

3 ~ 6 Flutes HARDMAX



Size $\phi 1 \sim \phi 12$

HMS

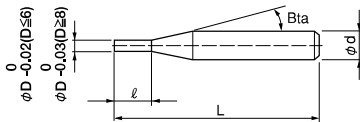


Material Applications (★ Highly Recommended ● Recommended ○ Suggested)

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										
		○	●	●	●	●											

Features

Offering outstanding tool life by selecting appropriate 3, 4 or 6 flutes on each tool diameter.
Highly efficient milling on hard materials up to 65HRC with HARDMAX COAT.



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.

Total 27 models

Unit (mm)

Model Number	Outside Diameter ϕD	Length of Cut ℓ	Shank Taper Angle β_{ta}	Overall Length L	Shank Diameter ϕd	Number of Flutes	Suggested Retail Price \yen
HMS 3010-0250	1	2.5	16°	45	4	3	7,500
HMS 3010-0350		3.5		45			10,800
HMS 3015-0400	1.5	4	16°	45	4	3	7,500
HMS 3015-0600		6		45			10,800
HMS 3020-0400	2	4	16°	45	4	3	6,700
HMS 3020-0700		7		45			10,000
HMS 3030-0600	3	6	16°	50	6	3	9,240
HMS 3030-1000		10		60			9,800
HMS 3030-1500		15		60			10,920
HMS 4040-0800	4	8	16°	50	6	4	9,870
HMS 4040-1200		12		60			10,470
HMS 4040-2000		20		70			11,450
HMS 4050-1000	5	10	16°	50	6	4	10,500
HMS 4050-1500		15		60			11,100
HMS 4050-2500		25		70			12,180
HMS 6060-1300	6	13	—	50	6	6	11,340
HMS 6060-1800		18		60			12,100
HMS 6060-2600		26		70			13,230
HMS 6080-1900	8	19	—	60	8	6	14,630
HMS 6080-2400		24		70			15,000
HMS 6080-3600		36		90			17,160
HMS 6100-2200	10	22	—	70	10	6	18,360
HMS 6100-3000		30		80			20,000
HMS 6100-4600		46		100			22,990
HMS 6120-2600		26		75			24,750
HMS 6120-3600	12	36	—	100	12	6	25,400
HMS 6120-5600		56		120			28,600

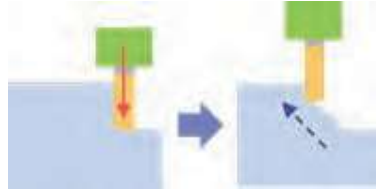
- φ3mm Shank V Series
- UDC-PCD Series
- CBN Series
- Square
- Long Neck Square
- Radius
- Long Neck Radius
- Taper Neck Radius
- Ball / Long Shank Ball
- Long Neck Ball
- Taper Neck Ball
- Taper
- Barrel
- Spiral V Cutter
- Drill
- Technical Data

Chip color : Selection example of optimal milling conditions from the viewpoint of cutting heat

SKH51 (63HRC)



- Work size : 50 × 50 × 30 mm
- Coolant : Air blow (Through spindle)



Climb up milling by Square end mills

What is climb up milling?

A milling method that makes effective use of the length of cut to make a large Z-cut in the first shot, and then runs up step by step.

1. Check the chip color under 6 types of conditions

	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	a_p (mm)	a_e (mm)	Feed per tooth (mm/t)	Chip color	Result	Efficiency (mm ³ /min)
Condition 1	4,000	1,350	10	0.15	0.056	Dark Blue	×	2,025
Condition 2	3,000	1,000	10	0.15	0.056	Red Gold	✓	1,500
Condition 3	2,000	675	10	0.15	0.056	Gold	✓	1,013
Condition 4	2,000	675	20	0.2	0.056	Red Gold	✓	2,700
Condition 5	2,000	1,000	20	0.2	0.083	Red Gold	✓	4,000
Condition 6	2,000	1,000	20	0.4	0.083	Dark Blue	×	8,000

2. Relationship between chip color and cutting heat



3. Optimal cutting condition

Condition 5 is judged to be the optimum condition based on the chip color and processing efficiency. No damage due to chipping of tools after 1 hour roughing process.

