



Long-neck & Ball nose end mills

PHX-LN-DBT PHX-LN-CRE

Volume 2



Key features PHX-LN-DBT



Time required for roughing can be greatly reduced with the PHX long neck ball nose end mill!

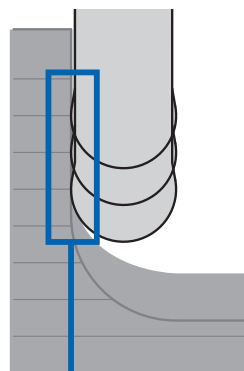
1 Short length of cut

Highly rigid 0.75D short length of cut geometry enables low resistance vertical wall milling.

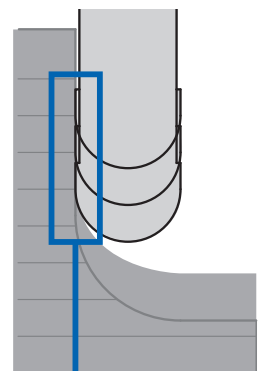


2 Improved accuracy in vertical wall milling

Without back taper, the PHX-LN-DBT's peripheral cutting edge is able to achieve flat milling to improve accuracy.



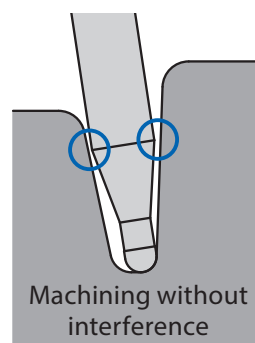
Peripheral cutting edge with back taper



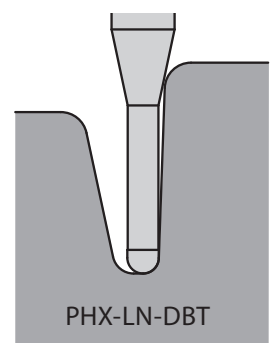
Peripheral cutting edge without back taper

3 Slim neck shape

Performs particularly well in five-axis milling with neck length limitation.



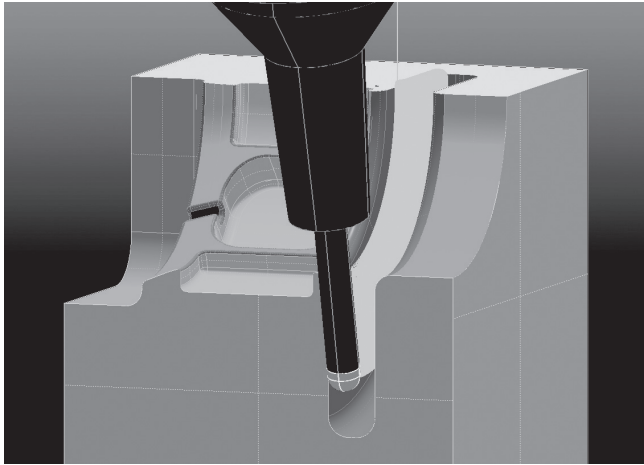
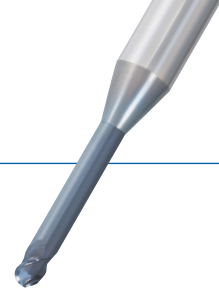
Machining without interference



PHX-LN-DBT



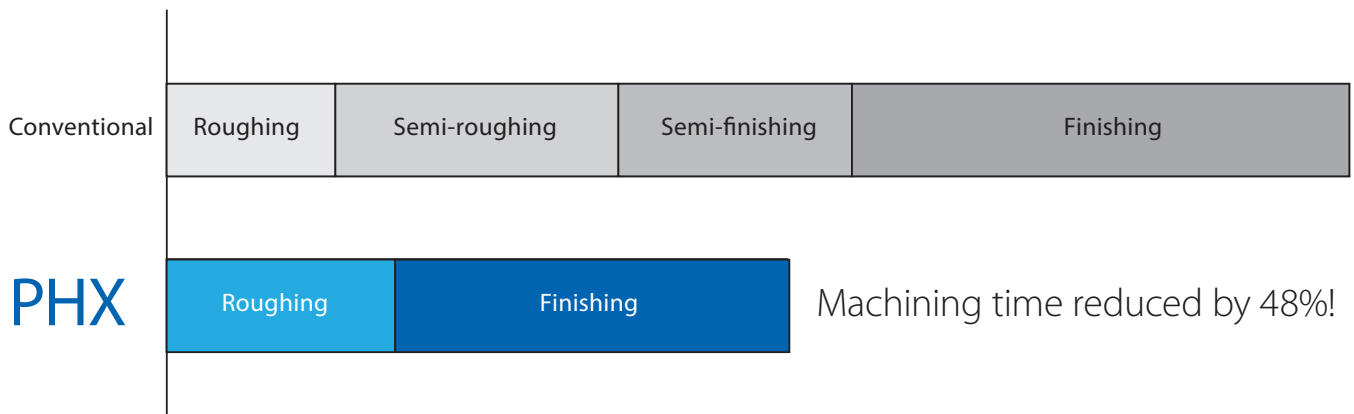
Example in five-axis machining



Work size	50×50×50mm
Work Material	NAK80 40HRC
Machine	Five-axis Machining Center
Main Spindle	HSK A63
Coolant	Air Blow
Maximum RPM	18,000 min ⁻¹
Holder	Shrink Fit

