

# 4 Flutes HARDMAX



Size  $\phi 1 \sim \phi 6$

# HTNRS

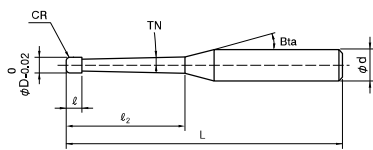


Material Applications (★ Highly Recommended ● Recommended ○ Suggested)

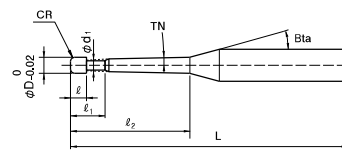
Work Material																	
Carbon Steels S45C S55C	Alloy Steels SK / SCM SUS	Prehardened Steels NAK HPM	Hardened Steels					Cast Iron	Aluminum Alloys	Graphite	Copper	Plastics	Glass Filled Plastics	Titanium Alloys	Heat Resistant Alloys	Cemented Carbide	Hard Brittle (Non-Metallic) Materials
			~ 50HRC	~ 55HRC	~ 60HRC	~ 65HRC	~ 70HRC										
		●	●	●	●	○											

The shank taper angle shown is not an exact value and to avoid contact with the work piece, we recommend the user controls the precise value of this angle. Shank taper angle should not make contact with the work piece.

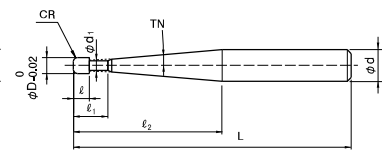
Shape A



Shape B



Shape C



Total 111 models

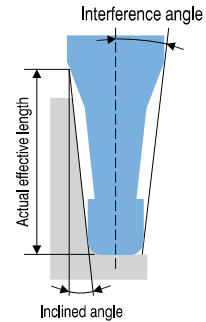
Unit (mm)

Model Number	Outside Diameter $\phi D$	Corner Radius CR	Neck Taper Angle TN	Neck Length $l_2$	Effective Length $l_1$	Length of Cut $l$	Neck Diameter $\phi d_1$	Shank Taper Angle Bta	Overall Length L	Shank Diameter $\phi d$	
HTNRS 4010-020608	1	R0.2	0.4°	6	—	1	—	16°	50	4	
HTNRS 4010-021008				10					50	4	
HTNRS 4010-022008				20					60	4	
HTNRS 4010-023008				30					70	4	
HTNRS 4010-020618				6					50	4	
HTNRS 4010-021018				10					50	4	
HTNRS 4010-021518			15	50	4						
HTNRS 4010-022018			20	60	4						
HTNRS 4010-022518			25	60	4						
HTNRS 4010-023018			30	70	4						
HTNRS 4010-023518			35	80	4						
HTNRS 4010-024018			40	80	4						
HTNRS 4010-025018			50	90	4						
HTNRS 4010-020628			6	1.4°	1.8	50	0.94	—	16°	50	4
HTNRS 4010-021028			10			50				4	
HTNRS 4010-022028			20			60				4	
HTNRS 4010-023028			30			70				4	

- φ3mm Shank V Series
- UDC-PCD Series
- CBN Series
- Square
- Long Neck Square
- Radius
- Long Neck Radius
- Taper Neck Radius
- Ball / Long Shank Ball
- Long Neck Ball
- Taper Neck Ball
- Taper
- Barrel
- Spiral V Cutter
- Drill
- Technical Data

## Features

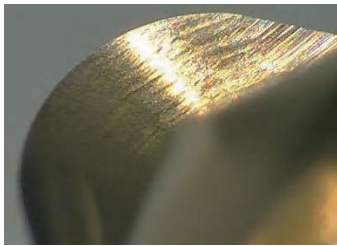
**4 Flute Taper Neck Radius End Mills for milling hard materials.**  
**Corner radius design from the edge to the periphery ensures less cutting resistance,**  
**and the variable pitch design minimizes chattering and vibration.**  
**Can achieve stable milling and excellent surface finish on deep milling.**  
**HARDMAX coating offers longer tool life when milling hard materials. Recommended to**  
**use with any type of coolant.**



4 Flutes

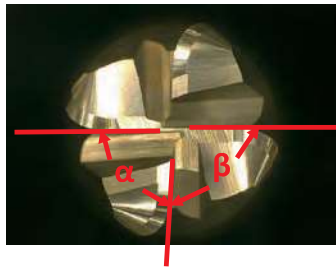
### Feature ①

**Seamless Corner Radius**  
**High rigidity! Less cutting resistance!**



### Feature ②

**Variable Pitch design**  
**Minimizing vibration and chattering !**



※ Variable Pitch :  $\alpha \neq \beta$

### Feature ③

**A wide choice of Taper Neck Angles available**  
**More efficient with 1.4° · 1.9° · 2.9° !**



Unit (mm)

Model Number	Outside Diameter $\phi D$	Corner Radius CR	Neck Taper Angle TN	Neck Length $\ell_2$	Shape	Suggested Retail Price ¥	Interference Angle	Effective Length by Inclined Angles — : Interference				
								30'	1°	1°30'	2°	3°
HTNRS 4010-020608	1	R0.2	0.4°	6	A	10,000	7.37°	6.56	6.92	7.20	7.45	8.00
HTNRS 4010-021008				10		10,000	5.54°	10.61	11.12	11.50	11.89	12.77
HTNRS 4010-022008				20		10,000	3.42°	20.73	21.52	22.24	23.00	24.71
HTNRS 4010-023008				30		12,000	2.47°	30.83	31.91	32.97	34.11	No Interference
HTNRS 4010-020618				6		10,000	7.49°	—	6.61	6.96	7.23	7.76
HTNRS 4010-021018				10		10,000	5.65°	—	10.66	11.15	11.53	12.38
HTNRS 4010-021518			15	10,000	4.33°	—	15.72	16.35	16.92	18.17		
HTNRS 4010-022018			20	10,000	3.50°	—	20.77	21.56	22.30	23.95		
HTNRS 4010-022518			25	10,000	2.94°	—	25.82	26.76	27.68	No Interference		
HTNRS 4010-023018			30	12,000	2.54°	—	30.87	31.96	33.06	No Interference		
HTNRS 4010-023518			35	14,000	2.23°	—	35.92	37.16	38.44	No Interference		
HTNRS 4010-024018			40	14,000	1.99°	—	40.96	42.36	No Interference	No Interference		
HTNRS 4010-025018			50	15,000	1.64°	—	51.02	52.74	No Interference	No Interference		
HTNRS 4010-020628			6	10,000	7.61°	—	—	6.66	7.00	7.53		
HTNRS 4010-021028			10	10,000	5.77°	—	—	10.71	11.18	12.00		
HTNRS 4010-022028			20	10,000	3.59°	—	—	20.81	21.59	23.20		
HTNRS 4010-023028			30	12,000	2.61°	—	—	30.91	32.01	No Interference		