Tool after 1 hour roughing process



3 Flutes

4 Flutes

6 Flutes

Ø3mm 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 HMS

◆Short length of cut

WORK MATERIAL			PREHARDENED STEELS HARDENED STEELS (40~50HRC)					HARDENED STEELS (50~60HRC)					HARDENED STEELS (60HRC~)							
Model Number	Number of Flutes	Outside Diameter (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	Slotting		Side Milling		Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	Slotting		Side Milling		Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	Slotting		Side Milling	
					a _p (mm)	a _e (mm)	a _p (mm)	a _e (mm)			a _p (mm)	a _e (mm)	a _p (mm)	a _e (mm)			a _p (mm)	a _e (mm)		
3010-0250	3	1	9,500	140	0.05	1	0.05	6,400	95	0.05	1	0.05	6,400	90	0.05	1	0.05			
3015-0400		1.5	6,400	100	0.075	1.5	0.075	4,200	60	0.075	1.5	0.075	4,200	60	0.075	1.5	0.075			
3020-0400		2	4,700	80	0.1	2	0.1	3,200	75	0.1	2	0.1	3,200	70	0.1	2	0.1			
3030-0600		3	3,200	85	0.15	3	0.15	2,100	80	0.15	3	0.15	2,100	80	0.15	3	0.15			
4040-0800	4	4	2,400	90	0.2	4	0.2	1,600	85	0.2	4	0.2	1,600	80	0.2	4	0.2			
4050-1000		5	1,900	90	0.25	5	0.25	1,300	85	0.25	5	0.25	1,300	80	0.25	5	0.25			
6060-1300	6	6	1,600	170	0.3	6	0.3	1,100	120	0.3	6	0.3	1,100	110	0.3	6	0.3			
6080-1900		8	1,200	170	0.4	8	0.4	800	120	0.4	8	0.4	800	110	0.4	8	0.4			
6100-2200		10	950	170	0.5	15	0.5	640	100	0.5	15	0.5	640	80	0.5	15	0.5			
6120-2600		12	800	170	0.5	18	0.5	530	90	0.5	18	0.5	530	70	0.5	18	0.5			
Milling Amount (mm)		Slotting	$a_p \leq 0.05D$ (max 0.5 mm)																	
		Side Milling	$D \leq \phi 8$ $a_p = 1D$ $D \geq \phi 10$ $a_p = 1.5D$ $a_e \leq 0.05D$ (max 0.5 mm)																	

◆High speed milling for short length of cut

WORK MATERIAL			PREHARDENED STEELS HARDENED STEELS (40~50HRC)					HARDENED STEELS (50~60HRC)					HARDENED STEELS (60HRC~)				
Model Number	Number of Flutes	Outside Diameter (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	Side Milling		Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	Side Milling		Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	Side Milling				
					a _p (mm)	a _e (mm)			a _p (mm)	a _e (mm)			a _p (mm)	a _e (mm)			
3010-0250	3	1	22,500	630	1.5	0.03	20,000	540	1.5	0.02	15,000	450	0.5	0.01			
3015-0400		1.5	18,000	720	2.25	0.045	16,000	630	2.25	0.03	11,500	540	0.75	0.015			
3020-0400		2	14,300	850	3	0.06	13,000	750	3	0.04	8,500	630	1	0.02			
3030-0600		3	13,100	1,120	4.5	0.09	11,200	950	4.5	0.06	6,700	760	1.5	0.03			
4040-0800	4	4	11,300	1,300	6	0.12	9,900	1,170	6	0.08	2,850	630	8	0.08			
4050-1000		5	10,100	1,530	7.5	0.15	8,900	1,350	7.5	0.1	2,400	700	10	0.1			
6060-1300	6	6	8,900	1,950	9	0.18	8,000	1,800	9	0.12	2,150	830	12	0.12			
6080-1900		8	7,700	2,350	12	0.24	6,900	2,200	12	0.16	2,100	900	16	0.16			
6100-2200		10	6,700	3,100	15	0.3	6,000	2,700	15	0.2	2,000	1,000	20	0.2			
6120-2600		12	5,800	3,000	18	0.36	5,300	2,500	18	0.24	1,950	1,070	24	0.24			
Milling Amount (mm)		Side Milling	$a_p = 1.5D$ $a_e = 0.03D$ (max 0.5 mm)					$a_p = 1.5D$ $a_e = 0.02D$					$D \leq \phi 3$ $a_p = 0.5D$ $D \geq \phi 4$ $a_e = 0.01D$ $a_p = 2D$ $a_e = 0.02D$				

