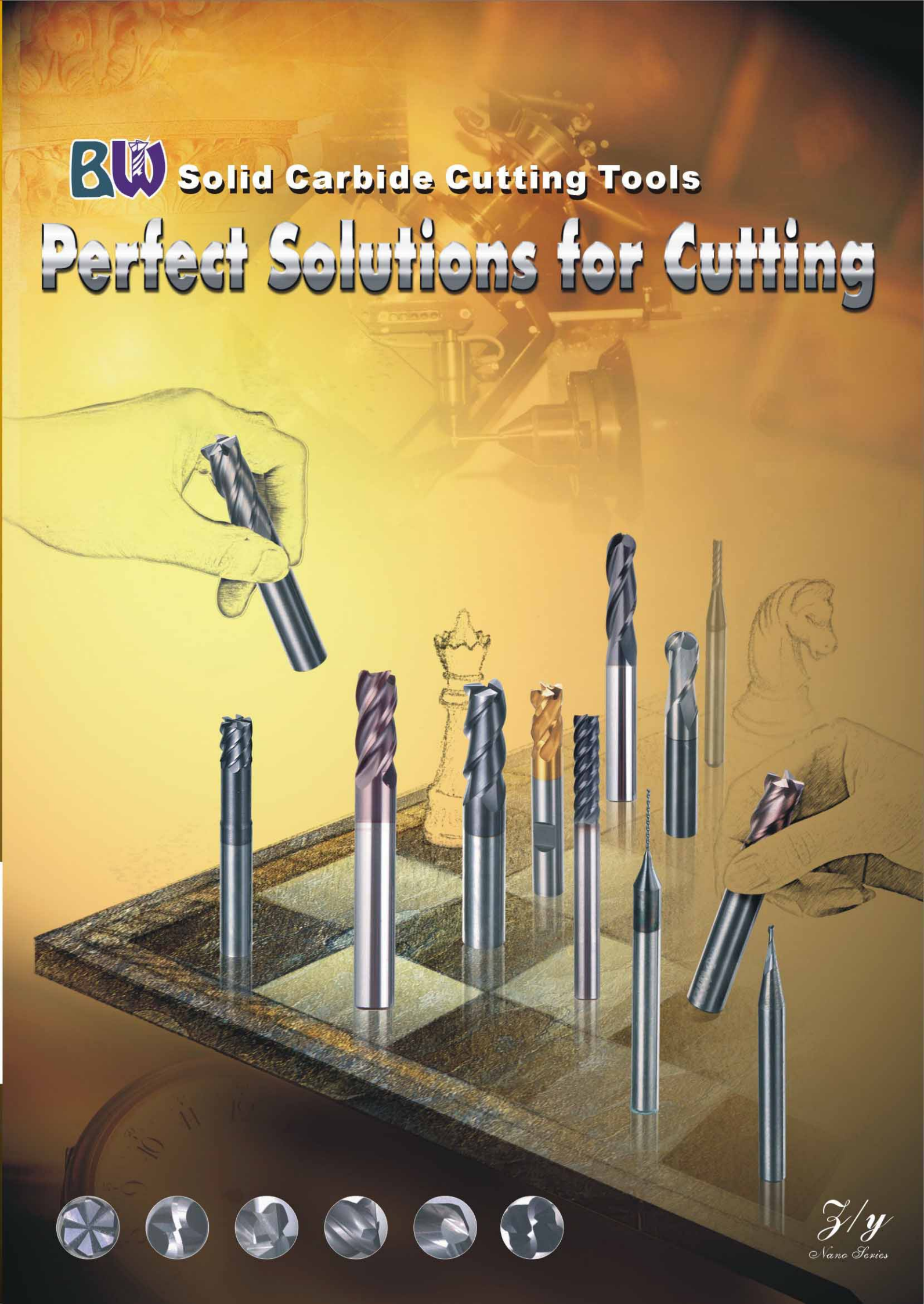
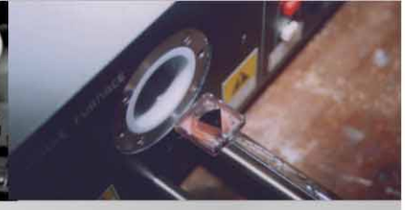
BW Solid Carbide Cutting Tools

# Perfect Solutions for Cutting



Z/y Nano Series

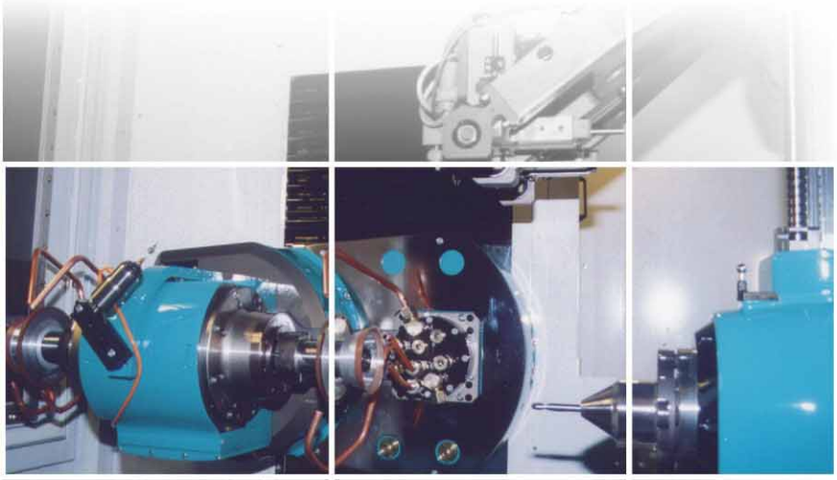
# Index



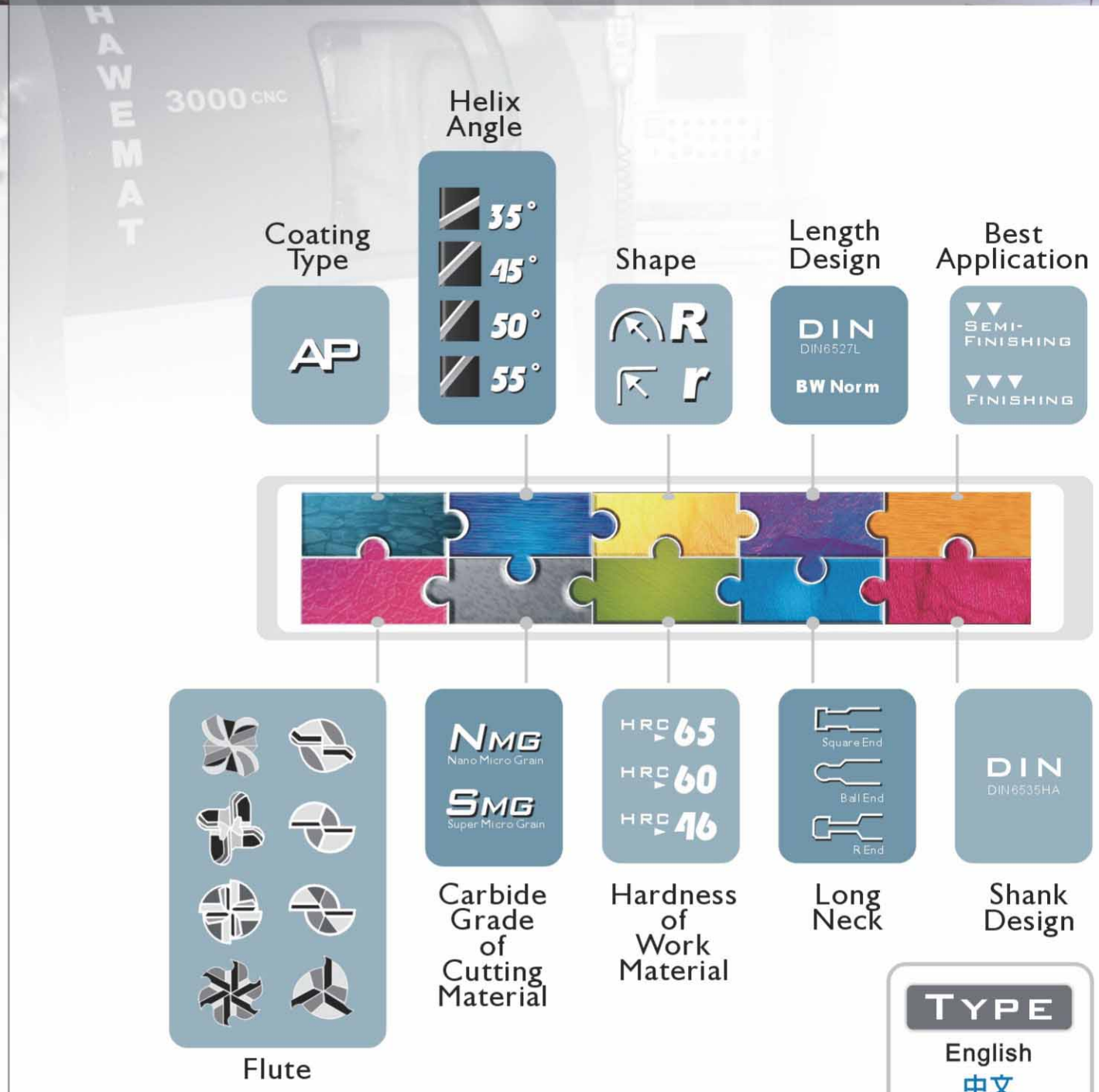

2 Description of The Buttons
3 BW Philosophy
5 Material
6 Coating


| | ORDER CODE | Style | Flutes | Grade | Helix Angle | ϕ -range | Length Norm |
|---|---|---|---|---|---|---|---|
| 7 | 2BZ | ball end | 2 | NMG K10-K30 | 35° | 0.2-20.0 | BW Norm |
| 9 | 2BSZ | | 2 | | | 1.0-16.0 | BW Norm |
| 10 | 4BZ | | 4 | | | 3.0-20.0 | BW Norm |
| 11 | 2BNZ | | 2 | | | 0.5-4.0 | BW Norm |
| 13 | 2RZ | R end | 2 | | 35° | 2.0-16.0 | DIN 6527L |
| 15 | 4RZ | | 4 | | 35° | 4.0-16.0 | DIN 6527L |
| 16 | 2Z | square end | 2 | | 35° | 0.2-4.0 | BW Norm |
| 17 | 3Z | | 3 | | 45° | 3.0-20.0 | DIN 6527L |
| 18 | 4Z | | 4 | | 50° | 4.0-20.0 | DIN 6527L |
| 19 | 2XZ | | 2 | | 35° | 2.0-12.0 | BW Norm |
| 20 | 4XZ | | 4 | | 50° | 4.0-20.0 | BW Norm |
| 21 | 2NZ | | 2 | | 35° | 0.5-4.0 | BW Norm |
| 23 | 6Z | | 6 | | 55° | 6.0-20.0 | DIN 6527L |
| 24 | 6XZ | | 6 | | 55° | 6.0-20.0 | BW Norm |
| 25 | 2CZ | | 2 | | 55° | 0.5-16.0 | DIN 6527L |
| 26 | 3CZ | | 3 | | 55° | 3.0-20.0 | DIN 6527L |
| 27 | 2BY | ball end | 2 | SMG K40-K50 | 35° | 2.0-20.0 | BW Norm |
| 28 | 4BY | | 4 | | 35° | 5.0-20.0 | BW Norm |
| 29 | 4Y | square end | 4 | | 50° | 4.0-20.0 | DIN 6527L |
| 30 | 3Y | | 3 | | 45° | 3.0-20.0 | DIN 6527L |


31 TECH-1
32 TECH-2
33 Special Tool

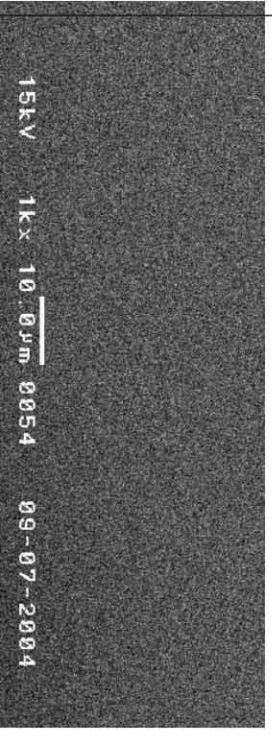
# Description of the buttons



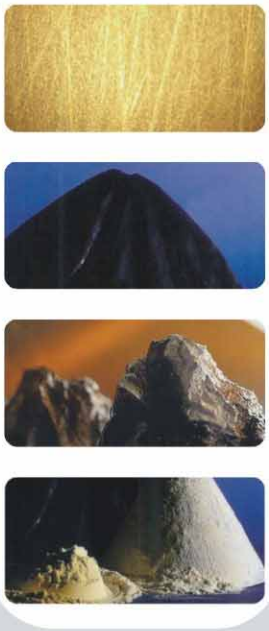

| UNIT | |
|---|---|
| R.P.M. | rev/min |
| Feed | mm/min |

**TYPE**

English
中文
Deutsch
Français
Español
Italiano
日本語




ISO Certified Carbide



## Material ~body of tool~

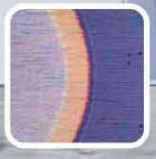
The Advanced Solid Tungsten Carbide

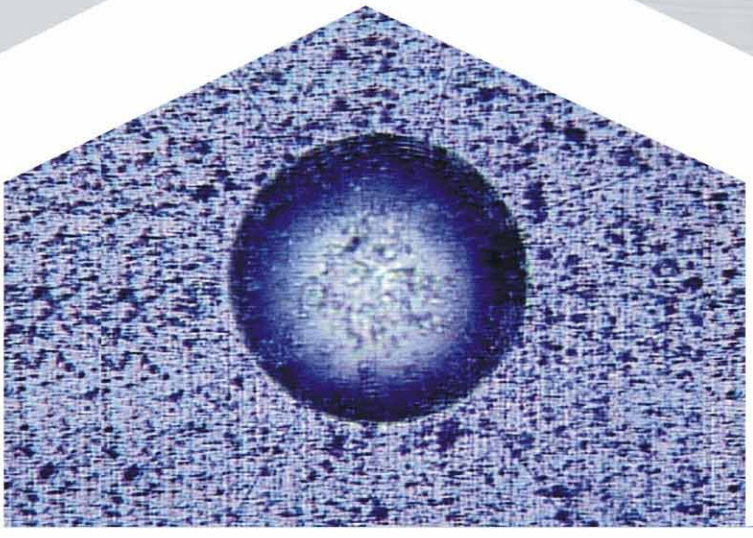
- stable microstructure
- high strength
- wide areas application

# Material Technical Info of Carbide Material

| Type of Carbide | | MG | SMG | NMG |
|---|---|---|---|---|
| Chemical Data | Co (%) | 10 | 12 | 9 |
| | WC incl. Doping (%) | 90 | 88 | 91 |
| Physical Data | Density ISO 3369 (g/cm3) | 14,5 | 14,1 | 14,3 |
| | Hardness HV30 ISO 3878 | 1610 | 1680 | 2000 |
| | Hardness HRA ISO 3778 | 91,9 | 92,3 | 94,1 |
| | Transverse Rupture Strength (N/mm2) | >3600 | >3800 | >4000 |
| | Transverse Rupture Strength (1000 psi) | > 522 | > 551 | >565 |
| Metallographic Data | Porosity ISO 4505 A | <=02 | <=02 | <=02 |
| | Porosity ISO 4505 B | 00 | 00 | 00 |
| | Porosity ISO 4505 C | 00 | 00 | 00 |
| Microstructure | Average Grain Size ( µm) | 0,6 | 0,5 | 0,2 |
| ISO-Range | Classification ISO 513 | K30-K40 | K40-K50 | K10-K30 |
| Application | Work Material | Stainless steels<br>Plastics<br>Non ferrous metals<br>Corrosion and heat resistant steels | Stainless steels<br>Titanium alloys<br>Non ferrous metals<br>Corrosion and heat resistant steels | Fibreglass-reinforced plastic<br>Carbon fibre-reinforeced materials<br>Hardened steel<br>Titanium alloys<br>Graphite composite materials |
| | Characters | Extra fine grain hard metal for solid carbide rotary tools applications in the ISO K30-K40/C2-C3. Suit for most cuttings. | Superior grain for solid carbide rotary tools applications in very wide range ISO K40-K50/ C1-C2. The high hardness combine with high transverse rupture strength. Great for low and high speed milling and roughing work when milling and boring. | High hardness and extreme bending strength, suit for the drilling of electronic boards and other fibreglass-reinforced plastics and milling of difficult materials. |