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φ3mm Shank  
V Series

UDC-PCD  
Series

CBN  
Series

Square  
Square  
Long Neck  
Square

Radius

Radius  
Long Neck  
Radius

Radius  
Taper Neck  
Radius

Ball / Long  
Shank Ball

Ball  
Long Neck  
Ball

Ball  
Taper Neck  
Ball

Taper  
Taper

Barrel

Spiral  
V Cutter

Drill

Technical Data

## 4 Flutes HARDMAX

Unit (mm)

- $\phi$ 3mm Shark V Series
- UDC-PCD Series
- CBN Series
- Square
- Long Neck Square
- Radius
- Long Neck Radius
- Taper Neck Radius
- Ball / Long Shark Ball
- Long Neck Ball
- Taper Neck Ball
- Taper
- Barrel
- Spiral V Cutter
- Drill
- Technical Data

Model Number	Outside Diameter $\phi D$	Corner Radius CR	Neck Taper Angle TN	Neck Length $\ell_2$	Effective Length $\ell_1$	Length of Cut $\ell$	Neck Diameter $\phi d_1$	Shank Taper Angle Bta	Overall Length L	Shank Diameter $\phi d$							
HTNRS 40125-020618	1.25	R0.2	0.9°	6	—	1.25	—	16°	50	4							
HTNRS 40125-021018				10					50	4							
HTNRS 40125-021518				15					50	4							
HTNRS 40125-022018				20					60	4							
HTNRS 40125-023018				30					70	4							
HTNRS 40125-024018				40					80	4							
HTNRS 40125-025018				50					90	4							
HTNRS 4015-030608	1.5	R0.3	0.4°	6	—	1.5	—	16°	50	4							
HTNRS 4015-031008				10					50	4							
HTNRS 4015-032008				20					60	4							
HTNRS 4015-033008			30	70					4								
HTNRS 4015-030618			0.9°	1.4°					6	2.7	1.43	—	16°	50	4		
HTNRS 4015-031018									10					50	4		
HTNRS 4015-031518									15					50	4		
HTNRS 4015-032018									20					60	4		
HTNRS 4015-032518									25					60	4		
HTNRS 4015-033018									30					70	4		
HTNRS 4015-034018	40	80			4												
HTNRS 4015-035018	50	90	4														
HTNRS 4015-030628	1.75	R0.3	0.9°	6	—	1.75	—	16°	50	4							
HTNRS 4015-031028				10					50	4							
HTNRS 4015-032028				20					60	4							
HTNRS 4015-033028				30					70	4							
HTNRS 40175-030618				0.4°					—	—	—	—	—	16°	50	4	
HTNRS 40175-031018															10	50	4
HTNRS 40175-031518															15	60	4
HTNRS 40175-032018															20	60	4
HTNRS 40175-033018															30	70	4
HTNRS 40175-034018															40	80	4
HTNRS 40175-035018	50	90	4														
HTNRS 4020-052008	2	R0.5	0.4°	20	—	2	—	16°	60	4							
HTNRS 4020-052608				26					60	4							
HTNRS 4020-053008				30					70	4							
HTNRS 4020-053608				36					80	4							
HTNRS 4020-054008				40					80	4							
HTNRS 4020-051018			0.9°	1.4°					10	3.6	1.9	—	16°	60	4		
HTNRS 4020-051518									15					60	4		
HTNRS 4020-052018									20					60	4		
HTNRS 4020-052518									25					60	4		
HTNRS 4020-053018									30					70	4		
HTNRS 4020-053518	35	80	4														
HTNRS 4020-054018	40	80	4														
HTNRS 4020-054518	45	90	4														
HTNRS 4020-055018	50	90	4														
HTNRS 4020-053028	1.4°	1.9°	30	3.6	1.9	—	16°	70	4								
HTNRS 4020-054028			40					80	4								
HTNRS 4020-053038			30					70	6								
HTNRS 4020-054038			40					80	6								
HTNRS 4020-053058			30					70	6								
HTNRS 4020-054258	42	90	6														

Unit (mm)

