# Van Hoorn Carbide

Van Hoorn Carbide is committed to manufacture and provide the best solid carbide endmills, leading innovations and reliable support. Developments of materials, machine tools for milling applications and product demands challenge us every day to improve our endmills and optimize the combination between solid carbide grades, geometries, grinding technology and coating.
Our goal is to improve your production processes and reduce your cost per product.

Van Hoorn Carbide sieht sich seinen Kunden gegenüber verpflichtet, neben der Herstellung von hochpräzisen Vollhartmetallfräsern, auch einen Innovationsvorsprung und einen zuverlässigen Service zu bieten. Die kontinuierliche Weiterentwicklung von Werkstoffen und Maschinen sowie wachsende Produktanforderungen motivieren uns täglich aufs Neue unsere Fräser, unter Berücksichtigung des Zusammenwirkens von Hartmetallsorte, Schneidengeometrie und Beschichtung, zu verbessern.
Unser Ziel ist es, Ihren Fertigungsprozess zu optimieren und damit Ihre Produkt- und Prozesskosten zu senken.


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***Warum Van Hoorn Carbide***

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| | Carbon steel \| Kohlenstoffstahl | Alloy steel \| Legierter Stahl | Tool steel \| Werkzeugstahl | Steel 45-52 HRc \| Stahl 45-52 HRc | Steel 50-60 HRc \| Stahl 50-60 HRc | Steel 58-70 HRc \| Stahl 58-70 HRc | Stainless steel soft \| Nichtrostender Stahl, weich | Stainless steel hard \| Nichtrostender Stahl, hart | High temp alloys \| Hochwarmfeste Legierungen | Titanium alloys \| Titanlegierungen | Cast Iron \| Guss | Aluminium \| Aluminium | Aluminium <5% Si \| Aluminium <5% Si | Aluminium >5% Si \| Aluminium >5% Si | Copper \| Kupfer | Brass, Bronze \| Messing, Bronze | Synthetics \| Kunststoffe | Composites and Synthetics \| Verbundwerkstoffe und Kunststoffe | Graphite \| Graphit | Number of Flutes \| Anzahl der Schneiden | Coating \| Beschichtung | Size range \| Durchmesserbereich | Page \| Seite |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VHPK | ● | ● | ● | ◐ | ● | ◐ | | | | | | | | | | | | | | | 2 | TiAlN+ | 0,5 / 12,0 | 8 |
| VHPT | ● | ● | ● | ◐ | ● | ◐ | | | | | | | | | | | | | | | 4 | TiAlN+ | 2,0 / 12,0 | 10 |
| VHPM | ● | ● | ● | ◐ | ● | ◐ | | | | | | | | | | | | | | | 6-16 | TiAlN+ | 3,0 / 20,0 | 12 |
| VHPMR | | | | ◐ | ● | ◐ | | | | | | | | | | | | | | | 6-16 | TiAlN+ | 3,0 / 20,0 | 14 |
| VHKF2 | ◐ | ◐ | ◐ | ◐ | ● | ◐ | | | | | | | | | | | | | | | 2 | TiAlN | 3,0 / 16,0 | 18 |
| VHKF4 | ◐ | ◐ | ◐ | ◐ | ● | ◐ | | | | | | | | | | | | | | | 4 | TiAlN | 6,0 / 16,0 | 20 |
| VHKK | ◐ | ◐ | ◐ | ◐ | ● | ◐ | | | | | | | | | | | | | | | 2 | TiAlN | 3,0 / 16,0 | 22 |
| VHTF2 | ◐ | ◐ | ◐ | ◐ | ● | ◐ | | | | | | | | | | | | | | | 2 | TiAlN | 1,5 / 16,0 | 24 |
| VHTF4 | ◐ | ◐ | ◐ | ◐ | ● | ◐ | | | | | | | | | | | | | | | 4 | TiAlN | 6,0 / 16,0 | 28 |
| VHDR | ● | ● | ● | | | | | | | ● | | | | | | | | | | | 4 | TiAlN | 2,0 / 12,0 | 30 |
| VHMF | ◐ | ◐ | ◐ | ◐ | ● | ◐ | | | | | | | | | | | | | | | 6-8 | TiAlN | 3,0 / 20,0 | 32 |
| VHMFR | ◐ | ◐ | ◐ | ◐ | ● | ◐ | | | | | | | | | | | | | | | 6-8 | TiAlN | 3,0 / 20,0 | 34 |
| VHMS | ● | ● | ● | ● | ● | ◐ | ◐ | ◐ | ◐ | ◐ | | | | | | | | | | | 2 | TiAlN | 0,1 / 3,0 | 36 |
| VHMSR | ● | ● | ● | ● | ● | ◐ | ◐ | ◐ | ◐ | ◐ | | | | | | | | | | | 2 | TiAlN | 0,3 / 3,0 | 38 |
| VHMSK | ● | ● | ● | ● | ● | ◐ | ◐ | ◐ | ◐ | ◐ | | | | | | | | | | | 2 | TiAlN | 0,1 / 3,0 | 40 |
| HABM | ● | ● | ● | ◐ | | | ● | ● | ◐ | ◐ | ◐ | | | | | | | | | | 2 | TiAlN | 0,4 / 12,0 | 46 |
| HAMF[1-xl] | ● | ● | ● | ● | | | ● | ● | ◐ | ◐ | ◐ | | | | | | | | | | 6-8 | TiAlN | 6,0 / 20,0 | 48 |
| VHVTR | ◐ | ◐ | ◐ | ◐ | | | ● | ● | ● | ● | ◐ | | | | | | | | | | 4-5 | TiAlN | 3,0 / 25,0 | 50 |
| VHVFR | ● | ● | ● | ◐ | | | ● | ● | ◐ | ● | ● | | | | | | ◐ | | | | 3 | TiAlN | 2,0 / 16,0 | 54 |
| VHVF | ● | ● | ● | ◐ | | | ● | ● | ◐ | ● | ● | | | | | | ◐ | | | | 3 | TiAlN | 2,0 / 16,0 | 56 |
| VHVFF3 | ● | ● | ● | ◐ | | | ● | ● | ◐ | ● | ● | | | | | | ◐ | | | | 3 | TiAlN | 2,0 / 16,0 | 58 |
| VHVFF4 | ● | ● | ● | ● | | | ◐ | ◐ | ◐ | ◐ | ◐ | | | | | | | | | | 4 | TiAlN | 4,0 / 20,0 | 60 |
| VHRFF | ● | ● | ● | | | | | | | | ● | | | | | | | | | | 3 | TiAlN | 6,0 / 20,0 | 62 |

● Well suited / besonders geeignet
◐ Suited / geeignet

| | Carbon steel \| Kohlenstoffstahl | Alloy steel \| Legierter Stahl | Tool steel \| Werkzeugstahl | Steel 45-52 HRc \| Stahl 45-52 HRc | Steel 50-60 HRc \| Stahl 50-60 HRc | Steel 58-70 HRc \| Stahl 58-70 HRc | Stainless steel soft \| Nichtrostender Stahl, weich | Stainless steel hard \| Nichtrostender Stahl, hart | High temp alloys \| Hochwarmfeste Legierungen | Titanium alloys \| Titanlegierungen | Cast Iron \| Guss | Aluminium \| Aluminium | Aluminium <5% Si \| Aluminium <5% Si | Aluminium >5% Si \| Aluminium >5% Si | Copper \| Kupfer | Brass, Bronze \| Messing, Bronze | Synthetics \| Kunststoffe | Composites and Synthetics \| Verbundwerkstoffe und Kunststoffe | Graphite \| Graphit | Number of Flutes \| Anzahl der Schneiden | Coating \| Beschichtung | Size range \| Durchmesserbereich | Page \| Seite |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| VHKE | | | | | | | | | | | | ◐ | ◐ | ◐ | ◐ | ◐ | ● | ● | | | 1 | Uncoated | 1,0 / 12,0 | 66 |
| VHDT | | | | | | | | | | | | ◐ | ◐ | ● | | | ● | ● | ● | | 2 | Diamond | 3,0 / 12,0 | 68 |
| VHDB | | | | | | | | | | | | ◐ | ◐ | ● | | | ● | ● | ● | | 2 | Diamond | 3,0 / 12,0 | 70 |
| VHCF | | | | | | | | | | | | | | | | | ● | ● | | | 4 | Diamond | 6,0 / 20,0 | 72 |
| VHCR | | | | | | | | | | | | | | | | | ● | ● | | | 2 | Diamond | 3,0 / 20,0 | 74 |
| VHGR | | | | | | | | | | | | | | | | | ● | ◐ | ● | | 2 | Diamond | 4,0 / 12,0 | 78 |
| VHGT | | | | | | | | | | | | | | ◐ | | | | | ● | | 3 | Diamond | 2,0 / 12,0 | 80 |
| VHGTF | | | | | | | | | | | | | | ◐ | | | | | ● | | 2-3-4 | Diamond | 2,0 / 12,0 | 82 |
| VHGKF | | | | | | | | | | | | | | ◐ | | | | | ● | | 2-3-4 | Diamond | 2,0 / 12,0 | 84 |
| VHMG | | | | | | | | | | | | | | ◐ | | | | | ● | | 2 | Diamond | 0,3 / 1,5 | 86 |
| VHMGK | | | | | | | | | | | | | | ◐ | | | | | ● | | 2 | Diamond | 0,3 / 1,5 | 88 |
| VHKC | | | | | | | | | | | | ◐ | ◐ | ◐ | ● | ● | ◐ | | | | 4 | C+ | 3,0 / 16,0 | 92 |
| VHTC | | | | | | | | | | | | ◐ | ◐ | ◐ | ● | ● | ◐ | | | | 4 | C+ | 3,0 / 16,0 | 94 |
| VHSC | | | | | | | | | | | | ◐ | ◐ | ◐ | ● | ● | ◐ | ◐ | | | 3 | C+ | 2,0 / 16,0 | 96 |
| VHSCR | | | | | | | | | | | | ◐ | ◐ | ◐ | ● | ● | ◐ | ◐ | | | 3 | C+ | 2,0 / 16,0 | 98 |
| VHMC | | | | | | | | | | | | ◐ | ◐ | ◐ | ● | ● | ◐ | ◐ | | | 2 | C+ | 0,3 / 3,0 | 100 |
| VHMCK | | | | | | | | | | | | ◐ | ◐ | ◐ | ● | ● | ◐ | ◐ | | | 2 | C+ | 0,3 / 3,0 | 102 |
| VHRAW | | | | | | | | | | | | ● | ● | ● | ◐ | ◐ | ◐ | ◐ | | | 3 | Uncoated | 6,0 / 25,0 | 106 |
| VHLAW | | | | | | | | | | | | ● | ● | ● | ◐ | ◐ | ◐ | ◐ | | | 2-3 | Uncoated | 2,0 / 25,0 | 108 |
| VHAE | | | | | | | | | | | | ● | ● | ● | ◐ | ◐ | ◐ | ◐ | | | 1 | Uncoated | 0,6 / 12,0 | 110 |
| VHAD | | | | | | | | | | | | ● | ● | ● | ◐ | ◐ | ◐ | ◐ | | | 3 | Uncoated | 4,0 / 20,0 | 112 |
| VHTA | | | | | | | | | | | | ● | ● | ● | ◐ | ◐ | ◐ | | | | 2 | Uncoated | 6,0 / 25,0 | 114 |
| VHKA | | | | | | | | | | | | ● | ● | ● | ◐ | ◐ | ◐ | | | | 2 | Uncoated | 6,0 / 25,0 | 116 |

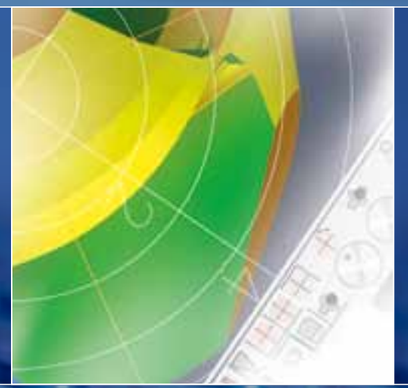
● Well suited / besonders geeignet
◐ Suited / geeignet

# Knowledge is the key!

## Wissen ist der Schlüssel!

Van Hoorn Carbide is the solid carbide end mills specialist: the highest quality standards, leading technology, technical knowledge, experience and support.

Van Hoorn Carbide bietet als der Spezialist für Vollhartmetall Fräswerkzeuge: höchste Qualitätsstandards, führende Technologien, technisches Wissen, Erfahrung und Service.



