HAHN+KOLB GROUP

LET'S WORK TOGETHER.

# ORION®

# HPC MILLING TOOLS

Discover the latest generation of our reliable and high-performance ORION® HPC milling tools.


## ONLINE CUTTING VALUES

We maintain a comprehensive package of cutting data for all machining tools.
All essential tool information is available in the highest data quality. Conveniently retrieve the data relevant to you in our online shop.

**Your advantages:**

- Tested and reliable cutting data from practical experience
- All processing parameters can be retrieved simply at any time in the online shop
- Greater planning and process reliability


## THE HAHN+KOLB ONLINE SHOP

In order to offer HAHN+KOLB customers the best possible shopping experience, the HK online shop provides a whole series of special features. The convenient product search will lead to the desired item around the clock - whether by name or manufacturer number. Extensive filter functions for important product characteristics such as length, width or diameter are at your disposal.

**www.hahn-kolb.com**

**Your advantages:**

- Round-the-clock access
- Individual prices and company conditions
- Order overview
- Intelligent user management
- Comprehensive product information
- Easy re-ordering
- Universal search
- Live availability
- CAD and cutting data





## SC HPC MILLING TOOLS

| Type | Dia. range | Number of teeth | Overall length | Shank shape | Number | | Image | Page |
|---|---|---|---|---|---|---|---|---|
| HPC end mills T=4 | 3-20 mm | 4 | Standard | HA | 16851 830-850 | | | 7 |
| HPC end mills T=4 | 3-20 mm | 4 | Standard | HB | 16851 800-820 | | | 7 |
| HPC end mills T=4 | 3-20 mm | 4 | long | HB | 16851 150-160 | | | 7 |
| HPC end mills T=4 | 3-20 mm | 4 | extra-long | HB | 16851 161-179 | | | 7 |
| TVC end mills 3xD T=4 | 3-20 mm | 4 | long | HB | 16851 860-880 | TVC | | 9 |
| HPC end mills T=4 IC | 6-20 mm | 4 | Standard | HB | 16851 380-390 | | | 11 |
| HPC end mills T=4 VA | 3-20 mm | 4 | short | HB | 16851 553-570 | | | 13 |
| HPC end mills T=4 VA | 3-20 mm | 4 | Standard | HB | 16851 503-520 | | | 13 |
| HPC end mills T=5 | 6-20 mm | 5 | Standard | HB | 16851 900-910 | | | 15 |
| TVC end mills 3xD T=5 | 6-20 mm | 5 | long | HB | 16851 920-930 | TVC | | 15 |
| Finishing cutters T=6 | 6-25 mm | 6 | Standard | HA | 16851 580-612 | | | 17 |
| Finishing cutters T=6 | 6-25 mm | 6 | long | HA | 16851 580-612 | | | 17 |
| HPC roughing end mills T=4 NR | 3-20 mm | 4 | Standard | HB | 16851 330-349 | | | 19 |
| HPC roughing end mills T=4 NF | 3-20 mm | 4 | Standard | HB | 16851 260-279 | | | 19 |
| HPC torus milling cutters T=4 | 3-20 mm | 4 | Standard | HB | 16851 620-656 | | | 21 |
| HPC torus milling cutters T=4 | 3-20 mm | 4 | Standard | HB | 16851 660-703 | | | 22 |
| HPC end mills T=4 in a set | 6-16 mm | 4 | Standard | HB | 16851 180-181 | | | 24 |
| HPC end mills T=5 in a set | 6-16 mm | 5 | Standard | HB | 16851 190-191 | | | 24 |

**FURTHER DIMENSIONS, DETAILS AND CUTTING VALUES CAN BE FOUND IN OUR SHOP.**

## SUITABLE FOR VIRTUALLY ANY APPLICATION

Groove milling | Circumferential milling | Shoulder milling | Ramp milling | Circular milling | Contour milling | Pocket milling | Drilling | Rough machining and finishing

All the tools can be found in the main catalogue and are available online at www.hahn-kolb.de

# ORION® HPC MILLING TOOLS

## OUR LATEST GENERATION FORRELIABLE APPLICATION IN A VARIETY OF MATERIALS

The tool family for virtually any application - significantly increase your efficiency and reduce your tool diversity at the same time. Whether steel, high-grade steel or cast iron - the newly developed geometry and coating of the ORION HPC milling range is designed for a wide variety of applications and covers a wide variety of materials. Due to the high-quality cutting material and optimal HPC geometry, the milling tools offer extraordinarily high performance. The uneven pitch ensures maximum smoothness and process reliability, while the excellent surface quality of the machined workpieces provides a further advantage.

What's more, HAHN+KOLB has optimised the high-tech multi-layer coatings and layer thicknesses of the bestseller range. In application, this means improved layer adhesion and therefore higher temperature resistance.

You can also benefit from the extensive scope of this range, which boasts an impressive 260 types in various shank versions.

## THE ADVANTAGES AT A GLANCE

- ⊕ Universal application, one tool for every purpose
- ⊕ Outstanding increase in service life compared to previous tools
- ⊕ Optimal surface quality and high precision
- ⊕ Optimised cutting edge geometry for universal application
- ⊕ Stable design with increased core diameter
- ⊕ Modern high-tech coating ensures high wear resistance
- ⊕ Especially wear- and break-resistant micro fine-grain carbide



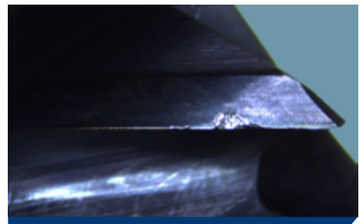

# ORION® OUR PERFORMANCE TESTS

Our aspiration when reworking HPC milling tools is to make a good tool even better. When carrying out machining tests and performance tests, we first needed to clarify how the newly developed geometries and coatings behave in use. The focus was on questions about the application area, service life and cutting values.

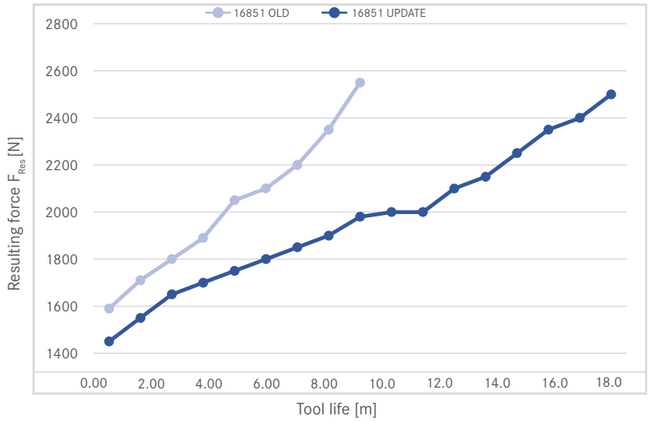
Tests were carried out in a wide variety of materials, both in classical test applications and in numerous field tests at customer sites.
The result: An average cutting value increase of 20 to 40 %, while simultaneously extending the service life by 30 to 40 %.

**ORION 16851 OLD**
**1,2379/8 metres**

**ORION 16851 UPDATE**
**1,2379/8 metres**



**Competitor 1**
**1,2379/8 metres**

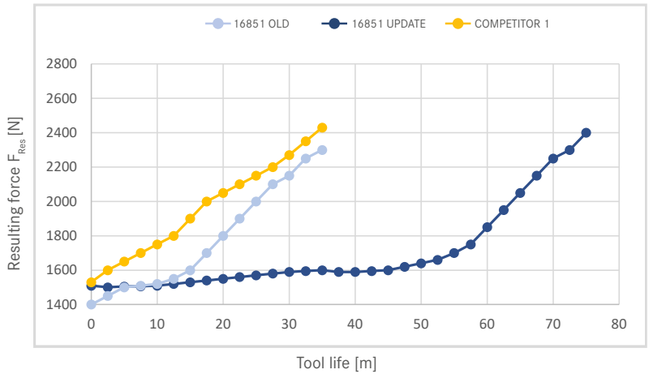



**TEST CONDITIONS**

| | |
|---|---|
| Material: | X155CrMo5-1 |
| Material number: | 1,2379 |
| Tool: | HPC end mill 16851810 |

**CUTTING DATA:**

| | |
|---|---|
| Vc (m/min) | 160 |
| fz (mm) | 0.06 |
| ap (mm) | 10 |
| ae (mm) | 8 |
| D (mm) | 10 |
| n (rpm) | 5,093 |
| Vf (mm/min) | 1,222 |
| Coolant | Emulsion 9 % |




**TEST CONDITIONS**

| | |
|---|---|
| Material: | 42CrMoS4ex |
| Material number: | 1,7225 |
| Tool: | HPC end mill 16851810 |

**CUTTING DATA:**

| | |
|---|---|
| Vc (m/min) | 180 |
| fz (mm) | 0.06 |
| ap (mm) | 10 |
| ae (mm) | 8 |
| D (mm) | 10 |
| n (rpm) | 5,730 |
| Vf (mm/min) | 1,375 |
| Coolant | Emulsion 10 % |

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# SOLID CARBIDE HPC END MILLS T=4

## HIGH-PERFORMANCE HPC MILLING IN GENERAL MECHANICAL ENGINEERING, TOOL MANUFACTURING AND MOULD-MAKING APPLICATIONS

VHM | ULTRA PRO | Typ N | Z 4 | 35°/38° | γ = 9° | 45° | HB | HA | HPC

FURTHER DIMENSIONS, DETAILS AND CUTTING VALUES CAN BE FOUND IN OUR SHOP.