Process	Milling Process	Tool	Length	(min ⁻¹) Speed	(mm/min) Feed	(mm) ap	(mm) pf	(mm) Remnants	(m) Milling Length	Milling Time
1	Contour roughing	PHX-DFR 10xR2	25.0	3,800	2,100	0.50	2.50	0.1	15.4	0:07:16
2	Side finish milling	↓	25.0	3,800	600	-	2.40	0	376.0	0:00:50
3	Contour roughing	↓	25.0	2,400	2,100	0.50	2.50	0.05	20.1	0:08:37
4	Fixed inclined-axis surface milling	↓	25.0	3,800	1,000	-	0.20	0	8.9	0:10:42
5	Contour surface roughing	PHX-LN-DBT R2×20	23.0	7,600	1,550	0.25	1.00	0.01	17.5	0:13:46
6	Contour surface finish milling	↓	23.0	5,500	1,350	0.12	0.10	0	16.2	0:10:40
7	Contour surface roughing	PHX-LN-DBT R1.5×12	14.0	12,000	1,700	0.30	0.70	0.05	14.0	0:09:26
8	Contour surface finish milling	↓	14.0	11,000	2,050	0.09	0.10	0	9.5	0:04:31
9	Circumferential surface finish milling	↓	14.0	11,000	2,050	-	0.08	0	5.4	0:02:49
10	Surface milling (rounded corners)	↓	14.0	11,000	2,050	-	0.08	0	5.4	0:03:12
11	Milling of remaining areas	PHX-LN-DBT R0.75×6	13.0	16,000	960	0.04	0.04	0	18.4	0:24:54
12	Contour surface roughing	PHX-LN-DBT R0.5×4	12.0	18,000	1,000	0.05	0.16	0	9.0	0:09:45
13	Contour surface finish milling	↓	12.0	18,000	900	-	0.03	0	339.0	0:00:29

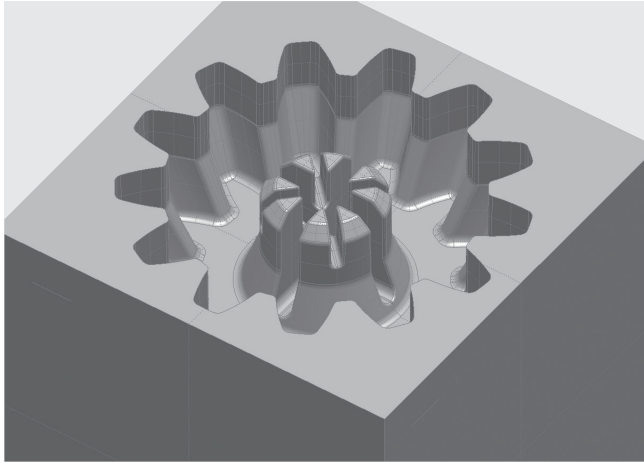
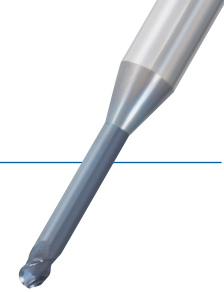
Tool operation time 1:46:57



Milling | Solid carbide



Machining data



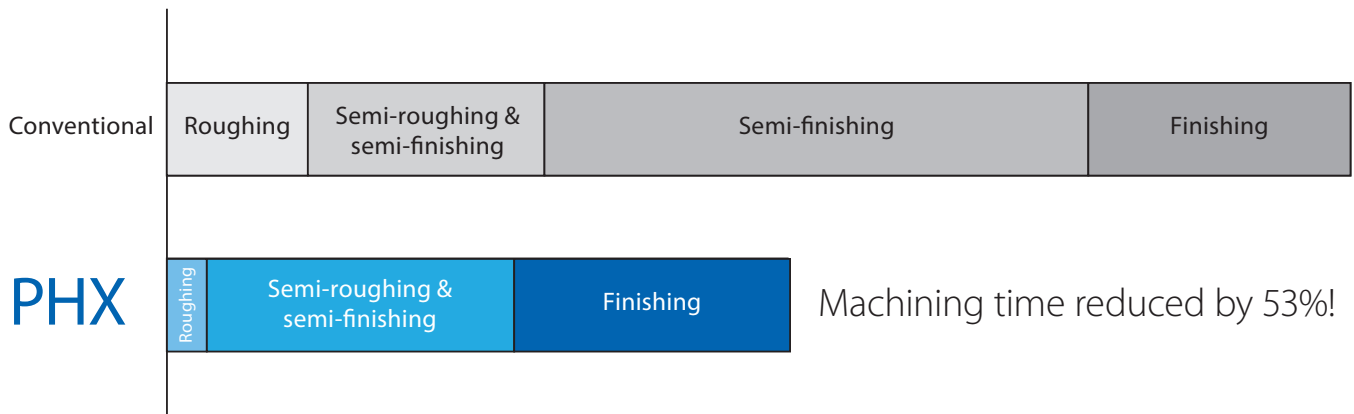
Work size	50×50×50mm
Work Material	NAK80 40HRC
Machine	Five-axis Machining Center
Main Spindle	HSK A63
Coolant	Air Blow
Maximum RPM	18,000 min ⁻¹
Holder	Shrink Fit