### Highest level of production
**Modernster Stand der Fertigungstechnik**

- Fully automated process
  Voll automatisierter Fertigungsprozess
- New CNC grinding machines
  Modernste CNC-Schleifmaschinen
- 24-7 production
  24/7 Rund-um-die-Uhr-Produktion
- Climate controlled production
  Klimatisierte Produktionsräume
- Know-how
  Know-How

### Quality
**Qualität**

- Climatized measuring
  Klimatisierte Messräume
- CNC measuring equipment
  CNC gesteuerte Messeinrichtungen
- 100% tool inspection
  100% Qualitätskontrolle
- Master tools
  Prüfmittel
- Measuring protocols
  Prüfprotokolle
- Tolerances of ± 0.001mm possible
  Toleranzen bis ± 0.001mm möglich

### Research & Development
**Forschung und Entwicklung**

- In-house development of cutting tools
  Eigene Entwicklungsabteilung für Schneidwerkzeuge
- 3-D simulation
  3-D Simulationen
- Manufacturing of test tools
  Herstellung von Testwerkzeugen
- Continuous optimization of program
  Permanente Optimierung von Steuerungsprogrammen

### Demonstration & Test centre
**Vorführ- und Testzentrum**

- Mikron VCP 600
  Mikron VCP 600
- 20.000 RPM 130 N/m
  20.000 U/min. 130 N/m
- Emulsion, minimal lubrication and air coolant
  *Emulsionen,* Minimalmengenschmierung und Luftkühlung
- Shrink fit holders, collet chuck, weldon holders
  Schrumpfaufnahmen, Spannzangenfutter, Weldon-Aufnahmen
- Highly skilled application engineers
  Hochqualifizierte Anwendungstechniker

### Technical support
**Technische Unterstützung**

- Testing on our Mikron milling machine
  Test auf unserer MIKRON Fräsmaschine
- Remote support by phone
  Technische Telefonberatung
- Support on site
  Technische Unterstützung vor Ort
- Large database of test reports
  Umfangreiche Testdatenbank

# Milling hardened steels from 58-70 HRc with VHC Technology:

## Fräsen in gehärteten Stählen 58-70 HRc mittels VHC Technologie:

**Advantages / Vorteile:**

1. No EDM is required (milling is much faster).

Kein Errodieren nötig (Fräsen deutlich zeitsparender).

2. Polishing can be minimized.

Aufwand für Nacharbeiten kann minimiert werden.

3. One single clamping, so it is easier to achieve accurate results.

Nur eine Aufspannung - erleichtert das Erreichen von Zielvorgaben.

## Several strategies are possible / Mehrere Strategien sind möglich

**HPM (High Perfomance Machining)**
**Hochleistungsbearbeitung**

- High cutting speed (Vc)
  Hohe Schnittgeschwindigkeit (Vc)
- Large cutting depth (Ap)
  Große Schnitttiefe (Ap)
- Small cutting width (Ae)
  Geringe Schnittbreite (Ae)
- Medium feed per tooth (Fz)/ table feed (Vf)
  Mittlere(r) Zahnvorschub (Fz) / Vorschubgeschwindigkeit (Vf)

**HSM (High Speed Machining)**
**Hochgeschwindigkeitsbearbeitung**

- High cutting speed (Vc)
  Hohe Schnittgeschwindigkeit (Vc)
- Small cutting depth (Ap)
  Geringe Schnitttiefe (Ap)
- Small cutting width (Ae)
  Geringe Schnittbreite (Ae)
- High feed per tooth (Fz) / table feed (Vf)
  Hohe(r) Zahnvorschub (Fz) / Vorschubgeschwindigkeit (Vf)

Depending on the workpiece different strategies can be chosen. Chip removal and coolant in such applications are crucial.

Abhängig vom Werkstück können unterschiedliche Strategien eingesetzt werden.
Spänefluss und Kühlung spielen bei diesen Anwendungen die entscheidende Rolle.

## Tips / Tipps:

- Use a rigid milling machine and clamping method.
  Nutzen Sie eine stabile Fräsmaschine und Spannmethode.
- Try to minimize entering and exiting the workpiece.
  Fräsunterbrechungen während der Bearbeitung möglichst gering halten.
- Use minimum lubrication or oil-mist-spray.
  Nutzen Sie Minimalmengenschmierung oder Öl-Nebel.

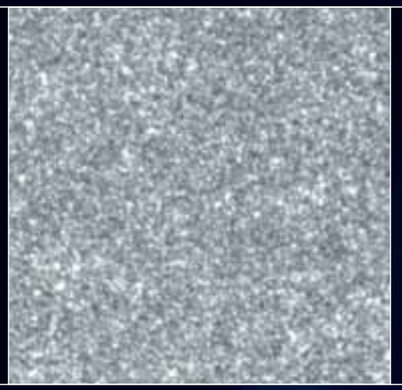




# Van Hoorn Carbide's leading technology for hardened materials (58-70 HRc):

## Van Hoorn Carbide's Technologievorsprung für gehärtete Werkstoffe (58-70 HRc):

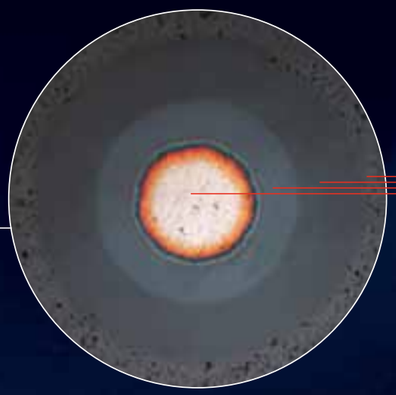
- 2 Flute Ballnose geometry VHPK
  2 Schneiden Radiusfräser VHPK
- 4 Flute Torus Geometry VHPT (New)
  4 Schneiden Torusfräser VHPT (Neu)
- Multiple flute VHPM
  Mehrschneidenfräser VHPM
- Multiple flute with corner radius VHPMR
  Mehrschneidenfräser mit Eckenradius VHPMR

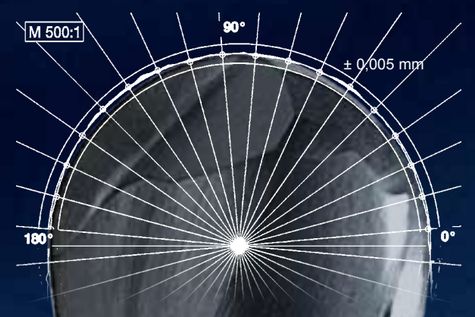


New designed ballnose geometry
Neu gestaltete Radiusfräser Geometrie

Mirror finish & high precision
Spiegelschliff & höchste Genauigkeit

Ultra fine carbide
VHM Ultra-Feinstkorn

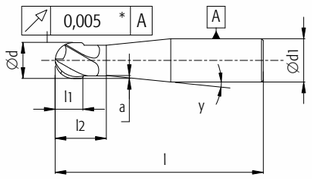





## Coating / Beschichtung

- Multi layer coating
  Mehrlagenbeschichtung
- Nano structure
  Nano-Struktur
- Extreme hardness
  Extreme Härte
- Longer toollife
  Höhere Standzeiten

### Standard




* For endmills / für Schaftfräser L < 100 mm.

NEW GENERATION

| Article Number<br>*Artikelnummer* | Ød<br>(mm) | r<br>(mm) | Ød1<br>(mm) | L<br>(mm) | L1<br>(mm) | L2<br>(mm) | a<br>(mm) | z | γ<br>(°) | |
|---|---|---|---|---|---|---|---|---|---|---|
| VHPK 2 005 064 06 L007 | 0,5 | 0,25 | 6 | 64 | 0,7 | - | - | 2 | 15 | |
| VHPK 2 006 064 06 L008 | 0,6 | 0,30 | 6 | 64 | 0,8 | - | - | 2 | 15 | |
| VHPK 2 006 064 06 L020 | 0,6 | 0,30 | 6 | 64 | 0,8 | 2 | 0,02 | 2 | 15 | |
| VHPK 2 008 064 06 L010 | 0,8 | 0,40 | 6 | 64 | 1,0 | - | - | 2 | 15 | |
| VHPK 2 010 064 06 L012 | 1,0 | 0,50 | 6 | 64 | 1,2 | - | - | 2 | 15 | |
| VHPK 2 010 064 06 L020 | 1,0 | 0,50 | 6 | 64 | 1,2 | 2 | 0,02 | 2 | 15 | |
| VHPK 2 010 064 06 L040 | 1,0 | 0,50 | 6 | 64 | 1,2 | 4 | 0,02 | 2 | 15 | |
| VHPK 2 015 064 06 L018 | 1,5 | 0,75 | 6 | 64 | 1,8 | - | - | 2 | 15 | |
| VHPK 2 020 064 06 L025 | 2,0 | 1,00 | 6 | 64 | 2,5 | - | - | 2 | 15 | |
| VHPK 2 020 064 06 L040 | 2,0 | 1,00 | 6 | 64 | 2,5 | 4 | 0,05 | 2 | 15 | new/neu |
| VHPK 2 025 064 06 L030 | 2,5 | 1,25 | 6 | 64 | 3,0 | - | - | 2 | 15 | |
| VHPK 2 030 064 06 L035 | 3,0 | 1,50 | 6 | 64 | 3,5 | - | - | 2 | 15 | |
| VHPK 2 030 064 06 L070 | 3,0 | 1,50 | 6 | 64 | 3,5 | 7 | 0,05 | 2 | 15 | |
| VHPK 2 040 064 06 L045 | 4,0 | 2,00 | 6 | 64 | 4,5 | - | - | 2 | 15 | new/neu |
| VHPK 2 040 064 06 L080 | 4,0 | 2,00 | 6 | 64 | 4,5 | 8 | 0,10 | 2 | 15 | new/neu |
| VHPK 2 050 064 06 L060 | 5,0 | 2,50 | 6 | 64 | 6,0 | - | - | 2 | 15 | new/neu |
| VHPK 2 050 064 06 L100 | 5,0 | 2,50 | 6 | 64 | 6,0 | 10 | 0,15 | 2 | 15 | new/neu |
| VHPK 2 060 064 06 L070 | 6,0 | 3,00 | 6 | 64 | 7,0 | - | - | 2 | - | |
| VHPK 2 060 064 06 L120 | 6,0 | 3,00 | 6 | 64 | 7,0 | 12 | 0,15 | 2 | - | new/neu |
| VHPK 2 060 064 06 L250 | 6,0 | 3,00 | 6 | 64 | 7,0 | 25 | 0,15 | 2 | - | new/neu |
| VHPK 2 080 064 08 L090 | 8,0 | 4,00 | 8 | 64 | 9,0 | - | - | 2 | - | |
| VHPK 2 080 064 08 L160 | 8,0 | 4,00 | 8 | 64 | 9,0 | 16 | 0,20 | 2 | - | new/neu |
| VHPK 2 080 064 08 L250 | 8,0 | 4,00 | 8 | 64 | 9,0 | 25 | 0,20 | 2 | - | |
| VHPK 2 100 078 10 L120 | 10,0 | 5,00 | 10 | 78 | 12,0 | - | - | 2 | - | |
| VHPK 2 100 078 10 L200 | 10,0 | 5,00 | 10 | 78 | 12,0 | 20 | 0,20 | 2 | - | new/neu |
| VHPK 2 120 078 12 L150 | 12,0 | 6,00 | 12 | 78 | 15,0 | - | - | 2 | - | |

For an extra charge we offer an inspection report of the tool geometry.
Auf Wunsch erhalten Sie zu jedem Werkzeug ein separates Prüfprotokoll (aufpreispflichtig).





**For Coolant we advise:**
**Empfohlene Kühlung:**

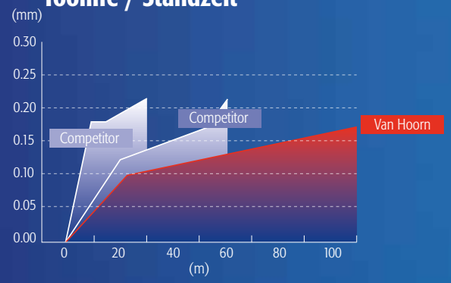
- Minimum lubrication
  Minimalmengenschmierung
- Air Pressure
  Luft

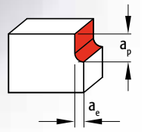
| *Material group* | *TSR* (N/mm²) | *Hardness* | *Cutting speed* Vc m/min |
|---|---|---|---|
| Hardened steel | | 45-52 HRc | |
| | | 50-60 HRc | **150 - 220** |
| | | 58-70 HRc | **200 - 250** |

**VHPK206006406L070**
**Workpiece Material:** 1.2379
**Hardness:** 60 HRC

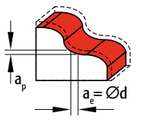
| | Van Hoorn | Competitor |
|---|---|---|
| $v_c$ | 160 m/min | 160 m/min |
| n | 8400 rpm | 8400 rpm |
| $F_z$ | 0,157 mm/t | 0,157 mm/t |
| $v_f$ | 2630 mm/min | 2630 mm/min |
| $a_p$ | 0,3 mm | 0,3 mm |
| $a_e$ | 1,2 mm | 1,2 mm |
| Coolant | min. lubrication | min. lubrication |
| Q | **0,95 mm³/min** | **0,95 mm³/min** |

**Toolife / Standzeit**



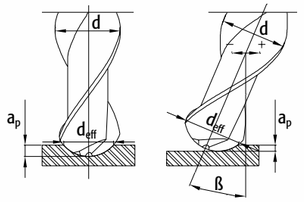




Hardened material
*Gehärtete Werkstoffe*
$a_p$ up to 0,50 x d
$a_e$ up to 0,10 x d