**Application:**
High-performance HPC end mill for universal roughing and finishing in general mechanical engineering, tool manufacturing and mould making applications using a wide variety of materials.
Optimal application in trochoidal milling and in edge, corner and groove machining.

Large gashing version for improved chip removal during ramping etc.

### REDUCED VIBRATIONS
Fewer vibrations and optimal smoothness as the cutting edges have unequal helix angles and therefore unequal pitch. This facilitates higher cutting speeds and cutting depths

### REDUCED WEAR
All tools are manufactured with an edge protection chamfer to prevent wear

### OPTIMISED GEOMETRY
Minimises breakouts with robust cutting geometry and microfinishing

### OPTIMUM CHIP REMOVAL
Large chip space and special, CAD-optimised groove profiles

### ULTRA PRO COATING
High-performance, TiAlN-based PVD coating extends the service life and is optimised for higher cutting speeds



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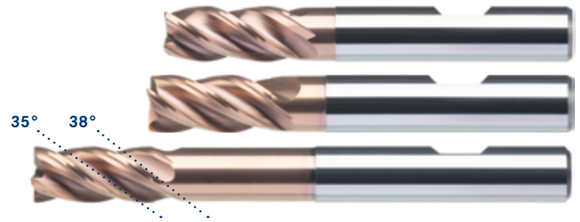
## SC HPC END MILL T=4

VHM | ULTRA PRO | Typ N | Z 4 | 35°/38° | γ = 9° | 45° | HB | HA | HPC

4 cutting edges, ULTRA PRO-coated

**Version:**
- Cutting material: solid carbide, ultra-fine grain
- ULTRA PRO high-performance coating
- Cutting edge finish
- HA and HB shank in accordance with DIN 6535
- With clearance and centre cutting
- Unequal helix angle 35°/38°
- Unequal cutting edge pitch
- Optimised 45° edge protection chamfer
- Rake angle: 9°




### Standard version

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Type | N | N |
| | | | | | | | | Surface | ULTRA PRO | ULTRA PRO |
| | | | | | | | | Tool holder | HB straight shank | HA straight shank |
| | | | | | | | | Cutting diameter tolerance | e8 | e8 |
| | | | | | | | | Shank diameter tolerance | h6 | h6 |
| mm | mm | mm | mm | mm | mm | F mm | Teeth (no.) | fz steel 1,000 ● (mm) | 16851... Ref. no. | 16851... Ref. no. |
| 3 | 8 | 13 | 57 | 2.8 | 6 | 0.05 | 4 | 0.03 | 800 | 830 |
| 4 | 11 | 17 | 57 | 3.8 | 6 | 0.1 | 4 | 0.035 | 802 | 832 |
| 5 | 13 | 19 | 57 | 4.7 | 6 | 0.1 | 4 | 0.04 | 804 | 834 |
| 6 | 13 | 19 | 57 | 5.8 | 6 | 0.1 | 4 | 0.05 | 806 | 836 |
| 8 | 21 | 25 | 63 | 7.7 | 8 | 0.2 | 4 | 0.06 | 808 | 838 |
| 10 | 22 | 30 | 72 | 9.7 | 10 | 0.2 | 4 | 0.07 | 810 | 840 |
| 12 | 26 | 36 | 83 | 11.6 | 12 | 0.2 | 4 | 0.08 | 812 | 842 |
| 14 | 26 | 36 | 83 | 13.6 | 14 | 0.2 | 4 | 0.1 | 814 | 844 |
| 16 | 36 | 42 | 92 | 15.5 | 16 | 0.2 | 4 | 0.12 | 816 | 846 |
| 18 | 36 | 42 | 92 | 17.5 | 18 | 0.2 | 4 | 0.13 | 818 | 848 |
| 20 | 41 | 52 | 104 | 19.5 | 20 | 0.2 | 4 | 0.14 | 820 | 850 |

### Long version

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 6 | 9 | 55 | 2.8 | 6 | 0.1 | 4 | 0.11 | 150 |
| 4 | 8 | 12 | 55 | 3.8 | 6 | 0.1 | 4 | 0.11 | 151 |
| 5 | 10 | 15 | 58 | 4.8 | 6 | 0.1 | 4 | 0.11 | 152 |
| 6 | 13 | 18 | 58 | 5.8 | 6 | 0.1 | 4 | 0.11 | 153 |
| 8 | 17 | 24 | 64 | 7.7 | 8 | 0.2 | 4 | 0.11 | 154 |
| 10 | 21 | 30 | 74 | 9.7 | 10 | 0.2 | 4 | 0.11 | 155 |
| 12 | 25 | 36 | 85 | 11.6 | 12 | 0.3 | 4 | 0.11 | 156 |
| 14 | 29 | 42 | 91 | 13.6 | 14 | 0.3 | 4 | 0.11 | 157 |
| 16 | 33 | 48 | 100 | 15.5 | 16 | 0.3 | 4 | 0.11 | 158 |
| 18 | 38 | 54 | 106 | 17.5 | 18 | 0.3 | 4 | 0.11 | 159 |
| 20 | 42 | 60 | 114 | 19.5 | 20 | 0.3 | 4 | 0.11 | 160 |

### Extra-long version

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 6 | 15 | 58 | 2.8 | 6 | 0.1 | 4 | 0.11 | 161 |
| 4 | 8 | 20 | 62 | 3.8 | 6 | 0.1 | 4 | 0.11 | 170 |
| 5 | 10 | 25 | 70 | 4.8 | 6 | 0.1 | 4 | 0.11 | 171 |
| 6 | 13 | 30 | 70 | 5.8 | 6 | 0.1 | 4 | 0.11 | 172 |
| 8 | 17 | 40 | 80 | 7.7 | 8 | 0.2 | 4 | 0.11 | 173 |
| 10 | 21 | 50 | 94 | 9.7 | 10 | 0.2 | 4 | 0.11 | 174 |
| 12 | 25 | 60 | 109 | 11.6 | 12 | 0.3 | 4 | 0.11 | 175 |
| 14 | 29 | 70 | 119 | 13.6 | 14 | 0.3 | 4 | 0.11 | 176 |
| 16 | 33 | 80 | 132 | 15.5 | 16 | 0.3 | 4 | 0.11 | 177 |
| 18 | 38 | 90 | 142 | 17.5 | 18 | 0.3 | 4 | 0.11 | 178 |
| 20 | 42 | 100 | 154 | 19.5 | 20 | 0.3 | 4 | 0.11 | 179 |

ORION®

# SOLID CARBIDE TVC END MILL 3XD T=4

## TROCHOIDAL MILLING IN MATERIALS UP TO 1,400 N/MM²

VHM | ULTRA PRO | Typ N | Z 4 | 35°/38° | γ = 9° | 45° | HB | TVC

**Application:**
The TVC end mills are ideally suited for machining using modern milling strategies, and for universal roughing and finishing in general mechanical engineering, tool manufacturing and mould making using a wide range of materials.
3xD cutting edge lengths, reinforced cores and specially developed chip breaker geometries allow high application depths with maximum process reliability.

FURTHER DIMENSIONS, DETAILS AND CUTTING VALUES CAN BE FOUND IN OUR SHOP.

Large gashing version for improved chip removal during helical milling etc.