# Coating





## Coating ~armor of tool~

Arc evaporation and magneton sputtering

- wear and corrosion resistance
- low friction
- perfect protection

| Coating Type | TA | *AP | TM | DMC |
|---|---|---|---|---|
| Coating | AlTiN Nano-coat | AlTiN+PLC-coat | TiCN-MP coat | TiB2 + CrN + Cr + DLC |
| Color | Violet | Silver | Rose | Dark Grey |
| Oxidation Onset Temp ( °C) | 700° - 800° | 800° - 1000° | 500° - 600° | 700° - 900° |
| Substrate | high speed steel, carbide, cermet | high speed steel, carbide, cermet | high speed steel, carbide, cermet | high speed steel, carbide |
| Coating Structure | Multi-layers | Multi-layers | Multi-layers | Multi-layers |
| CoatingThickness (µm) | 1 - 4 | 1-4 | 1-4 | 1 - 2 |
| Friction against dry steel | 0.4-0.45 | 0.15-0.2 | 0.4-0.45 | 0.15-0.2 |
| Micro Hardness (HV 0,05) | 3500 | 3500 | 3000 | 3500 |
| Application temperature max. (°C) | < 800-900 | < 800-950 | < 400-450 | < 800-950 |
| Preferred machining materials | For high speed & dry machining | Stainless steel hard-to-cut material | Soft material | Al, Non Ferrous, Titanium |
| Characteristic | dry machining | dry machining min. lubrication | machining soft alloy | HSM, dry, with micro lubrication |

*available in stock

# NMG Ball Nose End Mills

奈米微粒圓頭立銑刀

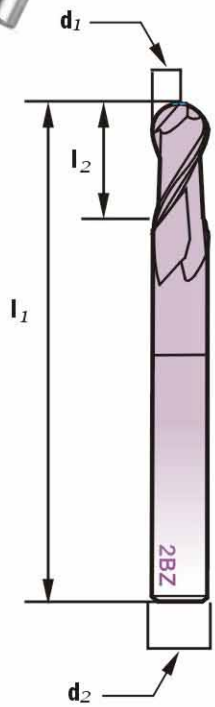
VHM-Radiusfräser

Fraises à bout hémisphérique en carbure monobloc

Fresa metal duro submicrograno punta esférica

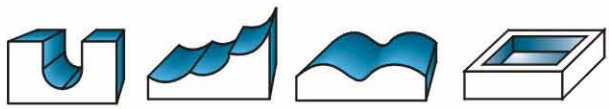
Fresa a testa semisferica

ボールエンドミル




| d1 | tol |
|---|---|
| 0.2-2.0 | e8 |
| 2.0-20.0 | h10 |

## 2BZ

mm

| Order Code | ⌀ $d_1$ (e8/h10) | $l_2$ | $l_1$ | ⌀ $d_2$ (h6) |
|---|---|---|---|---|
| 2BZ002 | R0.1 | 0.4 | 38 | 3.0 |
| 2BZ003 | R0.15 | 0.6 | 38 | 3.0 |
| 2BZ004 | R0.2 | 0.8 | 38 | 3.0 |
| 2BZ005 | R0.25 | 1.0 | 38 | 3.0 |
| 2BZ006 | R0.3 | 1.2 | 38 | 3.0 |
| 2BZ007 | R0.35 | 1.4 | 38 | 3.0 |
| 2BZ008 | R0.4 | 1.6 | 38 | 3.0 |
| 2BZ010 | R0.5 | 2.0 | 38 | 3.0 |
| 2BZ012 | R0.6 | 2.4 | 38 | 3.0 |
| 2BZ014 | R0.7 | 2.8 | 38 | 3.0 |
| 2BZ015 | R0.75 | 3.0 | 38 | 3.0 |
| 2BZ016 | R0.8 | 3.2 | 38 | 3.0 |
| 2BZ018 | R0.9 | 3.6 | 38 | 3.0 |
| 2BZ020 | R1 | 4.0 | 38 | 3.0 |
| 2BZ020E | R1 | 4.0 | 75 | 6.0 |
| 2BZ030 | R1.5 | 6.0 | 50 | 6.0 |
| 2BZ030E | R1.5 | 6.0 | 75 | 6.0 |
| 2BZ030F | R1.5 | 6.0 | 100 | 6.0 |
| 2BZ040 | R2 | 8.0 | 50 | 6.0 |
| 2BZ040E | R2 | 8.0 | 75 | 6.0 |
| 2BZ040F | R2 | 8.0 | 100 | 6.0 |
| 2BZ050 | R2.5 | 10.0 | 50 | 6.0 |
| 2BZ060 | R3 | 12.0 | 50 | 6.0 |
| 2BZ060E | R3 | 12.0 | 75 | 6.0 |
| 2BZ060F | R3 | 12.0 | 100 | 6.0 |
| 2BZ070 | R3.5 | 14.0 | 60 | 8.0 |
| 2BZ070E | R3.5 | 14.0 | 75 | 8.0 |
| 2BZ070F | R3.5 | 14.0 | 100 | 8.0 |
| 2BZ080 | R4 | 16.0 | 60 | 8.0 |
| 2BZ080E | R4 | 16.0 | 75 | 8.0 |
| 2BZ080F | R4 | 16.0 | 100 | 8.0 |
| 2BZ100 | R5 | 20.0 | 75 | 10.0 |
| 2BZ100F | R5 | 20.0 | 100 | 10.0 |
| 2BZ100H | R5 | 20.0 | 150 | 10.0 |
| 2BZ120 | R6 | 24.0 | 75 | 12.0 |
| 2BZ120F | R6 | 24.0 | 100 | 12.0 |
| 2BZ120H | R6 | 24.0 | 150 | 12.0 |
| 2BZ160 | R8 | 32.0 | 100 | 16.0 |
| 2BZ160I | R8 | 32.0 | 200 | 16.0 |
| 2BZ200 | R10 | 40.0 | 100 | 20.0 |
| 2BZ200I | R10 | 40.0 | 200 | 20.0 |

## 2BZ Recommendations for Cutting Conditions

| WORK Material | S45C,P20S,FCD | | SUS403,SKD11,SCr | |
|---|---|---|---|---|
| Order Code | <HRC30-50 | | <HRC50-65 | |
| | R.P.M. | Feed | R.P.M. | Feed |
| 2BZ002 | 42000 | 760 | 40000 | 720 |
| 2BZ003 | 41000 | 740 | 39000 | 710 |
| 2BZ004 | 41500 | 750 | 39500 | 700 |
| 2BZ005 | 40000 | 880 | 38000 | 840 |
| 2BZ006 | 39000 | 860 | 37000 | 820 |
| 2BZ007 | 38000 | 840 | 36000 | 800 |
| 2BZ008 | 37000 | 820 | 35000 | 770 |

Max Milling Volume


l2<0.02R
P<0.02R


l2<0.01R
P<0.02R

| WORK Material | S45C,P20S,FCD | | SUS403,SKD11,SCr | | Ti-6Al-4V PRE/HARDENED STEELS | |
|---|---|---|---|---|---|---|
| Order Code | <HRC30-50 | | <HRC30-45 | | <HRC45-65 | |
| | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed |
| 2BZ010 | 35000 | 1400 | 32000 | 1280 | 30000 | 1200 |
| 2BZ012 | 31000 | 1260 | 30000 | 1120 | 29000 | 1180 |
| 2BZ014 | 30500 | 1250 | 29500 | 1200 | 28500 | 1170 |
| 2BZ015 | 30000 | 1930 | 29000 | 1870 | 28000 | 1800 |
| 2BZ016 | 29500 | 1900 | 28500 | 1830 | 27500 | 1770 |
| 2BZ018 | 28500 | 1830 | 27500 | 1770 | 26500 | 1700 |
| 2BZ020 | 28000 | 2150 | 27000 | 2070 | 26000 | 2000 |
| 2BZ030 | 26000 | 3030 | 25000 | 2910 | 24000 | 2800 |
| 2BZ040 | 22000 | 3300 | 21000 | 3150 | 20000 | 3000 |
| 2BZ050 | 21000 | 3150 | 20000 | 3000 | 19000 | 2850 |
| 2BZ060 | 20000 | 3330 | 19000 | 3160 | 18000 | 3000 |
| 2BZ070 | 19000 | 3160 | 18000 | 3000 | 17000 | 2830 |
| 2BZ080 | 18000 | 4500 | 17000 | 4250 | 16000 | 4000 |
| 2BZ100 | 16000 | 4570 | 15000 | 4280 | 14000 | 4000 |
| 2BZ120 | 15500 | 4420 | 14500 | 4140 | 13500 | 3850 |
| 2BZ160 | 9300 | 2660 | 9100 | 2600 | 8500 | 2430 |

Max Milling Volume


l2<0.02R
P<0.05R


l2<0.01R
P<0.02R

| WORK Material | S45C,P20S,FCD | | SUS403,SKD11,SCr | | Ti-6Al-4V PRE/HARDENED STEELS | |
|---|---|---|---|---|---|---|
| Order Code | <HRC30 | | <HRC30-45 | | <HRC45-65 | |
| | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed |
| 2BZ020E | 28000 | 2150 | 27000 | 2070 | 26000 | 2000 |
| 2BZ030E | 26000 | 3030 | 25000 | 2910 | 24000 | 2800 |
| 2BZ040E | 22000 | 3300 | 21000 | 3150 | 20000 | 3000 |
| 2BZ060E | 20000 | 3330 | 19000 | 3160 | 18000 | 3000 |
| 2BZ070E | 19000 | 3160 | 18000 | 3000 | 17000 | 2830 |
| 2BZ080E | 18000 | 4500 | 17000 | 4250 | 16000 | 4000 |

Max Milling Volume


l2<0.02R
P<0.05R


l2<0.02R
P<0.025R

| WORK Material | S45C,P20S,FCD | | SUS403,SKD11,SCr | | Ti-6Al-4V PRE/HARDENED STEELS | |
|---|---|---|---|---|---|---|
| Order Code | <HRC30 | | <HRC30-45 | | <HRC45-65 | |
| | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed |
| 2BZ020F | 28000 | 2150 | 27000 | 2070 | 26000 | 2000 |
| 2BZ030F | 26000 | 3030 | 25000 | 2910 | 24000 | 2800 |
| 2BZ040F | 22000 | 3300 | 21000 | 3150 | 20000 | 3000 |
| 2BZ060F | 20000 | 3330 | 19000 | 3160 | 18000 | 3000 |
| 2BZ070F | 19000 | 3160 | 18000 | 3000 | 17000 | 2830 |
| 2BZ080F | 18000 | 4500 | 17000 | 4250 | 16000 | 4000 |
| 2BZ100F | 16000 | 4570 | 15000 | 4280 | 14000 | 4000 |
| 2BZ120F | 15500 | 4420 | 14500 | 4140 | 13500 | 3850 |

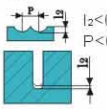
Max Milling Volume


l2<0.02R
P<0.02R

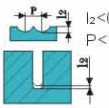

l2<0.02R
P<0.025R

| WORK Material | S45C,P20S,FCD | | SUS403,SKD11,SCR. | | Ti-6Al-4V PRE/HARDENED STEELS | |
|---|---|---|---|---|---|---|
| Order Code | <HRC30 | | <HRC30-45 | | <HRC45-65 | |
| | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed |
| 2BZ100H | 16000 | 4570 | 15000 | 4280 | 14000 | 4000 |
| 2BZ120H | 15500 | 4420 | 14500 | 4140 | 13500 | 3850 |
| 2BZ160I | 9300 | 2660 | 9100 | 2600 | 8500 | 2430 |
| 2BZ200I | 9380 | 3130 | 8750 | 2910 | 6880 | 2290 |

Max Milling Volume




l2<0.02R
P<0.02R




l2<0.02R
P<0.05R

# NMG Short Flute Ball Nose End Mills

奈米微粒短刃圓頭立銑刀

VHM-Radiusfräser kurz, mit abgesetztem Hals

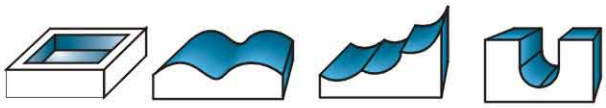
Fraises à bout hémisphérique en carbure monobloc, court flute

Fresa metal duro submicrograno punta esférica

Fresa a testa semisferica – Tagliente corto

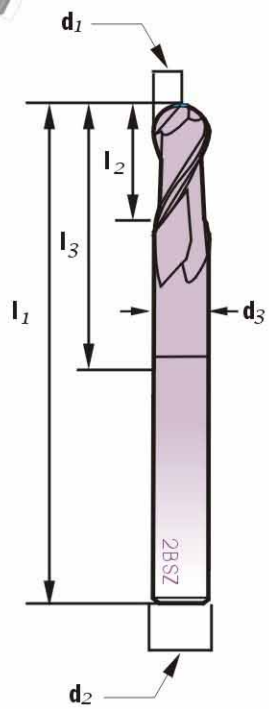
ショートフルーボールエンドミル

## 2BSZ

mm

| Order Code | ⌀ $d_1$ (e8/h10) | $l_2$ | $l_3$ | $l_1$ | ⌀$d_3$ | ⌀ $d_2$ (h6) |
|---|---|---|---|---|---|---|
| 2BSZ010 | R0.5 | 1.0 | 2.5 | 38 | 0.8 | 3.0 |
| 2BSZ015 | R0.75 | 1.5 | 4 | 38 | 1.3 | 3.0 |
| 2BSZ020 | R1 | 2.0 | 5 | 38 | 1.8 | 3.0 |
| 2BSZ030 | R1.5 | 3.0 | 8 | 50 | 2.8 | 6.0 |
| 2BSZ040 | R2 | 4.0 | 10 | 50 | 3.8 | 6.0 |
| 2BSZ050 | R2.5 | 5.0 | 13 | 50 | 4.8 | 6.0 |
| 2BSZ060 | R3 | 6.0 | 15 | 50 | 5.8 | 6.0 |
| 2BSZ070 | R3.5 | 7.0 | 16 | 60 | 6.8 | 8.0 |
| 2BSZ080 | R4 | 8.0 | 20 | 60 | 7.7 | 8.0 |
| 2BSZ100 | R5 | 10.0 | 25 | 75 | 9.7 | 10.0 |
| 2BSZ120 | R6 | 12.0 | 30 | 75 | 11.7 | 12.0 |
| 2BSZ160 | R8 | 16.0 | 40 | 100 | 15.7 | 16.0 |

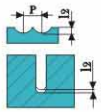


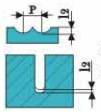

| $d_1$ | tol |
|---|---|
| 0.2-2.0 | e8 |
| 2.0-16.0 | h10 |

### 2BSZ Recommendations for Cutting Conditions

| WORK Material | S45C,P20S,FCD | | SUS403,SKD11,SCr | | Ti-6Al-4V PRE-HARDENED STEELS | |
|---|---|---|---|---|---|---|
| Order Code | <HRC30 | | <HRC30-45 | | <HRC45-65 | |
| | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed |
| 2BSZ010 | 35000 | 1400 | 32000 | 1280 | 30000 | 1200 |
| 2BSZ015 | 30000 | 1930 | 29000 | 1870 | 28000 | 1800 |
| 2BSZ020 | 28000 | 2150 | 27000 | 2070 | 26000 | 2000 |
| 2BSZ030 | 26000 | 3030 | 25000 | 2910 | 24000 | 2800 |
| 2BSZ040 | 22000 | 3300 | 21000 | 3150 | 20000 | 3000 |
| 2BSZ050 | 21000 | 3150 | 20000 | 3000 | 19000 | 2850 |
| 2BSZ060 | 20000 | 3330 | 19000 | 3160 | 18000 | 3000 |
| 2BSZ070 | 19000 | 3160 | 18000 | 3000 | 17000 | 2830 |
| 2BSZ080 | 18000 | 4500 | 17000 | 4250 | 16000 | 4000 |
| 2BSZ100 | 16000 | 4570 | 15000 | 4280 | 14000 | 4000 |
| 2BSZ120 | 15500 | 4420 | 14500 | 4140 | 13500 | 3850 |
| 2BSZ160 | 9000 | 1900 | 8800 | 1860 | 8500 | 1800 |