Model Number	Outside Diameter $\phi D$	Corner Radius CR	Neck Taper Angle TN	Neck Length $l_2$	Shape	Suggested Retail Price ¥	Interference Angle	Effective Length by Inclined Angles — : Interference					
								30'	1°	1°30'	2°	3°	
HTNRS 40125-020618	1.25	R0.2	0.9°	6	A	10,000	7.14°	—	6.63	6.97	7.24	7.77	
HTNRS 40125-021018				10		10,000	5.34°	—	10.68	11.16	11.55	12.40	
HTNRS 40125-021518				15		10,000	4.05°	—	15.74	16.37	16.93	18.18	
HTNRS 40125-022018				20		10,000	3.27°	—	20.79	21.57	22.31	23.96	
HTNRS 40125-023018				30		12,000	2.36°	—	30.89	31.97	33.07	No Interference	
HTNRS 40125-024018				40		14,000	1.84°	—	40.97	42.37	No Interference	No Interference	
HTNRS 40125-025018				50		15,000	1.51°	—	51.03	52.75	No Interference	No Interference	
HTNRS 4015-030608	1.5	R0.3	0.4°	6	A	10,000	6.69°	6.62	6.96	7.23	7.47	8.01	
HTNRS 4015-031008				10		10,000	4.92°	10.66	11.15	11.52	11.91	12.79	
HTNRS 4015-032008				20		10,000	2.96°	20.78	21.55	22.26	23.03	No Interference	
HTNRS 4015-033008				30		12,000	2.12°	30.87	31.94	33.00	34.13	No Interference	
HTNRS 4015-030618			0.9°	6	A	10,000	6.80°	—	6.69	7.01	7.27	7.79	
HTNRS 4015-031018				10		10,000	5.03°	—	10.73	11.19	11.57	12.42	
HTNRS 4015-031518				15		10,000	3.79°	—	15.79	16.39	16.95	18.20	
HTNRS 4015-032018				20		10,000	3.04°	—	20.84	21.60	22.34	23.99	
HTNRS 4015-032518				25		10,000	2.54°	—	25.88	26.80	27.72	No Interference	
HTNRS 4015-033018			30	12,000	2.18°	—	30.93	32.00	33.10	No Interference			
HTNRS 4015-034018			40	14,000	1.70°	—	41.01	42.40	No Interference	No Interference			
HTNRS 4015-035018			50	15,000	1.39°	—	51.07	No Interference	No Interference	No Interference			
HTNRS 4015-030628			1.4°	B	0.9°	6	10,000	6.92°	—	—	6.76	7.06	7.58
HTNRS 4015-031028						10	10,000	5.13°	—	—	10.80	11.23	12.05
HTNRS 4015-032028						20	10,000	3.12°	—	—	20.89	21.65	23.25
HTNRS 4015-033028						30	12,000	2.24°	—	—	30.98	32.07	No Interference
HTNRS 40175-030618			1.75	R0.3	0.9°	6	A	10,000	6.37°	—	6.75	7.06	7.31
HTNRS 40175-031018	10	10,000				4.66°		—	10.79	11.23	11.61	12.46	
HTNRS 40175-031518	15	10,000				3.49°		—	15.84	16.43	16.99	18.24	
HTNRS 40175-032018	20	10,000				2.78°		—	20.89	21.63	22.38	No Interference	
HTNRS 40175-033018	30	12,000				1.99°		—	30.98	32.04	No Interference	No Interference	
HTNRS 40175-034018	40	14,000				1.54°		—	41.06	42.44	No Interference	No Interference	
HTNRS 40175-035018	50	15,000				1.26°		—	51.11	No Interference	No Interference	No Interference	
HTNRS 4020-052008	2	R0.5	0.4°	20	A	11,000	2.48°	20.86	21.60	22.30	23.06	No Interference	
HTNRS 4020-052608				26		11,000	1.98°	26.92	27.83	28.75	No Interference	No Interference	
HTNRS 4020-053008				30		11,000	1.75°	30.95	31.98	33.04	No Interference	No Interference	
HTNRS 4020-053608				36		14,000	1.49°	37.00	38.22	No Interference	No Interference	No Interference	
HTNRS 4020-054008			40	14,000	1.35°	41.03	42.37	No Interference	No Interference	No Interference			
HTNRS 4020-051018			0.9°	10	A	11,000	4.33°	—	10.84	11.25	11.63	12.46	
HTNRS 4020-051518				15		11,000	3.21°	—	15.88	16.45	17.01	18.25	
HTNRS 4020-052018				20		11,000	2.54°	—	20.93	21.66	22.39	No Interference	
HTNRS 4020-052518				25		11,000	2.11°	—	25.97	26.86	27.77	No Interference	
HTNRS 4020-053018				30		11,000	1.80°	—	31.01	32.06	No Interference	No Interference	
HTNRS 4020-053518			35	14,000	1.57°	—	36.05	37.26	No Interference	No Interference			
HTNRS 4020-054018			40	14,000	1.39°	—	41.09	No Interference	No Interference	No Interference			
HTNRS 4020-054518			45	15,000	1.25°	—	46.10	No Interference	No Interference	No Interference			
HTNRS 4020-055018			50	15,000	1.14°	—	51.14	No Interference	No Interference	No Interference			
HTNRS 4020-053028			1.4°	B	0.9°	30	11,000	1.85°	—	—	31.07	No Interference	No Interference
HTNRS 4020-054028						40	14,000	1.43°	—	—	No Interference	No Interference	No Interference
HTNRS 4020-053038			1.9°	B	0.9°	30	12,000	3.39°	—	—	—	31.12	33.41
HTNRS 4020-054038						40	15,000	2.69°	—	—	—	41.19	No Interference
HTNRS 4020-053058			2.9°	C	0.9°	30	12,000	3.58°	—	—	—	—	31.23
HTNRS 4020-054258						42	16,500	2.74°	—	—	—	—	No Interference

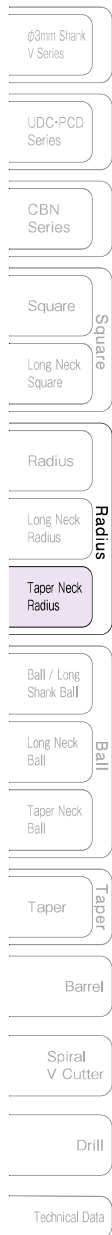
4 Flutes

- ③3mm Shank V Series
- UDC-PCD Series
- CBN Series
- Square
  - Square
  - Long Neck Square
- Radius
  - Radius
  - Long Neck Radius
  - Taper Neck Radius
- Ball
  - Ball / Long Shank Ball
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- Taper
  - Taper
- Barrel
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## 4 Flutes HARDMAX

Unit (mm)