### 3xD APPLICATION DEPTH
The large cutting edge lengths ensure high application depths and maximum material removal rate

### CHIPBREAKER GEOMETRY
Produces short chips, thereby optimising chip removal

### REDUCED VIBRATIONS
Fewer vibrations and optimal smoothness as the cutting edges have unequal helix angles and therefore unequal pitch. This facilitates higher cutting speeds and cutting depths

### OPTIMISED GEOMETRY
Minimises breakouts with robust cutting geometry and microfinishing

### ULTRA PRO COATING
High-performance, TiAlN-based PVD coating extends the service life and is optimised for higher cutting speeds



ORION®

# SOLID CARBIDE TVC END MILL 3xD T=4

4 cutting edges, ULTRA PRO-coated

VHM | ULTRA PRO | Typ N | Z 4 | 35°/38° | γ = 9° | 45° | HB | TVC

**Version:**
- Cutting material: solid carbide, ultra-fine grain
- ULTRA PRO high-performance coating
- Cutting edge finish
- HB shank in accordance with DIN 6535
- With clearance and centre cutting
- Unequal helix angle 35°/38°
- Unequal cutting edge pitch
- Chip breaker on every cutting edge
- Optimised 45° edge protection chamfer
- Rake angle: 9°


**CHIPBREAKER ON ALL CUTTING EDGES**
Produces short chips, thereby optimising chip removal

**Standard version**

| mm | mm | mm | mm | mm | mm | F mm | Teeth (no.) | fz steel 1,000 ● (mm) | 16851... Ref. no. |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 9 | 12 | 54 | 2.8 | 6 | 0.1 | 4 | 0.03 | 860 |
| 4 | 12 | 16 | 57 | 3.8 | 6 | 0.1 | 4 | 0.035 | 862 |
| 5 | 15 | 20 | 57 | 4.8 | 6 | 0.1 | 4 | 0.04 | 864 |
| 6 | 18 | 24 | 62 | 5.8 | 6 | 0.1 | 4 | 0.05 | 866 |
| 8 | 24 | 30 | 68 | 7.7 | 8 | 0.2 | 4 | 0.06 | 868 |
| 10 | 31 | 38 | 80 | 9.7 | 10 | 0.2 | 4 | 0.07 | 870 |
| 12 | 41 | 46 | 93 | 11.6 | 12 | 0.2 | 4 | 0.08 | 872 |
| 14 | 43 | 53 | 100 | 13.6 | 14 | 0.3 | 4 | 0.1 | 874 |
| 16 | 51 | 58 | 108 | 15.5 | 16 | 0.2 | 4 | 0.11 | 876 |
| 18 | 55 | 73 | 123 | 17.5 | 18 | 0.3 | 4 | 0.13 | 878 |
| 20 | 61 | 74 | 126 | 19.5 | 20 | 0.2 | 4 | 0.13 | 880 |

## TVC = TROCHOIDAL VOLUME CUTTING

### WHAT IS TROCHOIDAL MILLING?

Particularly during roughing, this milling strategy results in smarter and more efficient tool paths. This means that more material can be removed in a shorter time - without any loss of quality.
Overlapping a circular path on the feed movement has a positive influence on contact conditions. Reducing stepover while at the same time utilising the entire cutting edge length results in the process forces being significantly reduced.

**ADVANTAGES:**
- Cutting depths of 3-4xD can be easily achieved
- Optimised and controlled tool engagement
- Almost constant engagement angle (max. 70°) and average chip thickness
- Reduced loads on the tool/spindle/bearings
- Extremely aggressive cutting parameters can be selected

**Static:** Only grooves are milled.
The tool paths consist exclusively of circular tool paths.

**Dynamic:** Free workpiece contours are milled. The tool paths consist of circular and straight tool paths. The circular paths may in some cases include very large radii or linear movements.

ORION®

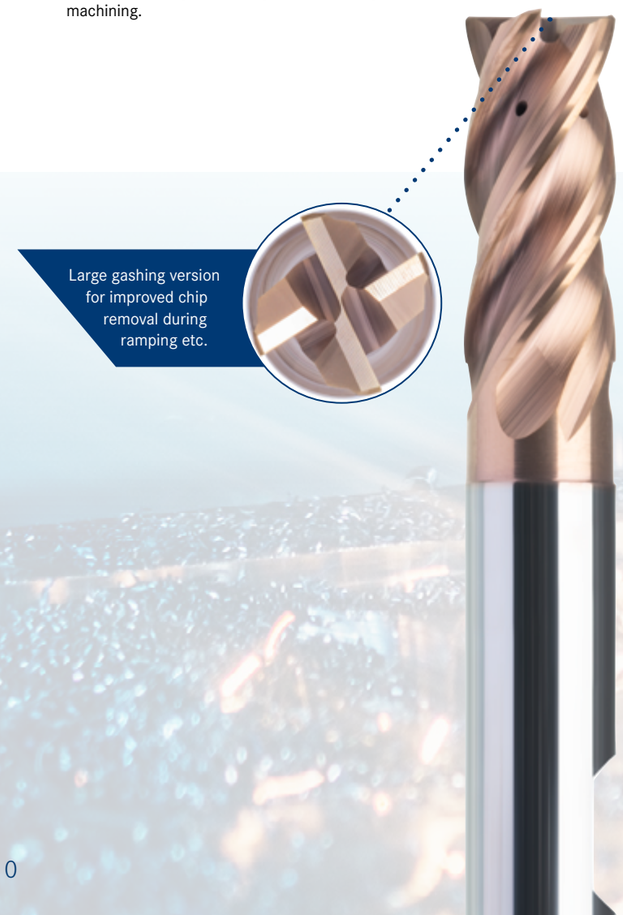
# SOLID CARBIDE HPC END MILLS T=4 WITH INTERNAL COOLING

## HPC MILLING WITH INTERNAL COOLING IN GENERAL MECHANICAL ENGINEERING, TOOL MANUFACTURING AND MOULD MAKING APPLICATIONS

VHM | ULTRA PRO | Typ N | Z 4 | 35°/38° | γ = 9° | 45° | HB | HPC | IK

FURTHER DIMENSIONS, DETAILS AND CUTTING VALUES CAN BE FOUND IN OUR SHOP.

**Application:**
High-performance HPC end mill with internal cooling for universal roughing and finishing in general mechanical engineering, tool manufacturing and mould making applications using a wide variety of materials. With radial cooling, i.e. in the chip space, enabling a significant increase in service life through better chip removal and temperature control. Optimal application in trochoidal milling and in edge, corner and groove machining.



Large gashing version for improved chip removal during ramping etc.

### INTERNAL COOLING
Radial internal coolant supply for safe chip removal and temperature control even under unfavourable conditions

### REDUCED VIBRATIONS
Fewer vibrations and optimal smoothness as the cutting edges have unequal helix angles and therefore unequal pitch. This facilitates higher cutting speeds and cutting depths

### OPTIMISED GEOMETRY
Minimises breakouts with robust cutting geometry and microfinishing

### ULTRA PRO COATING
High-performance, TiAlN-based PVD coating extends the service life and is optimised for higher cutting speeds



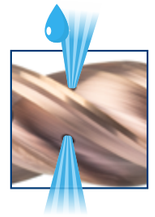
ORION®

## SC HPC END MILLS T=4 WITH INTERNAL COOLING

VHM | ULTRA PRO | Typ N | Z 4 | 35°/38° | γ = 9° | 45° | HB | HPC | IK

4 cutting edges, ULTRA PRO-coated

**Version:**
- Cutting material: solid carbide, ultra-fine grain
- ULTRA PRO high-performance coating
- With radial internal cooling
- Cutting edge finish
- HB shank in accordance with DIN 6535
- With clearance and centre cutting
- Unequal helix angle 35°/38°
- Unequal cutting edge pitch
- Optimised 45° edge protection chamfer
- Rake angle: 9°

**INTERNAL COOLING**
Radial internal coolant supply for safe chip removal and temperature control even under unfavourable conditions

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Type | | N |
| | | | | | | | Surface | | ULTRA PRO |
| | | | | | | | Tool holder | | HB straight shank |
| | | | | | | | Cutting diameter tolerance | | f8 |
| | | | | | | | Shank diameter tolerance | | h6 |
| mm | mm | mm | mm | mm | mm | mm | Teeth (no.) | fz steel 1,000 ● (mm) | Ref. no. |
| 6 | 13 | 19 | 57 | 5.8 | 6 | 0.1 | 4 | 0.05 | **16851...** **380** |
| 8 | 21 | 25 | 63 | 7.7 | 8 | 0.2 | 4 | 0.06 | **382** |
| 10 | 22 | 30 | 72 | 9.7 | 10 | 0.2 | 4 | 0.07 | **384** |
| 12 | 26 | 36 | 83 | 11.6 | 12 | 0.3 | 4 | 0.08 | **386** |
| 16 | 36 | 42 | 92 | 15.5 | 16 | 0.3 | 4 | 0.11 | **388** |
| 20 | 41 | 52 | 104 | 19.5 | 20 | 0.3 | 4 | 0.13 | **390** |

## TOOLREX CUTTING FLUIDS AND OILS - ENVIRONMENTALLY FRIENDLY, GENTLE ON SKIN AND EFFICIENT

As your technology partner for metal working, we have an innovative range of cutting fluids and oils under the name Toolrex.