Process	Milling Process	Tool	Length	(min ⁻¹) Speed	(mm/min) Feed	(mm) ap	(mm) pf	(mm) Remnants	(m) Milling Length	Milling Time
1	3D Arbitrary Stock Roughing	PHX-LN-DBT R3×20	22	8,000	4,500	0.50	1.5	0.1	10.1	0:06:27
2	Arbitrary Stock Roughing	PHX-LN-DBT R1×12	20	12,000	1,200	0.15	0.8	0.05	28.3	0:43:19
3 ¹	3D Complete Machining	↓	20	12,000	1,200	-	0.4	0.05	782.0	
4	3D Z-Level Finishing	↓	20	12,000	2,000	0.12	-	0	33.4	0:31:31
5	3D Plofile Finishing	↓	20	12,000	2,000	-	0.12	0	4.4	
6	3D Rest Machining	↓	20	12,000	2,000	0.12	0.12	0	2.5	
7	3D Z-Level Finishing	PHX-LN-DBT R0.5×6	15	12,000	600	0.06	-	0	8.3	0:36:58
8	3D Z-Level Finishing	↓	15	12,000	800	0.06	-	0	6.7	
9	3D Plofile Finishing	↓	15	12,000	800	-	0.06	0	433.0	

¹ For flat surface milling

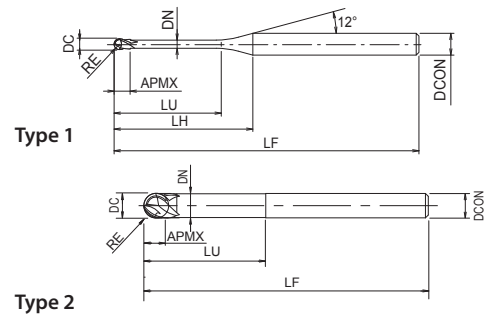
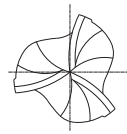
Tool operation time 1:58:15

Milling | Solid carbide

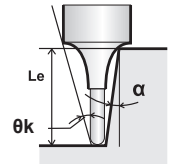


PHX-LN-DBT

Milling | Solid carbide



- Carbide end mill with WXS coating
- For steels up to 60 HRC
- 3 flutes, long neck, ball nose