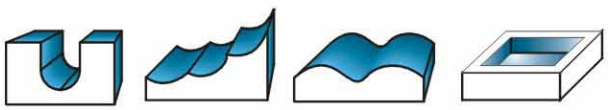
Max Milling Volume



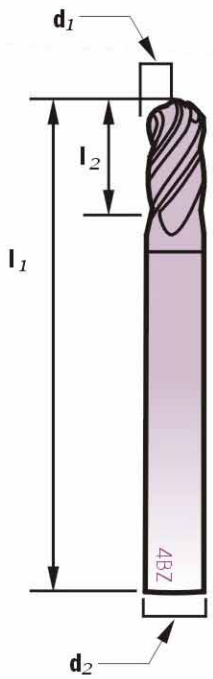
# NMG Ball Nose End Mills
奈米微粒圓頭立銑刀
VHM-Radiusfräser
Fraises à bout hémisphérique en carbure monobloc
Fresa metal duro submicrograno punta esférica
Fresa a testa semisferica
ボールエンドミル

4BZ

mm

| Order Code | ⌀ $d_1$ (h10) | $l_2$ | $l_1$ | ⌀ $d_2$ (h6) |
|---|---|---|---|---|
| 4BZ030 | R1.5 | 6.0 | 50 | 6.0 |
| 4BZ040 | R2 | 8.0 | 50 | 6.0 |
| 4BZ050 | R2.5 | 10.0 | 50 | 6.0 |
| 4BZ060 | R3 | 12.0 | 50 | 6.0 |
| 4BZ060F | R3 | 12.0 | 100 | 6.0 |
| 4BZ080 | R4 | 16.0 | 60 | 8.0 |
| 4BZ080F | R4 | 16.0 | 100 | 8.0 |
| 4BZ100 | R5 | 20.0 | 75 | 10.0 |
| 4BZ100F | R5 | 20.0 | 100 | 10.0 |
| 4BZ120 | R6 | 24.0 | 75 | 12.0 |
| 4BZ120F | R6 | 24.0 | 100 | 12.0 |
| 4BZ160 | R8 | 32.0 | 100 | 16.0 |
| 4BZ200 | R10 | 40.0 | 100 | 20.0 |




## 4BZ Recommendations for Cutting Conditions

| WORK Material | S45C, P20S, FCD | | SUS403, SKD11, SCr | | Ti-6Al-4V PRE-HARDENED STEELS | |
|---|---|---|---|---|---|---|
| Order Code | <HRC30 | | <HRC30-45 | | <HRC45-65 | |
| | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed |
| 4BZ030 | 28000 | 2150 | 27000 | 2070 | 26000 | 2000 |
| 4BZ040 | 26000 | 3030 | 25000 | 2910 | 24000 | 2800 |
| 4BZ050 | 21000 | 3150 | 20000 | 3000 | 19000 | 2850 |
| 4BZ060 | 20000 | 3330 | 19000 | 3160 | 18000 | 3000 |
| 4BZ060F | 20000 | 3330 | 19000 | 3160 | 18000 | 3000 |
| 4BZ080 | 18000 | 4500 | 17000 | 4250 | 16000 | 4000 |
| 4BZ080F | 18000 | 4500 | 17000 | 4250 | 16000 | 4000 |
| 4BZ100 | 16000 | 4570 | 15000 | 4280 | 14000 | 4000 |
| 4BZ100F | 16000 | 4570 | 15000 | 4280 | 14000 | 4000 |
| 4BZ120 | 15500 | 4420 | 14500 | 4140 | 13500 | 3850 |
| 4BZ120F | 15500 | 4420 | 14500 | 4140 | 13500 | 3850 |
| 4BZ160 | 9300 | 2660 | 9100 | 2600 | 8500 | 2430 |
| 4BZ200 | 9380 | 3130 | 8750 | 2910 | 6880 | 2290 |

Max Milling Volume


$l_2$<0.02R
P<0.02R


$l_2$<0.02R
P<0.025R

# NMG Long Neck Ball Nose End Mills

奈米微粒深溝用圓頭立銑刀

VHM-Radiusfräser,mit langem Hals

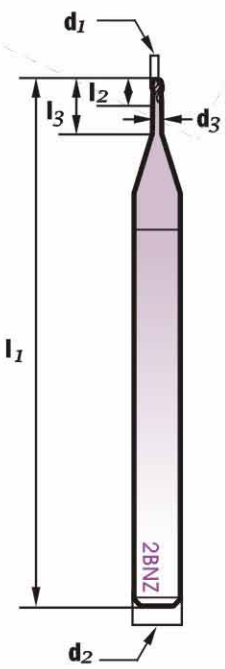
Fraises à bout hémispherique en carbure monobloc,longue cou

Fresa metal duro submicrograno punta esférica con cuello largo

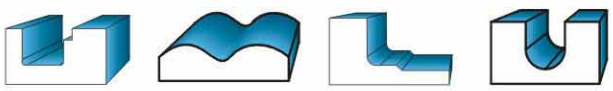
Fresa a testa semisferica－Stelo lungo

ショートフルーラジアスエンドミル






## 2BNZ

mm

| Order Code | ⌀ $d_1$ (e8) | $l_2$ | $l_3$ | $l_1$ | ⌀ $d_3$ | ⌀ $d_2$ (h6) |
|---|---|---|---|---|---|---|
| 2BNZ0504 | R0.25 | 1.0 | 4 | 50 | 0.47 | 6.0 |
| 2BNZ0506 | R0.25 | 1.0 | 6 | 50 | 0.47 | 6.0 |
| 2BNZ0604 | R0.3 | 1.2 | 4 | 50 | 0.57 | 6.0 |
| 2BNZ0606 | R0.3 | 1.2 | 6 | 50 | 0.57 | 6.0 |
| 2BNZ0806 | R0.4 | 1.2 | 6 | 50 | 0.77 | 6.0 |
| 2BNZ0808 | R0.4 | 1.2 | 8 | 50 | 0.77 | 6.0 |
| 2BNZ1006 | R0.5 | 1.5 | 6 | 50 | 0.97 | 6.0 |
| 2BNZ1008 | R0.5 | 1.5 | 8 | 50 | 0.97 | 6.0 |
| 2BNZ1010 | R0.5 | 1.5 | 10 | 50 | 0.97 | 6.0 |
| 2BNZ1012 | R0.5 | 1.5 | 12 | 50 | 0.97 | 6.0 |
| 2BNZ1208 | R0.6 | 2.0 | 8 | 50 | 1.17 | 6.0 |
| 2BNZ1212 | R0.6 | 2.0 | 12 | 50 | 1.17 | 6.0 |
| 2BNZ1508 | R0.75 | 2.0 | 8 | 50 | 1.47 | 6.0 |
| 2BNZ1512 | R0.75 | 2.0 | 12 | 50 | 1.47 | 6.0 |
| 2BNZ1516 | R0.75 | 2.0 | 16 | 50 | 1.47 | 6.0 |
| 2BNZ1520 | R0.75 | 2.0 | 20 | 50 | 1.47 | 6.0 |
| 2BNZ1608 | R0.8 | 2.5 | 8 | 50 | 1.57 | 6.0 |
| 2BNZ1612 | R0.8 | 2.5 | 12 | 50 | 1.57 | 6.0 |
| 2BNZ1616 | R0.8 | 2.5 | 16 | 50 | 1.57 | 6.0 |
| 2BNZ2008 | R1 | 3.0 | 8 | 50 | 1.95 | 6.0 |
| 2BNZ2012 | R1 | 3.0 | 12 | 50 | 1.95 | 6.0 |
| 2BNZ2016 | R1 | 3.0 | 16 | 50 | 1.95 | 6.0 |
| 2BNZ2020 | R1 | 3.0 | 20 | 50 | 1.95 | 6.0 |
| 2BNZ3008 | R1.5 | 4.0 | 8 | 50 | 2.90 | 6.0 |
| 2BNZ3012 | R1.5 | 4.0 | 12 | 50 | 2.90 | 6.0 |
| 2BNZ3016 | R1.5 | 4.0 | 16 | 50 | 2.90 | 6.0 |
| 2BNZ3020 | R1.5 | 4.0 | 20 | 75 | 2.90 | 6.0 |
| 2BNZ3025 | R1.5 | 4.0 | 25 | 75 | 2.90 | 6.0 |
| 2BNZ4010 | R2 | 5.0 | 10 | 75 | 3.90 | 6.0 |
| 2BNZ4015 | R2 | 5.0 | 15 | 75 | 3.90 | 6.0 |
| 2BNZ4020 | R2 | 5.0 | 20 | 75 | 3.90 | 6.0 |
| 2BNZ4025 | R2 | 5.0 | 25 | 75 | 3.90 | 6.0 |
| 2BNZ4030 | R2 | 5.0 | 30 | 75 | 3.90 | 6.0 |

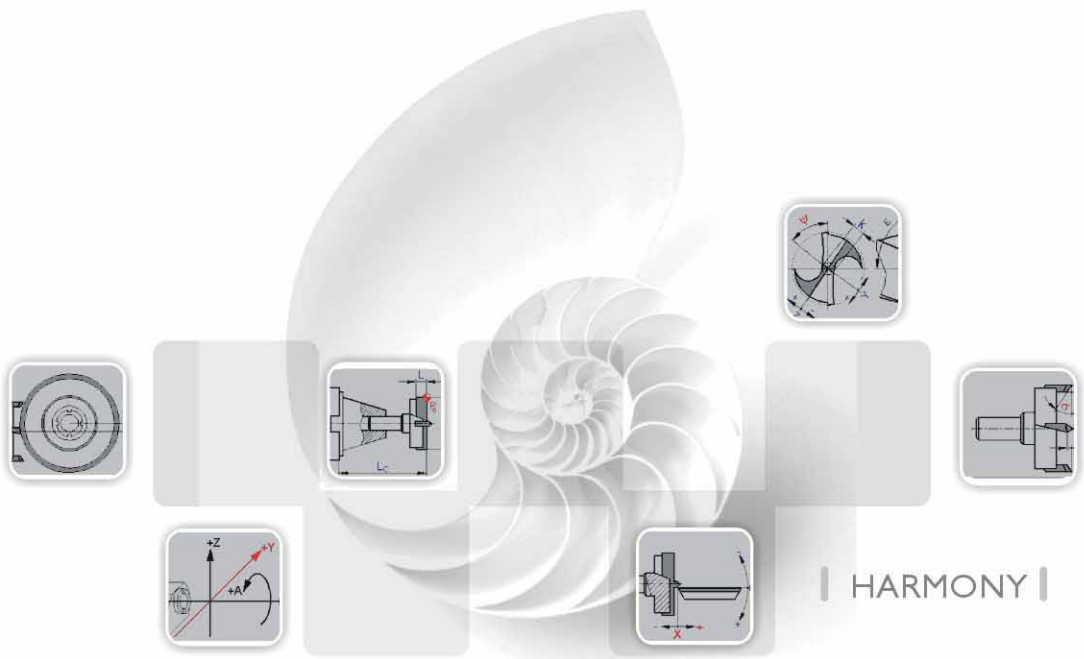
## 2BNZ Recommendations for Cutting Conditions

| WORK Material | S45C,P20S,FCD | | SUS403,SKD11,SCr | | Ti-6Al-4V PRE/HARDENED STEELS | |
|---|---|---|---|---|---|---|
| Order Code | <HRC30 | | <HRC30-45 | | <HRC45-65 | |
| | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed |
| 2BNZ0504 | 34500 | 2130 | 32500 | 2060 | 30500 | 2000 |
| 2BNZ0506 | 34500 | 2130 | 32500 | 2060 | 30500 | 2000 |
| 2BNZ0604 | 34500 | 1630 | 32500 | 1560 | 30500 | 1500 |
| 2BNZ0606 | 34500 | 1630 | 32500 | 1560 | 30500 | 1500 |
| 2BNZ0806 | 34000 | 1130 | 32000 | 1060 | 30000 | 1000 |
| 2BNZ0808 | 34000 | 1130 | 32000 | 1060 | 30000 | 1000 |
| 2BNZ1006 | 34000 | 1360 | 32000 | 1280 | 30000 | 1200 |
| 2BNZ1008 | 34000 | 1360 | 32000 | 1280 | 30000 | 1200 |
| 2BNZ1010 | 34000 | 1360 | 32000 | 1280 | 30000 | 1200 |
| 2BNZ1012 | 34000 | 1360 | 32000 | 1280 | 30000 | 1200 |
| 2BNZ1208 | 34000 | 1580 | 32000 | 1500 | 30000 | 1400 |
| 2BNZ1212 | 34000 | 1580 | 32000 | 1500 | 30000 | 1400 |
| 2BNZ1508 | 34000 | 1700 | 32000 | 1600 | 30000 | 1500 |
| 2BNZ1512 | 34000 | 1700 | 32000 | 1600 | 30000 | 1500 |
| 2BNZ1516 | 34000 | 1700 | 32000 | 1600 | 30000 | 1500 |
| 2BNZ1520 | 34000 | 1700 | 32000 | 1600 | 30000 | 1500 |
| 2BNZ1608 | 28000 | 2100 | 26000 | 1950 | 24000 | 1800 |
| 2BNZ1612 | 28000 | 2100 | 26000 | 1950 | 24000 | 1800 |
| 2BNZ1616 | 28000 | 2100 | 26000 | 1950 | 24000 | 1800 |
| 2BNZ2008 | 28000 | 2330 | 26000 | 2160 | 24000 | 2000 |
| 2BNZ2012 | 28000 | 2330 | 26000 | 2160 | 24000 | 2000 |
| 2BNZ2016 | 28000 | 2330 | 26000 | 2160 | 24000 | 2000 |
| 2BNZ2020 | 28000 | 2330 | 26000 | 2160 | 24000 | 2000 |
| 2BNZ3008 | 28000 | 2910 | 26000 | 2700 | 24000 | 2500 |
| 2BNZ3010 | 28000 | 2910 | 26000 | 2700 | 24000 | 2500 |
| 2BNZ3016 | 28000 | 2910 | 26000 | 2700 | 24000 | 2500 |
| 2BNZ3020 | 28000 | 2910 | 26000 | 2700 | 24000 | 2500 |
| 2BNZ3025 | 28000 | 2910 | 26000 | 2700 | 24000 | 2500 |
| 2BNZ4010 | 24000 | 3600 | 22000 | 3300 | 20000 | 3000 |
| 2BNZ4015 | 24000 | 3600 | 22000 | 3300 | 20000 | 3000 |
| 2BNZ4020 | 24000 | 3600 | 22000 | 3300 | 20000 | 3000 |
| 2BNZ4025 | 24000 | 3600 | 22000 | 3300 | 20000 | 3000 |
| 2BNZ4030 | 24000 | 3600 | 22000 | 3300 | 20000 | 3000 |