The innovative high-performance cutting fluids, oils and emulsions not only optimise metal working from an ecological perspective, but also increase the efficiency of the production process.

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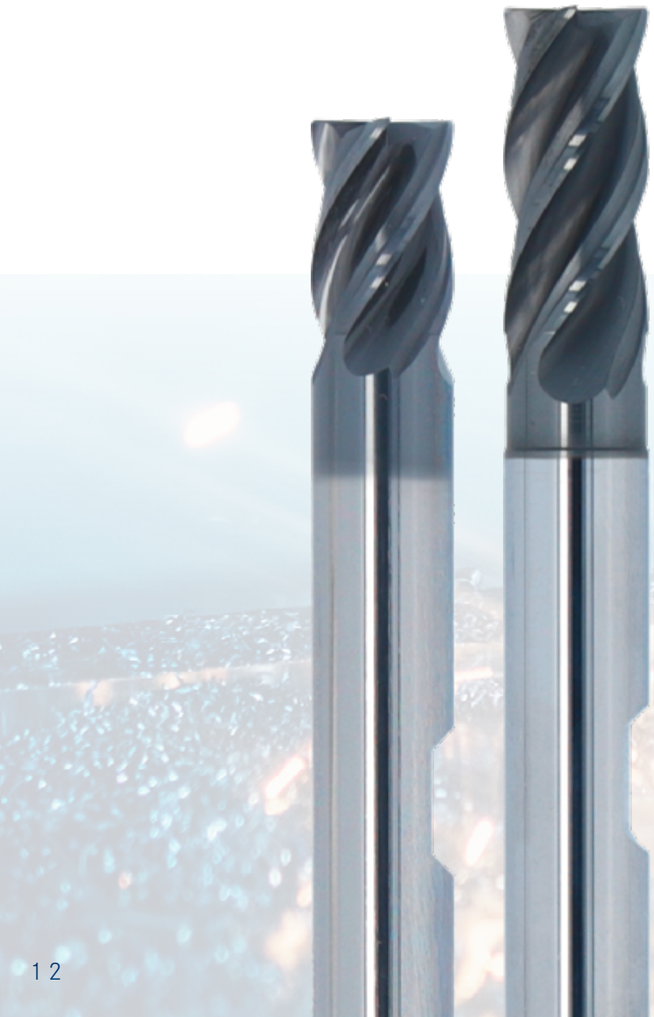
# SOLID CARBIDE HPC END MILLS T=4 FOR HIGH-GRADE STEEL

## HIGH-PERFORMANCE HPC MILLING IN GENERAL MECHANICAL ENGINEERING, TOOL MANUFACTURING AND MOULD MAKING APPLICATIONS

VHM | AlCrN | Typ VA | Z 4 | 35°/38° | γ = 12° | 45° | HB | HPC

FURTHER DIMENSIONS, DETAILS AND CUTTING VALUES CAN BE FOUND IN OUR SHOP.

**Application:**
High-performance HPC end mill for roughing and finishing high-grade steels in general mechanical engineering, tool manufacturing and mould making applications. Optimal application in trochoidal milling and in edge, corner and groove machining.



### REDUCED VIBRATIONS
Fewer vibrations and optimal smoothness as the cutting edges have unequal helix angles and therefore unequal pitch. This enables higher cutting speeds and cutting depths

### OPTIMISED COATING
High-performance AlCrN-based PVD coating extends service life and is optimised for maximum wear protection in high-grade steel

### REDUCED WEAR
All tools are manufactured with an edge protection chamfer to prevent wear

### OPTIMUM CHIP REMOVAL
Large chip space and special, CAD-optimised groove profiles



ORION®

## SC HPC END MILLS T=4 FOR HIGH-GRADE STEEL

VHM | AlCrN | Typ VA | Z 4 | 35°/38° | γ = 12° | 45° | HB | HPC

4 cutting edges, AlCrN-coated

**Version:**
- Cutting material: solid carbide, ultra-fine grain
- High-performance AlCrN coating
- Cutting edge finish
- HB shank in accordance with DIN 6535
- With clearance and centre cutting
- Unequal helix angle 35°/38°
- Unequal cutting edge pitch
- Optimised 45° edge protection chamfer
- Rake angle: 12°


**Short version**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Type | | VA |
| | | | | | | | Surface | | AlCrN |
| | | | | | | | Tool holder | | HB straight shank |
| | | | | | | | Cutting diameter tolerance | | f8 |
| | | | | | | | Shank diameter tolerance | | h6 |
| mm | mm | mm | mm | mm | mm | F mm | Teeth (no.) | fz high-grade steel ● (mm) | 16851... Ref. no. |
| 3 | 5 | - | 50 | - | 6 | 0.1 | 4 | 0.012 | **553** |
| 4 | 8 | - | 54 | - | 6 | 0.1 | 4 | 0.015 | **554** |
| 5 | 9 | - | 54 | - | 6 | 0.1 | 4 | 0.019 | **555** |
| 6 | 10 | - | 54 | - | 6 | 0.1 | 4 | 0.025 | **556** |
| 8 | 12 | - | 58 | - | 8 | 0.2 | 4 | 0.032 | **558** |
| 10 | 14 | - | 66 | - | 10 | 0.2 | 4 | 0.04 | **560** |
| 12 | 16 | - | 73 | - | 12 | 0.3 | 4 | 0.045 | **562** |
| 16 | 22 | - | 82 | - | 16 | 0.3 | 4 | 0.06 | **566** |
| 20 | 26 | - | 92 | - | 20 | 0.3 | 4 | 0.09 | **570** |

**Standard version**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 3 | 8 | 13 | 57 | 2.8 | 6 | 0.1 | 4 | 0.012 | **503** |
| 4 | 11 | 17 | 57 | 3.8 | 6 | 0.1 | 4 | 0.015 | **504** |
| 5 | 13 | 19 | 57 | 4.8 | 6 | 0.1 | 4 | 0.019 | **505** |
| 6 | 13 | 19 | 57 | 5.8 | 6 | 0.1 | 4 | 0.025 | **506** |
| 8 | 21 | 25 | 63 | 7.7 | 8 | 0.2 | 4 | 0.032 | **508** |
| 10 | 22 | 30 | 72 | 9.7 | 10 | 0.2 | 4 | 0.04 | **510** |
| 12 | 26 | 36 | 83 | 11.6 | 12 | 0.3 | 4 | 0.045 | **512** |
| 14 | 26 | 36 | 83 | 13.6 | 14 | 0.3 | 4 | 0.05 | **514** |
| 16 | 36 | 42 | 92 | 15.5 | 16 | 0.3 | 4 | 0.06 | **516** |
| 18 | 36 | 42 | 92 | 17.5 | 18 | 0.3 | 4 | 0.07 | **518** |
| 20 | 41 | 52 | 104 | 19.5 | 20 | 0.3 | 4 | 0.09 | **520** |

ORION®

# SOLID CARBIDE HPC/TVC END MILLS T=5

## HIGH-PERFORMANCE MILLING IN GENERAL MECHANICAL ENGINEERING, TOOL MANUFACTURING AND MOULD MAKING

VHM | ULTRA PRO | Typ N | Z 5 | 35°/38° | γ = 9° | 45° | HB | | HPC | TVC

**Application:**
High-performance HPC end mill for universal roughing and finishing in general mechanical engineering, tool manufacturing and mould making applications using a wide variety of materials.
Optimal application in trochoidal milling and in edge, corner and groove machining.
Five cutting edges for higher feed speeds.

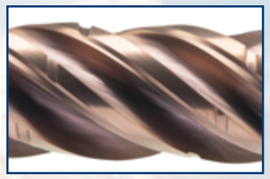
FURTHER DIMENSIONS, DETAILS AND CUTTING VALUES CAN BE FOUND IN OUR SHOP.