EDP	ZEFP	DC	RE	LU	LF	APMX	LH	DCON	DN	θk	Le (α=0,5°)	Le (α=1°)	Type
3194901	3	0,6	0,3	1	50	0,45	9,1	4	0,55	11,02	1,03	1,06	1
3194902	3	0,6	0,3	2	50	0,45	10,1	4	0,55	9,92	2,07	2,15	1
3194903	3	0,6	0,3	3	50	0,45	11,1	4	0,55	9,01	3,12	3,24	1
3194904	3	0,6	0,3	4	50	0,45	12,1	4	0,55	8,25	4,16	4,33	1
3194906	3	0,6	0,3	6	50	0,45	14,1	4	0,55	7,07	6,24	6,51	1
3195004	3	1	0,5	4	50	0,75	11,2	4	0,95	8,06	4,15	4,31	1
3195006	3	1	0,5	6	50	0,75	13,2	4	0,95	6,8	6,24	6,49	1
3195008	3	1	0,5	8	50	0,75	15,2	4	0,95	5,87	8,32	8,67	1
3195010	3	1	0,5	10	50	0,75	17,2	4	0,95	5,17	10,41	10,85	1
3195012	3	1	0,5	12	50	0,75	19,2	4	0,95	4,62	12,49	13,03	1
3195014	3	1	0,5	14	50	0,75	21,2	4	0,95	4,17	14,58	15,21	1
3195016	3	1	0,5	16	50	0,75	23,2	4	0,95	3,8	16,66	17,39	1
3195106	3	1,5	0,75	6	50	1,13	12	4	1,45	6,38	6,22	6,47	1
3195108	3	1,5	0,75	8	50	1,13	14	4	1,45	5,42	8,31	8,65	1
3195110	3	1,5	0,75	10	50	1,13	16	4	1,45	4,71	10,4	10,83	1
3195112	3	1,5	0,75	12	50	1,13	18	4	1,45	4,17	12,48	13,01	1
3195116	3	1,5	0,75	16	50	1,13	22	4	1,45	3,38	16,65	17,36	1
3195206	3	2	1	6	50	1,5	11	4	1,95	5,85	6,21	6,45	1
3195208	3	2	1	8	50	1,5	13	4	1,95	4,87	8,3	8,63	1
3195210	3	2	1	10	50	1,5	15	4	1,95	4,16	10,39	10,81	1
3195212	3	2	1	12	50	1,5	17	4	1,95	3,64	12,47	12,98	1
3195214	3	2	1	14	50	1,5	19	4	1,95	3,23	14,56	15,16	1
3195216	3	2	1	16	50	1,5	21	4	1,95	2,9	16,64	17,34	1
3195218	3	2	1	18	60	1,5	23	4	1,95	2,64	18,73	19,52	1
3195220	3	2	1	20	60	1,5	25	4	1,95	2,41	20,81	21,7	1
3195222	3	2	1	22	60	1,5	27	4	1,95	2,23	22,9	23,88	1
3195312	3	3	1,5	12	60	2,25	14,5	4	2,85	2,22	12,45	12,94	1
3195316	3	3	1,5	16	60	2,25	18,5	4	2,85	1,7	16,62	17,3	1
3195320	3	3	1,5	20	60	2,25	22,5	4	2,85	1,37	20,79	21,66	1
3195325	3	3	1,5	25	60	2,25	27,5	4	2,85	1,11	26,01	27,1	1
3195416	3	4	2	16	60	3	-	4	3,85	-	-	-	2
3195420	3	4	2	20	60	3	-	4	3,85	-	-	-	2
3195425	3	4	2	25	60	3	-	4	3,85	-	-	-	2
3195520	3	6	3	20	70	4,5	-	6	5,85	-	-	-	2
3195530	3	6	3	30	70	4,5	-	6	5,85	-	-	-	2