Hardened material
*Gehärtete Werkstoffe*
$a_p$ up to 0,02 x d
$a_e$ up to 0,02 x d

| Ød (mm) | *Shoulder milling / Stirnfräsen* $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) | *Profile milling / Profilfräsen* $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|---|---|---|
| 0,5 | < 0,25 | < 0,010 | 0,005 - 0,008 | < 0,01 | < 0,005 | 0,005 - 0,009 |
| 0,6 | < 0,30 | < 0,012 | 0,007 - 0,010 | < 0,02 | < 0,006 | 0,007 - 0,012 |
| 0,8 | < 0,40 | < 0,015 | 0,010 - 0,015 | < 0,03 | < 0,008 | 0,010 - 0,015 |
| 1,0 | < 0,50 | < 0,020 | 0,015 - 0,025 | < 0,04 | < 0,010 | 0,015 - 0,030 |
| 1,5 | < 0,80 | < 0,030 | 0,020 - 0,030 | < 0,06 | < 0,015 | 0,020 - 0,035 |
| 2,0 | < 1,00 | < 0,040 | 0,030 - 0,050 | < 0,08 | < 0,020 | 0,030 - 0,050 |
| 2,5 | < 1,25 | < 0,050 | 0,035 - 0,055 | < 0,09 | < 0,025 | 0,035 - 0,055 |
| 3,0 | < 1,50 | < 0,060 | 0,040 - 0,060 | < 0,11 | < 0,030 | 0,040 - 0,060 |
| 4,0 | < 2,00 | < 0,100 | 0,050 - 0,080 | < 0,14 | < 0,050 | 0,050 - 0,080 |
| 5,0 | < 2,50 | < 0,130 | 0,060 - 0,110 | < 0,18 | < 0,065 | 0,075 - 0,120 |
| 6,0 | < 3,00 | < 0,180 | 0,065 - 0,120 | < 0,20 | < 0,090 | 0,080 - 0,125 |
| 8,0 | < 4,00 | < 0,200 | 0,080 - 0,130 | < 0,25 | < 0,120 | 0,090 - 0,130 |
| 10,0 | < 5,00 | < 0,220 | 0,085 - 0,135 | < 0,30 | < 0,150 | 0,100 - 0,135 |
| 12,0 | < 6,00 | < 0,250 | 0,100 - 0,140 | < 0,36 | < 0,200 | 0,110 - 0,140 |



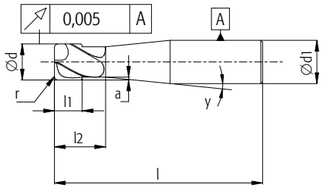

- For the cutting speed Vc calculation the effective cutting diameter $d_{eff}$ has to be taken into account. See formula.

  Für die Berechnung der Schnittgeschwindigkeit muss der effektive Durchmesser $d_{eff}$ berücksichtigt werden (siehe Formel).

ß = 0: $d_{eff} = 2 \bullet \sqrt{d \bullet a_p - a_p^2}$

ß ≠ 0: $d_{eff} = d \bullet \sin\left[ß \pm \arccos\left(\frac{d - 2a_p}{d}\right)\right]$

***Standard***



**For Coolant we advise:**
**Empfohlene Kühlung:**

- Minimum lubrication
  Minimalmengenschmierung
- Air Pressure
  Luft

| *Material group* | *TSR* (N/mm²) | *Hardness* | *Cutting speed* Vc m/min |
|---|---|---|---|
| Hardened steel | | 45-52 HRc | |
| | | 50-60 HRc | **150 - 220** |
| | | 58-70 HRc | **200 - 250** |

**VHPT408B0780840L160**
**Workpiece Material:** 1.2162
**Hardness:** 60 HRC

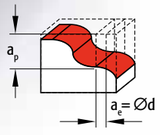
| | **Van Hoorn** | **Competitor** |
|---|---|---|
| $v_c$ | 200 m/min | 25 m/min |
| **n** | 7958 rpm | 995 rpm |
| $F_z$ | 0,079 mm/t | 0,038 mm/t |
| $v_f$ | 2500 mm/min | 150 mm/min |
| $a_p$ | 3 mm | 3 mm |
| $a_e$ | 0,1 mm | 0,25 mm |
| **Coolant** | air | air |
| **Q** | **0,75 mm³/min** | **0,11 mm³/min** |

**Finishing application / Schlichtbearbeitung**
**6 times faster than Competitor! / 6-mal**

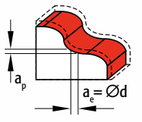
## VHC Technology for hardened materials (58-70 HRc)
## VHC Technologie für gehärtete Werkstoffe (58-70 HRc)

- Consistency of cutting Speeds.
- Gleichbleibende Schnittgeschwindigkeit.
- Optimized performance.
- Optimierte Leistung.
- Significant production time reductions.
- Deutlich verkürzte Fertigungszeiten.

| Article Number<br>Artikelnummer | Ød<br>(mm) | r<br>(mm) | Ød1<br>(mm) | L<br>(mm) | L1<br>(mm) | L2<br>(mm) | a<br>(mm) | z | γ<br>(°) | |
|---|---|---|---|---|---|---|---|---|---|---|
| VHPT 4 020 064 06 40 L040 | 2,0 | 0,10 | 6 | 64 | 2,0 | 4 | 0,05 | 4 | 15 | new/neu |
| VHPT 4 020 064 06 40 L080 | 2,0 | 0,10 | 6 | 64 | 2,0 | 8 | 0,05 | 4 | 15 | new/neu |
| VHPT 4 020 064 06 40 L120 | 2,0 | 0,10 | 6 | 64 | 2,0 | 12 | 0,05 | 4 | 15 | new/neu |
| VHPT 4 02A 064 06 40 L040 | 2,0 | 0,30 | 6 | 64 | 2,0 | 4 | 0,05 | 4 | 15 | new/neu |
| VHPT 4 02A 064 06 40 L080 | 2,0 | 0,30 | 6 | 64 | 2,0 | 8 | 0,05 | 4 | 15 | new/neu |
| VHPT 4 02A 064 06 40 L120 | 2,0 | 0,30 | 6 | 64 | 2,0 | 12 | 0,05 | 4 | 15 | new/neu |
| VHPT 4 030 064 06 40 L060 | 3,0 | 0,20 | 6 | 64 | 3,0 | 6 | 0,05 | 4 | 15 | new/neu |
| VHPT 4 030 064 06 40 L120 | 3,0 | 0,20 | 6 | 64 | 3,0 | 12 | 0,05 | 4 | 15 | new/neu |
| VHPT 4 030 064 06 40 L180 | 3,0 | 0,20 | 6 | 64 | 3,0 | 18 | 0,05 | 4 | 15 | new/neu |
| VHPT 4 03B 064 06 40 L060 | 3,0 | 0,50 | 6 | 64 | 3,0 | 6 | 0,05 | 4 | 15 | new/neu |
| VHPT 4 03B 064 06 40 L120 | 3,0 | 0,50 | 6 | 64 | 3,0 | 12 | 0,05 | 4 | 15 | new/neu |
| VHPT 4 03B 064 06 40 L180 | 3,0 | 0,50 | 6 | 64 | 3,0 | 18 | 0,05 | 4 | 15 | new/neu |
| VHPT 4 040 064 06 40 L080 | 4,0 | 0,20 | 6 | 64 | 4,0 | 8 | 0,10 | 4 | 15 | new/neu |
| VHPT 4 040 064 06 40 L160 | 4,0 | 0,20 | 6 | 64 | 4,0 | 16 | 0,10 | 4 | 15 | new/neu |
| VHPT 4 040 064 06 40 L240 | 4,0 | 0,20 | 6 | 64 | 4,0 | 24 | 0,10 | 4 | 15 | new/neu |
| VHPT 4 04B 064 06 40 L080 | 4,0 | 0,50 | 6 | 64 | 4,0 | 8 | 0,10 | 4 | 15 | new/neu |
| VHPT 4 04B 064 06 40 L160 | 4,0 | 0,50 | 6 | 64 | 4,0 | 16 | 0,10 | 4 | 15 | new/neu |
| VHPT 4 04B 064 06 40 L240 | 4,0 | 0,50 | 6 | 64 | 4,0 | 24 | 0,10 | 4 | 15 | new/neu |
| VHPT 4 06B 064 06 40 L120 | 6,0 | 0,50 | 6 | 64 | 6,0 | 12 | 0,15 | 4 | - | new/neu |
| VHPT 4 06B 064 06 40 L240 | 6,0 | 0,50 | 6 | 64 | 6,0 | 24 | 0,15 | 4 | - | new/neu |
| VHPT 4 06C 064 06 40 L120 | 6,0 | 1,00 | 6 | 64 | 6,0 | 12 | 0,15 | 4 | - | new/neu |
| VHPT 4 06C 064 06 40 L240 | 6,0 | 1,00 | 6 | 64 | 6,0 | 24 | 0,15 | 4 | - | new/neu |
| VHPT 4 08B 078 08 40 L160 | 8,0 | 0,50 | 8 | 78 | 8,0 | 16 | 0,20 | 4 | - | new/neu |
| VHPT 4 08B 078 08 40 L320 | 8,0 | 0,50 | 8 | 78 | 8,0 | 32 | 0,20 | 4 | - | new/neu |
| VHPT 4 08C 078 08 40 L160 | 8,0 | 1,00 | 8 | 78 | 8,0 | 16 | 0,20 | 4 | - | new/neu |
| VHPT 4 08C 078 08 40 L320 | 8,0 | 1,00 | 8 | 78 | 8,0 | 32 | 0,20 | 4 | - | new/neu |
| VHPT 4 10B 100 10 40 L200 | 10,0 | 0,50 | 10 | 100 | 10,0 | 20 | 0,20 | 4 | - | new/neu |
| VHPT 4 10B 100 10 40 L400 | 10,0 | 0,50 | 10 | 100 | 10,0 | 40 | 0,20 | 4 | - | new/neu |
| VHPT 4 10C 100 10 40 L200 | 10,0 | 1,00 | 10 | 100 | 10,0 | 20 | 0,20 | 4 | - | new/neu |
| VHPT 4 10C 100 10 40 L400 | 10,0 | 1,00 | 10 | 100 | 10,0 | 40 | 0,20 | 4 | - | new/neu |
| VHPT 4 12B 100 12 40 L240 | 12,0 | 0,50 | 12 | 100 | 12,0 | 24 | 0,20 | 4 | - | new/neu |
| VHPT 4 12B 100 12 40 L480 | 12,0 | 0,50 | 12 | 100 | 12,0 | 48 | 0,20 | 4 | - | new/neu |
| VHPT 4 12C 100 12 40 L240 | 12,0 | 1,00 | 12 | 100 | 12,0 | 24 | 0,20 | 4 | - | new/neu |
| VHPT 4 12C 100 12 40 L480 | 12,0 | 1,00 | 12 | 100 | 12,0 | 48 | 0,20 | 4 | - | new/neu |

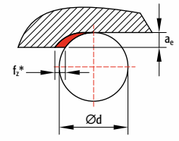



Hardened material
*Gehärtete Werkstoffe*
$a_p$ up to 1,00 x d
$a_e$ up to 0,025 x d




Hardened material
*Gehärtete Werkstoffe*
$a_p$ up to 0,030 x d
$a_e$ up to 0,015 x d

| | ***Shoulder milling / Eckfräsen*** | | | ***Profile milling / Profilfräsen*** | | |
|---|---|---|---|---|---|---|
| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
| 2,0 | < 2,0 | < 0,05 | 0,020 - 0,045 | < 0,05 | < 0,03 | 0,025 - 0,050 |
| 3,0 | < 3,0 | < 0,08 | 0,035 - 0,055 | < 0,08 | < 0,04 | 0,040 - 0,060 |
| 4,0 | < 4,0 | < 0,10 | 0,045 - 0,070 | < 0,15 | < 0,06 | 0,050 - 0,080 |
| 6,0 | < 6,0 | < 0,15 | 0,055 - 0,080 | < 0,20 | < 0,09 | 0,060 - 0,090 |
| 8,0 | < 8,0 | < 0,20 | 0,065 - 0,090 | < 0,25 | < 0,12 | 0,070 - 0,100 |
| 10,0 | < 10,0 | < 0,25 | 0,070 - 0,100 | < 0,30 | < 0,15 | 0,080 - 0,110 |
| 12,0 | < 12,0 | < 0,30 | 0,090 - 0,110 | < 0,35 | < 0,18 | 0,100 - 0,120 |



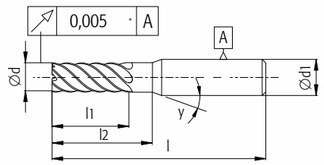

$$f_z^* = f_z \sqrt{\frac{d}{a_e}}$$

- At shoulder milling, feed per tooth $f_z$* for lower $a_e$ values should be converted according formula.

  Beim Eckfräsen ist der Vorschub $f_z$* von der Schnittbreite $a_e$ abhängig.

| $a_e$ | $f_z$*= |
|---|---|
| 0,10 x d | $f_z$ x 3 |
| 0,25 x d | $f_z$ x 2 |
| 0,50 x d | $f_z$ x 1 |

### *Standard*




* For endmills / für Schaftfräser L < 100 mm.

