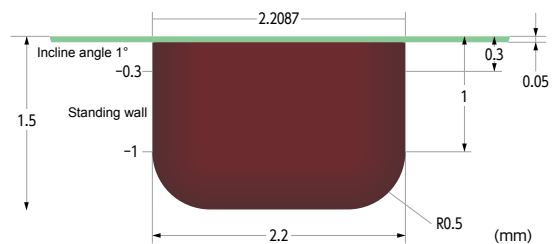
Comparison to cBN tools

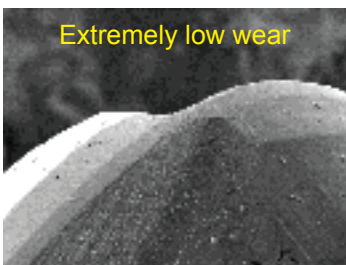
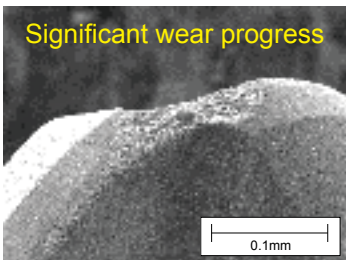
Tool : IX-EPDB2006-1.5-TH3 ($\phi 0.6$ Under neck length 1.5mm) Machine : Vertical MC (HSK-E25)
 Work material : VANADIS23(64HRC)
 Cutting conditions : $n=40,000\text{min}^{-1}$ ($v_c=75\text{m/min}$) $v_f=800\text{mm/min}$ ($f_z=0.01\text{mm/t}$) $a_p \times a_e = 0.005\text{mm} \times 0.01\text{mm}$
 Machining allowance : 0.01mm Cutting time : 191min. (154m)
 Coolant : Mist blow
 * Finish machining two grooves using each tool.

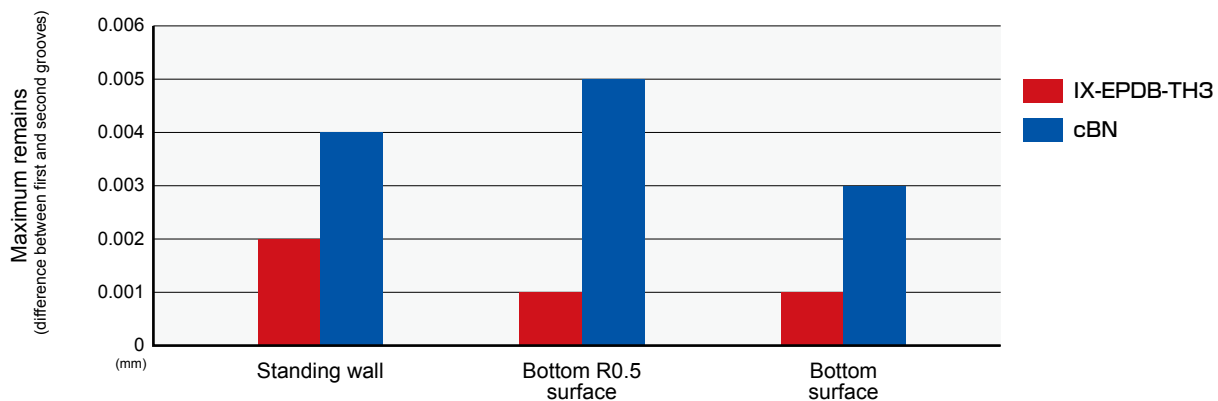
Machining profile



Groove cross-sectional shape



	Tool damage (after 191 minutes of use)	Appearance and bottom roughness of machined surface (machined surface photographed from above using CCD camera)	
		First profile	Second profile
IX-EPDB-TH3	 Extremely low wear	 Rz 0.50 μm	 Rz 0.69 μm
cBN	 Significant wear progress 0.1mm	 Rz 0.62 μm	 Rz 2.20 μm



IX-EPDB-TH3 produces an even, glossy machined surface with fewer cutter marks and remains.
Replacing cBN tools can significantly reduce tool costs.



The diagrams and table data are examples of test results, and are not guaranteed values.

"MOLDINO" is a registered trademark of MOLDINO Tool Engineering, Ltd.

Carbide material of the IX series is a product developed based on the technology of NIPPON TOKUSHU GOUKIN CO., LTD.

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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