Model Number	Outside Diameter $\phi D$	Corner Radius CR	Neck Taper Angle TN	Neck Length $\ell_2$	Effective Length $\ell_1$	Length of Cut $\ell$	Neck Diameter $\phi d_1$	Shank Taper Angle Bta	Overall Length L	Shank Diameter $\phi d$									
HTNRS 4030-082008	3	R0.8	0.4°	20	—	3	—	16°	60	6									
HTNRS 4030-082608				26					60	6									
HTNRS 4030-083008				30					70	6									
HTNRS 4030-083608				36					80	6									
HTNRS 4030-084008				40					80	6									
HTNRS 4030-082018			20	R1					0.9°	20	4.5	2.89	—	60	6				
HTNRS 4030-082518			25							60				6					
HTNRS 4030-083018			30							70				6					
HTNRS 4030-083518			35							80				6					
HTNRS 4030-084018			40							80				6					
HTNRS 4030-085018			50						90	6									
HTNRS 4030-086018			60						100	6									
HTNRS 4030-083028			30						R1	1.4°				30	—	—	16°	70	6
HTNRS 4030-084028			40											80				6	
HTNRS 4030-083038			30											70				6	
HTNRS 4030-084038			40											80				6	
HTNRS 4030-083358	33	80	6																
HTNRS 4040-102508	25	R1	0.4°		25	—	—	16°		60				6					
HTNRS 4040-103008	30				70					6									
HTNRS 4040-103508	35				80					6									
HTNRS 4040-104008	40				80					6									
HTNRS 4040-104508	45			90	6														
HTNRS 4040-105008	50		90	6															
HTNRS 4040-102018	20		R1	0.9°	20					6	3.8	—	60	6					
HTNRS 4040-102518	25				60								6						
HTNRS 4040-103018	30				70								6						
HTNRS 4040-103518	35				80								6						
HTNRS 4040-104018	40				80								6						
HTNRS 4040-105018	50			90	6														
HTNRS 4040-106018	60			100	6														
HTNRS 4040-104928	49			R1.5	1.4°				49				—	—	16°	90	6		
HTNRS 4040-106028	60								100							8			
HTNRS 4040-103038	30								70							8			
HTNRS 4040-106738	67	120				8													
HTNRS 4040-104558	45	90				8													
HTNRS 4060-152018	20	R1.5			0.9°	20	9	5.8	—							60	8		
HTNRS 4060-153018	30					70										8			
HTNRS 4060-154018	40					80										8			
HTNRS 4060-155018	50					90										8			
HTNRS 4060-156018	60		100			8													
HTNRS 4060-155128	51		90		8														
HTNRS 4060-153938	39		80		8														
HTNRS 4060-156938	69		110		10														
HTNRS 4060-154758	47		90		10														

Unit (mm)

Model Number	Outside Diameter $\phi D$	Corner Radius CR	Neck Taper Angle TN	Neck Length $l_2$	Shape	Suggested Retail Price ¥	Interference Angle	Effective Length by Inclined Angles — : Interference						
								30'	1°	1°30'	2°	3°		
HTNRS 4030-082008	3	R0.8	0.4°	20	A	12,000	3.48°	20.88	21.60	22.30	23.05	24.72		
HTNRS 4030-082608				26		12,000	2.82°	26.94	27.84	28.74	29.72	No Interference		
HTNRS 4030-083008				30		12,000	2.51°	30.97	31.99	33.04	34.16	No Interference		
HTNRS 4030-083608				36		14,000	2.14°	37.02	38.22	39.48	40.82	No Interference		
HTNRS 4030-084008				40		14,000	1.96°	41.05	42.38	43.78	No Interference	No Interference		
HTNRS 4030-082018			0.9°	20	12,000	3.56°	—	20.98	21.69	22.41	24.03			
HTNRS 4030-082518				25	12,000	2.99°	—	26.02	26.89	27.79	No Interference			
HTNRS 4030-083018				30	12,000	2.57°	—	31.06	32.09	33.18	No Interference			
HTNRS 4030-083518				35	14,000	2.25°	—	36.10	37.29	38.56	No Interference			
HTNRS 4030-084018				40	14,000	2.01°	—	41.13	42.49	43.94	No Interference			
HTNRS 4030-085018				50	15,000	1.65°	—	51.18	52.87	No Interference	No Interference			
HTNRS 4030-086018				60	16,000	1.40°	—	61.25	No Interference	No Interference	No Interference			
HTNRS 4030-083028				1.4°	30	12,000	2.64°	—	—	31.14	32.19	No Interference		
HTNRS 4030-084028					40	14,000	2.06°	—	—	41.21	42.61	No Interference		
HTNRS 4030-083038				1.9°	30	12,000	2.71°	—	—	—	31.21	No Interference		
HTNRS 4030-084038			40		14,000	2.12°	—	—	—	41.28	No Interference			
HTNRS 4030-083358			2.9°	33	C	16,500	2.64°	—	—	—	No Interference			
HTNRS 4040-102508			4	R1	0.4°	25	A	12,000	2.12°	25.49	26.28	27.13	28.04	No Interference
HTNRS 4040-103008						30		12,000	1.80°	30.52	31.48	32.50	No Interference	No Interference
HTNRS 4040-103508						35		14,000	1.57°	35.55	36.67	37.87	No Interference	No Interference
HTNRS 4040-104008	40	14,000				1.39°		40.58	41.87	No Interference	No Interference	No Interference		
HTNRS 4040-104508	45	15,000				1.24°		45.61	47.06	No Interference	No Interference	No Interference		
HTNRS 4040-105008	50	15,000			1.13°	50.63	52.24	No Interference	No Interference	No Interference				
HTNRS 4040-102018	0.9°	20			12,000	2.64°	—	20.57	21.23	21.93	No Interference			
HTNRS 4040-102518		25			12,000	2.18°	—	25.60	26.43	27.32	No Interference			
HTNRS 4040-103018		30			12,000	1.85°	—	30.64	31.63	No Interference	No Interference			
HTNRS 4040-103518		35			14,000	1.61°	—	35.67	36.83	No Interference	No Interference			
HTNRS 4040-104018		40			14,000	1.42°	—	40.70	No Interference	No Interference	No Interference			
HTNRS 4040-105018	50	15,000			1.16°	—	50.75	No Interference	No Interference	No Interference				
HTNRS 4040-106018	60	16,000			0.98°	—	No Interference	No Interference	No Interference	No Interference				
HTNRS 4040-104928	1.4°	49			C	15,000	1.21°	—	—	No Interference	No Interference	No Interference		
HTNRS 4040-106028		60			B	17,000	1.88°	—	—	60.94	No Interference	No Interference		
HTNRS 4040-103038	1.9°	30			B	16,000	3.46°	—	—	—	30.89	33.13		
HTNRS 4040-106738		67			C	23,000	1.75°	—	—	—	No Interference	No Interference		
HTNRS 4040-104558	2.9°	45			C	18,000	2.62°	—	—	—	—	No Interference		
HTNRS 4060-152018	6	R1.5			0.9°	20	A	17,000	2.69°	—	20.63	21.28	21.97	No Interference
HTNRS 4060-153018						30		17,000	1.88°	—	30.70	31.68	No Interference	No Interference
HTNRS 4060-154018			40	17,000		1.44°		—	40.76	No Interference	No Interference	No Interference		
HTNRS 4060-155018			50	17,000		1.17°		—	50.83	No Interference	No Interference	No Interference		
HTNRS 4060-156018			60	18,000		0.98°		—	No Interference	No Interference	No Interference	No Interference		
HTNRS 4060-155128			1.4°	51	C	17,000	1.18°	—	—	No Interference	No Interference	No Interference		
HTNRS 4060-153938				39	17,000	1.55°	—	—	—	No Interference	No Interference			
HTNRS 4060-156938			1.9°	69	C	23,500	1.71°	—	—	—	No Interference	No Interference		
HTNRS 4060-154758				47	23,000	2.53°	—	—	—	—	No Interference			