Five cutting edges for higher feed speeds

### REDUCED VIBRATIONS
Fewer vibrations and optimal smoothness as the cutting edges have unequal helix angles and therefore unequal pitch. This enables higher cutting speeds and cutting depths

### 3XD APPLICATION DEPTH
The large cutting edge lengths ensure high application depths and maximum material removal rate

### CHIPBREAKER GEOMETRY
Produces short chips, optimising chip removal



### OPTIMISED GEOMETRY
Minimises breakouts with robust cutting edge geometry and microfinishing

### ULTRA PRO COATING
High-performance, TiAlN-based PVD coating extends the service life and is optimised for higher cutting speeds



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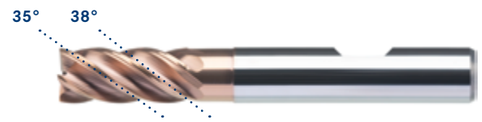
## SC HPC END MILLS T=5

VHM | ULTRA PRO | Typ N | Z 5 | 35°/38° | γ = 8° | 45° | HB | | HPC

5 cutting edges, ULTRA PRO-coated

**Version:**
- Cutting material: solid carbide, ultra-fine grain
- ULTRA PRO high-performance coating
- Cutting edge finish
- HB shank in accordance with DIN 6535
- With clearance and centre cutting
- Unequal helix angle 35°/38°
- Unequal cutting edge pitch
- Optimised 45° edge protection chamfer
- Rake angle: 8°




| | | | | | | | Type | N |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Surface | ULTRA PRO |
| | | | | | | | Tool holder | HB straight shank |
| | | | | | | | Cutting diameter tolerance | e8 |
| | | | | | | | Shank diameter tolerance | h5 |
| mm | mm | mm | mm | mm | mm | F mm | Teeth (no.) | fz steel 1,000 ● (mm) | 16851... Ref. no. |
| 6 | 13 | 19 | 57 | 5.8 | 6 | 0.1 | 5 | 0.05 | 900 |
| 8 | 21 | 25 | 63 | 7.7 | 8 | 0.2 | 5 | 0.06 | 902 |
| 10 | 22 | 30 | 72 | 9.7 | 10 | 0.2 | 5 | 0.07 | 904 |
| 12 | 26 | 36 | 83 | 11.6 | 12 | 0.3 | 5 | 0.08 | 906 |
| 16 | 36 | 42 | 92 | 15.5 | 16 | 0.3 | 5 | 0.11 | 908 |
| 20 | 41 | 52 | 104 | 19.5 | 20 | 0.3 | 5 | 0.13 | 910 |

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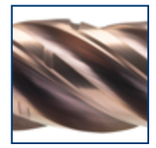
## SC TVC END MILLS 3xD T=5

VHM | ULTRA PRO | Typ N | Z 5 | 35°/38° | γ = 8° | 45° | HB | | TVC

5 cutting edges, ULTRA PRO-coated

**Version:**
- Cutting material: solid carbide, ultra-fine grain
- ULTRA PRO high-performance coating
- Cutting edge finish
- HB shank in accordance with DIN 6535
- With clearance and centre cutting
- Unequal helix angle 35°/38°
- Unequal cutting edge pitch
- Chip breaker on every cutting edge
- Optimised 45° edge protection chamfer
- Rake angle: 8°

**CHIP BREAKERS ON ALL CUTTING EDGES**
Produces short chips, thereby optimising chip removal

| | | | | | | | Type | N |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Surface | ULTRA PRO |
| | | | | | | | Tool holder | HB straight shank |
| | | | | | | | Cutting diameter tolerance | e8 |
| | | | | | | | Shank diameter tolerance | h5 |
| mm | mm | mm | mm | mm | mm | F mm | Teeth (no.) | fz steel 1,000 ● (mm) | 16851... Ref. no. |
| 6 | 18 | 24 | 62 | 5.8 | 6 | 0.1 | 5 | 0.05 | 920 |
| 8 | 24 | 30 | 68 | 7.7 | 8 | 0.2 | 5 | 0.06 | 922 |
| 10 | 30 | 38 | 80 | 9.7 | 10 | 0.2 | 5 | 0.07 | 924 |
| 12 | 36 | 46 | 93 | 11.6 | 12 | 0.3 | 5 | 0.08 | 926 |
| 16 | 48 | 58 | 108 | 15.5 | 16 | 0.3 | 5 | 0.11 | 928 |
| 20 | 60 | 74 | 126 | 19.5 | 20 | 0.3 | 5 | 0.13 | 930 |

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# SOLID CARBIDE FINISHING CUTTER T=6

## FINISHING IN GENERAL MECHANICAL ENGINEERING, TOOL MANUFACTURING AND MOULD MAKING

FURTHER DIMENSIONS, DETAILS AND CUTTING VALUES CAN BE FOUND IN OUR SHOP.

VHM | ULTRA PRO | Typ N | Z 6 | 48°/50° | γ = 13° | HA

**Application:**
High-precision finishing cutters for circumferential, fine finishing and semi-roughing work in general mechanical engineering, tool manufacturing and mould making applications using a wide range of materials.
The optimised geometry and coating ensure high-precision machining results with excellent surfaces.


### BROAD RANGE OF APPLICATIONS
This facilitates circumferential, fine finishing and semi-roughing work using almost all materials

### GREATER ACCURACY
The taper of a maximum of 0.005 mm results in exact angular accuracy

### INCREASED CORE DIAMETER
Stable core diameter reduces vibrations for finishing with very good surface quality

### OPTIMISED GEOMETRY
The special cutting edge geometry ensures optimum surface quality and highest precision during finishing

### ULTRA PRO COATING
High-performance, TiAlN-based PVD coating extends the service life and is optimised for higher cutting speeds



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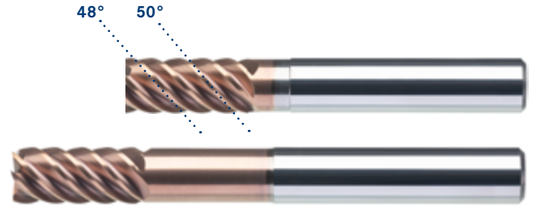
## SOLID CARBIDE FINISHING CUTTER T=6

6 cutting edges, ULTRA PRO-coated

VHM | ULTRA PRO | Typ N | Z 6 | 48°/50° | γ = 13° | HA

**Version:**
- Cutting material: solid carbide, ultra-fine grain
- ULTRA PRO high-performance coating
- Cutting edge finish
- HA shank in accordance with DIN 6535
- With clearance and centre cutting
- Unequal helix angle 48°/50°
- Unequal cutting edge pitch
- Optimised corner protection, with face-cutting correction
- Rake angle: 13°




| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Type | | N |
| | | | | | | Surface | | ULTRA PRO |
| | | | | | | Tool holder | | HA straight shank |
| | | | | | | Cutting diameter tolerance | | e8 |
| | | | | | | Shank diameter tolerance | | h6 |
| mm | mm | mm | mm | mm | mm | Teeth (no.) | fz steel 1,000 ● (mm) | 16851... Ref. no. |
| 6 | 10 | 18 | 58 | 5.8 | 6 | 6 | 0.11 | 580 |
| 6 | 13 | 19 | 57 | 5.6 | 6 | 6 | 0.11 | 581 |
| 6 | 13 | 27 | 67 | 5.8 | 6 | 6 | 0.11 | 582 |
| 6 | 13 | 36 | 76 | 5.8 | 6 | 6 | 0.11 | 583 |
| 6 | 15 | 42 | 80 | 5.6 | 6 | 6 | 0.11 | 584 |
| 8 | 13 | 24 | 64 | 7.7 | 8 | 6 | 0.11 | 585 |
| 8 | 19 | 25 | 63 | 7.6 | 8 | 6 | 0.11 | 586 |
| 8 | 17 | 36 | 76 | 7.7 | 8 | 6 | 0.11 | 587 |
| 8 | 17 | 48 | 89 | 7.7 | 8 | 6 | 0.11 | 588 |
| 8 | 20 | 62 | 100 | 7.6 | 8 | 6 | 0.11 | 589 |
| 10 | 22 | 30 | 72 | 9.6 | 10 | 6 | 0.11 | 590 |
| 10 | 16 | 30 | 74 | 9.7 | 10 | 6 | 0.11 | 591 |
| 10 | 21 | 45 | 89 | 9.7 | 10 | 6 | 0.11 | 592 |
| 10 | 21 | 60 | 104 | 9.7 | 10 | 6 | 0.11 | 593 |
| 10 | 25 | 58 | 100 | 9.6 | 10 | 6 | 0.11 | 594 |
| 12 | 26 | 36 | 83 | 11.5 | 12 | 6 | 0.11 | 595 |
| 12 | 19 | 36 | 85 | 11.6 | 12 | 6 | 0.11 | 596 |
| 12 | 25 | 54 | 103 | 11.6 | 12 | 6 | 0.11 | 597 |
| 12 | 25 | 72 | 121 | 11.6 | 12 | 6 | 0.11 | 598 |
| 12 | 30 | 73 | 120 | 11.5 | 12 | 6 | 0.11 | 599 |
| 16 | 25 | 48 | 100 | 15.5 | 16 | 6 | 0.11 | 600 |
| 16 | 32 | 42 | 92 | 15.5 | 16 | 6 | 0.11 | 601 |
| 16 | 33 | 72 | 124 | 15.5 | 16 | 6 | 0.11 | 602 |
| 16 | 33 | 96 | 148 | 15.5 | 16 | 6 | 0.11 | 603 |
| 16 | 40 | 100 | 150 | 15.5 | 16 | 6 | 0.11 | 604 |
| 20 | 32 | 60 | 114 | 19.5 | 20 | 6 | 0.11 | 605 |
| 20 | 38 | 52 | 104 | 19.5 | 20 | 6 | 0.11 | 606 |
| 20 | 42 | 90 | 144 | 19.5 | 20 | 6 | 0.11 | 607 |
| 20 | 42 | 120 | 174 | 19.5 | 20 | 6 | 0.11 | 608 |
| 20 | 50 | 98 | 150 | 19.5 | 20 | 6 | 0.11 | 609 |
| 25 | 40 | 75 | 136 | 24.5 | 25 | 6 | 0.11 | 610 |
| 25 | 52 | 113 | 174 | 24.5 | 25 | 6 | 0.11 | 611 |
| 25 | 52 | 150 | 210 | 24.5 | 25 | 6 | 0.11 | 612 |