Milling | Solid carbide



CUTTING CONDITIONS

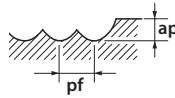
Milling | Endmills | Cutting conditions

PHX-LN-DBT

Vibration control

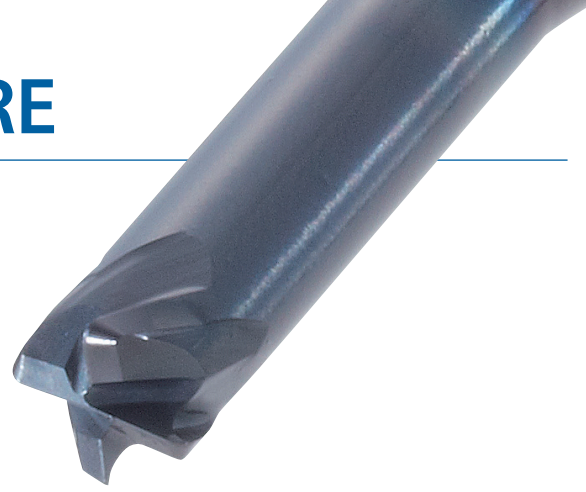
			High feed roughing ~40HRC SKT4 • SKD61 • NAK80 • HPM1 • DH** SCM • S40C~S60C • CoCrMo 42~55HRC				Semi-roughing 40~60HRC DH** • DAC** • ZHD** • SKD61 • SKD11 • Ti-6Al-4V(H) • CoCr • SKT4 • NAK80 • HPM** • SCM** 42~55HRC				Slotting ~60HRC DH** • DAC** • ZHD** • SKD61 • SKD11 • Ti-6Al-4V(H) • CoCr • SKT4 • NAK80 • HPM** • SCM**				Finishing ~60HRC DH** • DAC** • ZHD** • SKD61 • SKD11 • Ti-6Al-4V(H) • CoCr • SKT4 • NAK80 • HPM** • SCM**				
R	l1	Angle	S (min ⁻¹)	F (mm/min)	ap (mm)	Pf (mm)	S (min ⁻¹)	F (mm/min)	ap (mm)	Pf (mm)	S (min ⁻¹)	F (mm/min)	ap (mm)	Last pitch*1	S (min ⁻¹)	F (mm/min)	ap (mm)	Pf (mm)	Clearance (mm)
0,3	1	0,3°	18.000	1.200	0,060	0,140	18.000	1.000	0,050	0,100	18.000	300	0,050	0,050	18.000	700	0,018	0,018	0,03
0,3	2	0,3°	18.000	1.000	0,050	0,120	18.000	850	0,040	0,100	18.000	255	0,040	0,050	18.000	700	0,018	0,018	0,03
0,3	3	0,3°	18.000	850	0,040	0,120	18.000	700	0,030	0,080	18.000	210	0,030	0,040	18.000	700	0,018	0,018	0,025
0,3	4	0,3°	18.000	700	0,030	0,100	18.000	600	0,025	0,080	18.000	180	0,025	0,040	18.000	700	0,018	0,018	0,02
0,3	6	0,3°	18.000	500	0,020	0,090	16.000	400	0,020	0,060	16.000	120	0,020	0,030	16.000	620	0,018	0,018	0,01
0,5	4	0,3°	18.000	1.200	0,080	0,200	18.000	1.100	0,070	0,160	18.000	330	0,070	0,070	18.000	900	0,030	0,030	0,05
0,5	6	0,3°	18.000	1.000	0,050	0,160	18.000	900	0,050	0,160	18.000	270	0,050	0,070	18.000	900	0,030	0,030	0,05
0,5	8	0,3°	16.000	800	0,040	0,160	16.000	700	0,040	0,160	16.000	210	0,040	0,050	16.000	720	0,030	0,030	0,03
0,5	10	0,3°	12.000	650	0,040	0,160	10.000	550	0,030	0,150	10.000	160	0,030	0,050	12.000	540	0,030	0,030	0,03
0,5	12	0,3°	8.000	420	0,030	0,150	8.000	420	0,030	0,150	-	-	-	-	8.000	360	0,030	0,030	0,02
0,5	14	0,3°	7.000	350	0,020	0,130	7.000	350	0,020	0,130	-	-	-	-	7.000	320	0,030	0,030	0,02
0,5	16	0,3°	6.000	260	0,010	0,100	6.000	260	0,010	0,100	-	-	-	-	6.000	270	0,020	0,020	0,01
0,75	6	0,3°	18.000	1.500	0,100	0,300	16.000	1.300	0,100	0,230	16.000	390	0,100	0,100	18.000	1.100	0,040	0,040	0,05
0,75	8	0,3°	16.000	1.300	0,080	0,300	16.000	1.150	0,080	0,230	16.000	340	0,080	0,100	16.000	960	0,040	0,040	0,05
0,75	10	0,3°	15.000	1.100	0,060	0,250	15.000	950	0,060	0,230	15.000	280	0,060	0,100	15.000	900	0,040	0,040	0,03
0,75	12	0,3°	10.000	700	0,040	0,200	10.000	600	0,030	0,200	10.000	180	0,030	0,100	10.000	600	0,040	0,040	0,02
0,75	16	0,3°	7.500	400	0,025	0,150	7.500	400	0,020	0,150	7.500	120	0,020	0,070	10.000	600	0,040	0,040	0,01
1	6	0,3°	18.000	1.600	0,200	0,600	15.000	1.400	0,200	0,300	15.000	420	0,200	0,100	15.000	1.800	0,060	0,050	0,1
1	8	0,3°	14.000	1.400	0,180	0,500	14.000	1.200	0,150	0,300	14.000	360	0,150	0,100	12.000	1.500	0,060	0,050	0,07
1	10	0,3°	12.000	1.250	0,160	0,400	12.000	1.100	0,120	0,300	12.000	330	0,120	0,100	12.000	1.500	0,060	0,050	0,07
1	12	0,3°	10.000	1.050	0,140	0,400	10.000	900	0,100	0,300	10.000	300	0,100	0,100	10.000	1.200	0,060	0,050	0,07
1	14	0,3°	8.000	850	0,120	0,350	8.000	700	0,080	0,300	8.000	240	0,080	0,100	8.000	1.000	0,060	0,050	0,05
1	16	0,3°	7.500	780	0,120	0,400	7.500	650	0,070	0,250	7.500	260	0,070	0,070	7.500	950	0,060	0,050	0,03
1	18	0,3°	6.800	700	0,100	0,400	6.800	630	0,060	0,200	6.800	250	0,060	0,070	6.800	700	0,060	0,050	0,03
1	20	0,3°	6.200	650	0,100	0,400	6.200	600	0,050	0,200	6.200	240	0,050	0,050	6.200	600	0,060	0,050	0,02
1	22	0,3°	6.000	600	0,080	0,300	6.000	450	0,050	0,150	6.000	180	0,050	0,050	6.000	550	0,060	0,050	0,02
1,5	12	0,3°	12.000	1.700	0,300	0,700	8.000	1.200	0,250	0,500	8.000	480	0,250	0,150	11.000	2.050	0,090	0,080	0,1
1,5	16	0,3°	10.000	1.550	0,250	0,700	8.000	1.200	0,200	0,500	8.000	480	0,200	0,150	10.000	1.900	0,090	0,080	0,07
1,5	20	0,3°	7.500	1.150	0,200	0,600	7.200	1.100	0,200	0,500	7.200	440	0,200	0,150	7.500	1.400	0,090	0,080	0,07
1,5	25	0,3°	4.800	750	0,180	0,600	4.600	700	0,180	0,500	4.600	280	0,180	0,150	4.800	900	0,090	0,080	0,05
2	16	0,5°	9.300	1.900	0,270	1,000	6.000	1.200	0,270	0,800	6.000	480	0,270	0,200	9.000	2.250	0,120	0,100	0,1
2	20	0,5°	7.600	1.550	0,250	1,000	6.000	1.150	0,250	0,800	6.000	450	0,250	0,200	8.200	2.050	0,120	0,100	0,1
2	25	0,5°	6.100	1.250	0,230	0,800	5.500	1.100	0,230	0,600	5.500	420	0,230	0,200	5.500	1.350	0,120	0,100	0,07
3	20	0,5°	8.000	3.000	0,430	1,500	4.000	1.200	0,300	1,000	4.000	480	0,300	0,200	8.000	1.800	0,180	0,160	0,1
3	30	0,5°	5.100	1.500	0,340	1,200	4.000	1.150	0,300	1,000	4.000	480	0,300	0,200	5.100	1.150	0,180	0,160	0,07