4 Flutes


 3mm Shank V Series


 UDC-PCD Series


 CBN Series


 Square


 Long Neck Square


 Radius


 Long Neck Radius


 Taper Neck Radius


 Ball / Long Shank Ball


 Long Neck Ball


 Taper Neck Ball


 Taper


 Barrel


 Spiral V Cutter


 Drill


 Technical Data

Milling Conditions for HTNRS

- φ3mm Shank V Series
- UDC-PCD Series
- CBN Series
- Square
- Long Neck Square
- Radius
- Long Neck Radius
- Taper Neck Radius
- Ball / Long Shank Ball
- Long Neck Ball
- Taper Neck Ball
- Taper
- Barrel
- Spiral V Cutter
- Drill
- Technical Data

WORK MATERIAL				PREHARDENED STEELS / HARDENED STEELS NAK / SKD (30~45HRC)				HARDENED STEELS SKD / SKT (45~55HRC)				HARDENED STEELS SKD / SKH (55~65HRC)						
Model Number	Outside Diameter (mm)	Corner Radius (mm)	Neck Taper Angle TN	Neck Length (mm)	Spindle Speed (min <sup>-1</sup> )	Feed Rate (mm/min)	a <sub>p</sub> Axial Depth (mm)	a <sub>e</sub> Radial Depth (mm)	Spindle Speed (min <sup>-1</sup> )	Feed Rate (mm/min)	a <sub>p</sub> Axial Depth (mm)	a <sub>e</sub> Radial Depth (mm)	Spindle Speed (min <sup>-1</sup> )	Feed Rate (mm/min)	a <sub>p</sub> Axial Depth (mm)	a <sub>e</sub> Radial Depth (mm)		
4010-020608	1	R0.2	0.4°	6	20,000	2,600	0.06	0.44	11,600	980	0.029	0.23	8,900	530	0.012	0.09		
4010-021008				10	19,000	2,450	0.03	0.42	11,000	920	0.015	0.21	8,500	480	0.008	0.07		
4010-022008				20	17,000	2,150	0.008	0.37	9,700	800	0.005	0.18	7,600	400	0.004	0.05		
4010-023008				30	12,000	1,500	0.003	0.26	7,200	570	0.002	0.12	6,000	310	0.002	0.04		
4010-020618			0.9°	6	20,000	2,600	0.06	0.45	11,600	980	0.029	0.24	8,900	530	0.012	0.1		
4010-021018				10	19,000	2,450	0.03	0.43	11,000	920	0.015	0.22	8,500	480	0.008	0.075		
4010-021518				15	18,500	2,400	0.02	0.41	10,700	880	0.01	0.21	8,200	450	0.006	0.065		
4010-022018				20	18,000	2,300	0.01	0.4	10,400	850	0.006	0.2	8,000	430	0.005	0.05		
4010-022518				25	17,000	2,150	0.008	0.38	9,900	800	0.005	0.19	7,700	410	0.004	0.05		
4010-023018				30	16,000	2,000	0.007	0.35	9,400	750	0.004	0.18	7,400	390	0.004	0.05		
4010-023518				35	15,000	1,850	0.006	0.32	8,800	700	0.004	0.16	7,000	370	0.003	0.05		
4010-024018				40	14,000	1,750	0.005	0.3	8,300	660	0.003	0.15	6,700	350	0.003	0.05		
4010-025018				50	12,000	1,500	0.003	0.28	7,200	570	0.002	0.14	6,000	310	0.002	0.05		
4010-020628				1.4°	6	20,000	2,600	0.06	0.46	11,600	980	0.029	0.25	8,900	530	0.012	0.11	
4010-021028			10		20,000	2,600	0.04	0.45	11,400	960	0.02	0.24	8,750	510	0.01	0.08		
4010-022028			20		19,000	2,400	0.02	0.4	10,900	900	0.01	0.2	8,400	470	0.005	0.06		
4010-023028			30		18,000	2,300	0.01	0.4	10,400	850	0.006	0.2	8,000	430	0.005	0.05		
40125-020618			1.25	R0.2	0.9°	6	16,000	2,600	0.075	0.56	9,200	990	0.036	0.3	7,100	540	0.015	0.12
40125-021018						10	16,000	2,600	0.057	0.55	9,200	990	0.027	0.29	7,100	540	0.012	0.1
40125-021518						15	15,500	2,500	0.04	0.53	8,900	950	0.019	0.27	6,900	500	0.01	0.08
40125-022018	20	15,000				2,400	0.022	0.51	8,700	900	0.011	0.26	6,700	470	0.007	0.07		
40125-023018	30	14,400			2,300	0.011	0.47	8,300	860	0.006	0.23	6,400	440	0.005	0.06			
40125-024018	40	12,800			2,000	0.008	0.42	7,500	750	0.004	0.21	5,900	390	0.004	0.06			
40125-025018	50	11,000			1,700	0.006	0.37	6,500	650	0.003	0.19	5,300	350	0.003	0.06			
4015-030608	1.5	R0.3			0.4°	6	13,500	2,600	0.09	0.67	7,800	990	0.043	0.36	6,000	540	0.018	0.15
4015-031008						10	13,500	2,600	0.083	0.66	7,700	980	0.04	0.35	6,000	540	0.017	0.13
4015-032008						20	12,500	2,400	0.028	0.61	7,000	880	0.015	0.31	5,500	460	0.009	0.09
4015-033008			30	12,000		2,300	0.012	0.55	6,900	860	0.007	0.27	5,350	440	0.006	0.07		
4015-030618			0.9°	6	13,500	2,600	0.09	0.67	7,800	990	0.043	0.36	6,000	540	0.018	0.15		
4015-031018				10	13,500	2,600	0.083	0.67	7,800	990	0.04	0.36	6,000	540	0.017	0.14		
4015-031518				15	13,000	2,500	0.055	0.65	7,500	950	0.029	0.34	5,800	500	0.013	0.12		
4015-032018				20	12,500	2,400	0.035	0.63	7,200	900	0.018	0.32	5,600	470	0.01	0.1		
4015-032518				25	12,500	2,400	0.025	0.61	7,000	880	0.013	0.31	5,500	460	0.009	0.08		
4015-033018				30	12,000	2,300	0.015	0.6	6,900	860	0.008	0.3	5,350	440	0.007	0.07		
4015-034018				40	12,000	2,300	0.012	0.55	6,900	860	0.007	0.27	5,350	440	0.006	0.07		
4015-035018				50	10,500	2,000	0.009	0.5	6,100	740	0.005	0.25	4,850	380	0.005	0.07		
4015-030628			1.4°	6	13,500	2,600	0.09	0.67	7,800	990	0.043	0.36	6,000	540	0.018	0.15		
4015-031028				10	13,500	2,600	0.085	0.67	7,800	990	0.04	0.36	6,000	540	0.017	0.15		
4015-032028				20	13,000	2,500	0.05	0.63	7,300	920	0.02	0.33	5,600	480	0.011	0.11		
4015-033028				30	12,500	2,400	0.025	0.61	7,000	880	0.013	0.31	5,500	460	0.009	0.08		