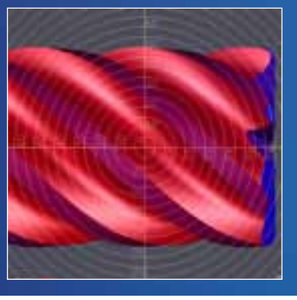
**For Coolant we advise:**
**Empfohlene Kühlung:**

- Minimum lubrication
  Minimalmengenschmierung
- Air Pressure
  Luft

| *Material group* | *TSR* (N/mm²) | *Hardness* | *Cutting speed* Vc m/min |
|---|---|---|---|
| Hardened steel | | 45-52 HRc | **120 - 180** |
| | | 50-60 HRc | **80 - 150** |
| | | 58-70 HRc | |

**Negative rake angle**
**Negativer Spanwinkel**

**New designed relief geometry**
**Neu entwickelte Schneidengeometrie**



### *Standard*

| Article Number<br>*Artikelnummer* | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
|---|---|---|---|---|---|---|---|---|---|
| VHPM 6 030 064 06 40 | 3,0 | - | 6 | 64 | 8 | 15 | 0,05 | 6 | 15 |
| VHPM 6 040 064 06 40 | 4,0 | - | 6 | 64 | 10 | 16 | 0,10 | 6 | 15 |
| VHPM 6 050 064 06 40 | 5,0 | - | 6 | 64 | 12 | 18 | 0,15 | 6 | 15 |
| VHPM 6 060 064 06 40 | 6,0 | - | 6 | 64 | 14 | 20 | 0,20 | 6 | - |
| VHPM 6 080 078 08 40 | 8,0 | - | 8 | 78 | 18 | 25 | 0,20 | 6 | - |
| VHPM 6 100 078 10 40 | 10,0 | - | 10 | 78 | 22 | 30 | 0,30 | 6 | - |
| VHPM 6 120 089 12 40 | 12,0 | - | 12 | 89 | 26 | 35 | 0,30 | 6 | - |
| VHPM 6 160 089 16 40 | 16,0 | - | 16 | 89 | 34 | 40 | 0,30 | 6 | - |
| VHPM 8 200 102 20 40 | 20,0 | - | 20 | 102 | 42 | 48 | 0,30 | 8 | - |

### *Extra teeth / Erhöhte Zähnezahl*

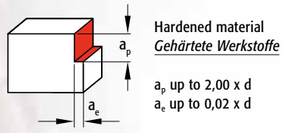
| Article Number<br>*Artikelnummer* | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
|---|---|---|---|---|---|---|---|---|---|
| VHPM 8 080 078 08 40 | 8,0 | - | 8 | 78 | 18 | 25 | 0,20 | 8 | - |
| VHPM 10 100 078 10 40 | 10,0 | - | 10 | 78 | 22 | 30 | 0,30 | 10 | - |
| VHPM 12 120 089 12 40 | 12,0 | - | 12 | 89 | 26 | 35 | 0,30 | 12 | - |
| VHPM 16 160 089 16 40 | 16,0 | - | 16 | 89 | 34 | 40 | 0,30 | 16 | - |

For an extra charge we offer an inspection report of the tool geometry.
Auf Wunsch erhalten Sie zu jedem Werkzeug ein separates Prüfprotokoll (aufpreispflichtig).



Also available with extra teeth for higher productivity.

Auch mit höherer Zähnezahl zur Produktivitätssteigerung lieferbar.

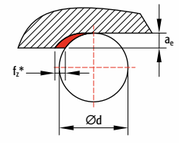



Hardened material
*Gehärtete Werkstoffe*

$a_p$ up to 2,00 x d
$a_e$ up to 0,02 x d

### *Shoulder milling / Eckfräsen*

| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 3,0 | < 3,0 | < 0,03 | 0,020 - 0,035 |
| 4,0 | < 6,0 | < 0,05 | 0,030 - 0,045 |
| 5,0 | < 7,5 | < 0,07 | 0,035 - 0,055 |
| 6,0 | < 12,0 | < 0,10 | 0,045 - 0,065 |
| 8,0 | < 16,0 | < 0,13 | 0,060 - 0,080 |
| 10,0 | < 20,0 | < 0,17 | 0,070 - 0,095 |
| 12,0 | < 24,0 | < 0,21 | 0,085 - 0,110 |
| 16,0 | < 32,0 | < 0,28 | 0,095 - 0,125 |
| 20,0 | < 40,0 | < 0,35 | 0,105 - 0,140 |
| | | | |
| 8,0 | < 16,0 | < 0,13 | 0,060 - 0,080 |
| 10,0 | < 20,0 | < 0,17 | 0,070 - 0,095 |
| 12,0 | < 24,0 | < 0,21 | 0,085 - 0,110 |
| 16,0 | < 32,0 | < 0,28 | 0,095 - 0,125 |

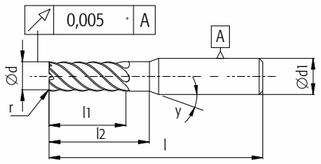



$$f_z^* = f_z \sqrt{\frac{d}{a_e}}$$

- At shoulder milling, feed per tooth $f_z^*$ for lower $a_e$ values should be converted according formula.
  Beim Eckfräsen ist der Vorschub $f_z^*$ von der Schnittbreite $a_e$ abhängig.

| $a_e$ | $f_z^*$= |
|---|---|
| 0,10 x d | $f_z$ x 3 |
| 0,25 x d | $f_z$ x 2 |
| 0,50 x d | $f_z$ x 1 |

### Standard




* For endmills / für Schaftfräser L < 100 mm.

**For Coolant we advise:**
**Empfohlene Kühlung:**

- Minimum lubrication
  Minimalmengenschmierung
- Air Pressure
  Luft

| Material group | TSR (N/mm²) | Hardness | Cutting speed Vc m/min |
|---|---|---|---|
| Hardened steel | | 45-52 HRc | **120 - 180** |
| | | 50-60 HRc | **80 - 150** |
| | | 58-70 HRc | |

### Standard

| Article Number<br>*Artikelnummer* | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
|---|---|---|---|---|---|---|---|---|---|
| VHPMR 6 030 064 06 40 030 | 3,0 | 0,3 | 6 | 64 | 8 | 15 | 0,05 | 6 | 15 |
| VHPMR 6 040 064 06 40 030 | 4,0 | 0,3 | 6 | 64 | 10 | 16 | 0,10 | 6 | 15 |
| VHPMR 6 050 064 06 40 030 | 5,0 | 0,3 | 6 | 64 | 12 | 18 | 0,15 | 6 | 15 |
| VHPMR 6 050 064 06 40 050 | 5,0 | 0,5 | 6 | 64 | 12 | 18 | 0,15 | 6 | 15 |
| VHPMR 6 060 064 06 40 050 | 6,0 | 0,5 | 6 | 64 | 14 | 20 | 0,20 | 6 | - |
| VHPMR 6 060 064 06 40 100 | 6,0 | 1,0 | 6 | 64 | 14 | 20 | 0,20 | 6 | - |
| VHPMR 6 080 070 08 40 050 | 8,0 | 0,5 | 8 | 70 | 18 | 25 | 0,30 | 6 | - |
| VHPMR 6 080 070 08 40 100 | 8,0 | 1,0 | 8 | 70 | 18 | 25 | 0,30 | 6 | - |
| VHPMR 6 100 078 10 40 050 | 10,0 | 0,5 | 10 | 78 | 22 | 30 | 0,30 | 6 | - |
| VHPMR 6 100 078 10 40 100 | 10,0 | 1,0 | 10 | 78 | 22 | 30 | 0,30 | 6 | - |
| VHPMR 6 100 078 10 40 150 | 10,0 | 1,5 | 10 | 78 | 22 | 30 | 0,30 | 6 | - |
| VHPMR 6 120 078 12 40 050 | 12,0 | 0,5 | 12 | 78 | 26 | 35 | 0,30 | 6 | - |
| VHPMR 6 120 078 12 40 100 | 12,0 | 1,0 | 12 | 78 | 26 | 35 | 0,30 | 6 | - |
| VHPMR 6 120 078 12 40 200 | 12,0 | 2,0 | 12 | 78 | 26 | 35 | 0,30 | 6 | - |
| VHPMR 6 160 089 16 40 100 | 16,0 | 1,0 | 16 | 89 | 34 | 40 | 0,30 | 6 | - |
| VHPMR 6 160 089 16 40 200 | 16,0 | 2,0 | 16 | 89 | 34 | 40 | 0,30 | 6 | - |
| VHPMR 8 200 102 20 40 100 | 20,0 | 1,0 | 20 | 102 | 42 | 48 | 0,30 | 8 | - |
| VHPMR 8 200 102 20 40 200 | 20,0 | 2,0 | 20 | 102 | 42 | 48 | 0,30 | 8 | - |

### Extra teeth / Erhöhte Zähnezahl

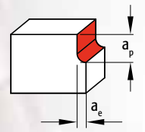
| Article Number<br>*Artikelnummer* | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
|---|---|---|---|---|---|---|---|---|---|
| VHPMR 8 080 078 08 40 050 | 8,0 | 0,5 | 8 | 78 | 18 | 25 | 0,20 | 8 | - |
| VHPMR 10 100 078 10 40 050 | 10,0 | 0,5 | 10 | 78 | 22 | 30 | 0,30 | 10 | - |
| VHPMR 12 120 089 12 40 050 | 12,0 | 0,5 | 12 | 89 | 26 | 35 | 0,30 | 12 | - |
| VHPMR 16 160 089 16 40 050 | 16,0 | 0,5 | 16 | 89 | 34 | 40 | 0,30 | 16 | - |

For an extra charge we offer an inspection report of the tool geometry
Auf Wunsch erhalten Sie zu jedem Werkzeug ein separates Prüfprotokoll (aufpreispflichtig).

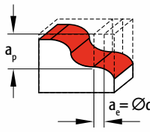


Also available with extra teeth for higher productivity

Auch mit höherer Zähnezahl zur Produktivitätssteigerung lieferbar.

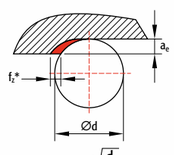



Hardened material
*Gehärtete Werkstoffe*
$a_p$ up to 2,00 x d
$a_e$ up to 0,02 x d




Hardened material
*Gehärtete Werkstoffe*
$a_p$ up to 2,00 x d
$a_e$ up to 0,02 x d

| Ød (mm) | Shoulder milling / Eckfräsen $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) | Profile milling / Profilfräsen $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|---|---|---|
| 3,0 | < 3,0 | < 0,03 | 0,020 - 0,035 | < 3,0 | < 0,03 | 0,020 - 0,035 |
| 4,0 | < 6,0 | < 0,05 | 0,030 - 0,045 | < 6,0 | < 0,05 | 0,030 - 0,045 |
| 5,0 | < 7,5 | < 0,07 | 0,035 - 0,055 | < 7,5 | < 0,07 | 0,035 - 0,055 |
| 6,0 | < 12,0 | < 0,10 | 0,045 - 0,065 | < 12,0 | < 0,10 | 0,045 - 0,065 |
| 8,0 | < 16,0 | < 0,13 | 0,060 - 0,080 | < 16,0 | < 0,13 | 0,060 - 0,080 |
| 10,0 | < 20,0 | < 0,17 | 0,070 - 0,095 | < 20,0 | < 0,17 | 0,070 - 0,095 |
| 12,0 | < 24,0 | < 0,21 | 0,085 - 0,110 | < 24,0 | < 0,21 | 0,085 - 0,110 |
| 16,0 | < 32,0 | < 0,28 | 0,095 - 0,125 | < 32,0 | < 0,28 | 0,095 - 0,125 |
| 20,0 | < 40,0 | < 0,35 | 0,105 - 0,140 | < 40,0 | < 0,35 | 0,105 - 0,140 |
| | | | | | | |
| 8,0 | < 16,0 | < 0,13 | 0,060 - 0,080 | < 16,0 | < 0,13 | 0,060 - 0,080 |
| 10,0 | < 20,0 | < 0,17 | 0,070 - 0,095 | < 20,0 | < 0,17 | 0,070 - 0,095 |
| 12,0 | < 24,0 | < 0,21 | 0,085 - 0,110 | < 24,0 | < 0,21 | 0,085 - 0,110 |
| 16,0 | < 32,0 | < 0,28 | 0,095 - 0,125 | < 32,0 | < 0,28 | 0,095 - 0,125 |




- At shoulder milling, feed per tooth $f_z$* for lower $a_e$ values should be converted according formula.
  Beim Eckfräsen ist der Vorschub $f_z$* von der Schnittbreite $a_e$ abhängig.

| $a_e$ | $f_z$*= |
|---|---|
| 0,10 x d | $f_z$ x 3 |
| 0,25 x d | $f_z$ x 2 |
| 0,50 x d | $f_z$ x 1 |

# A complete range of high end solutions for typical Mould & Die applications

## Ein vollständiges Sortiment an High-End-Produkten für den Werkzeug- und Formenbau.

An optimized combination between geometry, coating and tolerances result in an excellent surface finish and extended toollife.

Eine optimierte Kombination aus Schneidengeometrie, Beschichtung und Toleranzen gewährleisten ausgezeichnete Oberflächen und verlängerte Standzeiten.