Max cutting depth



Key features PHX-LN-CRE

4-flute Long Neck Small Bull Nose End Mill

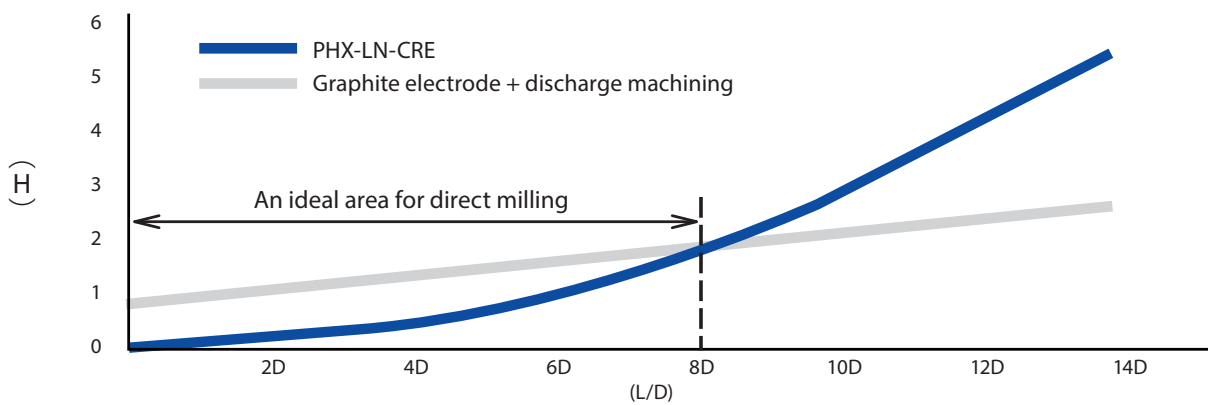


- 1 The corner radius shape provides both cutting force and cutting edge rigidity.
- 2 Radial and end edge configurations suppress the generation of chattering vibration.
- 3 Special edge lines prevent biting.
- 4 An ideal chip pocket for superior chip evacuation.

<p>1. Length of cut</p> <p>2. Short flute length</p> <p>3. Unequal spacing</p>	<p>PHX-LN-CRE</p>	<p>conventional</p>	<p>photo of end edge</p>
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Milling | Solid carbide

A map for effective machining



This graph is the image graph of 1.5mm wide 40mm long flute dimension.



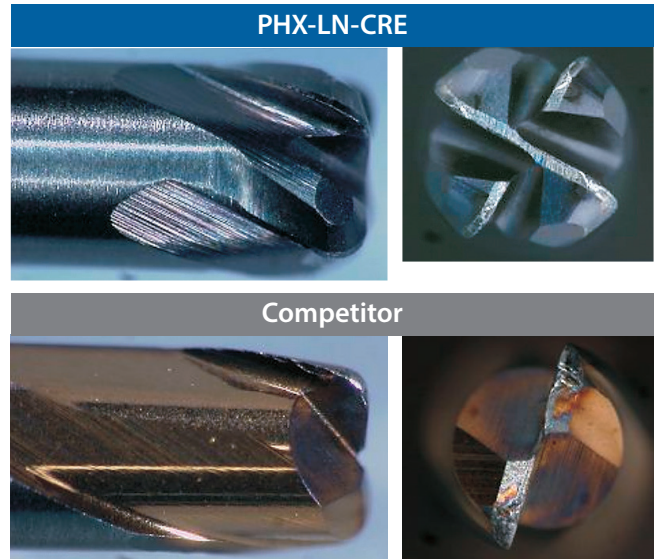
Machining data

Lib operation on plastic mold.