## Milling Conditions for HTNRS

WORK MATERIAL				PREHARDENED STEELS / HARDENED STEELS NAK / SKD (30~45HRC)				HARDENED STEELS SKD / SKT (45~55HRC)				HARDENED STEELS SKD / SKH (55~65HRC)						
Model Number	Outside Diameter (mm)	Corner Radius (mm)	Neck Taper Angle TN	Neck Length (mm)	Spindle Speed (min <sup>-1</sup> )	Feed Rate (mm/min)	a <sub>p</sub> Axial Depth (mm)	a <sub>e</sub> Radial Depth (mm)	Spindle Speed (min <sup>-1</sup> )	Feed Rate (mm/min)	a <sub>p</sub> Axial Depth (mm)	a <sub>e</sub> Radial Depth (mm)	Spindle Speed (min <sup>-1</sup> )	Feed Rate (mm/min)	a <sub>p</sub> Axial Depth (mm)	a <sub>e</sub> Radial Depth (mm)		
40175-030618	1.75	R0.3	0.9°	6	11,500	2,600	0.105	0.78	6,600	990	0.05	0.42	5,100	540	0.021	0.17		
40175-031018				10	11,500	2,600	0.105	0.78	6,600	990	0.05	0.42	5,100	540	0.021	0.17		
40175-031518				15	11,500	2,600	0.07	0.76	6,500	950	0.037	0.4	5,000	510	0.017	0.14		
40175-032018				20	11,000	2,450	0.047	0.74	6,400	920	0.024	0.38	4,900	480	0.013	0.12		
40175-033018				30	11,000	2,450	0.027	0.71	6,400	920	0.014	0.36	4,900	480	0.01	0.1		
40175-034018				40	10,000	2,200	0.016	0.67	5,800	820	0.009	0.33	4,450	420	0.008	0.08		
40175-035018				50	10,000	2,200	0.013	0.62	5,800	820	0.008	0.31	4,450	420	0.007	0.08		
4020-052008	2	R0.5	0.4°	20	9,500	2,450	0.06	0.85	5,500	920	0.025	0.43	4,250	480	0.015	0.13		
4020-052608				26	9,500	2,450	0.04	0.83	5,500	920	0.021	0.42	4,250	480	0.013	0.12		
4020-053008				30	9,000	2,300	0.03	0.79	5,400	880	0.016	0.41	4,100	450	0.012	0.11		
4020-053608				36	9,000	2,300	0.02	0.75	5,200	850	0.011	0.39	4,000	430	0.01	0.1		
4020-054008				40	9,000	2,300	0.02	0.7	5,200	850	0.01	0.38	4,000	430	0.009	0.1		
4020-051018				10	10,000	2,600	0.12	0.9	5,800	990	0.057	0.49	4,450	540	0.024	0.2		
4020-051518			15	10,000	2,600	0.09	0.88	5,600	950	0.044	0.47	4,350	510	0.02	0.17			
4020-052018			20	9,500	2,450	0.06	0.86	5,500	920	0.03	0.45	4,250	480	0.016	0.15			
4020-052518			25	9,500	2,450	0.05	0.85	5,500	920	0.025	0.43	4,250	480	0.015	0.13			
4020-053018			30	9,500	2,450	0.04	0.83	5,500	920	0.021	0.42	4,250	480	0.013	0.12			
4020-053518			35	9,000	2,300	0.03	0.81	5,300	880	0.016	0.41	4,100	450	0.012	0.11			
4020-054018			40	9,000	2,300	0.02	0.8	5,200	850	0.012	0.4	4,000	430	0.01	0.1			
4020-054518			45	9,000	2,300	0.02	0.75	5,200	850	0.011	0.39	4,000	430	0.01	0.1			
4020-055018			50	9,000	2,300	0.017	0.75	5,200	850	0.01	0.38	4,000	430	0.009	0.1			
4020-053028			30	9,500	2,450	0.05	0.85	5,500	920	0.025	0.43	4,250	480	0.015	0.13			
4020-054028			40	9,500	2,450	0.04	0.83	5,500	920	0.02	0.42	4,250	480	0.013	0.12			
4020-053038			30	9,500	2,450	0.06	0.85	5,500	920	0.03	0.43	4,250	480	0.017	0.14			
4020-054038			40	9,500	2,450	0.05	0.85	5,500	920	0.025	0.43	4,250	480	0.015	0.13			
4020-053058			30	9,500	2,450	0.07	0.85	5,500	920	0.035	0.45	4,250	480	0.017	0.16			
4020-054258			42	9,500	2,450	0.06	0.85	5,500	920	0.03	0.45	4,250	480	0.016	0.15			
4030-082008			3	R0.8	0.4°	20	6,500	2,500	0.12	1.06	3,900	960	0.05	0.58	3,200	550	0.029	0.25
4030-082608						26	6,300	2,400	0.08	1.04	3,800	940	0.038	0.56	3,100	520	0.025	0.22
4030-083008						30	6,300	2,400	0.064	1.01	3,800	920	0.034	0.55	3,100	510	0.022	0.21
4030-083608						36	6,300	2,400	0.05	1	3,800	920	0.028	0.52	3,100	510	0.02	0.19
4030-084008						40	6,300	2,400	0.04	0.98	3,800	920	0.023	0.51	3,100	510	0.018	0.17
4030-082018						20	6,700	2,600	0.13	1.07	4,000	1,000	0.065	0.6	3,300	590	0.034	0.28
4030-082518					25	6,500	2,500	0.1	1.05	3,900	960	0.05	0.58	3,200	550	0.029	0.25	
4030-083018	30	6,300			2,400	0.072	1.03	3,800	920	0.038	0.56	3,100	510	0.024	0.22			
4030-083518	35	6,300			2,400	0.064	1.01	3,800	920	0.034	0.55	3,100	510	0.022	0.21			
4030-084018	40	6,300			2,400	0.056	1	3,800	920	0.03	0.54	3,100	510	0.021	0.2			
4030-085018	50	6,300			2,400	0.04	0.98	3,800	920	0.023	0.51	3,100	510	0.018	0.17			
4030-086018	60	6,000			2,300	0.024	0.96	3,600	870	0.015	0.49	2,900	470	0.015	0.15			
4030-083028	30	6,500			2,500	0.09	1.03	3,900	960	0.045	0.57	3,200	550	0.03	0.24			
4030-084028	40	6,300			2,400	0.06	1.01	3,800	920	0.035	0.55	3,100	510	0.02	0.21			
4030-083038	30	6,500			2,500	0.1	1.05	3,900	960	0.05	0.58	3,200	550	0.03	0.25			
4030-084038	40	6,300			2,400	0.07	1.03	3,800	920	0.04	0.56	3,100	510	0.025	0.22			
4030-083358	33	6,700			2,500	0.12	1.07	3,900	1,000	0.06	0.6	3,200	590	0.03	0.28			