Max Milling Volume

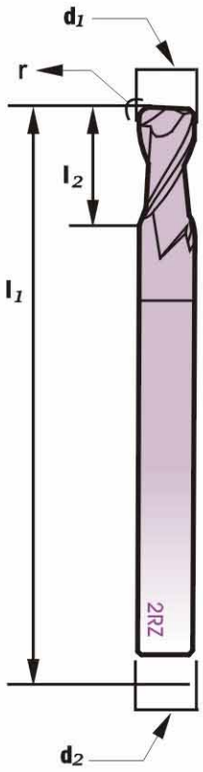

$l_2$<0.02R
P<0.02R


$l_2$<0.01R
P<0.025R

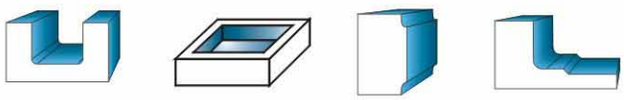



HARMONY

# NMG Corner Radius End Mills
## 奈米微粒圓鼻角立銑刀
## VHM-Torusfräser
## Fraises à rayon en carbure monobloc
## Fresa metal duro submicrograno tórica
## Frese frontali—Torica
## ラジアスエンドミル




**2RZ**

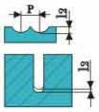
mm

| Order Code | ⌀ $d_1$ (h10) | r | $l_2$ | $l_1$ | ⌀ $d_2$ (h6) |
|---|---|---|---|---|---|
| 2RZ0205 | 2.0 | 0.5 | 6.0 | 38 | 3.0 |
| 2RZ0255 | 2.5 | 0.5 | 7.0 | 38 | 3.0 |
| 2RZ0305 | 3.0 | 0.5 | 7.0 | 57 | 6.0 |
| 2RZ0405 | 4.0 | 0.5 | 8.0 | 57 | 6.0 |
| 2RZ0405E | 4.0 | 0.5 | 8.0 | 75 | 6.0 |
| 2RZ0505 | 5.0 | 0.5 | 10.0 | 57 | 6.0 |
| 2RZ0605 | 6.0 | 0.5 | 10.0 | 57 | 6.0 |
| 2RZ0605F | 6.0 | 0.5 | 10.0 | 100 | 6.0 |
| 2RZ0610 | 6.0 | 1.0 | 10.0 | 57 | 6.0 |
| 2RZ0610F | 6.0 | 1.0 | 10.0 | 100 | 6.0 |
| 2RZ0805 | 8.0 | 0.5 | 16.0 | 63 | 8.0 |
| 2RZ0805F | 8.0 | 0.5 | 16.0 | 100 | 8.0 |
| 2RZ0810 | 8.0 | 1.0 | 16.0 | 63 | 8.0 |
| 2RZ0810F | 8.0 | 1.0 | 16.0 | 100 | 8.0 |
| 2RZ1005 | 10.0 | 0.5 | 19.0 | 72 | 10.0 |
| 2RZ1005F | 10.0 | 0.5 | 19.0 | 100 | 10.0 |
| 2RZ1010 | 10.0 | 1.0 | 19.0 | 72 | 10.0 |
| 2RZ1010F | 10.0 | 1.0 | 19.0 | 100 | 10.0 |
| 2RZ1020 | 10.0 | 2.0 | 19.0 | 72 | 10.0 |
| 2RZ1020F | 10.0 | 2.0 | 19.0 | 100 | 10.0 |
| 2RZ1205 | 12.0 | 0.5 | 22.0 | 83 | 12.0 |
| 2RZ1210 | 12.0 | 1.0 | 22.0 | 83 | 12.0 |
| 2RZ1210F | 12.0 | 1.0 | 22.0 | 100 | 12.0 |
| 2RZ1220 | 12.0 | 2.0 | 22.0 | 83 | 12.0 |
| 2RZ1220F | 12.0 | 2.0 | 22.0 | 100 | 12.0 |
| 2RZ1605 | 16.0 | 0.5 | 26.0 | 92 | 16.0 |
| 2RZ1610 | 16.0 | 1.0 | 26.0 | 92 | 16.0 |

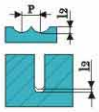
## 2RZ Recommendations for Cutting Conditions

| WORK Material | S45C,P20S,FCD | | SUS403,SKD11,SCr | | Ti-6Al-4V PRE/HARDENED STEELS | |
|---|---|---|---|---|---|---|
| Order Code | <HRC30 | | <HRC30-45 | | <HRC45-60 | |
| | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed |
| 2RZ0205 | 28000 | 2150 | 27000 | 2070 | 26000 | 2000 |
| 2RZ0255 | 28000 | 2150 | 27000 | 2070 | 26000 | 2000 |
| 2RZ0305 | 26000 | 3030 | 25000 | 2910 | 24000 | 2800 |
| 2RZ0405 | 22000 | 3300 | 21000 | 3150 | 20000 | 3000 |
| 2RZ0405E | 22000 | 3300 | 21000 | 3150 | 20000 | 3000 |
| 2RZ0505 | 21000 | 3150 | 20000 | 3000 | 19000 | 2850 |
| 2RZ0605 | 20000 | 3330 | 19000 | 3160 | 18000 | 3000 |
| 2RZ0605F | 20000 | 3330 | 19000 | 3160 | 18000 | 3000 |
| 2RZ0610 | 20000 | 3330 | 19000 | 3160 | 18000 | 3000 |
| 2RZ0610F | 20000 | 3330 | 19000 | 3160 | 18000 | 3000 |
| 2RZ0805 | 18000 | 4500 | 17000 | 4250 | 16000 | 4000 |
| 2RZ0805F | 18000 | 4500 | 17000 | 4250 | 16000 | 4000 |
| 2RZ0810 | 18000 | 4500 | 17000 | 4250 | 16000 | 4000 |
| 2RZ0810F | 18000 | 4500 | 17000 | 4250 | 16000 | 4000 |
| 2RZ1005 | 16000 | 4570 | 15000 | 4280 | 14000 | 4000 |
| 2RZ1005F | 16000 | 4570 | 15000 | 4280 | 14000 | 4000 |
| 2RZ1010 | 16000 | 4570 | 15000 | 4280 | 14000 | 4000 |
| 2RZ1010F | 16000 | 4570 | 15000 | 4280 | 14000 | 4000 |
| 2RZ1020 | 16000 | 4570 | 15000 | 4280 | 14000 | 4000 |
| 2RZ1020F | 16000 | 4570 | 15000 | 4280 | 14000 | 4000 |
| 2RZ1205 | 15500 | 4420 | 14500 | 4140 | 13500 | 3850 |
| 2RZ1210 | 15500 | 4420 | 14500 | 4140 | 13500 | 3850 |
| 2RZ1210F | 15500 | 4420 | 14500 | 4140 | 13500 | 3850 |
| 2RZ1220 | 15500 | 4420 | 14500 | 4140 | 13500 | 3850 |
| 2RZ1220F | 15500 | 4420 | 14500 | 4140 | 13500 | 3850 |
| 2RZ1605 | 9300 | 2660 | 9100 | 2600 | 8500 | 2430 |
| 2RZ1610 | 9300 | 2660 | 9100 | 2600 | 8500 | 2430 |

Max Milling Volume

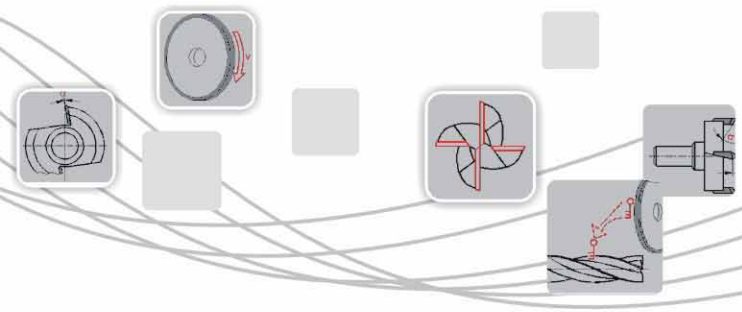



$l_2$<0.02R
P<0.02R

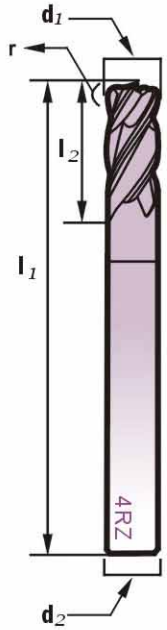



$l_2$<0.02R
P<0.25R

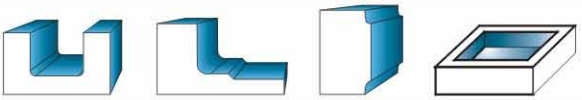




# NMG Corner Radius End Mills
奈米微粒圓鼻角立銑刀
VHM-Torusfräser
Fraises à rayon en carbure monobloc
Fresa metal duro submicrograno tórica
Frese frontali—Torica
ラジアスエンドミル




## 4RZ

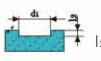
mm

| Order Code | ⌀ $d_1$ (h10) | r | $l_2$ | $l_1$ | ⌀ $d_2$ (h6) |
|---|---|---|---|---|---|
| 4RZ0405 | 4.0 | 0.5 | 11.0 | 57 | 6.0 |
| 4RZ0505 | 5.0 | 0.5 | 13.0 | 57 | 6.0 |
| 4RZ0510 | 5.0 | 1.0 | 13.0 | 57 | 6.0 |
| 4RZ0605 | 6.0 | 0.5 | 13.0 | 57 | 6.0 |
| 4RZ0605F | 6.0 | 0.5 | 13.0 | 100 | 6.0 |
| 4RZ0610 | 6.0 | 1.0 | 13.0 | 57 | 6.0 |
| 4RZ0610F | 6.0 | 1.0 | 13.0 | 100 | 6.0 |
| 4RZ0805 | 8.0 | 0.5 | 19.0 | 63 | 8.0 |
| 4RZ0805F | 8.0 | 0.5 | 19.0 | 100 | 8.0 |
| 4RZ0810 | 8.0 | 1.0 | 19.0 | 63 | 8.0 |
| 4RZ0810F | 8.0 | 1.0 | 19.0 | 100 | 8.0 |
| 4RZ1005 | 10.0 | 0.5 | 22.0 | 72 | 10.0 |
| 4RZ1005F | 10.0 | 0.5 | 22.0 | 100 | 10.0 |
| 4RZ1010 | 10.0 | 1.0 | 22.0 | 72 | 10.0 |
| 4RZ1010F | 10.0 | 1.0 | 22.0 | 100 | 10.0 |
| 4RZ1020 | 10.0 | 2.0 | 22.0 | 72 | 10.0 |
| 4RZ1020F | 10.0 | 2.0 | 22.0 | 100 | 10.0 |
| 4RZ1030 | 10.0 | 3.0 | 22.0 | 72 | 10.0 |
| 4RZ1205 | 12.0 | 0.5 | 26.0 | 83 | 12.0 |
| 4RZ1210 | 12.0 | 1.0 | 26.0 | 83 | 12.0 |
| 4RZ1210F | 12.0 | 1.0 | 26.0 | 100 | 12.0 |
| 4RZ1220 | 12.0 | 2.0 | 26.0 | 83 | 12.0 |
| 4RZ1220F | 12.0 | 2.0 | 26.0 | 100 | 12.0 |
| 4RZ1605 | 16.0 | 0.5 | 32.0 | 92 | 16.0 |
| 4RZ1610 | 16.0 | 1.0 | 32.0 | 92 | 16.0 |

## 4RZ Recommendations for Cutting Conditions

| WORK Material | S45C,SKS,VK30 | | SCr,SNC,SKD | | SCM,SUS403,NAK80 | | Ti-6A1-4V | | PRE/HARDENED STEELS | |
|---|---|---|---|---|---|---|---|---|---|---|
| Order Code | <HRC30 | | <HRC30-45 | | <HRC35-40 | | <HRC40-45 | | <HRC45-60 | |
| | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed |
| 4RZ0405 | 24000 | 3600 | 23000 | 3450 | 22000 | 3300 | 21000 | 3150 | 20000 | 3000 |
| 4RZ0505 | 23000 | 3450 | 22000 | 3300 | 21000 | 3150 | 20000 | 3000 | 19000 | 2850 |
| 4RZ0510 | 23000 | 3450 | 22000 | 3300 | 21000 | 3150 | 20000 | 3000 | 19000 | 2850 |
| 4RZ0605/F | 22000 | 4120 | 21000 | 3930 | 20000 | 3750 | 19000 | 3560 | 18000 | 3000 |
| 4RZ0610/F | 22000 | 4120 | 21000 | 3930 | 20000 | 3750 | 19000 | 3560 | 18000 | 3000 |
| 4RZ0805/F | 20000 | 5000 | 19000 | 4750 | 18000 | 4500 | 17000 | 4250 | 16000 | 4000 |
| 4RZ0810/F | 20000 | 5000 | 19000 | 4750 | 18000 | 4500 | 17000 | 4250 | 16000 | 4000 |
| 4RZ1005/F | 18000 | 5140 | 17000 | 4850 | 16000 | 4570 | 15000 | 4280 | 14000 | 4000 |
| 4RZ1010/F | 18000 | 5140 | 17000 | 4850 | 16000 | 4570 | 15000 | 4280 | 14000 | 4000 |
| 4RZ1020/F | 18000 | 5140 | 17000 | 4850 | 16000 | 4570 | 15000 | 4280 | 14000 | 4000 |
| 4RZ1030 | 18000 | 5140 | 17000 | 4850 | 16000 | 4570 | 15000 | 4280 | 14000 | 4000 |
| 4RZ1205 | 17500 | 5000 | 16500 | 4710 | 15500 | 4420 | 14500 | 4140 | 13500 | 3850 |
| 4RZ1210/F | 17500 | 5000 | 16500 | 4710 | 15500 | 4420 | 14500 | 4140 | 13500 | 3850 |
| 4RZ1220/F | 17500 | 5000 | 16500 | 4710 | 15500 | 4420 | 14500 | 4140 | 13500 | 3850 |
| 4RZ1605 | 9300 | 2660 | 9100 | 2600 | 8900 | 2550 | 8700 | 2500 | 8500 | 2430 |
| 4RZ1610 | 9300 | 2660 | 9100 | 2600 | 8900 | 2550 | 8700 | 2500 | 8500 | 2430 |

Max Milling Volume




$l_2$<0.02$d_2$


$l_2$<0.02$d_2$
W<0.02$d_2$


$l_2$<0.02$d_2$


$l_2$<0.1$d_2$
W<0.01$d_2$

# NMG Miniature End Mills
奈米微粒小徑立銑刀
VHM-Microschaftfräser
Fraises à queue en carbure monobloc, petit diametre
Fresa microdiámetro metal duro submicrograno
Frese frontali
ミラクルスクエアエンドミル



2Z


mm

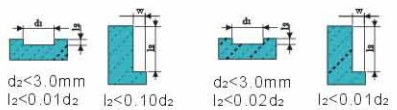
| Order Code | ⌀ $d_1$ (e8/h10) | $l_2$ | $l_1$ | ⌀ $d_2$ (h6) |
|---|---|---|---|---|
| 2Z002 | 0.2 | 0.4 | 38 | 3.0 |
| 2Z003 | 0.3 | 0.6 | 38 | 3.0 |
| 2Z004 | 0.4 | 0.8 | 38 | 3.0 |
| 2Z005 | 0.5 | 1.0 | 38 | 3.0 |
| 2Z006 | 0.6 | 1.2 | 38 | 3.0 |
| 2Z007 | 0.7 | 1.4 | 38 | 3.0 |
| 2Z008 | 0.8 | 1.6 | 38 | 3.0 |
| 2Z009 | 0.9 | 1.8 | 38 | 3.0 |
| 2Z010 | 1.0 | 3.0 | 38 | 3.0 |
| 2Z012 | 1.2 | 3.0 | 38 | 3.0 |
| 2Z014 | 1.4 | 3.0 | 38 | 3.0 |
| 2Z015 | 1.5 | 4.0 | 38 | 3.0 |
| 2Z016 | 1.6 | 4.0 | 38 | 3.0 |
| 2Z018 | 1.8 | 5.0 | 38 | 3.0 |
| 2Z020 | 2.0 | 6.0 | 38 | 3.0 |
| 2Z025 | 2.5 | 7.0 | 38 | 3.0 |
| 2Z030 | 3.0 | 7.0 | 57 | 6.0 |
| 2Z040 | 4.0 | 8.0 | 57 | 6.0 |


| $d_1$ | tol |
|---|---|
| 0.2-2.0 | e8 |
| 2.0-4.0 | h10 |

## 2Z Recommendations for Cutting Conditions

| WORK Material | S45C,SKS,YK30 | | SCr,SNC,SKD | |
|---|---|---|---|---|
| Order Code | <HRC30 | | <HRC30-45 | |
| | R.P.M. | Feed | R.P.M. | Feed |
| 2Z002 | 42000 | 760 | 40000 | 720 |
| 2Z003 | 41000 | 740 | 39000 | 710 |
| 2Z004 | 41500 | 750 | 39500 | 700 |
| 2Z005 | 40000 | 880 | 38000 | 840 |
| 2Z006 | 39000 | 860 | 37000 | 820 |
| 2Z007 | 38000 | 840 | 36000 | 800 |
| 2Z008 | 37000 | 820 | 35000 | 770 |
| 2Z009 | 36000 | 800 | 34000 | 750 |