## Micro endmills:

### Mikro-Schaftfräser:

VHC Micro Endmills:
VHC Mikro-Schaftfräser:

| | |
|---|---|
| - Sharp corners<br>Scharfkantig | VHMS<br>VHMS |
| - Corner radius<br>Eckenradius | VHMSR<br>VHMSR |
| - Ball Nose<br>Vollradius | VHMSK<br>VHMSK |

**Ballnose geometries:**
**Vollradius Geometrien:**

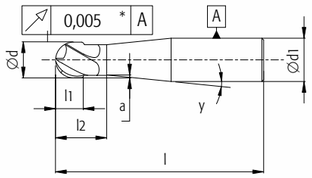
- 2 Flute
  2 Schneiden
- 4 Flute (for higher table feeds)
  4 Schneiden (für höhere Vorschübe)
- 2 Flute 220°
  2 Schneiden 220°

Multiple flutes with and without corner radius for excellent finish on side and bottom surfaces.
Mehrschneidenfräser mit und ohne Eckenradius für ausgezeichnete Oberflächen.

**Torus endmills for finishing, semi finishing and roughing applications**
**Torusfräser für Schlicht-, Semi- und Schruppbearbeitung**

- Constant cutting speed
  Konstante Schnittgeschwindigkeit
- Large effective diameter
  Großer effektiver Durchmesser
- Smoother surface finish
  Glatte Oberflächen
- 2 Flute & 4 Flute (for higher table feeds)
  2 Schneiden & 4 Schneiden (für höhere Vorschübe)

### Standard




* For endmills / für Schaftfräser L < 100 mm.

### Standard

| Article Number<br>*Artikelnummer* | Ød<br>(mm) | r<br>(mm) | Ød1<br>(mm) | L<br>(mm) | L1<br>(mm) | L2<br>(mm) | a<br>(mm) | z | γ<br>(°) |
|---|---|---|---|---|---|---|---|---|---|
| VHKF 2 030 064 06 03 | 3,0 | 1,5 | 6 | 64 | 4 | 7 | 0,05 | 2 | 5 |
| VHKF 2 030 078 06 03 | 3,0 | 1,5 | 6 | 78 | 4 | 15 | 0,05 | 2 | 4 |
| VHKF 2 030 100 06 03 | 3,0 | 1,5 | 6 | 100 | 4 | 7 | 0,05 | 2 | 2 |
| VHKF 2 040 064 06 03 | 4,0 | 2,0 | 6 | 64 | 5 | 8 | 0,10 | 2 | 4 |
| VHKF 2 040 078 06 03 | 4,0 | 2,0 | 6 | 78 | 5 | 15 | 0,10 | 2 | 3 |
| VHKF 2 040 100 06 03 | 4,0 | 2,0 | 6 | 100 | 5 | 8 | 0,10 | 2 | 1 |
| VHKF 2 050 064 06 03 | 5,0 | 2,5 | 6 | 64 | 5 | 10 | 0,15 | 2 | 3 |
| VHKF 2 050 078 06 03 | 5,0 | 2,5 | 6 | 78 | 5 | 20 | 0,15 | 2 | 2 |
| VHKF 2 060 064 06 03 | 6,0 | 3,0 | 6 | 64 | 6 | 25 | 0,20 | 2 | - |
| VHKF 2 060 078 06 03 | 6,0 | 3,0 | 6 | 78 | 6 | 35 | 0,20 | 2 | - |
| VHKF 2 060 100 08 03 | 6,0 | 3,0 | 8 | 100 | 6 | 25 | 0,20 | 2 | 2 |
| VHKF 2 080 064 08 03 | 8,0 | 4,0 | 8 | 64 | 8 | 25 | 0,30 | 2 | - |
| VHKF 2 080 078 08 03 | 8,0 | 4,0 | 8 | 78 | 8 | 35 | 0,30 | 2 | - |
| VHKF 2 080 100 08 03 | 8,0 | 4,0 | 8 | 100 | 8 | 50 | 0,30 | 2 | - |
| VHKF 2 080 120 10 03 | 8,0 | 4,0 | 10 | 120 | 8 | 30 | 0,30 | 2 | 2 |
| VHKF 2 100 078 10 03 | 10,0 | 5,0 | 10 | 78 | 10 | 35 | 0,30 | 2 | - |
| VHKF 2 100 100 10 03 | 10,0 | 5,0 | 10 | 100 | 10 | 55 | 0,30 | 2 | - |
| VHKF 2 100 120 12 03 | 10,0 | 5,0 | 12 | 120 | 10 | 30 | 0,30 | 2 | 2 |
| VHKF 2 120 078 12 03 | 12,0 | 6,0 | 12 | 78 | 12 | 35 | 0,30 | 2 | - |
| VHKF 2 120 100 12 03 | 12,0 | 6,0 | 12 | 100 | 12 | 55 | 0,30 | 2 | - |
| VHKF 2 120 120 16 03 | 12,0 | 6,0 | 16 | 120 | 12 | 40 | 0,30 | 2 | 5 |
| VHKF 2 160 100 16 03 | 16,0 | 8,0 | 16 | 100 | 20 | 50 | 0,30 | 2 | - |
| VHKF 2 160 150 16 03 | 16,0 | 8,0 | 16 | 150 | 20 | 100 | 0,30 | 2 | - |

### Long / Lange Ausführung

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| VHKFL 2 060 150 08 03 | 6,0 | 3,0 | 8 | 150 | 6 | 15 | 0,20 | 2 | 2 |
| VHKFL 2 080 150 10 03 | 8,0 | 4,0 | 10 | 150 | 8 | 20 | 0,30 | 2 | 2 |
| VHKFL 2 100 150 12 03 | 10,0 | 5,0 | 12 | 150 | 10 | 25 | 0,30 | 2 | 2 |
| VHKFL 2 120 150 16 03 | 12,0 | 6,0 | 16 | 150 | 12 | 30 | 0,30 | 2 | 3 |



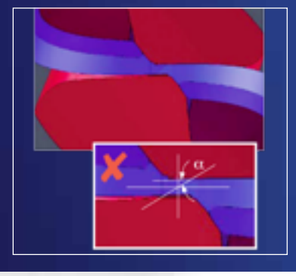


**For Coolant we advise:**
**Empfohlene Kühlung:**

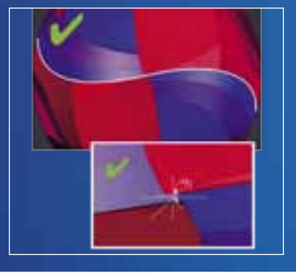
- Minimum lubrication
  Minimalmengenschmierung
- Air Pressure
  Luft

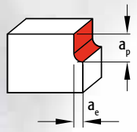
| Material group | TSR<br>(N/mm²) | Hardness<br>HB | Cutting speed<br>Vc m/min |
|---|---|---|---|
| Carbon Steel | < 750 | < 250 | **150 - 250** |
| Alloy Steel | < 1000 | < 300 | **120 - 200** |
| Tool Steel | > 850 | > 250 | **100 - 160** |
| | > 1000 | > 300 | **90 - 140** |
| Hardened steel | | 45-52 HRc | **120 - 200** |
| | | 50-60 HRc | **200 - 250** |
| | | 58-70 HRc | **220 - 270** |

**Ballnose geometry Old**
**Schneidengeometrie Alt**

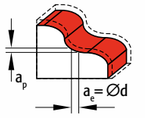



**Ballnose geometry New**
**Schneidengeometrie Neu**






Hardened material
*Gehärtete Werkstoffe*
$a_p$ up to 0,50 x d
$a_e$ up to 0,03 x d



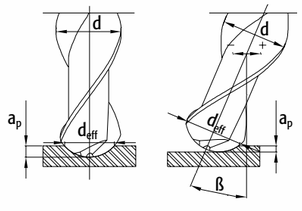

Hardened material
*Gehärtete Werkstoffe*
$a_p$ up to 0,1 x d
$a_e$ up to 0,015 x d

### Shoulder milling / Stirnfräsen

| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 1,0 | < 0,5 | < 0,02 | 0,020 - 0,030 |
| 1,5 | < 0,8 | < 0,03 | 0,020 - 0,030 |
| 2,0 | < 1,0 | < 0,04 | 0,030 - 0,050 |
| 3,0 | < 1,5 | < 0,06 | 0,040 - 0,060 |
| 4,0 | < 2,0 | < 0,10 | 0,050 - 0,080 |
| 5,0 | < 2,5 | < 0,13 | 0,060 - 0,120 |
| 6,0 | < 3,0 | < 0,18 | 0,065 - 0,125 |
| 8,0 | < 4,0 | < 0,24 | 0,080 - 0,130 |
| 10,0 | < 5,0 | < 0,30 | 0,085 - 0,135 |
| 12,0 | < 6,0 | < 0,36 | 0,100 - 0,140 |
| 16,0 | < 8,0 | < 0,50 | 0,100 - 0,150 |

### Profile milling / Profilfräsen

| $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|
| < 0,04 | < 0,01 | 0,030 - 0,040 |
| < 0,06 | < 0,02 | 0,030 - 0,040 |
| < 0,08 | < 0,02 | 0,050 - 0,075 |
| < 0,11 | < 0,03 | 0,055 - 0,090 |
| < 0,14 | < 0,05 | 0,065 - 0,100 |
| < 0,18 | < 0,07 | 0,075 - 0,120 |
| < 0,20 | < 0,09 | 0,080 - 0,125 |
| < 0,25 | < 0,12 | 0,090 - 0,130 |
| < 0,30 | < 0,15 | 0,100 - 0,135 |
| < 0,36 | < 0,20 | 0,110 - 0,140 |
| < 0,40 | < 0,28 | 0,120 - 0,150 |



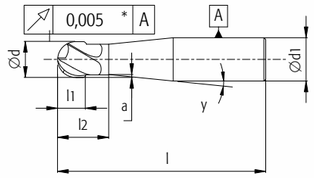

- **For the cutting speed Vc calculation the effective cutting diameter $d_{eff}$ has to be taken into account. See formula.**

  Für die Berechnung der Schnittgeschwindigkeit muss der effektive Durchmesser $d_{eff}$ berücksichtigt werden (siehe Formel).

ß = 0: $d_{eff} = 2 \bullet \sqrt{d \bullet a_p - a_p^2}$

ß ≠ 0: $d_{eff} = d \bullet \sin\left[ß \pm \arccos\left(\frac{d - 2a_p}{d}\right)\right]$

### Standard




* For endmills / für Schaftfräser L < 100 mm.

| Article Number<br>*Artikelnummer* | Ød<br>(mm) | r<br>(mm) | Ød1<br>(mm) | L<br>(mm) | L1<br>(mm) | L2<br>(mm) | a<br>(mm) | z | γ<br>(°) |
|---|---|---|---|---|---|---|---|---|---|
| VHKF 4 060 064 06 03 | 6,0 | 3,0 | 6 | 64 | 6 | 25 | 0,20 | 4 | - |
| VHKF 4 060 078 06 03 | 6,0 | 3,0 | 6 | 78 | 6 | 35 | 0,20 | 4 | - |
| VHKF 4 060 100 08 03 | 6,0 | 3,0 | 8 | 100 | 6 | 25 | 0,20 | 4 | 2 |
| VHKF 4 080 064 08 03 | 8,0 | 4,0 | 8 | 64 | 8 | 25 | 0,30 | 4 | - |
| VHKF 4 080 078 08 03 | 8,0 | 4,0 | 8 | 78 | 8 | 35 | 0,30 | 4 | - |
| VHKF 4 080 100 08 03 | 8,0 | 4,0 | 8 | 100 | 8 | 50 | 0,30 | 4 | - |
| VHKF 4 080 120 10 03 | 8,0 | 4,0 | 10 | 120 | 8 | 30 | 0,30 | 4 | 2 |
| VHKF 4 100 078 10 03 | 10,0 | 5,0 | 10 | 78 | 10 | 35 | 0,30 | 4 | - |
| VHKF 4 100 100 10 03 | 10,0 | 5,0 | 10 | 100 | 10 | 55 | 0,30 | 4 | - |
| VHKF 4 100 120 12 03 | 10,0 | 5,0 | 12 | 120 | 10 | 30 | 0,30 | 4 | 2 |
| VHKF 4 120 078 12 03 | 12,0 | 6,0 | 12 | 78 | 12 | 35 | 0,30 | 4 | - |
| VHKF 4 120 100 12 03 | 12,0 | 6,0 | 12 | 100 | 12 | 55 | 0,30 | 4 | - |
| VHKF 4 120 120 16 03 | 12,0 | 6,0 | 16 | 120 | 12 | 40 | 0,30 | 4 | 5 |
| VHKF 4 160 100 16 03 | 16,0 | 8,0 | 16 | 100 | 20 | 50 | 0,30 | 4 | - |
| VHKF 4 160 150 16 03 | 16,0 | 8,0 | 16 | 150 | 20 | 100 | 0,30 | 4 | - |





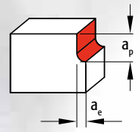
**For Coolant we advise:**
**Empfohlene Kühlung:**

- Minimum lubrication
  Minimalmengenschmierung
- Air Pressure
  Luft

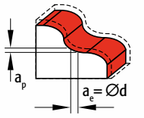
| Material group | TSR (N/mm²) | Hardness HB | Cutting speed Vc m/min |
|---|---|---|---|
| Carbon Steel | < 750 | < 250 | **150 - 250** |
| Alloy Steel | < 1000 | < 300 | **120 - 200** |
| Tool Steel | > 850 | > 250 | **100 - 160** |
| | > 1000 | > 300 | **90 - 140** |
| Hardened steel | | 45-52 HRc | **120 - 200** |
| | | 50-60 HRc | **200 - 250** |
| | | 58-70 HRc | **220 - 270** |

**Recommendations:**
**Empfehlungen:**

- Down-milling.
  Abwärtsfräsen.
- Inclination angle max. 15 degrees.
  Eintauchwinkel max. 15°.
- Use the effective diameter $d_{eff}$ to calculate cutting speed.
  Effektiven Durchmesser $d_{eff}$ bei der Schnittgeschwindigkeitsberechnung berücksichtigen.