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# SOLID CARBIDE HPC ROUGHING END MILL T=4

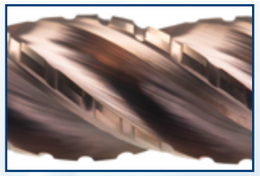
## HIGH-PERFORMANCE ROUGH MILLING IN GENERAL MECHANICAL ENGINEERING, TOOL MANUFACTURING AND MOULD MAKING APPLICATIONS

VHM | ULTRA PRO | Typ NR | Typ NF | Z 4 | 35°/38° | γ = 9° | 45° | HB | | HPC

FURTHER DIMENSIONS, DETAILS AND CUTTING VALUES CAN BE FOUND IN OUR SHOP.

**Application:**
HPC roughing end mill for universal roughing in general mechanical engineering, tool manufacturing and mould making applications using a wide variety of materials, with very good cutting performance and low power consumption.

### NF FLAT TYPE ROUGH PROFILE
Produces short chips at low power input and usually sufficient surface



### NR ROUND TYPE ROUGH PROFILE
Produces short chips at the lowest power input

### REDUCED VIBRATIONS
Fewer vibrations and optimal smoothness as the cutting edges have unequal helix angles and therefore unequal pitch.

This enables higher cutting speeds and cutting depths

### ULTRA PRO COATING
High-performance, TiAlN-based PVD coating extends the service life and is optimised for higher cutting speeds

### OPTIMAL CORNER PROTECTION
Versions with corner protection chamfer or corner radius deliverable



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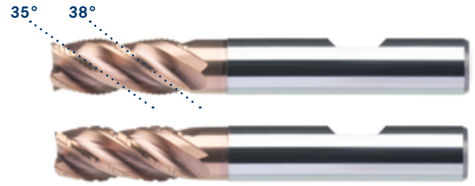
## SOLID CARBIDE HPC ROUGHING END MILL T=4

VHM | ULTRA PRO | Typ NR | Typ NF | Z 4 | 35°/38° | γ = 9° | 45° | HB | | HPC

4 cutting edges, ULTRA PRO-coated

**Version:**
- Cutting material: solid carbide, ultra-fine grain
- ULTRA PRO high-performance coating
- Cutting edge finish
- HB shank in accordance with DIN 6535
- With clearance and centre cutting
- Unequal helix angle 35°/38°
- Unequal cutting edge pitch
- Optimised 45° edge protection chamfer
- Rake angle: 9°
- With round or flat rough profile




**Roughing end mill Type NR Round rough profile**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Type | | NR |
| | | | | | | | Surface | | ULTRA PRO |
| | | | | | | | Tool holder | | HB straight shank |
| | | | | | | | Cutting diameter tolerance | | f8 |
| | | | | | | | Shank diameter tolerance | | h6 |
| mm | mm | mm | mm | mm | mm | F mm | Teeth (no.) | fz steel 1,000 ● (mm) | 16851... Ref. no. |
| 3 | 8 | 13 | 57 | 2.8 | 6 | 0.1 | 4 | 0.11 | 330 |
| 3.5 | 11 | 17 | 57 | 3.3 | 6 | 0.1 | 4 | 0.11 | 331 |
| 4 | 11 | 17 | 57 | 3.8 | 6 | 0.1 | 4 | 0.11 | 332 |
| 4.5 | 13 | 19 | 57 | 4.3 | 6 | 0.1 | 4 | 0.11 | 333 |
| 5 | 13 | 19 | 57 | 4.8 | 6 | 0.1 | 4 | 0.11 | 334 |
| 5.5 | 13 | 19 | 57 | 5.3 | 6 | 0.1 | 4 | 0.11 | 335 |
| 6 | 13 | 19 | 57 | 5.8 | 6 | 0.1 | 4 | 0.11 | 336 |
| 7 | 21 | 25 | 63 | 6.7 | 8 | 0.2 | 4 | 0.11 | 337 |
| 8 | 21 | 25 | 63 | 7.7 | 8 | 0.2 | 4 | 0.11 | 338 |
| 9 | 22 | 30 | 72 | 8.7 | 10 | 0.2 | 4 | 0.11 | 339 |
| 10 | 22 | 30 | 72 | 9.7 | 10 | 0.2 | 4 | 0.11 | 340 |
| 11 | 26 | 36 | 83 | 10.6 | 12 | 0.3 | 4 | 0.11 | 341 |
| 12 | 26 | 36 | 83 | 11.6 | 12 | 0.3 | 4 | 0.11 | 342 |
| 14 | 26 | 36 | 83 | 13.6 | 14 | 0.3 | 4 | 0.11 | 343 |
| 15 | 36 | 42 | 92 | 14.5 | 16 | 0.3 | 4 | 0.11 | 344 |
| 16 | 36 | 42 | 92 | 15.5 | 16 | 0.3 | 4 | 0.11 | 345 |
| 17 | 36 | 42 | 92 | 16.5 | 18 | 0.3 | 4 | 0.11 | 346 |
| 18 | 36 | 42 | 92 | 17.5 | 18 | 0.3 | 4 | 0.11 | 347 |
| 19 | 41 | 52 | 104 | 18.5 | 20 | 0.3 | 4 | 0.11 | 348 |
| 20 | 41 | 52 | 104 | 19.5 | 20 | 0.3 | 4 | 0.11 | 349 |

**Roughing and finishing cutter Type NF Flat rough profile**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 8 | 13 | 57 | 2.8 | 6 | 0.1 | 4 | 0.11 | 260 |
| 3.5 | 11 | 17 | 57 | 3.3 | 6 | 0.1 | 4 | 0.11 | 261 |
| 4 | 11 | 17 | 57 | 3.8 | 6 | 0.1 | 4 | 0.11 | 262 |
| 4.5 | 13 | 19 | 57 | 4.3 | 6 | 0.1 | 4 | 0.11 | 263 |
| 5 | 13 | 19 | 57 | 4.8 | 6 | 0.1 | 4 | 0.11 | 264 |
| 5.5 | 13 | 19 | 57 | 5.3 | 6 | 0.1 | 4 | 0.11 | 265 |
| 6 | 13 | 19 | 57 | 5.8 | 6 | 0.1 | 4 | 0.11 | 266 |
| 7 | 21 | 25 | 63 | 6.7 | 8 | 0.2 | 4 | 0.11 | 267 |
| 8 | 21 | 25 | 63 | 7.7 | 8 | 0.2 | 4 | 0.11 | 268 |
| 9 | 22 | 30 | 72 | 8.7 | 10 | 0.2 | 4 | 0.11 | 269 |
| 10 | 22 | 30 | 72 | 9.7 | 10 | 0.2 | 4 | 0.11 | 270 |
| 11 | 26 | 36 | 83 | 10.6 | 12 | 0.3 | 4 | 0.11 | 271 |
| 12 | 26 | 36 | 83 | 11.6 | 12 | 0.3 | 4 | 0.11 | 272 |
| 14 | 26 | 36 | 83 | 13.6 | 14 | 0.3 | 4 | 0.11 | 273 |
| 15 | 36 | 42 | 92 | 14.5 | 16 | 0.3 | 4 | 0.11 | 274 |
| 16 | 36 | 42 | 92 | 15.5 | 16 | 0.3 | 4 | 0.11 | 275 |
| 17 | 36 | 42 | 92 | 16.5 | 18 | 0.3 | 4 | 0.11 | 276 |
| 18 | 36 | 42 | 92 | 17.5 | 18 | 0.3 | 4 | 0.11 | 277 |
| 19 | 41 | 52 | 104 | 18.5 | 20 | 0.3 | 4 | 0.11 | 278 |
| 20 | 41 | 52 | 104 | 19.5 | 20 | 0.3 | 4 | 0.11 | 279 |