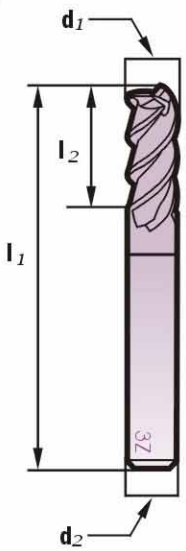
Max Milling Volume




| WORK Material | S45C,SKS,YK30 | | SCr,SNC,SKD | | SCM,SUS403,NAK80 | | Ti-6A1-4V | | PRE-HARDENED STEELS | |
|---|---|---|---|---|---|---|---|---|---|---|
| Order Code | <HRC30 | | <HRC30-35 | | <HRC35-40 | | <HRC40-45 | | <HRC45-65 | |
| | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed |
| 2Z010 | 34000 | 1360 | 33000 | 1320 | 32000 | 1280 | 31000 | 1240 | 30000 | 1200 |
| 2Z012 | 33000 | 1340 | 32000 | 1300 | 31000 | 1260 | 30000 | 1220 | 29000 | 1180 |
| 2Z014 | 33500 | 1370 | 32500 | 1330 | 31500 | 1290 | 29500 | 1210 | 28500 | 1170 |
| 2Z015 | 32000 | 2050 | 31000 | 1990 | 30000 | 1930 | 29000 | 1860 | 28000 | 1800 |
| 2Z016 | 31500 | 1610 | 30500 | 1560 | 29500 | 1900 | 28500 | 1830 | 27500 | 1770 |
| 2Z018 | 30500 | 1950 | 29500 | 1890 | 28500 | 1190 | 27500 | 1760 | 26500 | 1700 |
| 2Z020 | 30000 | 2300 | 29000 | 2230 | 28000 | 2150 | 27000 | 2070 | 26000 | 2000 |
| 2Z025 | 30000 | 2770 | 29000 | 2670 | 28000 | 2580 | 27000 | 2490 | 26000 | 2400 |
| 2Z030 | 28000 | 3260 | 27000 | 3150 | 26000 | 3030 | 25000 | 2910 | 24000 | 2800 |
| 2Z040 | 24000 | 3600 | 23000 | 3450 | 22000 | 3300 | 21000 | 3150 | 20000 | 3000 |

Max Milling Volume

# NMG End Mills
奈米微粒立銑刀
VHM-Schaftfräser
Fraises à queue en carbure monobloc
Fresa metal duro submicrograno con mango
Frese frontali
スクエアエンドミル




## 3Z


mm

| Order Code | ⌀ $d_1$ (h10) | $l_2$ | $l_1$ | ⌀ $d_2$ (h6) |
|---|---|---|---|---|
| 3Z030 | 3.0 | 7.0 | 57 | 6.0 |
| 3Z040 | 4.0 | 8.0 | 57 | 6.0 |
| 3Z050 | 5.0 | 10.0 | 57 | 6.0 |
| 3Z060 | 6.0 | 10.0 | 57 | 6.0 |
| 3Z080 | 8.0 | 16.0 | 63 | 8.0 |
| 3Z100 | 10.0 | 19.0 | 72 | 10.0 |
| 3Z120 | 12.0 | 22.0 | 83 | 12.0 |
| 3Z160 | 16.0 | 26.0 | 92 | 16.0 |
| 3Z200 | 20.0 | 32.0 | 104 | 20.0 |

### 3Z Recommendations for Cutting Conditions

| WORK Material | S45C,P20S,PCD | | SUS403,SKD11,SCr | | Ti-6Al-4V PRE-HARDENED STEELS | |
|---|---|---|---|---|---|---|
| Order Code | <HRC30 | | <HRC30-45 | | <HRC45-65 | |
| | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed |
| 3Z030 | 26000 | 3030 | 25000 | 2910 | 24000 | 2800 |
| 3Z040 | 22000 | 3300 | 21000 | 3150 | 20000 | 3000 |
| 3Z050 | 21000 | 3150 | 20000 | 3000 | 19000 | 2850 |
| 3Z060 | 20000 | 3330 | 19000 | 3160 | 18000 | 3000 |
| 3Z080 | 18000 | 4500 | 17000 | 4250 | 16000 | 4000 |
| 3Z100 | 16000 | 4570 | 15000 | 4280 | 14000 | 4000 |
| 3Z120 | 15500 | 4420 | 14500 | 4140 | 13500 | 3850 |
| 3Z160 | 9300 | 2660 | 9100 | 2600 | 8500 | 2430 |
| 3Z200 | 9380 | 3130 | 8750 | 2910 | 6880 | 2290 |

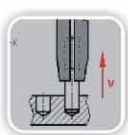
Max Milling Volume

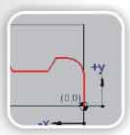

$d_2$<3.0mm
$l_2$<0.02$d_2$

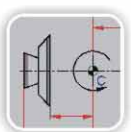

$l_2$<0.05$d_2$
W<0.05$d_2$


$d_2$<3.0mm
$l_2$<0.02$d_2$


$l_2$<0.05$d_2$
W<0.02$d_2$

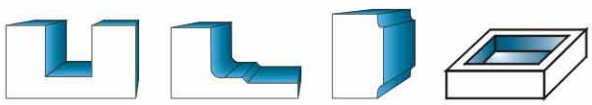




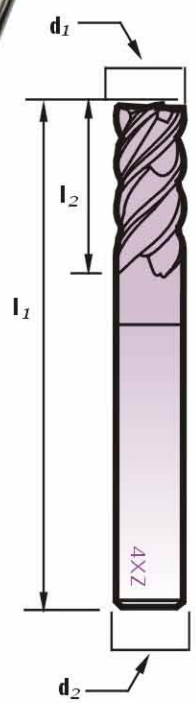
Power

# NMG End Mills
奈米微粒立銑刀
VHM-Schaftfräser
Fraises à queue en carbure monobloc
Fresa metal duro submicrograno con mango
Frese frontali
スクエアエンドミル

mm

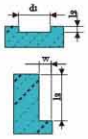
| Order Code | ⌀ $d_1$ (h10) | $l_2$ | $l_1$ | ⌀ $d_2$ (h6) |
|---|---|---|---|---|
| 4Z040 | 4.0 | 11.0 | 57 | 6.0 |
| 4Z050 | 5.0 | 13.0 | 57 | 6.0 |
| 4Z060 | 6.0 | 13.0 | 57 | 6.0 |
| 4Z060F | 6.0 | 13.0 | 100 | 6.0 |
| 4Z080 | 8.0 | 19.0 | 63 | 8.0 |
| 4Z080F | 8.0 | 19.0 | 100 | 8.0 |
| 4Z100 | 10.0 | 22.0 | 72 | 10.0 |
| 4Z100F | 10.0 | 22.0 | 100 | 10.0 |
| 4Z120 | 12.0 | 26.0 | 83 | 12.0 |
| 4Z120F | 12.0 | 26.0 | 100 | 12.0 |
| 4Z160 | 16.0 | 32.0 | 92 | 16.0 |
| 4Z160F | 16.0 | 32.0 | 150 | 16.0 |
| 4Z200 | 20.0 | 38.0 | 104 | 20.0 |

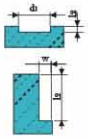



## 4Z Recommendations for Cutting Conditions

| WORK Material | S45C,SKS,YK30 | | SCr,SNC,SKD | | SCM,SUS403,NAK80 | | Ti-6A1-4V | | PRE/HARDENED STEELS | |
|---|---|---|---|---|---|---|---|---|---|---|
| Order Code | <HRC30 | | <HRC30-35 | | <HRC35-40 | | <HRC40-45 | | <HRC45-65 | |
| | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed |
| 4Z040 | 24000 | 3600 | 23000 | 3450 | 22000 | 3300 | 21000 | 3150 | 20000 | 3000 |
| 4Z050 | 23000 | 3450 | 22000 | 3300 | 21000 | 3150 | 20000 | 3000 | 19000 | 2850 |
| 4Z060 | 22000 | 4120 | 21000 | 3930 | 20000 | 3750 | 19000 | 3560 | 18000 | 3000 |
| 4Z060F | 22000 | 4120 | 21000 | 3930 | 20000 | 3750 | 19000 | 3560 | 18000 | 3000 |
| 4Z080 | 20000 | 5000 | 19000 | 4750 | 18000 | 4500 | 17000 | 4250 | 16000 | 4000 |
| 4Z080F | 20000 | 5000 | 19000 | 4750 | 18000 | 4500 | 17000 | 4250 | 16000 | 4000 |
| 4Z100 | 18000 | 5140 | 17000 | 4850 | 16000 | 4570 | 15000 | 4280 | 14000 | 4000 |
| 4Z100F | 18000 | 5140 | 17000 | 4850 | 16000 | 4570 | 15000 | 4280 | 14000 | 4000 |
| 4Z120 | 17500 | 5000 | 16500 | 4710 | 15500 | 4420 | 14500 | 4140 | 13500 | 3850 |
| 4Z120F | 17500 | 5000 | 16500 | 4710 | 15500 | 4420 | 14500 | 4140 | 13500 | 3850 |
| 4Z160 | 9300 | 2660 | 9100 | 2600 | 8900 | 2550 | 8700 | 2500 | 8500 | 2430 |
| 4Z160F | 9300 | 2660 | 9100 | 2600 | 8900 | 2550 | 8700 | 2500 | 8500 | 2430 |
| 4Z200 | 9380 | 3130 | 8750 | 2910 | 8130 | 2710 | 7500 | 1880 | 6880 | 2290 |

Max Milling Volume



# NMG Long Flute End Mills

奈米微粒長刃立銑刀

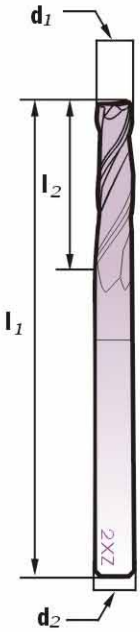
VHM-Schaftfräser,lang

Fraises à queue en carbure monobloc, longue flute

Fresa metal duro submicrograno con mango

Frese frontali－Tagliente lungo

ロングフルースクエアエンドミル




## 2XZ

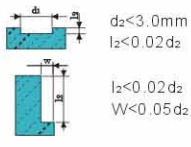

mm

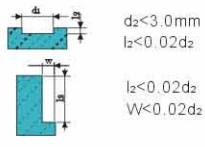
| Order Code | ⌀ $d_1$ (h10) | $l_2$ | $l_1$ | ⌀ $d_2$ (h6) |
|---|---|---|---|---|
| 2XZ020 | 2.0 | 15.0 | 75 | 6.0 |
| 2XZ030 | 3.0 | 20.0 | 75 | 6.0 |
| 2XZ040 | 4.0 | 25.0 | 75 | 6.0 |
| 2XZ050 | 5.0 | 30.0 | 75 | 6.0 |
| 2XZ060 | 6.0 | 30.0 | 75 | 6.0 |
| 2XZ080 | 8.0 | 40.0 | 100 | 8.0 |
| 2XZ100 | 10.0 | 40.0 | 100 | 10.0 |
| 2XZ120 | 12.0 | 45.0 | 100 | 12.0 |

## 2XZ Recommendations for Cutting Conditions

| WORK Material | S45C,SKS,VK30 | | SCr,SNC,SKD | | SCM,SUS403,NAK80 | | Ti-6A1-4V | | PRE/HARDENED STEELS | |
|---|---|---|---|---|---|---|---|---|---|---|
| Order Code | <HRC30 | | <HRC30-35 | | <HRC35-40 | | <HRC40-45 | | <HRC45-65 | |
| | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed |
| 2XZ020 | 30000 | 2300 | 29000 | 2230 | 28000 | 2150 | 27000 | 2050 | 26000 | 2000 |
| 2XZ030 | 28000 | 3260 | 27000 | 3150 | 26000 | 3030 | 25000 | 2910 | 24000 | 2800 |
| 2XZ040 | 24000 | 3600 | 23000 | 3450 | 22000 | 3300 | 21000 | 3150 | 20000 | 3000 |
| 2XZ050 | 23000 | 3450 | 22000 | 3300 | 21000 | 3150 | 20000 | 3000 | 19000 | 2850 |
| 2XZ060 | 22000 | 4120 | 21000 | 3930 | 20000 | 3750 | 19000 | 3560 | 18000 | 3000 |
| 2XZ080 | 20000 | 5000 | 19000 | 4750 | 18000 | 4500 | 17000 | 4250 | 16000 | 4000 |
| 2XZ100 | 18000 | 5140 | 17000 | 4850 | 16000 | 4570 | 15000 | 4280 | 14000 | 4000 |
| 2XZ120 | 17500 | 5000 | 16500 | 4710 | 15500 | 4420 | 14500 | 4140 | 13500 | 3850 |

Max Milling Volume



# NMG Long Flute End Mills

奈米微粒長刃立銑刀

VHM-Schaftfräser,lang

Fraises à queue en carbure monobloc, longue flute

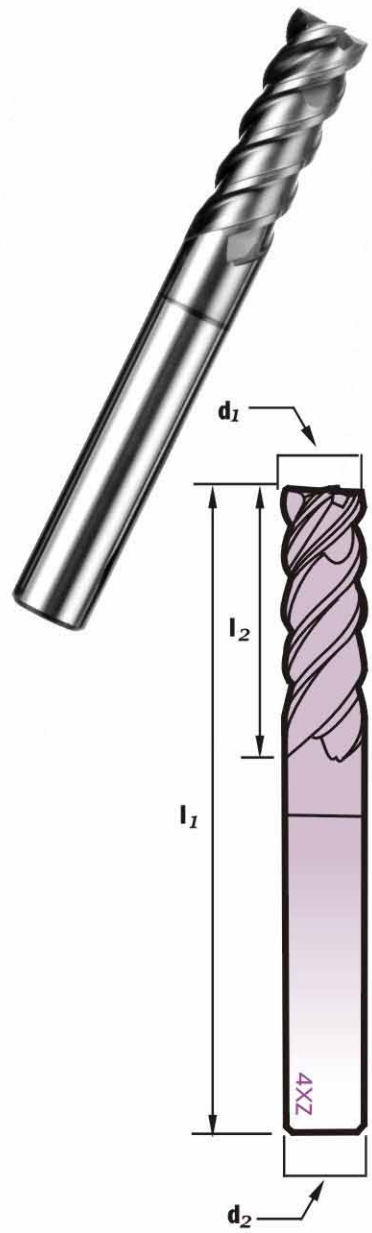
Fresa metal duro submicrograno con mango