Hardened material
*Gehärtete Werkstoffe*
$a_p$ up to 0,50 x d
$a_e$ up to 0,03 x d



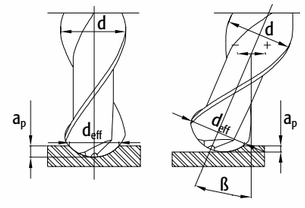

Hardened material
*Gehärtete Werkstoffe*
$a_p$ up to 0,1 x d
$a_e$ up to 0,015 x d

### Shoulder milling / Stirnfräsen

| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 6,0 | < 3,0 | < 0,18 | 0,065 - 0,125 |
| 8,0 | < 4,0 | < 0,24 | 0,080 - 0,130 |
| 10,0 | < 5,0 | < 0,30 | 0,085 - 0,135 |
| 12,0 | < 6,0 | < 0,36 | 0,100 - 0,140 |
| 16,0 | < 8,0 | < 0,50 | 0,110 - 0,150 |

### Profile milling / Profilfräsen

| $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|
| < 0,20 | < 0,09 | 0,080 - 0,125 |
| < 0,25 | < 0,12 | 0,090 - 0,130 |
| < 0,30 | < 0,15 | 0,100 - 0,135 |
| < 0,36 | < 0,20 | 0,110 - 0,140 |
| < 0,40 | < 0,28 | 0,120 - 0,150 |



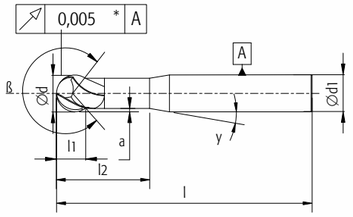

- For the cutting speed Vc calculation the effective cutting diameter $d_{eff}$ has to be taken into account. See formula.

  Für die Berechnung der Schnittgeschwindigkeit muss der effektive Durchmesser $d_{eff}$ berücksichtigt werden (siehe Formel).

ß = 0: $d_{eff} = 2 \bullet \sqrt{d \bullet a_p - a_p^2}$

ß ≠ 0: $d_{eff} = d \bullet \sin\left[ß \pm \arccos\left(\frac{d - 2a_p}{d}\right)\right]$

### *Standard*



| Article Number<br>*Artikelnummer* | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | ß (°) | z | γ (°) |
|---|---|---|---|---|---|---|---|---|---|---|
| VHKK 2 030 064 06 03 | 3,0 | 1,5 | 6 | 64 | 2,1 | 25 | 0,15 | 220 | 2 | 15 |
| VHKK 2 040 064 06 03 | 4,0 | 2,0 | 6 | 64 | 2,8 | 25 | 0,20 | 220 | 2 | 15 |
| VHKK 2 050 078 06 03 | 5,0 | 2,5 | 6 | 78 | 3,5 | 30 | 0,30 | 220 | 2 | 15 |
| VHKK 2 060 078 06 03 | 6,0 | 3,0 | 6 | 78 | 4,1 | 37 | 0,36 | 220 | 2 | - |
| VHKK 2 080 089 08 03 | 8,0 | 4,0 | 8 | 89 | 5,5 | 46 | 0,48 | 220 | 2 | - |
| VHKK 2 100 102 10 03 | 10,0 | 5,0 | 10 | 102 | 6,9 | 55 | 0,60 | 220 | 2 | - |
| VHKK 2 120 120 12 03 | 12,0 | 6,0 | 12 | 120 | 8,2 | 72 | 0,72 | 220 | 2 | - |
| VHKK 2 160 120 16 03 | 16,0 | 8,0 | 16 | 120 | 11,0 | 72 | 0,96 | 220 | 2 | - |

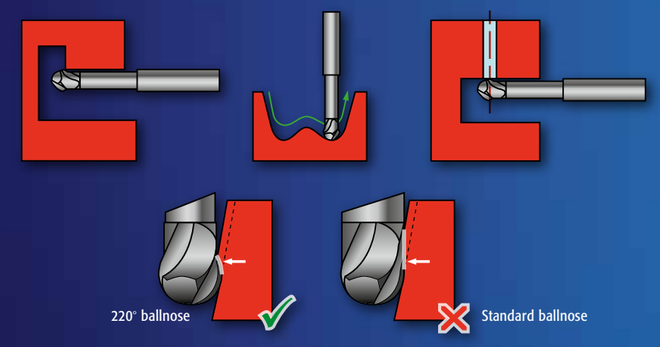


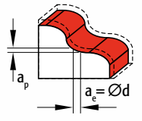


**For Coolant we advise:**
**Empfohlene Kühlung:**

- Minimum lubrication
  Minimalmengenschmierung
- Air Pressure
  Luft

| *Material group* | *TSR* (N/mm²) | *Hardness* HB | *Cutting speed* Vc m/min |
|---|---|---|---|
| Carbon Steel | < 750 | < 250 | **150 - 250** |
| Alloy Steel | < 1000 | < 300 | **120 - 200** |
| Tool Steel | > 850 | > 250 | **100 - 160** |
| | > 1000 | > 300 | **90 - 140** |
| Hardened steel | | 45-52 HRc | **120 - 200** |
| | | 50-60 HRc | **200 - 250** |
| | | 58-70 HRc | **220 - 270** |

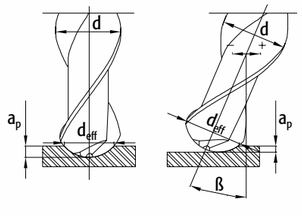



Hardened material
*Gehärtete Werkstoffe*
$a_p$ up to 0,1 x d
$a_e$ up to 0,015 x d

### *Profile milling / Profilfräsen*

| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 3,0 | < 0,11 | < 0,03 | 0,020 - 0,035 |
| 4,0 | < 0,14 | < 0,05 | 0,025 - 0,040 |
| 5,0 | < 0,18 | < 0,07 | 0,030 - 0,045 |
| 6,0 | < 0,20 | < 0,09 | 0,030 - 0,050 |
| 8,0 | < 0,25 | < 0,12 | 0,040 - 0,050 |
| 10,0 | < 0,30 | < 0,15 | 0,040 - 0,060 |
| 12,0 | < 0,36 | < 0,20 | 0,050 - 0,060 |
| 16,0 | < 0,40 | < 0,28 | 0,050 - 0,080 |



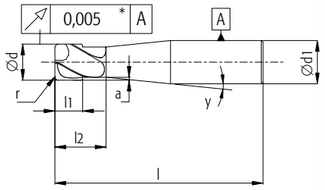

- For the cutting speed Vc calculation the effective cutting diameter $d_{eff}$ has to be taken into account. See formula.

  Für die Berechnung der Schnittgeschwindigkeit muss der effektive Durchmesser $d_{eff}$ berücksichtigt werden (siehe Formel).

ß = 0: $d_{eff} = 2 \bullet \sqrt{d \bullet a_p - a_p^2}$

ß ≠ 0: $d_{eff} = d \bullet \sin\left[ß \pm \arccos\left(\frac{d - 2a_p}{d}\right)\right]$

## *Standard*



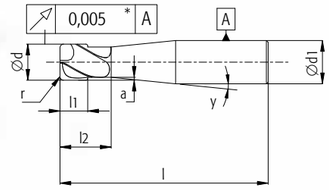

* For endmills / für Schaftfräser L < 100 mm.

| Article Number<br>*Artikelnummer* | Ød<br>(mm) | r<br>(mm) | Ød1<br>(mm) | L<br>(mm) | L1<br>(mm) | L2<br>(mm) | a<br>(mm) | z | γ<br>(°) |
|---|---|---|---|---|---|---|---|---|---|
| VHTF 2 015 064 06 03 L050 | 1,5 | 0,3 | 6 | 64 | 2 | 5 | 0,05 | 2 | 7 |
| VHTF 2 015 064 06 03 L100 | 1,5 | 0,3 | 6 | 64 | 2 | 10 | 0,05 | 2 | 9 |
| VHTF 2 020 064 06 03 | 2,0 | 0,5 | 6 | 64 | 3 | 5 | 0,05 | 2 | 6 |
| VHTF 2 020 064 06 03 L100 | 2,0 | 0,5 | 6 | 64 | 3 | 10 | 0,05 | 2 | 8 |
| VHTF 2 020 078 06 03 | 2,0 | 0,5 | 6 | 78 | 3 | 15 | 0,05 | 2 | 5 |
| VHTF 2 030 064 06 03 | 3,0 | 0,5 | 6 | 64 | 4 | 7 | 0,05 | 2 | 5 |
| VHTF 2 030 078 06 03 | 3,0 | 0,5 | 6 | 78 | 4 | 15 | 0,05 | 2 | 4 |
| VHTF 2 040 064 06 03 | 4,0 | 0,5 | 6 | 64 | 5 | 8 | 0,10 | 2 | 4 |
| VHTF 2 04D 064 06 03 | 4,0 | 1,0 | 6 | 64 | 5 | 8 | 0,10 | 2 | 4 |
| VHTF 2 04B 078 06 03 | 4,0 | 0,5 | 6 | 78 | 5 | 15 | 0,10 | 2 | 3 |
| VHTF 2 040 078 06 03 | 4,0 | 1,0 | 6 | 78 | 5 | 15 | 0,10 | 2 | 3 |
| VHTF 2 050 064 06 03 | 5,0 | 0,5 | 6 | 64 | 5 | 10 | 0,15 | 2 | 3 |
| VHTF 2 05D 064 06 03 | 5,0 | 1,0 | 6 | 64 | 5 | 10 | 0,15 | 2 | 3 |
| VHTF 2 05B 078 06 03 | 5,0 | 0,5 | 6 | 78 | 5 | 20 | 0,15 | 2 | 2 |
| VHTF 2 050 078 06 03 | 5,0 | 1,0 | 6 | 78 | 5 | 20 | 0,15 | 2 | 2 |
| VHTF 2 060 064 06 03 | 6,0 | 0,5 | 6 | 64 | 6 | 25 | 0,20 | 2 | - |
| VHTF 2 06D 064 06 03 | 6,0 | 1,0 | 6 | 64 | 6 | 25 | 0,20 | 2 | - |
| VHTF 2 06F 064 06 03 | 6,0 | 1,5 | 6 | 64 | 6 | 25 | 0,20 | 2 | - |
| VHTF 2 06B 078 06 03 | 6,0 | 0,5 | 6 | 78 | 6 | 35 | 0,20 | 2 | - |
| VHTF 2 06D 078 06 03 | 6,0 | 1,0 | 6 | 78 | 6 | 35 | 0,20 | 2 | - |
| VHTF 2 060 078 06 03 | 6,0 | 1,5 | 6 | 78 | 6 | 35 | 0,20 | 2 | - |
| VHTF 2 06B 100 08 03 | 6,0 | 0,5 | 8 | 100 | 6 | 25 | 0,20 | 2 | 2 |
| VHTF 2 06D 100 08 03 | 6,0 | 1,0 | 8 | 100 | 6 | 25 | 0,20 | 2 | 2 |
| VHTF 2 060 100 08 03 | 6,0 | 1,5 | 8 | 100 | 6 | 25 | 0,20 | 2 | 2 |





## *Standard*




* For endmills L < 100 mm.