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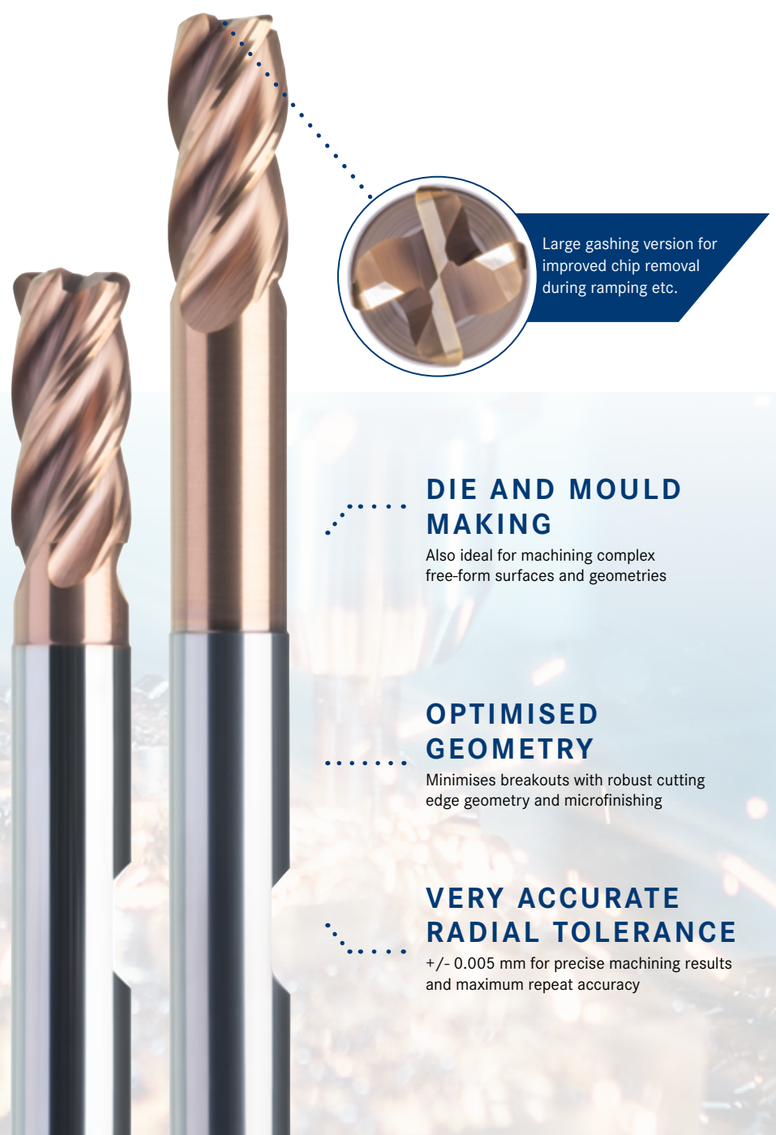
# SOLID CARBIDE HPC TORUS MILLING CUTTER T=4

## IDEAL FOR DIE AND MOULD MAKING APPLICATIONS

VHM | ULTRA PRO | Typ N | Z 4 | 35°/38° | γ = 9° | HB | HPC

**Application:**
High-performance HPC torus milling cutter for universal roughing and finishing in general mechanical engineering, tool manufacturing and mould making applications using a wide variety of materials.
Ideal for machining complex free-form surfaces and geometries.

FURTHER DIMENSIONS, DETAILS AND CUTTING VALUES CAN BE FOUND IN OUR SHOP.





Large gashing version for improved chip removal during ramping etc.

### REDUCED VIBRATIONS
Fewer vibrations and optimal smoothness as the cutting edges have unequal helix angles and therefore unequal pitch. This enables higher cutting speeds and cutting depths

### OPTIMAL CORNER PROTECTION
Versions with corner radius offer even better corner protection, e.g. for helical milling

### DIE AND MOULD MAKING
Also ideal for machining complex free-form surfaces and geometries

### OPTIMISED GEOMETRY
Minimises breakouts with robust cutting edge geometry and microfinishing

### VERY ACCURATE RADIAL TOLERANCE
+/- 0.005 mm for precise machining results and maximum repeat accuracy



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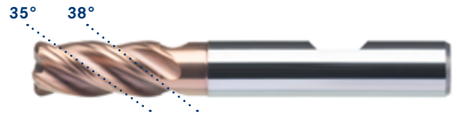
## SOLID CARBIDE HPC TORUS MILLING CUTTER T=4

VHM | ULTRA PRO | Typ N | Z 4 | 35°/38° | γ = 9° | HB | HPC

4 cutting edges, ULTRA PRO-coated

**Version:**
- Cutting material: solid carbide, ultra-fine grain
- ULTRA PRO high-performance coating
- Cutting edge finish
- HB shank in accordance with DIN 6535
- With clearance and centre cutting
- Unequal helix angle 35°/38°
- Unequal cutting edge pitch
- Rake angle: 9°




**Standard version**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Type | | N |
| | | | | | | | Surface | | ULTRA PRO |
| | | | | | | | Tool holder | | HB straight shank |
| | | | | | | | Cutting diameter tolerance | | e8 |
| | | | | | | | Shank diameter tolerance | | h6 |
| mm | R mm | mm | mm | mm | mm | mm | Teeth (no.) | fz steel 1,000 ● (mm) | 16851... Ref. no. |
| 3 | 0.1 | 8 | 13 | 57 | 2.8 | 6 | 4 | 0.11 | 620 |
| 3 | 0.4 | 8 | 13 | 57 | 2.8 | 6 | 4 | 0.11 | 621 |
| 3 | 0.5 | 8 | 13 | 57 | 2.8 | 6 | 4 | 0.11 | 622 |
| 3 | 1 | 8 | 13 | 57 | 2.8 | 6 | 4 | 0.11 | 623 |
| 4 | 0.1 | 11 | 17 | 57 | 3.8 | 6 | 4 | 0.11 | 624 |
| 4 | 0.4 | 11 | 17 | 57 | 3.8 | 6 | 4 | 0.11 | 625 |
| 4 | 0.5 | 11 | 17 | 57 | 3.8 | 6 | 4 | 0.11 | 626 |
| 4 | 1 | 11 | 17 | 57 | 3.8 | 6 | 4 | 0.11 | 627 |
| 5 | 0.1 | 13 | 19 | 57 | 4.8 | 6 | 4 | 0.11 | 628 |
| 5 | 0.5 | 13 | 19 | 57 | 4.8 | 6 | 4 | 0.11 | 629 |
| 5 | 1 | 13 | 19 | 57 | 4.8 | 6 | 4 | 0.11 | 630 |
| 6 | 0.1 | 13 | 19 | 57 | 5.8 | 6 | 4 | 0.11 | 631 |
| 6 | 0.5 | 13 | 19 | 57 | 5.8 | 6 | 4 | 0.11 | 632 |
| 6 | 1 | 13 | 19 | 57 | 5.8 | 6 | 4 | 0.11 | 633 |
| 6 | 1.5 | 13 | 19 | 57 | 5.8 | 6 | 4 | 0.11 | 634 |
| 8 | 0.15 | 21 | 25 | 63 | 7.7 | 8 | 4 | 0.11 | 635 |
| 8 | 0.5 | 21 | 25 | 63 | 7.7 | 8 | 4 | 0.11 | 636 |
| 8 | 1 | 21 | 25 | 63 | 7.7 | 8 | 4 | 0.11 | 637 |
| 8 | 1.5 | 21 | 25 | 63 | 7.7 | 8 | 4 | 0.11 | 638 |
| 8 | 2 | 21 | 25 | 63 | 7.7 | 8 | 4 | 0.11 | 639 |
| 10 | 0.15 | 22 | 30 | 72 | 9.7 | 10 | 4 | 0.11 | 640 |
| 10 | 0.5 | 22 | 30 | 72 | 9.7 | 10 | 4 | 0.11 | 641 |
| 10 | 1 | 22 | 30 | 72 | 9.7 | 10 | 4 | 0.11 | 642 |
| 10 | 1.5 | 22 | 30 | 72 | 9.7 | 10 | 4 | 0.11 | 643 |
| 10 | 2 | 22 | 30 | 72 | 9.7 | 10 | 4 | 0.11 | 644 |
| 12 | 0.2 | 26 | 36 | 83 | 11.6 | 12 | 4 | 0.11 | 645 |
| 12 | 0.5 | 26 | 36 | 83 | 11.6 | 12 | 4 | 0.11 | 646 |
| 12 | 1 | 26 | 36 | 83 | 11.6 | 12 | 4 | 0.11 | 647 |
| 12 | 1.5 | 26 | 36 | 83 | 11.6 | 12 | 4 | 0.11 | 648 |
| 12 | 2 | 26 | 36 | 83 | 11.6 | 12 | 4 | 0.11 | 649 |
| 16 | 0.3 | 36 | 42 | 92 | 15.5 | 16 | 4 | 0.11 | 650 |
| 16 | 1 | 36 | 42 | 92 | 15.5 | 16 | 4 | 0.11 | 651 |
| 16 | 2 | 36 | 42 | 92 | 15.5 | 16 | 4 | 0.11 | 652 |
| 16 | 4 | 36 | 42 | 92 | 15.5 | 16 | 4 | 0.11 | 653 |
| 20 | 1 | 41 | 52 | 104 | 19.5 | 20 | 4 | 0.11 | 654 |
| 20 | 2 | 41 | 52 | 104 | 19.5 | 20 | 4 | 0.11 | 655 |
| 20 | 4 | 41 | 52 | 104 | 19.5 | 20 | 4 | 0.11 | 656 |