Frese frontali－Tagliente lungo

ロングフルースクエアエンドミル





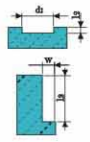

mm

| Order Code | ⌀ $d_1$ (h10) | $l_2$ | $l_1$ | ⌀ $d_2$ (h6) |
|---|---|---|---|---|
| 4XZ040 | 4.0 | 25.0 | 75 | 6.0 |
| 4XZ050 | 5.0 | 30.0 | 75 | 6.0 |
| 4XZ060 | 6.0 | 30.0 | 75 | 6.0 |
| 4XZ080 | 8.0 | 40.0 | 100 | 8.0 |
| 4XZ100 | 10.0 | 40.0 | 100 | 10.0 |
| 4XZ120 | 12.0 | 45.0 | 100 | 12.0 |
| 4XZ160 | 16.0 | 60.0 | 150 | 16.0 |
| 4XZ200 | 20.0 | 60.0 | 150 | 20.0 |

## 4XZ Recommendations for Cutting Conditions

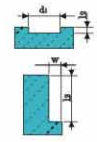
| WORK Material | S45C,SKS,YK30 | | SCr,SNC,SKD | | SCM,SUS403,NAK80 | | Ti-6A1-4V | | PRE/HARDENED STEELS | |
|---|---|---|---|---|---|---|---|---|---|---|
| Order Code | <HRC30 | | <HRC30-35 | | <HRC35-40 | | <HRC40-45 | | <HRC45-65 | |
| | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed |
| 4XZ040 | 24000 | 3600 | 23000 | 3450 | 22000 | 3300 | 21000 | 3150 | 20000 | 3000 |
| 4XZ050 | 23000 | 3450 | 22000 | 3300 | 21000 | 3150 | 20000 | 3000 | 19000 | 2850 |
| 4XZ060 | 22000 | 4120 | 21000 | 3930 | 20000 | 3750 | 19000 | 3560 | 18000 | 3000 |
| 4XZ080 | 20000 | 5000 | 19000 | 4750 | 18000 | 4500 | 17000 | 4250 | 16000 | 4000 |
| 4XZ100 | 18000 | 5140 | 17000 | 4850 | 16000 | 4570 | 15000 | 4280 | 14000 | 4000 |
| 4XZ120 | 17500 | 5000 | 16500 | 4710 | 15500 | 4420 | 14500 | 4140 | 13500 | 3850 |
| 4XZ160 | 9300 | 2660 | 9100 | 2600 | 8900 | 2550 | 8700 | 2500 | 8500 | 2430 |
| 4XZ200 | 6800 | 2270 | 6600 | 2200 | 6400 | 2130 | 6200 | 2070 | 6000 | 2000 |

**Max Milling Volume**



$d_2$<3.0mm
$l_2$<0.02$d_2$

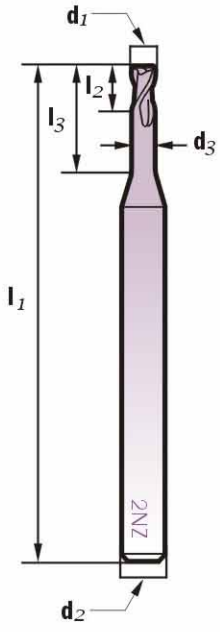
$l_2$<0.02$d_2$
W<0.05$d_2$



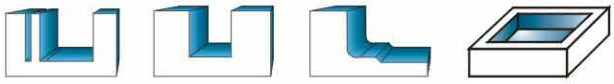
$d_2$<3.0mm
$l_2$<0.02$d_2$

$l_2$<0.05$d_2$
W<0.02$d_2$

# NMG Long Neck End Mills
奈米微粒深溝用立銑刀
VHM-Schaftfräser mit langem Hals und Freischliff
Fraises à queue en carbure monobloc, longue cou
Fresa metal duro submicrograno con mango y con cuello largo
Frese frontali—Stelo lungo
深リブ用エンドミル（ロングネック）




## 2NZ

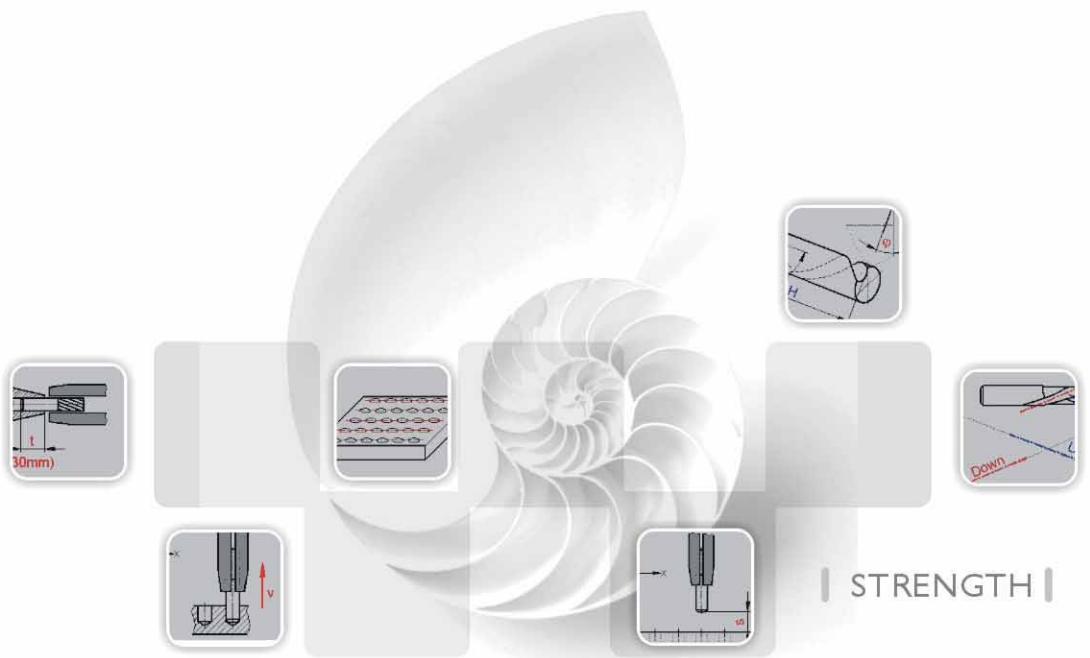
mm

| Order Code | ⌀ $d_1$ (e8) | $l_2$ | $l_3$ | $l_1$ | ⌀ $d_3$ | ⌀ $d_2$ (h6) |
|---|---|---|---|---|---|---|
| 2NZ0502 | 0.5 | 1.0 | 2 | 50 | 0.47 | 6.0 |
| 2NZ0504 | 0.5 | 1.0 | 4 | 50 | 0.47 | 6.0 |
| 2NZ0506 | 0.5 | 1.0 | 6 | 50 | 0.47 | 6.0 |
| 2NZ1004 | 1.0 | 1.5 | 4 | 50 | 0.97 | 6.0 |
| 2NZ1006 | 1.0 | 1.5 | 6 | 50 | 0.97 | 6.0 |
| 2NZ1008 | 1.0 | 1.5 | 8 | 50 | 0.97 | 6.0 |
| 2NZ1010 | 1.0 | 1.5 | 10 | 50 | 0.97 | 6.0 |
| 2NZ1012 | 1.0 | 1.5 | 12 | 50 | 0.97 | 6.0 |
| 2NZ1504 | 1.5 | 2.0 | 4 | 50 | 1.47 | 6.0 |
| 2NZ1508 | 1.5 | 2.0 | 8 | 50 | 1.47 | 6.0 |
| 2NZ1510 | 1.5 | 2.0 | 10 | 50 | 1.47 | 6.0 |
| 2NZ1512 | 1.5 | 2.0 | 12 | 50 | 1.47 | 6.0 |
| 2NZ1516 | 1.5 | 2.0 | 16 | 50 | 1.47 | 6.0 |
| 2NZ2010 | 2.0 | 3.0 | 10 | 50 | 1.95 | 6.0 |
| 2NZ2012 | 2.0 | 3.0 | 12 | 50 | 1.95 | 6.0 |
| 2NZ2016 | 2.0 | 3.0 | 16 | 50 | 1.95 | 6.0 |
| 2NZ2020 | 2.0 | 3.0 | 20 | 50 | 1.95 | 6.0 |
| 2NZ2510 | 2.5 | 3.0 | 10 | 50 | 2.45 | 6.0 |
| 2NZ2512 | 2.5 | 3.0 | 12 | 50 | 2.45 | 6.0 |
| 2NZ2516 | 2.5 | 3.0 | 16 | 50 | 2.45 | 6.0 |
| 2NZ2520 | 2.5 | 3.0 | 20 | 50 | 2.45 | 6.0 |
| 2NZ3010 | 3.0 | 4.0 | 10 | 50 | 2.90 | 6.0 |
| 2NZ3012 | 3.0 | 4.0 | 12 | 50 | 2.90 | 6.0 |
| 2NZ3016 | 3.0 | 4.0 | 16 | 50 | 2.90 | 6.0 |
| 2NZ3020 | 3.0 | 4.0 | 20 | 50 | 2.90 | 6.0 |
| 2NZ4010 | 4.0 | 4.0 | 10 | 50 | 3.90 | 6.0 |
| 2NZ4016 | 4.0 | 4.0 | 16 | 50 | 3.90 | 6.0 |
| 2NZ4020 | 4.0 | 4.0 | 20 | 50 | 3.90 | 6.0 |

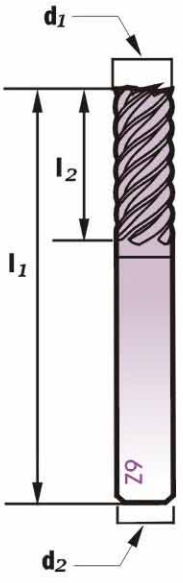
## 2NZ Recommendations for Cutting Conditions

| WORKMaterial | S45C,P20S,FCD | | SUS403,SKD11,SCr | | Ti-6Al-4V PRE-HARDENED STEELS | |
|---|---|---|---|---|---|---|
| Order Code | <HRC30 | | <HRC30-45 | | <HRC45-65 | |
| | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed |
| 2NZ0502 | 34500 | 2130 | 32500 | 2060 | 30500 | 2000 |
| 2NZ0504 | 34500 | 2130 | 32500 | 2060 | 30500 | 2000 |
| 2NZ0506 | 34500 | 1630 | 32500 | 1560 | 30500 | 1500 |
| 2NZ1004 | 34500 | 1630 | 32500 | 1560 | 30500 | 1500 |
| 2NZ1006 | 32000 | 1230 | 31000 | 1190 | 30000 | 1150 |
| 2NZ1008 | 32000 | 1230 | 31000 | 1190 | 30000 | 1150 |
| 2NZ1010 | 31000 | 1190 | 30000 | 1150 | 29000 | 1110 |
| 2NZ1012 | 31000 | 1190 | 30000 | 1150 | 29000 | 1110 |
| 2NZ1504 | 31000 | 2050 | 30000 | 2000 | 28000 | 1800 |
| 2NZ1508 | 31000 | 2050 | 30000 | 2000 | 28000 | 1800 |
| 2NZ1510 | 29000 | 1870 | 28000 | 1800 | 27000 | 1750 |
| 2NZ1512 | 29000 | 1870 | 28000 | 1800 | 27000 | 1750 |
| 2NZ1516 | 29000 | 1870 | 28000 | 1800 | 27000 | 1750 |
| 2NZ2010 | 29000 | 2230 | 28000 | 2150 | 26000 | 2000 |
| 2NZ2012 | 29000 | 2230 | 28000 | 2150 | 26000 | 2000 |
| 2NZ2016 | 27000 | 2050 | 26000 | 2050 | 25000 | 1920 |
| 2NZ2020 | 27000 | 2050 | 26000 | 2050 | 25000 | 1920 |
| 2NZ2510 | 29000 | 2680 | 28000 | 2590 | 26000 | 2400 |
| 2NZ2512 | 29000 | 2680 | 28000 | 2590 | 26000 | 2400 |
| 2NZ2516 | 27000 | 2500 | 26000 | 2400 | 25000 | 2310 |
| 2NZ2520 | 27000 | 2500 | 26000 | 2400 | 25000 | 2310 |
| 2NZ3010 | 26000 | 3050 | 25000 | 2900 | 24000 | 2800 |
| 2NZ3012 | 26000 | 3050 | 25000 | 2900 | 24000 | 2800 |
| 2NZ3016 | 25000 | 2950 | 24000 | 2820 | 23000 | 2700 |
| 2NZ3020 | 25000 | 2950 | 24000 | 2820 | 23000 | 2700 |
| 2NZ4010 | 22000 | 3330 | 21000 | 3150 | 20000 | 3000 |
| 2NZ4016 | 22000 | 3330 | 21000 | 3150 | 20000 | 3000 |
| 2NZ4020 | 21000 | 3300 | 20000 | 3000 | 19000 | 2870 |

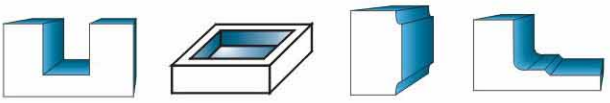
Max Milling Volume

# NMG End Mills
奈米微粒立銑刀
VHM-Schaftfräser
Fraises à queue en carbure monobloc
Fresa metal duro submicrograno con mango
Frese frontali
スクエアエンドミル




## 6Z

mm

| Order Code | ⌀ $d_1$ (h10) | $l_2$ | $l_1$ | ⌀ $d_2$ (h6) |
|---|---|---|---|---|
| 6Z060 | 6.0 | 13.0 | 57 | 6.0 |
| 6Z080 | 8.0 | 19.0 | 63 | 8.0 |
| 6Z100 | 10.0 | 22.0 | 72 | 10.0 |
| 6Z120 | 12.0 | 26.0 | 83 | 12.0 |
| 6Z160 | 16.0 | 32.0 | 92 | 16.0 |
| 6Z200 | 20.0 | 38.0 | 104 | 20.0 |

### 6Z Recommendations for Cutting Conditions

| WORK Material | SUS304,FDAC,NAK80 | | PRE/HARDENED STEELS | |
|---|---|---|---|---|
| Order Code | <HRC45-52 | | <HRC52-62 | |
| | R.P.M. | Feed | R.P.M. | Feed |
| 6Z060 | 22500 | 3460 | 19500 | 3000 |
| 6Z080 | 21000 | 4670 | 18000 | 4000 |
| 6Z100 | 19000 | 4750 | 16000 | 4000 |
| 6Z120 | 17840 | 2750 | 14840 | 3710 |
| 6Z160 | 8500 | 2430 | 8000 | 2290 |
| 6Z200 | 6500 | 2170 | 6000 | 2000 |

Max Milling Volume


$l_2$<0.05$d_2$
W<0.01$d_2$


$l_2$<0.05$d_2$
W<0.005$d_2$

2BZ
2BSZ
4BZ
2BNZ
2RZ
4RZ
2Z
3Z
4Z
2XZ
4XZ
2NZ
6Z
6XZ
2CZ
3CZ
2BY
4BY
4Y
3Y
TECH-1
TECH-2
Special tool

# NMG Long Flute End Mills

奈米微粒長刃立銑刀

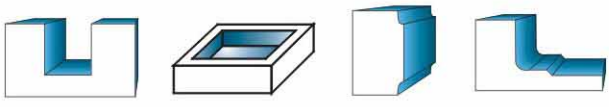
VHM-Schaftfräser,lang

Fraises à queue en carbure monobloc, longue flute

Fresa metal duro submicrograno con mango

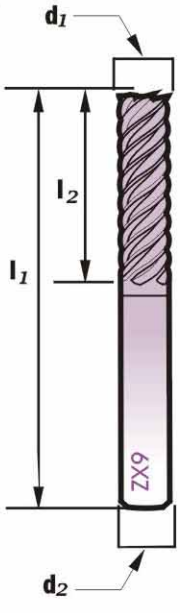
Frese frontali－Tagliente lungo

ロングフルースクエアエンドミル

mm

| Order Code | ⌀ $d_1$ (h10) | $l_2$ | $l_1$ | ⌀ $d_2$ (h6) |
|---|---|---|---|---|
| 6XZ060 | 6.0 | 30.0 | 75 | 6.0 |
| 6XZ080 | 8.0 | 40.0 | 100 | 8.0 |
| 6XZ100 | 10.0 | 40.0 | 100 | 10.0 |
| 6XZ120 | 12.0 | 45.0 | 150 | 12.0 |
| 6XZ160 | 16.0 | 65.0 | 150 | 16.0 |
| 6XZ200 | 20.0 | 65.0 | 150 | 20.0 |