A special designed tool for slot milling on high hardness steel as STAVAX(52HRC)

- A special tool for easy direct milling operations
- A special cutting edge design enabled a stable operation
- Capable even on shallow flute milling with ultra high speed

Tool	PHX-LN-CRE $\phi 1 \times R0.2 \times 6$
Work Material	STAVAX (52HRC)
Milling Method	Lib Groove Operation
Cutting Speed	63m/min (20,000min ⁻¹)
Feed	840mm/min (0.0105mm/t)
Depth of Cut	ap=0.02mm
Coolant	Air Blow
Machine	Vertical Machining Center
Milling Length	120m



High precision machining on HPM38 (53HRC) with gear shape

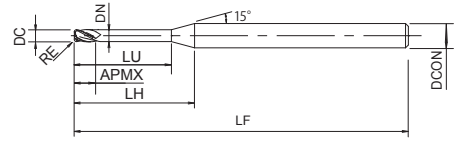
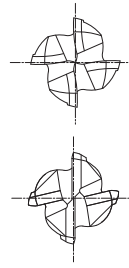
- From semi-finish to finishing operation
- Capable with high feed rate even at narrow area

Tool	PHX-LN-CRE $\phi 2 \times R0.5 \times 10$
Work Material	HPM38 (53HRC)
Milling Method	Countour Line Operation
Cutting Speed	113m/min (18,000min ⁻¹)
Feed	2,500mm/min (0.035mm/t)
Depth of Cut	ap=0.1mm ae=0.8mm
Coolant	Air Blow
Machine	Vertical Machining Center
Milling Length	80m

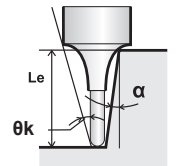


PHX-LN-CRE

Milling | Solid carbide



- Carbide end mill with WXS coating
- For steels up to 60 HRC
- 4 flutes, long neck, corner radius



EDP	ZEFP	DC	RE	LU	LF	APMX	LH	DCON	DN	θk	Le (α=0,5°)	Le (α=1°)
3190800	4	0,8	0,1	2	50	0,32	8,1	4	0,72	11,48	2,06	2,13
3190801	4	0,8	0,1	4	50	0,32	10,1	4	0,72	9,2	4,13	4,27
3190802	4	0,8	0,1	6	50	0,32	12,1	4	0,72	7,67	6,2	6,41
3190803	4	0,8	0,1	8	50	0,32	14,1	4	0,72	6,58	8,27	8,55
3191006	4	1	0,1	4	50	0,4	9,7	4	0,93	8,97	4,13	4,27
3191007	4	1	0,1	6	50	0,4	11,7	4	0,93	7,43	6,2	6,41
3191008	4	1	0,1	8	50	0,4	13,7	4	0,93	6,34	8,27	8,55
3191009	4	1	0,1	10	50	0,4	15,7	4	0,93	5,53	10,33	10,69
3191010	4	1	0,1	12	50	0,4	17,7	4	0,93	4,9	12,4	12,83
3191011	4	1	0,2	4	50	0,4	9,7	4	0,93	9,05	4,13	4,26
3191012	4	1	0,2	6	50	0,4	11,7	4	0,93	7,49	6,2	6,4
3191013	4	1	0,2	8	50	0,4	13,7	4	0,93	6,38	8,26	8,54
3191014	4	1	0,2	10	50	0,4	15,7	4	0,93	5,56	10,33	10,68
3191015	4	1	0,2	12	50	0,4	17,7	4	0,93	4,93	12,4	12,82
3191018	4	1	0,3	4	50	0,4	9,7	4	0,93	9,14	4,12	4,26
3191019	4	1	0,3	6	50	0,4	11,7	4	0,93	7,55	6,19	6,4
3191501	4	1,5	0,1	4	50	0,6	8,8	4	1,41	8,3	4,13	4,27
3191503	4	1,5	0,1	8	50	0,6	12,8	4	1,41	5,68	8,27	8,55
3191505	4	1,5	0,1	12	50	0,6	16,8	4	1,41	4,31	12,4	12,83
3191506	4	1,5	0,2	4	50	0,6	8,8	4	1,41	8,39	4,13	4,26
3191507	4	1,5	0,2	6	50	0,6	10,8	4	1,41	6,8	6,2	6,4
3191508	4	1,5	0,2	8	50	0,6	12,8	4	1,41	5,72	8,26	8,54
3192001	4	2	0,1	8	50	0,8	12,1	4	1,89	4,91	8,27	8,55
3192002	4	2	0,1	10	50	0,8	14,1	4	1,89	4,19	10,33	10,69
3192003	4	2	0,1	12	50	0,8	16,1	4	1,89	3,66	12,4	12,83
3192004	4	2	0,1	16	50	0,8	20,1	4	1,89	2,92	16,54	17,11
3192013	4	2	0,3	8	50	0,8	12,1	4	1,89	4,99	8,26	8,54
3192015	4	2	0,3	12	50	0,8	16,1	4	1,89	3,71	12,39	12,82
3192019	4	2	0,5	6	50	0,8	10,1	4	1,89	6,16	6,19	6,38
3192020	4	2	0,5	8	50	0,8	12,1	4	1,89	5,08	8,25	8,52
3192021	4	2	0,5	10	50	0,8	14,1	4	1,89	4,32	10,32	10,66
3192022	4	2	0,5	12	50	0,8	16,1	4	1,89	3,75	12,39	12,8
3193008	4	3	0,3	12	50	1,2	14,2	4	2,85	2,11	12,39	12,82