- φ3mm 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

Milling Conditions for HMS

◆Medium length of cut

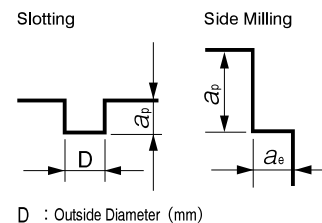
WORK MATERIAL			PREHARDENED STEELS HARDENED STEELS (40~50HRC)					HARDENED STEELS (50~60HRC)					HARDENED STEELS (60HRC~)				
Model Number	Number of Flutes	Outside Diameter (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	Slotting			Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	Side Milling			Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	Side Milling		
					a _p (mm)	a _p (mm)	a _e (mm)			a _p (mm)	a _p (mm)	a _e (mm)			a _p (mm)	a _p (mm)	a _e (mm)
3030-1000	3	3	3,200	43~85	0.09	6	0.09	2,100	40~80	0.09	6	0.09	2,100	40~80	0.09	6	0.09
4040-1200	4	4	2,400	45~90	0.12	8	0.12	1,600	43~85	0.12	8	0.12	1,600	40~80	0.12	8	0.12
4050-1500		5	1,900	45~90	0.15	10	0.15	1,300	43~85	0.15	10	0.15	1,300	40~80	0.15	10	0.15
6060-1800	6	6	1,600	85~170	0.18	12	0.18	1,100	60~120	0.18	12	0.18	1,100	55~110	0.18	12	0.18
6080-2400		8	1,200	85~170	0.24	16	0.24	800	60~120	0.24	16	0.24	800	55~110	0.24	16	0.24
6100-3000		10	950	85~170	0.3	25	0.3	640	50~100	0.3	25	0.3	640	40~80	0.3	25	0.3
6120-3600		12	800	85~170	0.3	30	0.3	530	45~90	0.3	30	0.3	530	35~70	0.3	30	0.3
Milling Amount (mm)		Slotting	$a_p \leq 0.03D$ (max 0.3 mm)														
		Side Milling	$D \leq \phi 8$ $a_p = 2D$ $D \geq \phi 10$ $a_p = 2.5D$ $a_e \leq 0.03D$ (max 0.3 mm)														

◆Long length of cut

WORK MATERIAL			PREHARDENED STEELS HARDENED STEELS (40~50HRC)				HARDENED STEELS (50~60HRC)				HARDENED STEELS (60HRC~)					
Model Number	Number of Flutes	Outside Diameter (mm)	Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	Side Milling		Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	Side Milling		Spindle Speed (min ⁻¹)	Feed Rate (mm/min)	Side Milling			
					a _p (mm)	a _e (mm)			a _p (mm)	a _e (mm)			a _p (mm)	a _e (mm)		
3010-0350	3	1	9,500	140~210	3	0.02	6,400	95~143	3	0.02	6,400	95~133	3	0.02		
3015-0600		1.5	6,300	100~150	4.5	0.03	4,200	80~120	4.5	0.03	4,200	80~112	4.5	0.03		
3020-0700		2	4,700	80~120	6	0.04	3,200	75~113	6	0.04	3,200	75~113	6	0.04		
3030-1500		3	3,200	85~128	9	0.06	2,100	80~120	9	0.06	2,100	80~120	9	0.06		
4040-2000	4	4	2,400	90~135	12	0.08	1,600	85~128	12	0.08	1,600	83~125	12	0.08		
4050-2500		5	1,900	90~135	15	0.1	1,300	85~128	15	0.1	1,300	83~125	15	0.1		
6060-2600	6	6	1,600	170~255	18	0.12	1,100	120~180	18	0.12	1,100	112~168	18	0.12		
6080-3600		8	1,200	170~255	24	0.16	800	120~180	24	0.16	800	110~166	24	0.16		
6100-4600		10	950	170~255	30	0.2	640	100~150	30	0.2	640	88~132	30	0.2		
6120-5600		12	800	170~255	36	0.24	530	90~135	36	0.24	530	76~114	36	0.24		
Milling Amount (mm)		Side Milling	$a_p = 3D$ $a_e \leq 0.02D$													

Note:

- Recommend down cut processing.
- Reduce cutting amount, feed rate, and apply zero-cut in accordance with required surface quality.
- Recommend air blow or oil mist.



3 Flutes

4 Flutes

6 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