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## SOLID CARBIDE HPC TORUS MILLING CUTTER T=4

VHM | ULTRA PRO | Typ N | Z 4 | 35°/38° | V = 9° | HB | HPC

4 cutting edges, ULTRA PRO-coated

**Version:**
- Cutting material: solid carbide, ultra-fine grain
- ULTRA PRO high-performance coating
- Cutting edge finish
- HB shank in accordance with DIN 6535
- With clearance and centre cutting
- Unequal helix angle 35°/38°
- Unequal cutting edge pitch
- Rake angle: 9°


**Long version**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Type | | N |
| | | | | | | | Surface | | ULTRA PRO |
| | | | | | | | Tool holder | | HB straight shank |
| | | | | | | | Cutting diameter tolerance | | e8 |
| | | | | | | | Shank diameter tolerance | | h6 |
| mm | R mm | mm | mm | mm | mm | mm | Teeth (no.) | fz steel 1,000 ● (mm) | 16851... Ref. no. |
| 3 | 0.3 | 8 | 15 | 69 | 2.8 | 6 | 4 | 0.11 | 660 |
| 3 | 0.5 | 8 | 15 | 69 | 2.8 | 6 | 4 | 0.11 | 661 |
| 3 | 1 | 8 | 15 | 69 | 2.8 | 6 | 4 | 0.11 | 662 |
| 4 | 0.3 | 11 | 20 | 69 | 3.8 | 6 | 4 | 0.11 | 663 |
| 4 | 0.5 | 11 | 20 | 69 | 3.8 | 6 | 4 | 0.11 | 664 |
| 4 | 1 | 11 | 20 | 69 | 3.8 | 6 | 4 | 0.11 | 665 |
| 5 | 0.3 | 13 | 25 | 69 | 4.8 | 6 | 4 | 0.11 | 666 |
| 5 | 0.5 | 13 | 25 | 69 | 4.8 | 6 | 4 | 0.11 | 667 |
| 5 | 1 | 13 | 25 | 69 | 4.8 | 6 | 4 | 0.11 | 668 |
| 6 | 0.3 | 13 | 30 | 69 | 5.8 | 6 | 4 | 0.11 | 669 |
| 6 | 0.5 | 13 | 30 | 69 | 5.8 | 6 | 4 | 0.11 | 670 |
| 6 | 1 | 13 | 30 | 69 | 5.8 | 6 | 4 | 0.11 | 671 |
| 6 | 1.5 | 13 | 30 | 69 | 5.8 | 6 | 4 | 0.11 | 672 |
| 6 | 2 | 13 | 30 | 69 | 5.8 | 6 | 4 | 0.11 | 673 |
| 8 | 0.3 | 17 | 40 | 79 | 7.7 | 8 | 4 | 0.11 | 674 |
| 8 | 0.5 | 17 | 40 | 79 | 7.7 | 8 | 4 | 0.11 | 675 |
| 8 | 1 | 17 | 40 | 79 | 7.7 | 8 | 4 | 0.11 | 676 |
| 8 | 1.5 | 17 | 40 | 79 | 7.7 | 8 | 4 | 0.11 | 677 |
| 8 | 2 | 17 | 40 | 79 | 7.7 | 8 | 4 | 0.11 | 678 |
| 10 | 0.3 | 21 | 50 | 93 | 9.7 | 10 | 4 | 0.11 | 679 |
| 10 | 0.5 | 21 | 50 | 93 | 9.7 | 10 | 4 | 0.11 | 680 |
| 10 | 1 | 21 | 50 | 93 | 9.7 | 10 | 4 | 0.11 | 681 |
| 10 | 1.5 | 21 | 50 | 93 | 9.7 | 10 | 4 | 0.11 | 682 |
| 10 | 2 | 21 | 50 | 93 | 9.7 | 10 | 4 | 0.11 | 683 |
| 12 | 0.3 | 25 | 60 | 108 | 11.6 | 12 | 4 | 0.11 | 684 |
| 12 | 0.5 | 25 | 60 | 108 | 11.6 | 12 | 4 | 0.11 | 685 |
| 12 | 1 | 25 | 60 | 108 | 11.6 | 12 | 4 | 0.11 | 686 |
| 12 | 1.5 | 25 | 60 | 108 | 11.6 | 12 | 4 | 0.11 | 687 |
| 12 | 2 | 25 | 60 | 108 | 11.6 | 12 | 4 | 0.11 | 688 |
| 12 | 3 | 25 | 60 | 108 | 11.6 | 12 | 4 | 0.11 | 689 |
| 16 | 0.3 | 33 | 80 | 132 | 15.5 | 16 | 4 | 0.11 | 690 |
| 16 | 0.5 | 33 | 80 | 132 | 15.5 | 16 | 4 | 0.11 | 691 |
| 16 | 1 | 33 | 80 | 132 | 15.5 | 16 | 4 | 0.11 | 692 |
| 16 | 1.5 | 33 | 80 | 132 | 15.5 | 16 | 4 | 0.11 | 693 |
| 16 | 2 | 33 | 80 | 132 | 15.5 | 16 | 4 | 0.11 | 694 |
| 20 | 0.5 | 42 | 100 | 154 | 19.5 | 20 | 4 | 0.11 | 698 |
| 20 | 1 | 42 | 100 | 154 | 19.5 | 20 | 4 | 0.11 | 699 |
| 20 | 2 | 42 | 100 | 154 | 19.5 | 20 | 4 | 0.11 | 701 |
| 20 | 4 | 42 | 100 | 154 | 19.5 | 20 | 4 | 0.11 | 703 |

ORION®

# SC HPC END MILLS T=4 AND T=5 IN A SET

VHM | ULTRA PRO | Typ N | Z 4 | Z 5 | 35°/38° | γ = 9° | 45° | HB | HPC

## Four and five cutting edges, ULTRA PRO coating

**Version:**

- Cutting material: solid carbide, ultra-fine grain
- ULTRA PRO high-performance coating
- Cutting edge finish
- HB shank in accordance with DIN 6535
- With clearance and centre cutting
- Unequal helix angle of 35°/38°
- Cutting edge with unequal pitch
- Optimised 45° edge protection chamfer
- Chip angle: 9°


**Set contents:**

- Ref. no. 180 - HPC end mills T=4 dia. 6-12 mm (16851 806-812)
- Ref. no. 181 - HPC end mills T=4 dia. 6-16 mm (16851 806-816)
- Ref. no. 190 - HPC end mills T=5 dia. 6-12 mm (16851 900-906)
- Ref. no. 191 - HPC end mills T=5 dia. 6-16 mm (16851 900-908)

| | | Four cutting edges | | Five cutting edges | |
|---|---|---|---|---|---|
| Composition of set | | 6/8/10/12 mm | 6/8/10/12/16 mm | 6/8/10/12 mm | 6/8/10/12/16 mm |
| Number of pieces in set | | 4 | 5 | 4 | 5 |
| **16851** | **Ref. no.** | **180** | **181** | **190** | **191** |

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