Milling | Solid carbide




CUTTING CONDITIONS

Milling | Endmills | Cutting conditions

PHX-LN-CRE

Rib groove milling & Contour line finish milling

			Slotting CENA1 · STAVAX · HPM38 · SKD61 42~55HRC				Contour offset CENA1 · STAVAX · HPM38 · SKD61 42~55HRC				Contour line finish milling CENA1 · STAVAX · HPM38 · SKD61 42~55HRC		
Ø	R	l2	S (min ⁻¹)	F (mm/min)	ap (mm)	ae (mm)	S (min ⁻¹)	F (mm/min)	ap (mm)	ae (mm)	S (min ⁻¹)	F (mm/min)	ae (mm)
0,8	0,1	2	18,000	720	0,020	0,200	18,000	930	0,020	0,200	18,000	1,150	0,015
0,8	0,1	4	18,000	720	0,020	0,200	18,000	930	0,020	0,200	18,000	1,150	0,015
0,8	0,1	6	18,000	720	0,020	0,200	18,000	930	0,020	0,200	18,000	1,150	0,015
0,8	0,1	8	15,000	540	0,013	0,200	15,000	630	0,013	0,200	16,000	700	0,013
1	0,1	4	18,000	830	0,030	0,230	18,000	880	0,030	0,230	18,000	1,440	0,015
1	0,1	6	18,000	830	0,024	0,230	18,000	880	0,024	0,230	18,000	1,440	0,015
1	0,1	8	15,000	750	0,013	0,230	15,000	800	0,013	0,230	15,000	1,200	0,015
1	0,1	10	12,000	300	0,007	0,200	12,000	400	0,007	0,200	12,000	960	0,015
1	0,1	12	10,500	220	0,006	0,180	10,500	288	0,006	0,180	10,500	840	0,015
1	0,2	4	18,000	830	0,030	0,230	18,000	880	0,030	0,230	18,000	1,440	0,018
1	0,2	6	18,000	830	0,024	0,230	18,000	880	0,024	0,230	18,000	1,440	0,018
1	0,2	8	15,000	750	0,013	0,230	15,000	800	0,013	0,230	15,000	1,200	0,018
1	0,2	10	12,000	300	0,007	0,200	12,000	400	0,007	0,200	12,000	960	0,018
1	0,2	12	10,500	220	0,006	0,180	10,500	290	0,006	0,180	10,500	840	0,018
1	0,3	4	18,000	830	0,030	0,230	18,000	1,000	0,030	0,230	18,000	1,440	0,022
1	0,3	6	18,000	830	0,024	0,230	18,000	890	0,024	0,230	18,000	1,440	0,022
1,5	0,1	4	16,000	1,230	0,030	0,340	16,000	1,300	0,030	0,340	18,000	1,620	0,015
1,5	0,1	8	16,000	1,230	0,026	0,340	16,000	1,300	0,026	0,340	18,000	1,620	0,015
1,5	0,1	12	10,000	480	0,013	0,300	10,000	750	0,013	0,300	10,000	900	0,015
1,5	0,2	4	16,000	1,230	0,030	0,340	16,000	1,300	0,030	0,340	18,000	1,620	0,018
1,5	0,2	6	16,000	1,230	0,029	0,340	16,000	1,300	0,029	0,340	18,000	1,620	0,018
1,5	0,2	8	16,000	1,230	0,026	0,340	16,000	1,300	0,026	0,340	18,000	1,620	0,018
2	0,1	8	12,000	1,300	0,030	0,460	12,000	1,760	0,030	0,460	18,000	1,620	0,015
2	0,1	10	12,000	1,200	0,030	0,460	12,000	1,620	0,030	0,460	15,000	1,350	0,015
2	0,1	12	12,000	1,150	0,024	0,460	12,000	1,320	0,024	0,460	13,000	1,170	0,015
2	0,1	16	7,600	780	0,012	0,460	7,600	750	0,012	0,460	7,000	630	0,015
2	0,3	8	12,000	1,300	0,050	0,460	12,000	1,620	0,050	0,460	18,000	1,620	0,022
2	0,3	12	12,000	1,150	0,040	0,460	12,000	1,320	0,040	0,460	13,000	1,170	0,022
2	0,5	6	12,000	1,300	0,080	0,450	12,000	1,760	0,080	0,450	18,000	1,620	0,025
2	0,5	8	12,000	1,300	0,075	0,450	12,000	1,760	0,075	0,450	18,000	1,620	0,025
2	0,5	10	12,000	1,200	0,070	0,450	12,000	1,620	0,070	0,450	15,000	1,350	0,025
2	0,5	12	12,000	1,150	0,060	0,450	12,000	1,320	0,060	0,450	13,000	1,170	0,025
3	0,3	12	8,000	1,200	0,046	0,700	8,000	1,400	0,046	0,700	13,000	1,170	0,022





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