4 Flutes

φ3mm Shank  
V Series

UDC-PCD  
Series

CBN  
Series

Square

Long Neck  
Square

Radius

Long Neck  
Radius

Taper Neck  
Radius

Ball / Long  
Shank Ball

Long Neck  
Ball

Taper Neck  
Ball

Taper

Barrel

Spiral  
V Cutter

Drill

Technical Data

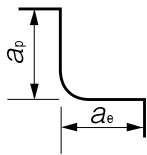


## 4 Flutes HARDMAX

- φ3mm Shank V Series
- UDC-PCD Series
- CBN Series
- Square
- Long Neck Square
- Radius
- Long Neck Radius
- Taper Neck Radius
- Ball / Long Shank Ball
- Long Neck Ball
- Taper Neck Ball
- Taper
- Barrel
- Spiral V Cutter
- Drill
- Technical Data

WORK MATERIAL				PREHARDENED STEELS / HARDENED STEELS NAK / SKD (30~45HRC)				HARDENED STEELS SKD / SKT (45~55HRC)				HARDENED STEELS SKD / SKH (55~65HRC)								
Model Number	Outside Diameter (mm)	Corner Radius (mm)	Neck Taper Angle TN	Neck Length (mm)	Spindle Speed (min <sup>-1</sup> )	Feed Rate (mm/min)	a <sub>p</sub> Axial Depth (mm)	a <sub>e</sub> Radial Depth (mm)	Spindle Speed (min <sup>-1</sup> )	Feed Rate (mm/min)	a <sub>p</sub> Axial Depth (mm)	a <sub>e</sub> Radial Depth (mm)	Spindle Speed (min <sup>-1</sup> )	Feed Rate (mm/min)	a <sub>p</sub> Axial Depth (mm)	a <sub>e</sub> Radial Depth (mm)				
4040-102508	4	R1	0.4°	25	5,000	2,600	0.17	1.42	3,000	1,000	0.085	0.8	2,450	600	0.045	0.38				
4040-103008				30	5,000	2,600	0.13	1.39	2,900	960	0.065	0.77	2,400	540	0.038	0.34				
4040-103508				35	4,800	2,450	0.09	1.37	2,900	920	0.048	0.75	2,350	480	0.032	0.3				
4040-104008				40	4,800	2,450	0.08	1.35	2,900	920	0.043	0.74	2,350	480	0.03	0.28				
4040-104508				45	4,800	2,450	0.07	1.33	2,900	920	0.038	0.72	2,350	480	0.028	0.26				
4040-105008				50	4,800	2,450	0.06	1.32	2,900	920	0.034	0.7	2,350	480	0.026	0.25				
4040-102018			4	R1	0.9°	20	5,000	2,600	0.19	1.44	3,000	1,000	0.095	0.82	2,450	600	0.048	0.4		
4040-102518						25	5,000	2,600	0.17	1.42	3,000	1,000	0.085	0.8	2,450	600	0.045	0.38		
4040-103018						30	5,000	2,600	0.15	1.41	3,000	1,000	0.076	0.79	2,450	600	0.042	0.36		
4040-103518						35	4,800	2,450	0.12	1.39	2,900	960	0.062	0.77	2,400	540	0.037	0.33		
4040-104018						40	4,800	2,450	0.09	1.37	2,900	920	0.048	0.75	2,350	480	0.032	0.3		
4040-105018						50	4,800	2,450	0.08	1.35	2,900	920	0.043	0.72	2,350	480	0.029	0.27		
4040-106018					4	R1	1.4°	60	4,800	2,450	0.06	1.32	2,900	920	0.034	0.7	2,350	480	0.026	0.25
4040-104928								49	4,800	2,500	0.1	1.37	2,900	960	0.05	0.74	2,350	540	0.035	0.28
4040-106028					4	R1	1.9°	60	4,800	2,500	0.08	1.35	2,900	960	0.04	0.72	2,350	540	0.03	0.27
4040-103038								30	5,000	2,600	0.15	1.42	3,000	1,000	0.08	0.8	2,450	600	0.045	0.38
4040-106738								67	4,800	2,500	0.12	1.4	2,900	960	0.05	0.78	2,350	540	0.03	0.35
4040-104558								45	5,000	2,600	0.15	1.41	3,000	1,000	0.08	0.79	2,450	600	0.045	0.36
4060-152018					6	R1.5	0.9°	20	3,350	2,600	0.28	2.16	2,000	1,000	0.14	1.24	1,650	600	0.072	0.6
4060-153018								30	3,350	2,600	0.28	2.16	2,000	1,000	0.14	1.24	1,650	600	0.072	0.6
4060-154018	40	3,350	2,600	0.26				2.14	2,000	1,000	0.131	1.21	1,650	600	0.068	0.57				
4060-155018	50	3,350	2,600	0.2				2.1	2,000	1,000	0.103	1.17	1,650	600	0.058	0.51				
4060-156018	60	3,150	2,400	0.14				2.06	1,900	920	0.075	1.12	1,550	510	0.048	0.45				
4060-155128	6	R1.5	1.4°	51			3,350	2,600	0.2	2.1	2,000	1,000	0.1	1.17	1,650	600	0.058	0.51		
4060-153938				39			3,350	2,600	0.26	2.14	2,000	1,000	0.13	1.21	1,650	600	0.068	0.57		
4060-156938	6	R1.5	1.9°	69			3,150	2,400	0.14	2.06	1,900	920	0.075	1.12	1,550	510	0.048	0.45		
4060-154758				47			3,350	2,600	0.26	2.14	2,000	1,000	0.13	1.21	1,650	600	0.068	0.57		

