



Size $\phi 1 \sim \phi 12$

HMS

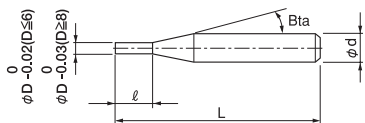


Material Applications (★ Highly Recommended ● Recommended ○ Suggested)

| 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)

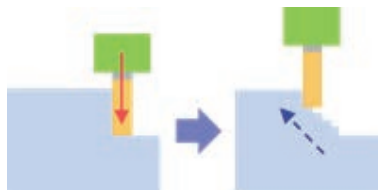
| Model Number | Outside Diameter ϕD | Length of Cut ℓ | Shank Taper Angle B_{ta} | Overall Length L | Shank Diameter ϕd | Number of Flutes | Suggested Retail Price ¥ |
|---------------|---------------------------|----------------------|----------------------------|--------------------|-------------------------|------------------|-----------------------------------|
| HMS 3010-0250 | 1 | 2.5 | 16° | 45 | 4 | 3 | 7,500 |
| HMS 3010-0350 | | 3.5 | | 45 | | | 10,800 |
| HMS 3015-0400 | | 4 | | 45 | | | 7,500 |
| HMS 3015-0600 | 1.5 | 6 | 16° | 45 | 4 | 3 | 10,800 |
| HMS 3020-0400 | | 4 | | 45 | | | 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 | 12 | 26 | — | 75 | 12 | 6 | 24,750 |
| HMS 6120-3600 | | 36 | | 100 | | | 25,400 |
| HMS 6120-5600 | | 56 | | 120 | | | 28,600 |

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) | 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) | | | | | $a_p = 1.5D$ $a_e = 0.02D$ | | | | | $D \leq \phi 3$ $a_p = 0.5D$ $a_e = 0.01D$ $D \geq \phi 4$ $a_p = 2D$ $a_e = 0.02D$ | | | | |

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 | | 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) | | | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 530 | 35~70 | 0.3 | 30 | 0.3 | |
| Milling Amount (mm) | | Slotting | $a_p \leq 0.03D$ (max 0.3 mm) | | | | | | | | | | | | | | | | | | | | |
| | | Side Milling | $D \leq \phi 8 \quad a_p = 2D$ $D \geq \phi 10 \quad a_p = 2.5D$ $a_e \leq 0.03D$ (max 0.3 mm) | | | | | | | | | | | | | | | | | | | | |

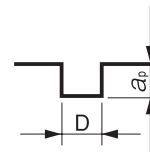
◆Long length of cut

| 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 | 4 | 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 | 2,400 | 90~135 | 12 | 0.08 | 1,600 | 85~128 | 12 | 0.08 | 1,600 | 83~125 | 12 | 0.08 |
| 4050-2500 | 6 | 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 | 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 | $a_p = 3D$ $a_e \leq 0.02D$ | | | | | | | | | | | |

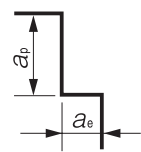
Note:

- 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.

Slotting



Side Milling



D : Outside Diameter (mm)

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