| Article Number<br>*Artikelnummer* | Ød<br>(mm) | r<br>(mm) | Ød1<br>(mm) | L<br>(mm) | L1<br>(mm) | L2<br>(mm) | a<br>(mm) | z | γ<br>(°) |
|---|---|---|---|---|---|---|---|---|---|
| VHTF 2 08B 064 08 03 | 8,0 | 0,5 | 8 | 64 | 8 | 25 | 0,30 | 2 | - |
| VHTF 2 080 064 08 03 | 8,0 | 1,0 | 8 | 64 | 8 | 25 | 0,30 | 2 | - |
| VHTF 2 08H 064 08 03 | 8,0 | 2,0 | 8 | 64 | 8 | 25 | 0,30 | 2 | - |
| VHTF 2 08B 078 08 03 | 8,0 | 0,5 | 8 | 78 | 8 | 25 | 0,30 | 2 | - |
| VHTF 2 08D 078 08 03 | 8,0 | 1,0 | 8 | 78 | 8 | 35 | 0,30 | 2 | - |
| VHTF 2 080 078 08 03 | 8,0 | 2,0 | 8 | 78 | 8 | 35 | 0,30 | 2 | - |
| VHTF 2 08D 100 08 03 | 8,0 | 1,0 | 8 | 100 | 8 | 50 | 0,30 | 2 | - |
| VHTF 2 080 100 08 03 | 8,0 | 2,0 | 8 | 100 | 8 | 50 | 0,30 | 2 | - |
| VHTF 2 08D 120 10 03 | 8,0 | 1,0 | 10 | 120 | 8 | 30 | 0,30 | 2 | 2 |
| VHTF 2 080 120 10 03 | 8,0 | 2,0 | 10 | 120 | 8 | 30 | 0,30 | 2 | 2 |
| VHTF 2 100 078 10 03 | 10,0 | 0,5 | 10 | 78 | 10 | 35 | 0,30 | 2 | - |
| VHTF 2 10D 078 10 03 | 10,0 | 1,0 | 10 | 78 | 10 | 36 | 0,30 | 3 | - |
| VHTF 2 10H 078 10 03 | 10,0 | 2,0 | 10 | 78 | 10 | 35 | 0,30 | 2 | - |
| VHTF 2 100 100 10 03 | 10,0 | 1,0 | 10 | 100 | 10 | 55 | 0,30 | 2 | - |
| VHTF 2 10H 100 10 03 | 10,0 | 2,0 | 10 | 100 | 10 | 55 | 0,30 | 2 | - |
| VHTF 2 100 120 12 03 | 10,0 | 2,0 | 12 | 120 | 10 | 30 | 0,30 | 2 | 2 |
| VHTF 2 120 078 12 03 | 12,0 | 0,5 | 12 | 78 | 12 | 35 | 0,30 | 2 | - |
| VHTF 2 12H 078 12 03 | 12,0 | 2,0 | 12 | 78 | 12 | 35 | 0,30 | 2 | - |
| VHTF 2 120 100 12 03 | 12,0 | 1,0 | 12 | 100 | 12 | 55 | 0,30 | 2 | - |
| VHTF 2 12H 100 12 03 | 12,0 | 2,0 | 12 | 100 | 12 | 55 | 0,30 | 2 | - |
| VHTF 2 120 120 16 03 | 12,0 | 2,0 | 16 | 120 | 12 | 40 | 0,30 | 2 | 5 |
| VHTF 2 160 100 16 03 | 16,0 | 3,5 | 16 | 100 | 20 | 50 | 0,30 | 2 | - |
| VHTF 2 160 150 16 03 | 16,0 | 3,5 | 16 | 150 | 20 | 100 | 0,30 | 2 | - |

| Material group | TSR (N/mm²) | Hardness HB | Cutting speed Vc m/min |
|---|---|---|---|
| Carbon Steel | < 750 | < 250 | **150 - 250** |
| Alloy Steel | < 1000 | < 300 | **120 - 200** |
| Tool Steel | > 850 | > 250 | **100 - 160** |
| | > 1000 | > 300 | **90 - 140** |
| Hardened steel | | 45-52 HRc | **120 - 200** |
| | | 50-60 HRc | **200 - 250** |
| | | 58-70 HRc | **220 - 270** |

**For Coolant we advise:**
**Empfohlene Kühlung:**

- Minimum lubrication
  Minimalmengenschmierung
- Air Pressure
  Luft

# The accuracy of toolholding systems

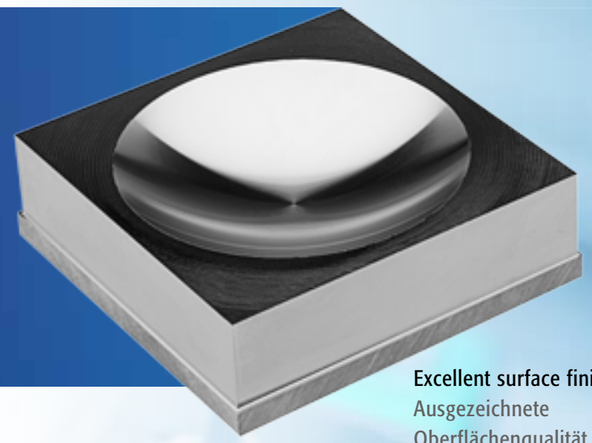
## Genauigkeit von Werkzeugspannsystemen

The radial runout is a crucial parameter in HSM applications. For this reason our application engineers recommend the most accurate and powerful system on finishing applications: the Shrink holder.

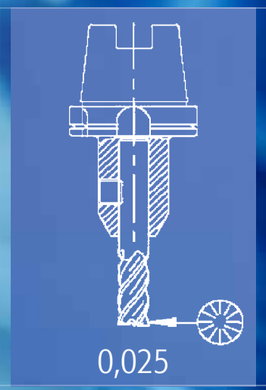
Die Rundlaufgenauigkeit der Spannwerkzeuge spielt eine entscheidende Rolle bei HSM-Anwendungen. Aus diesem Grund empfehlen unsere Anwendungstechniker Spannmittel mit hoher Genauigkeit und großen Spannkräften: Schrumpffutter.

**VHTF21000781003**
**Material** 1.2379

| | |
|---|---|
| $v_c$ | 200 m/min |
| n | 6300 rpm |
| $f_z$ | 0,10 mm/t |
| $v_f$ | 1260 mm/min |
| $a_p$ | 0,1 mm |
| $a_e$ | 0,5 mm |
| **Coolant** | min. librication |
| **Q** | **0,06 cm³/min** |

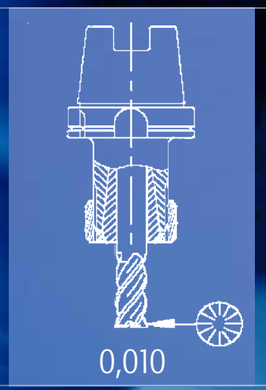


Excellent surface finish
Ausgezeichnete Oberflächenqualität



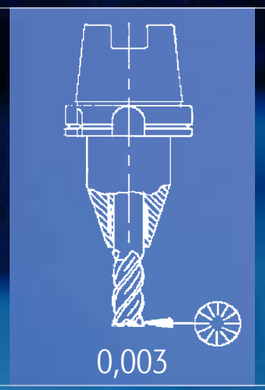
0,025

Weldon/Whistle notch
Weldon/Whistle Notch



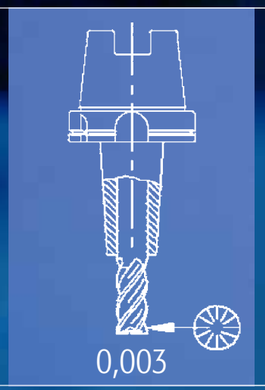
0,010

Collet chuck
Spannzangenfutter



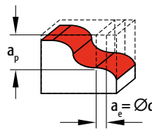
0,003

Hydrolic holder
Hydro-Dehnspannfutter

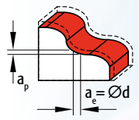


0,003

Shrink holder
Schrumpffutter

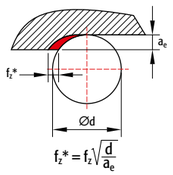



Hardened material
*Gehärtete Werkstoffe*
$a_p$ up to 0,50 x d
$a_e$ up to 0,03 x d




Hardened material
*Gehärtete Werkstoffe*
$a_p$ up to 0,1 x d
$a_e$ up to 0,015 x d

| Ød (mm) | Shoulder milling / Eckfräsen $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) | Profile milling / Profilfräsen $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|---|---|---|
| 1,5 | < 0,7 | < 0,03 | 0,025 - 0,040 | < 0,06 | < 0,01 | 0,045 - 0,060 |
| 2,0 | < 1,0 | < 0,04 | 0,030 - 0,050 | < 0,08 | < 0,02 | 0,050 - 0,075 |
| 3,0 | < 1,5 | < 0,06 | 0,040 - 0,060 | < 0,11 | < 0,03 | 0,055 - 0,090 |
| 4,0 | < 2,0 | < 0,10 | 0,050 - 0,080 | < 0,14 | < 0,05 | 0,065 - 0,100 |
| 5,0 | < 2,5 | < 0,13 | 0,060 - 0,120 | < 0,18 | < 0,07 | 0,075 - 0,120 |
| 6,0 | < 3,0 | < 0,18 | 0,065 - 0,125 | < 0,20 | < 0,09 | 0,080 - 0,125 |
| 8,0 | < 4,0 | < 0,24 | 0,080 - 0,130 | < 0,25 | < 0,12 | 0,090 - 0,130 |
| 10,0 | < 5,0 | < 0,30 | 0,085 - 0,135 | < 0,30 | < 0,15 | 0,100 - 0,135 |
| 12,0 | < 6,0 | < 0,36 | 0,100 - 0,140 | < 0,36 | < 0,20 | 0,110 - 0,140 |
| 16,0 | < 8,0 | < 0,50 | 0,110 - 0,150 | < 0,40 | < 0,28 | 0,120 - 0,150 |




$$f_z^* = f_z \sqrt{\frac{d}{a_e}}$$

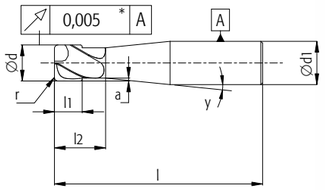
- At shoulder milling, feed per tooth $f_z$* for lower $a_e$ values should be converted according formula.
- Beim Eckfräsen ist der Vorschub $f_z$* von der Schnittbreite $a_e$ abhängig.

| $a_e$ | $f_z$*= |
|---|---|
| 0,10 x d | $f_z$ x 3 |
| 0,25 x d | $f_z$ x 2 |
| 0,50 x d | $f_z$ x 1 |

## Advantages shrinking system
## Vorteile Schrumpftechnik

- Shrinking gives a 2-3 times higher clamping force than the collet and hydrolic holder.
  Schrumpffutter besitzen eine 2-3 mal höhere Spannkraft als Spannzangen- und Hydro-Dehnspannfutter.
- Higher rigidity.
  Hohe Steifigkeit.
- Balanced design, no obstacles around the endmill.
  Schlanke Bauform.

### Standard




* For endmills / für Schaftfräser L < 100 mm.

| Article Number<br>*Artikelnummer* | Ød<br>(mm) | r<br>(mm) | Ød1<br>(mm) | L<br>(mm) | L1<br>(mm) | L2<br>(mm) | a<br>(mm) | z | γ<br>(°) |
|---|---|---|---|---|---|---|---|---|---|
| VHTF 4 060 064 06 03 050 | 6,0 | 0,5 | 6 | 64 | 6 | 25 | 0,20 | 4 | - |
| VHTF 4 060 064 06 03 100 | 6,0 | 1,0 | 6 | 64 | 6 | 25 | 0,20 | 4 | - |
| VHTF 4 060 064 06 03 150 | 6,0 | 1,5 | 6 | 64 | 6 | 25 | 0,20 | 4 | - |
| VHTF 4 060 078 06 03 050 | 6,0 | 0,5 | 6 | 78 | 6 | 35 | 0,20 | 4 | - |
| VHTF 4 060 078 06 03 150 | 6,0 | 1,5 | 6 | 78 | 6 | 35 | 0,20 | 4 | - |
| VHTF 4 060 100 08 03 050 | 6,0 | 0,5 | 8 | 100 | 6 | 25 | 0,20 | 4 | 2 |
| VHTF 4 060 100 08 03 150 | 6,0 | 1,5 | 8 | 100 | 6 | 25 | 0,20 | 4 | 2 |
| VHTF 4 080 064 08 03 050 | 8,0 | 0,5 | 8 | 64 | 8 | 25 | 0,30 | 4 | - |
| VHTF 4 080 064 08 03 100 | 8,0 | 1,0 | 8 | 64 | 8 | 25 | 0,30 | 4 | - |
| VHTF 4 080 064 08 03 200 | 8,0 | 2,0 | 8 | 64 | 8 | 25 | 0,30 | 4 | - |
| VHTF 4 080 078 08 03 050 | 8,0 | 0,5 | 8 | 78 | 8 | 25 | 0,30 | 4 | - |
| VHTF 4 080 078 08 03 100 | 8,0 | 1,0 | 8 | 78 | 8 | 35 | 0,30 | 4 | - |
| VHTF 4 080 078 08 03 200 | 8,0 | 2,0 | 8 | 78 | 8 | 35 | 0,30 | 4 | - |
| VHTF 4 080 100 08 03 100 | 8,0 | 1,0 | 8 | 100 | 8 | 50 | 0,30 | 4 | - |
| VHTF 4 080 100 08 03 200 | 8,0 | 2,0 | 8 | 100 | 8 | 50 | 0,30 | 4 | - |
| VHTF 4 080 120 10 03 100 | 8,0 | 1,0 | 10 | 120 | 8 | 30 | 0,30 | 4 | 2 |
| VHTF 4 080 120 10 03 200 | 8,0 | 2,0 | 10 | 120 | 8 | 30 | 0,30 | 4 | 2 |
| VHTF 4 100 078 10 03 050 | 10,0 | 0,5 | 10 | 78 | 10 | 35 | 0,30 | 4 | - |
| VHTF 4 100 078 10 03 200 | 10,0 | 2,0 | 10 | 78 | 10 | 35 | 0,30 | 4 | - |
| VHTF 4 100 100 10 03 100 | 10,0 | 1,0 | 10 | 100 | 10 | 55 | 0,30 | 4 | - |
| VHTF 4 100 100 10 03 200 | 10,0 | 2,0 | 10 | 100 | 10 | 55 | 0,30 | 4 | - |
| VHTF 4 100 120 12 03 200 | 10,0 | 2,0 | 12 | 120 | 10 | 30 | 0,30 | 4 | 2 |
| VHTF 4 120 078 12 03 050 | 12,0 | 0,5 | 12 | 78 | 12 | 35 | 0,30 | 4 | - |
| VHTF 4 120 078 12 03 200 | 12,0 | 2,0 | 12 | 78 | 12 | 35 | 0,30 | 4 | - |
| VHTF 4 120 100 12 03 100 | 12,0 | 1,0 | 12 | 100 | 12 | 55 | 0,30 | 4 | - |
| VHTF 4 120 100 12 03 200 | 12,0 | 2,0 | 12 | 100 | 12 | 55 | 0,30 | 4 | - |
| VHTF 4 120 120 16 03 200 | 12,0 | 2,0 | 16 | 120 | 12 | 40 | 0,30 | 4 | 5 |
| VHTF 4 160 100 16 03 350 | 16,0 | 3,5 | 16 | 100 | 20 | 50 | 0,30 | 4 | - |
| VHTF 4 160 150 16 03 350 | 16,0 | 3,5 | 16 | 150 | 20 | 100 | 0,30 | 4 | - |