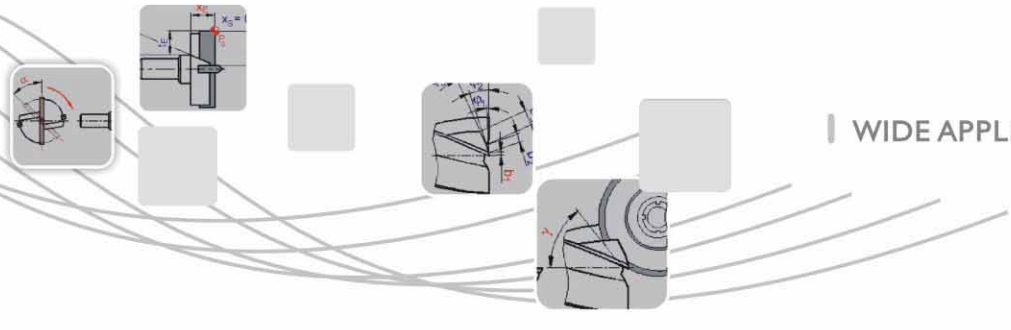



## 6XZ Recommendations for Cutting Conditions

| WORK Material | SUS304,FDAC,NAK80 | | PRE/HARDENED STEELS | |
|---|---|---|---|---|
| Order Code | <HRC45-52 | | <HRC52-62 | |
| | R.P.M. | Feed | R.P.M. | Feed |
| 6XZ060 | 22500 | 3460 | 19500 | 3000 |
| 6XZ080 | 21000 | 4670 | 18000 | 4000 |
| 6XZ100 | 19000 | 4750 | 16000 | 4000 |
| 6XZ120 | 17840 | 2750 | 14840 | 3710 |
| 6XZ160 | 8500 | 2430 | 8000 | 2290 |
| 6XZ200 | 6500 | 2170 | 6000 | 2000 |

| Max Milling Volume | | | | |
|---|---|---|---|---|
| |  | $l_2$<0.05$d_2$ W<0.01$d_2$ |  | $l_2$<0.05$d_2$ W<0.005$d_2$ |





WIDE APPLICATIONS

# NMG High Helix End Mills

奈米微粒高螺旋立銑刀

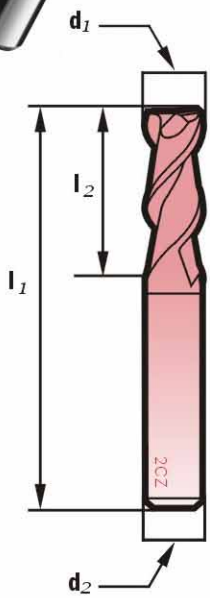
VHM-Schaftfräser

Fraises à queue en carbure monobloc, élevé angle d'hélice

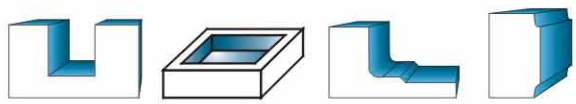
Fresa metal duro submicrograno con mango

Frese frontali—Forte torsione

ハイヘリスクエアエンドミル




## 2CZ

mm

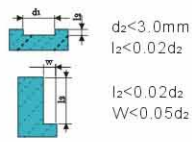
| Order Code | ⌀ $d_1$ (h10) | $l_2$ | $l_1$ | ⌀ $d_2$ (h6) |
|---|---|---|---|---|
| 2CZ005 | 0.5 | 1.5 | 38 | 3.0 |
| 2CZ010 | 1.0 | 3.0 | 38 | 3.0 |
| 2CZ015 | 1.5 | 4.0 | 38 | 3.0 |
| 2CZ020 | 2.0 | 6.0 | 38 | 3.0 |
| 2CZ030 | 3.0 | 7.0 | 57 | 6.0 |
| 2CZ040 | 4.0 | 8.0 | 57 | 6.0 |
| 2CZ050 | 5.0 | 10.0 | 57 | 6.0 |
| 2CZ060 | 6.0 | 10.0 | 57 | 6.0 |
| 2CZ080 | 8.0 | 16.0 | 63 | 8.0 |
| 2CZ100 | 10.0 | 19.0 | 72 | 10.0 |
| 2CZ120 | 12.0 | 22.0 | 83 | 12.0 |
| 2CZ160 | 16.0 | 26.0 | 92 | 16.0 |

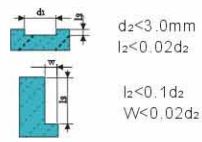
## 2CZ Recommendations for Cutting Conditions

| Order Code | Al(1070) | | Cu-Mg(2014) | | Si(4032) | |
|---|---|---|---|---|---|---|
| | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed |
| 2CZ005 | 36000 | 960 | 35000 | 933 | 34000 | 907 |
| 2CZ010 | 36000 | 1440 | 35000 | 1400 | 34000 | 1360 |
| 2CZ015 | 34000 | 3139 | 33000 | 3047 | 32000 | 2955 |
| 2CZ020 | 32000 | 2462 | 31000 | 2385 | 30000 | 2308 |
| 2CZ030 | 30000 | 3501 | 29000 | 3384 | 28000 | 3267 |
| 2CZ040 | 26000 | 3904 | 25000 | 3754 | 24000 | 3604 |
| 2CZ050 | 25000 | 3788 | 24000 | 3636 | 23000 | 3485 |
| 2CZ060 | 24000 | 4503 | 23000 | 4315 | 22000 | 4128 |
| 2CZ080 | 22000 | 5500 | 21000 | 5250 | 20000 | 5000 |
| 2CZ100 | 20000 | 5714 | 19000 | 5429 | 18000 | 5143 |
| 2CZ120 | 19000 | 5429 | 18000 | 5143 | 17000 | 4857 |
| 2CZ160 | 13850 | 920 | 13080 | 880 | 12310 | 820 |

| Order Code | Mg(5052) | | Mg-Si(4032) | | Zn-Mg(7075) | | (AC85) | |
|---|---|---|---|---|---|---|---|---|
| | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed |
| 2CZ005 | 33000 | 880 | 32000 | 853 | 31000 | 827 | 30000 | 800 |
| 2CZ010 | 33000 | 1320 | 32000 | 1280 | 31000 | 1240 | 30000 | 1200 |
| 2CZ015 | 31000 | 2862 | 30000 | 2770 | 29000 | 2678 | 28000 | 1600 |
| 2CZ020 | 29000 | 2231 | 28000 | 2154 | 27000 | 2077 | 26000 | 2000 |
| 2CZ030 | 27000 | 3151 | 26000 | 3034 | 25000 | 2917 | 24000 | 2400 |
| 2CZ040 | 23000 | 3453 | 22000 | 3303 | 21000 | 3153 | 20000 | 3000 |
| 2CZ050 | 22000 | 3333 | 21000 | 3182 | 20000 | 3030 | 19000 | 3000 |
| 2CZ060 | 21000 | 3940 | 20000 | 3752 | 19000 | 3565 | 18000 | 3000 |
| 2CZ080 | 19000 | 4750 | 18000 | 4500 | 17000 | 4250 | 16000 | 4000 |
| 2CZ100 | 17000 | 4857 | 16000 | 4571 | 15000 | 4286 | 14000 | 4000 |
| 2CZ120 | 16000 | 4571 | 15000 | 4286 | 14000 | 4000 | 13000 | 3000 |
| 2CZ160 | 8880 | 980 | 8280 | 910 | 7690 | 850 | 7100 | 780 |

Max Milling Volume



# NMG High Helix End Mills

奈米微粒高螺旋立銑刀

VHM-Schaftfräser

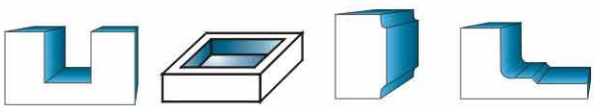
Fraises à queue en carbure monobloc, élevé angle d'hélice

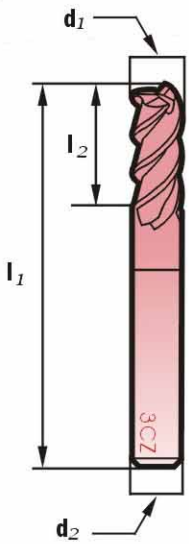
Fresa metal duro submicrograno con mango

Frese frontali—Forte torsione

ハイヘリスクエアエンドミル

3CZ




mm

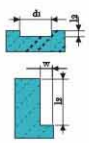
| Order Code | ⌀ $d_1$ (h10) | $l_2$ | $l_1$ | ⌀ $d_2$ (h6) |
|---|---|---|---|---|
| 3CZ030 | 3.0 | 7.0 | 57 | 6.0 |
| 3CZ040 | 4.0 | 8.0 | 57 | 6.0 |
| 3CZ050 | 5.0 | 10.0 | 57 | 6.0 |
| 3CZ060 | 6.0 | 10.0 | 57 | 6.0 |
| 3CZ080 | 8.0 | 16.0 | 63 | 8.0 |
| 3CZ100 | 10.0 | 19.0 | 72 | 10.0 |
| 3CZ120 | 12.0 | 22.0 | 83 | 12.0 |
| 3CZ160 | 16.0 | 26.0 | 92 | 16.0 |
| 3CZ200 | 20.0 | 32.0 | 104 | 20.0 |

## 3CZ Recommendations for Cutting Conditions

| Order Code | Al(1070) | | Cu-Mg(2014) | | Si(4032) | |
|---|---|---|---|---|---|---|
| | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed |
| 3CZ030 | 30000 | 5380 | 29000 | 5200 | 28000 | 3260 |
| 3CZ040 | 26000 | 3900 | 25000 | 3750 | 24000 | 2800 |
| 3CZ050 | 25000 | 3780 | 24000 | 3630 | 23000 | 3480 |
| 3CZ060 | 24000 | 4500 | 23000 | 4310 | 22000 | 4120 |
| 3CZ080 | 22000 | 5500 | 21000 | 5250 | 20000 | 5000 |
| 3CZ100 | 20000 | 5710 | 19000 | 5420 | 18000 | 5140 |
| 3CZ120 | 19000 | 5420 | 18000 | 5140 | 17000 | 4850 |
| 3CZ160 | 10650 | 1170 | 10060 | 1100 | 9470 | 1040 |
| 3CZ200 | 8170 | 900 | 7690 | 850 | 7210 | 790 |

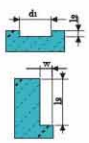
| Order Code | Mg(5052) | | Mg-Si(4032) | | Zn-Mg(7075) | | (AC85) | |
|---|---|---|---|---|---|---|---|---|
| | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed |
| 3CZ030 | 27000 | 3150 | 26000 | 3030 | 25000 | 2910 | 24000 | 2800 |
| 3CZ040 | 23000 | 2680 | 22000 | 2560 | 21000 | 2450 | 20000 | 3000 |
| 3CZ050 | 22000 | 3330 | 21000 | 3180 | 20000 | 3030 | 19000 | 2870 |
| 3CZ060 | 21000 | 3930 | 20000 | 3750 | 19000 | 3560 | 18000 | 3000 |
| 3CZ080 | 19000 | 4750 | 18000 | 4500 | 17000 | 4250 | 16000 | 4000 |
| 3CZ100 | 17000 | 4850 | 16000 | 4570 | 15000 | 4280 | 14000 | 4000 |
| 3CZ120 | 16000 | 4570 | 15000 | 4280 | 14000 | 4000 | 13000 | 3710 |
| 3CZ160 | 8880 | 980 | 8280 | 910 | 7690 | 850 | 7100 | 780 |
| 3CZ200 | 6730 | 740 | 6250 | 690 | 5770 | 640 | 5290 | 570 |

Max Milling Volume



$d_2$<3.0mm
$l_2$<0.02$d_2$

$l_2$<0.02$d_2$
W<0.05$d_2$



$d_2$<3.0mm
$l_2$<0.02$d_2$

$l_2$<0.1$d_2$
W<0.02$d_2$

# SMG Ball Nose End Mills

極細微粒圓頭銑刀

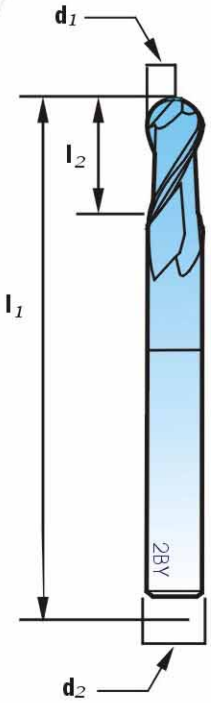
VHM-Radiusfräer

Fraises à bout hémisphérique en carbure monobloc

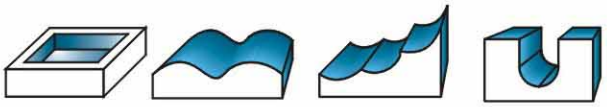
Fresa metal duro submicrograno punta esférica

Fresa a testa semisferica

ボールエンドミル




## 2BY

mm

| Order Code | ⌀ $d_1$ (h10) | $l_2$ | $l_1$ | ⌀ $d_2$ (h6) |
|---|---|---|---|---|
| 2BY020 | R1 | 4.0 | 38 | 3.0 |
| 2BY030 | R1.5 | 6.0 | 50 | 6.0 |
| 2BY040 | R2 | 8.0 | 50 | 6.0 |
| 2BY060 | R3 | 12.0 | 50 | 6.0 |
| 2BY080 | R4 | 16.0 | 60 | 8.0 |
| 2BY100 | R5 | 20.0 | 75 | 10.0 |
| 2BY120 | R6 | 24.0 | 75 | 12.0 |
| 2BY160 | R8 | 32.0 | 100 | 16.0 |
| 2BY200 | R10 | 40.0 | 100 | 20.0 |

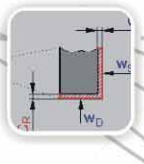
### 2BY Recommendations for Cutting Conditions

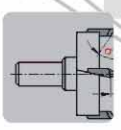
| WORK Material | S45C,P20S,FCD | | SUS403,SKD11,SCr | | Ti-6Al-4V PRE/HARDENED STEELS | |
|---|---|---|---|---|---|---|
| Order Code | <HRC30 | | <HRC30-45 | | <HRC45-60 | |
| | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed |
| 2BY020 | 27000 | 2080 | 26000 | 2000 | 25000 | 1920 |
| 2BY030 | 25000 | 2920 | 24000 | 2800 | 23000 | 2680 |
| 2BY040 | 21000 | 3150 | 20000 | 3000 | 19000 | 2850 |
| 2BY060 | 19000 | 3170 | 18000 | 3000 | 17000 | 2830 |
| 2BY080 | 17000 | 4250 | 16000 | 4000 | 15000 | 3750 |
| 2BY100 | 15000 | 4290 | 14000 | 4000 | 13000 | 3720 |
| 2BY120 | 14500 | 4140 | 13500 | 3850 | 12500 | 3570 |
| 2BY160 | 9000 | 2570 | 8500 | 2430 | 8000 | 2290 |
| 2BY200 | 7000 | 2330 | 6500 | 2170 | 6000 | 2000 |