Side Milling

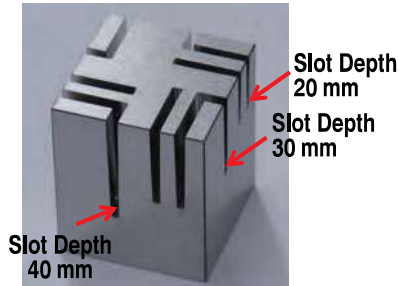


Note:

- Decrease both spindle speed and feed rate proportionally when the milling parameters exceed the machine's maximum spindle speed.
- Every coolant offers stable milling.

Milling Example of Taper Slotting  
HTNRS  $\phi 2 \times CR0.5 \times$  Neck Length 20 · 30 · 40

SKD61 (45HRC)



- Work Size : 50 × 50 × 60 mm
- Inclined Angle : 1°
- Slot Length : 27 mm (L Shape Slot)  
21 mm (Straight Slot)
- Slot Width : 2.6 mm (Bottom)
- Slot Depth : 20, 30, 40 mm
- Coolant : Water Soluble

4 Flutes

① Performance compared with straight neck type...Depth 20 mm L shape slotting

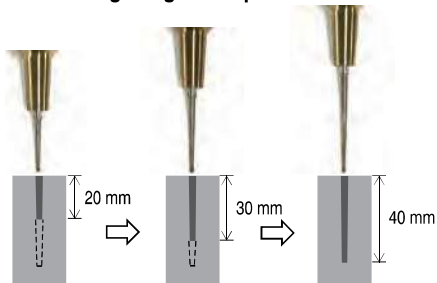
Milling Process	Tool	Neck Shape Helix Angle	Tool Size (mm)	Spindle Speed (min <sup>-1</sup> )	Feed Rate (mm/min)	$a_p$ (mm)	Cycle Time
Roughing	HTNRS 4020-052018	Taper Neck 0.9° 45° Helix Angle	$\phi 2 \times CR0.5 \times$ Neck Length 20	9,500	2,450	0.064	20 min 18 sec
Roughing	HLRS 4020-05-200	Straight Neck 30° Helix Angle	$\phi 2 \times CR0.5 \times$ Effective Length 20	7,000	800	0.025	1 h 30 min 9 sec

Taper neck is **7 times more efficient** in 20 mm depth slotting !

② Depth 40 mm L shape slotting

Milling Process	Tool	Neck Shape Helix Angle	Tool Size (mm)	Spindle Speed (min <sup>-1</sup> )	Feed Rate (mm/min)	$a_p$ (mm)	Cycle Time
Roughing	HTNRS 4020-052018	Taper Neck 0.9° 45° Helix Angle	$\phi 2 \times CR0.5 \times$ Neck Length 20 mm	9,500	2,450	0.064	27 min 8 sec
Roughing	HTNRS 4020-053018		$\phi 2 \times CR0.5 \times$ Neck Length 30 mm	9,500	2,450	0.047	15 min 32 sec
Roughing	HTNRS 4020-054018		$\phi 2 \times CR0.5 \times$ Neck Length 40 mm	9,000	2,300	0.02	40 min 26 sec
Finishing				4,500	500	0.0001 (Cusp Height)	4 h 28 min 50 sec

Slotting image of depth 40 mm



Depth 20 mm  
Ra : 0.287  $\mu$ m

Depth 30 mm  
Ra : 0.241  $\mu$ m

Depth 40 mm  
Ra : 0.274  $\mu$ m

40 mm slot depth roughing process completed in **1h 23 min ! Excellent surface finishing !**

$\phi 3$ mm Shank  
V Series

UDC-PCD  
Series

CBN  
Series

Square

Long Neck  
Square

Radius

Long Neck  
Radius

Taper Neck  
Radius

Ball / Long  
Shank Ball

Long Neck  
Ball

Taper Neck  
Ball

Taper

Barrel

Spiral  
V Cutter

Drill

Technical Data