Max Milling Volume


$l_2$<0.02R
P<0.05R


$l_2$<0.01R
P<0.02R

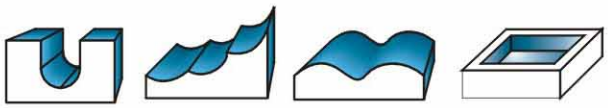




2BZ
2BSZ
4BZ
2BNZ
2RZ
4RZ
2Z
3Z
4Z
2XZ
4XZ
2NZ
6Z
6XZ
2CZ
3CZ
2BY
4BY
4Y
3Y
TECH-1
TECH-2
Special tool

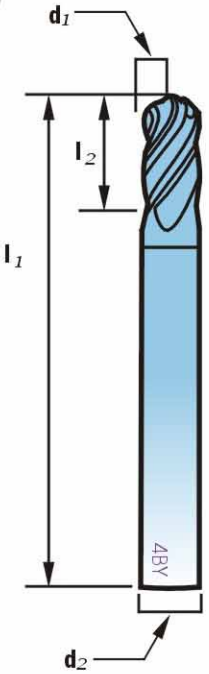
# SMG Ball Nose End Mills
# 極細超微粒圓頭銑刀
# VHM-Radiusfräer
# Fraises à bout hémisphérique en carbure monobloc
# Fresa metal duro submicrograno punta esférica
# Fresa a testa semisferica
# ボールエンドミル

4BY

mm

| Order Code | ⌀ $d_1$ (h10) | $l_2$ | $l_1$ | ⌀ $d_2$ (h6) |
|---|---|---|---|---|
| 4BY050 | R2.5 | 10.0 | 50 | 6.0 |
| 4BY060 | R3 | 12.0 | 50 | 6.0 |
| 4BY080 | R4 | 16.0 | 60 | 8.0 |
| 4BY100 | R5 | 20.0 | 75 | 10.0 |
| 4BY120 | R6 | 24.0 | 75 | 12.0 |
| 4BY160 | R8 | 32.0 | 100 | 16.0 |
| 4BY200 | R10 | 40.0 | 100 | 20.0 |




## 4BY Recommendations for Cutting Conditions

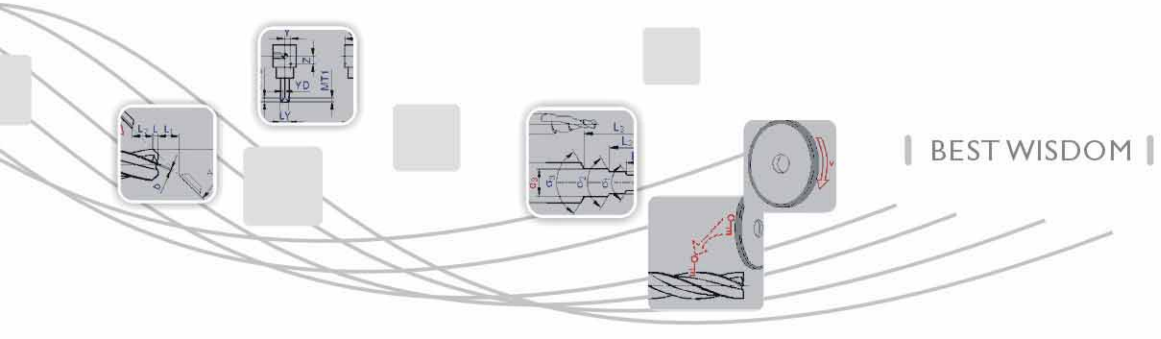
| WORK Material | S45C,P20S,FCD | | SUS403,SKD11,SCr | | Ti-6Al-4V PRE-HARDENED STEELS | |
|---|---|---|---|---|---|---|
| Order Code | <HRC30 | | <HRC30-45 | | <HRC45-60 | |
| | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed |
| 4BY050 | 20000 | 3000 | 19000 | 2850 | 18000 | 2700 |
| 4BY060 | 19000 | 3170 | 18000 | 3000 | 17000 | 2830 |
| 4BY080 | 17000 | 4250 | 16000 | 4000 | 15000 | 3750 |
| 4BY100 | 15000 | 4290 | 14000 | 4000 | 13000 | 3710 |
| 4BY120 | 14500 | 4140 | 13500 | 1400 | 12500 | 3570 |
| 4BY160 | 9000 | 2570 | 8500 | 2430 | 8000 | 2290 |
| 4BY200 | 7000 | 2330 | 6500 | 2170 | 6000 | 2000 |

Max Milling Volume

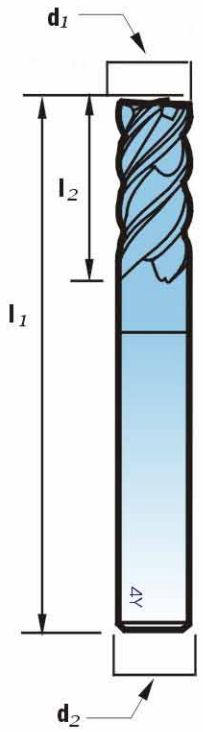

$l_2$<0.02R
P<0.02R


$l_2$<0.015R
P<0.025R

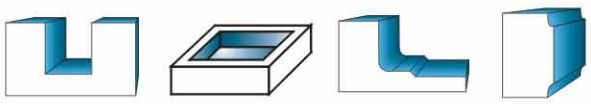




# SMG End Mills
極細微粒立銑刀
VHM-Schaftfräser
Fraises à queue en carbure monobloc
Fresa metal duro submicrograno con mango
Frese frontali
スクエアエンドミル




## 4Y

mm

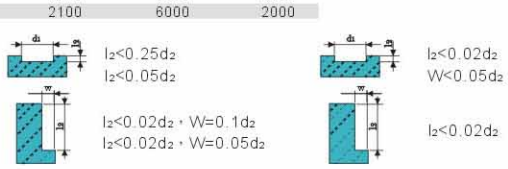
| Order Code | ⌀ $d_1$ (h10) | $l_2$ | $l_1$ | ⌀ $d_2$ (h6) |
|---|---|---|---|---|
| 4Y040 | 4.0 | 11.0 | 57 | 6.0 |
| 4Y050 | 5.0 | 13.0 | 57 | 6.0 |
| 4Y060 | 6.0 | 13.0 | 57 | 6.0 |
| 4Y080 | 8.0 | 19.0 | 63 | 8.0 |
| 4Y100 | 10.0 | 22.0 | 72 | 10.0 |
| 4Y120 | 12.0 | 26.0 | 83 | 12.0 |
| 4Y160 | 16.0 | 32.0 | 92 | 16.0 |
| 4Y200 | 20.0 | 38.0 | 104 | 20.0 |

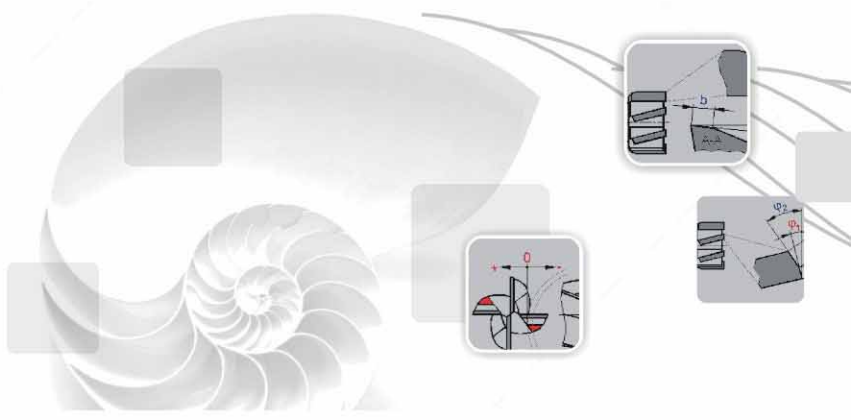
### 4Y Recommendations for Cutting Conditions

| WORK Material | S45C,P20S,FCD | | SCr SNC SKD | | SCM SUS403 NAK80 | |
|---|---|---|---|---|---|---|
| Order Code | <HRC30 | | <HRC30-35 | | <HRC35-40 | |
| | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed |
| 4Y040 | 23700 | 3537 | 22700 | 3388 | 21700 | 3239 |
| 4Y050 | 22700 | 3388 | 21700 | 3239 | 20700 | 3090 |
| 4Y060 | 21700 | 3617 | 20700 | 3450 | 19700 | 3283 |
| 4Y080 | 19700 | 4925 | 18700 | 4675 | 17700 | 4425 |
| 4Y100 | 17700 | 5057 | 16700 | 4771 | 15700 | 4486 |
| 4Y120 | 17200 | 4914 | 16200 | 4629 | 15200 | 4343 |
| 4Y160 | 9200 | 2630 | 8900 | 2540 | 8600 | 2460 |
| 4Y200 | 7200 | 2400 | 6900 | 2300 | 6600 | 2200 |

| WORK Material | Ti6Al-4V | | PRE HARDENED STEEL | |
|---|---|---|---|---|
| Order Code | <HRC40-45 | | <HRC45-60 | |
| | R.P.M. | Feed | R.P.M. | Feed |
| 4Y040 | 20700 | 3090 | 19700 | 2940 |
| 4Y050 | 19700 | 2940 | 18700 | 2791 |
| 4Y060 | 18700 | 3117 | 17700 | 2950 |
| 4Y080 | 16700 | 4250 | 15700 | 3925 |
| 4Y100 | 14700 | 4200 | 13700 | 3914 |
| 4Y120 | 14200 | 4057 | 13200 | 3771 |
| 4Y160 | 8300 | 2370 | 8000 | 2290 |
| 4Y200 | 6300 | 2100 | 6000 | 2000 |

Max Milling Volume

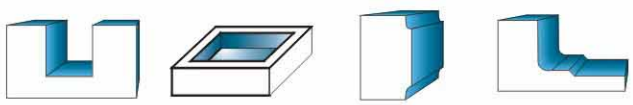


# SMG End Mills
# 極細微粒立銑刀
# VHM-Schaftfräser
# Fraises à queue en carbure monobloc
# Fresa metal duro submicrograno con mango
# Frese frontali
# スクエアエンドミル

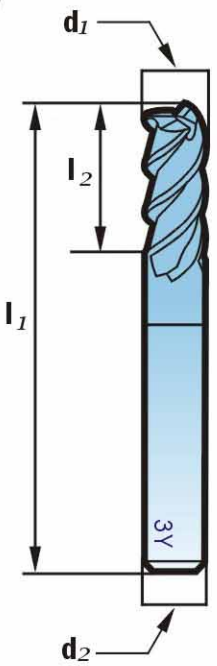


3Y

mm

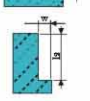
| Order Code | ⌀ $d_1$ (h10) | $l_2$ | $l_1$ | ⌀ $d_2$ (h6) |
|---|---|---|---|---|
| 3Y030 | 3.0 | 7.0 | 57 | 6.0 |
| 3Y040 | 4.0 | 8.0 | 57 | 6.0 |
| 3Y050 | 5.0 | 10.0 | 57 | 6.0 |
| 3Y060 | 6.0 | 10.0 | 57 | 6.0 |
| 3Y080 | 8.0 | 16.0 | 63 | 8.0 |
| 3Y100 | 10.0 | 19.0 | 72 | 10.0 |
| 3Y120 | 12.0 | 22.0 | 83 | 12.0 |
| 3Y160 | 16.0 | 26.0 | 92 | 16.0 |
| 3Y200 | 20.0 | 32.0 | 104 | 20.0 |



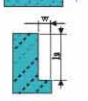

## 3Y Recommendations for Cutting Conditions

| WORK Material | S45C,P20S,FCD | | SUS403,SKD11,SCr | | Ti-6Al-4V PRE-HARDENED STEELS | |
|---|---|---|---|---|---|---|
| Order Code | <HRC30 | | <HRC30-45 | | <HRC45-65 | |
| | R.P.M. | Feed | R.P.M. | Feed | R.P.M. | Feed |
| 3Y030 | 25000 | 2920 | 24000 | 2800 | 23000 | 2680 |
| 3Y040 | 21000 | 3150 | 20000 | 3000 | 19000 | 2850 |
| 3Y050 | 20000 | 3000 | 19000 | 2850 | 18000 | 2700 |
| 3Y060 | 19000 | 3170 | 18000 | 3000 | 17000 | 2830 |
| 3Y080 | 17000 | 4250 | 16000 | 4000 | 15000 | 3750 |
| 3Y100 | 15000 | 4290 | 14000 | 4000 | 13000 | 3710 |
| 3Y120 | 14500 | 4140 | 13500 | 3850 | 12500 | 3570 |
| 3Y160 | 9000 | 2570 | 8500 | 2430 | 8000 | 2290 |
| 3Y200 | 7000 | 2330 | 6500 | 2170 | 6000 | 2000 |

Max Milling Volume

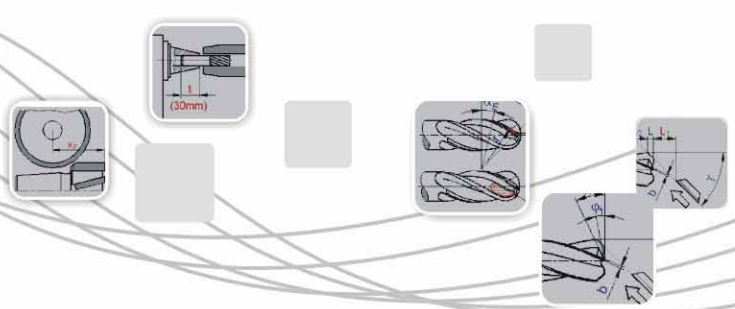



$d_2$<3.0mm
$l_2$<0.02$d_2$
$l_2$<0.05$d_2$
W<0.05$d_2$

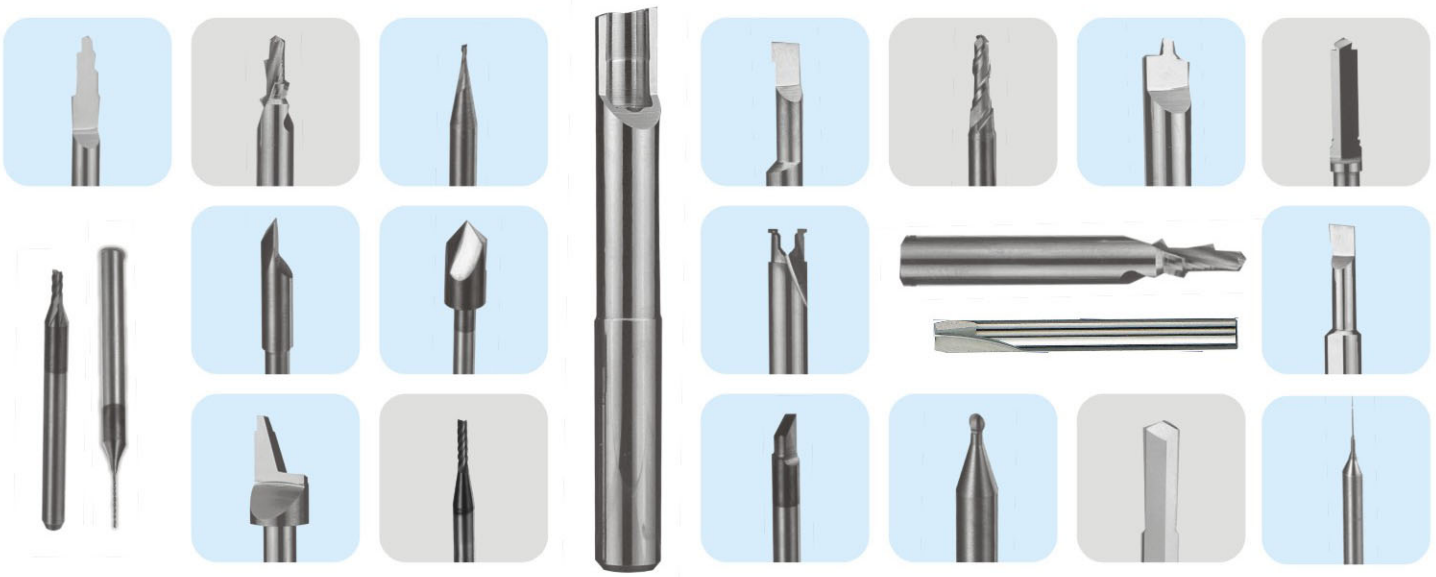
$d_2$<3.0mm
$l_2$<0.02$d_2$
$l_2$<0.05$d_2$
W<0.02$d_2$






PRODUCTIVITY

# SPECIAL TOOL

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