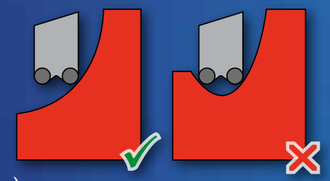
**For Coolant we advise:**
**Empfohlene Kühlung:**

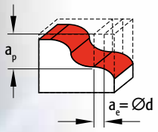
- Minimum lubrication
  Minimalmengenschmierung
- Air Pressure
  Luft

| Material group | TSR<br>(N/mm²) | Hardness<br>HB | Cutting speed<br>Vc m/min |
|---|---|---|---|
| Carbon Steel | < 750 | < 250 | **150 - 250** |
| Alloy Steel | < 1000 | < 300 | **120 - 200** |
| Tool Steel | > 850<br>> 1000 | > 250<br>> 300 | **100 - 160**<br>**90 - 140** |
| Hardened steel | | 45-52 HRc<br>50-60 HRc<br>58-70 HRc | **120 - 200**<br>**200 - 250**<br>**220 - 270** |

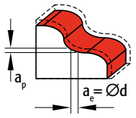
**Torus endmills:**
**Torusfräser:**

- High effective cutting speed
  Hohe Schnittgeschwindigkeit
- Optimized surface finish
  Optimale Oberflächenqualität
- 2 Flute and 4 flute
  2 Schneiden und 4 Schneiden
- Finishing – Semi finishing ( - Roughing)
  Schlicht-, Semi- und chruppbearbeitung






Hardened material
*Gehärtete Werkstoffe*
$a_p$ up to 0,50 x d
$a_e$ up to 0,03 x d



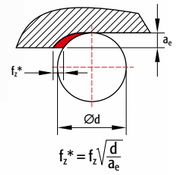

Hardened material
*Gehärtete Werkstoffe*
$a_p$ up to 0,1 x d
$a_e$ up to 0,015 x d

### Shoulder milling / Eckfräsen

| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 6,0 | < 3,0 | < 0,18 | 0,065 - 0,125 |
| 8,0 | < 4,0 | < 0,24 | 0,080 - 0,130 |
| 10,0 | < 5,0 | < 0,30 | 0,085 - 0,135 |
| 12,0 | < 6,0 | < 0,36 | 0,100 - 0,140 |
| 16,0 | < 8,0 | < 0,50 | 0,110 - 0,150 |

### Profile millin

| $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|
| < 0,20 | < 0,09 | 0,080 - 0,125 |
| < 0,25 | < 0,12 | 0,090 - 0,130 |
| < 0,30 | < 0,15 | 0,100 - 0,135 |
| < 0,36 | < 0,20 | 0,110 - 0,140 |
| < 0,40 | < 0,28 | 0,120 - 0,150 |

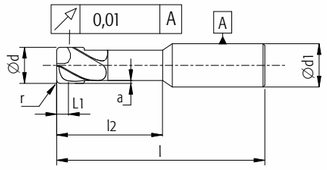


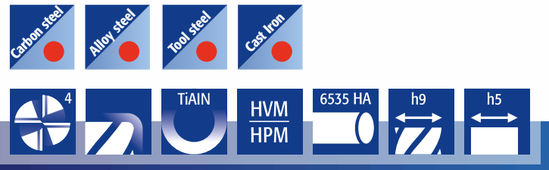

- At shoulder milling, feed per tooth $f_z$* for lower $a_e$ values should be converted according formula.

  Beim Eckfräsen ist der Vorschub $f_z$* von der Schnittbreite $a_e$ abhängig.

| $a_e$ | $f_z$*= |
|---|---|
| 0,10 x d | $f_z$ x 3 |
| 0,25 x d | $f_z$ x 2 |
| 0,50 x d | $f_z$ x 1 |

### Standard




NEW GENERATION

| Material group | TSR (N/mm²) | Hardness HB | Cutting speed Vc m/min |
|---|---|---|---|
| Carbon steel | < 750 | < 250 | **200 - 300** |
| Alloy steel | < 1000 | < 300 | **150 - 200** |
| Tool steel | > 850 | > 250 | **170 - 250** |
| | > 1000 | > 300 | **150 - 250** |
| Cast iron | | < 260 | **180 - 250** |

**VHDR4080900803L16**
**Material** 1.2311

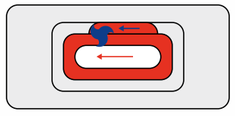
| | |
|---|---|
| $v_c$ | 150 m/min |
| n | 6000 rpm |
| $f_z$ | 0,70 mm/t |
| $v_f$ | 16800 mm/min |
| $a_p$ | 0,5 mm |
| $a_e$ | 8,0 mm |
| **Coolant** | emulsion |
| **Q** | **67,2 cm³/min** |

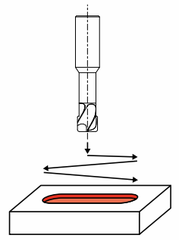
## Vf : 16,8 m/min

The new VHDR – the next step in high feed milling technology.
Der neue VHDR – ein weiterer Fortschritt beim Fräsen mit hohen Vorschüben.

**This endmill can be used for pocket milling; for strategy see drawings below. Always mill from inside to outside. If possible use helicoidal down-milling, otherwise ramping down.**

Dieser Fräser kann zum Taschenfräsen eingesetzt werden; entsprechende Frässtrategie entnehmen Sie nebenstehenden Zeichnungen. Fräsen Sie stets von Innen nach Außen. Wenn möglich zirkular Abwärtsfräsen oder Schrägeintauchen.





### 4 Flute / 4 Schneiden

| Article Number *Artikelnummer* | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) | |
|---|---|---|---|---|---|---|---|---|---|---|
| VHDR 4 020 060 06 03 L04 | 2,0 | 0,50 | 6 | 60 | 1,0 | 4 | 0,100 | 4 | 15 | new/neu |
| VHDR 4 020 060 06 03 L08 | 2,0 | 0,50 | 6 | 60 | 1,0 | 8 | 0,100 | 4 | 15 | new/neu |
| VHDR 4 030 060 06 03 L06 | 3,0 | 0,75 | 6 | 60 | 1,5 | 6 | 0,150 | 4 | 15 | new/neu |
| VHDR 4 030 060 06 03 L12 | 3,0 | 0,75 | 6 | 60 | 1,5 | 12 | 0,150 | 4 | 15 | new/neu |
| VHDR 4 040 060 06 03 L08 | 4,0 | 1,00 | 6 | 60 | 2,0 | 8 | 0,200 | 4 | 15 | new/neu |
| VHDR 4 040 060 06 03 L16 | 4,0 | 1,00 | 6 | 60 | 2,0 | 16 | 0,200 | 4 | 15 | new/neu |
| VHDR 4 060 080 06 03 L12 | 6,0 | 1,50 | 6 | 80 | 3,0 | 12 | 0,250 | 4 | - | new/neu |
| VHDR 4 060 080 06 03 L24 | 6,0 | 1,50 | 6 | 80 | 3,0 | 24 | 0,250 | 4 | - | new/neu |
| VHDR 4 080 090 08 03 L16 | 8,0 | 2,00 | 8 | 90 | 4,0 | 16 | 0,300 | 4 | - | new/neu |
| VHDR 4 080 090 08 03 L32 | 8,0 | 2,00 | 8 | 90 | 4,0 | 32 | 0,300 | 4 | - | new/neu |
| VHDR 4 100 100 10 03 L20 | 10,0 | 2,50 | 10 | 100 | 5,0 | 20 | 0,400 | 4 | - | new/neu |
| VHDR 4 100 100 10 03 L40 | 10,0 | 2,50 | 10 | 100 | 5,0 | 40 | 0,400 | 4 | - | new/neu |
| VHDR 4 120 100 12 03 L24 | 12,0 | 3,00 | 12 | 110 | 6,0 | 24 | 0,500 | 4 | - | new/neu |
| VHDR 4 120 100 12 03 L48 | 12,0 | 3,00 | 12 | 110 | 6,0 | 48 | 0,500 | 4 | - | new/neu |

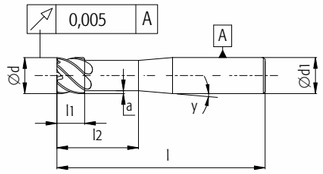
### Shoulder milling / Eckfräsen

| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 2,0 | < 0,1 | < 1,2 | 0,3 - 0,7 |
| 3,0 | < 0,2 | < 1,8 | 0,3 - 0,7 |
| 4,0 | < 0,3 | < 2,4 | 0,3 - 0,7 |
| 6,0 | < 0,4 | < 4,0 | 0,5 - 1,0 |
| 8,0 | < 0,5 | < 5,5 | 0,5 - 1,0 |
| 10,0 | < 0,6 | < 7,0 | 0,5 - 1,0 |
| 12,0 | < 0,8 | < 8,4 | 0,5 - 1,0 |
| | | | |
| 8,0 | < 0,5 | < 5,6 | 0,5 - 1,0 |
| 10,0 | < 0,6 | < 7,0 | 0,5 - 1,0 |
| 12,0 | < 0,8 | < 8,4 | 0,5 - 1,0 |

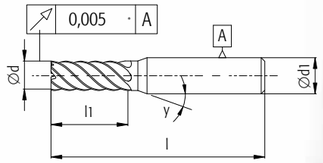
### Slot milling / Nutenfräsen

| $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|
| < 0,1 | < 2,0 | 0,3 - 0,6 |
| < 0,2 | < 3,0 | 0,3 - 0,6 |
| < 0,3 | < 4,0 | 0,3 - 0,6 |
| < 0,4 | < 6,0 | 0,4 - 0,9 |
| < 0,5 | < 8,0 | 0,4 - 0,9 |
| < 0,6 | < 10,0 | 0,4 - 0,9 |
| < 0,8 | < 12,0 | 0,4 - 0,9 |
| | | |
| < 0,5 | < 8,0 | 0,4 - 0,9 |
| < 0,6 | < 10,0 | 0,4 - 0,9 |
| < 0,8 | < 12,0 | 0,4 - 0,9 |

### Short / Kurze Ausführung




### Standard/Long / Lange Ausführung




* For endmills / für Schaftfräser L < 100 mm.

**For Coolant we advise:**
**Empfohlene Kühlung:**

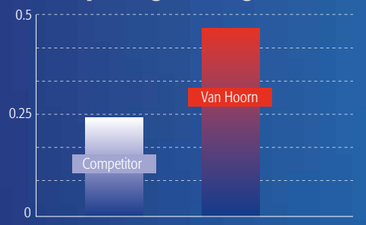
- Minimum lubrication
  Minimalmengenschmierung
- Air Pressure
  Luft

| Material group | TSR (N/mm²) | Hardness HB | Cutting speed Vc m/min |
|---|---|---|---|
| Carbon Steel | < 750 | < 250 | **130 - 180** |
| Alloy Steel | < 1000 | < 300 | **100 - 160** |
| Tool Steel | > 850 | > 250 | **90 - 140** |
| | > 1000 | > 300 | **80 - 120** |
| Hardened steel | | 45-52 HRc | **80 - 140** |
| | | 50-60 HRc | **120 - 200** |
| | | 58-70 HRc | **100 - 180** |

**VHMF60600640603**
**Workpiece Material:** 1.2343
**Hardness:** 52 HRC

| | Van Hoorn | Competitor |
|---|---|---|
| $v_c$ | 132 m/min | 132 m/min |
| n | 7000 rpm | 7000 rpm |
| $F_z$ | 0,036 mm/t | 0,029 mm/t |
| $v_f$ | 1500 mm/min | 800 mm/min |
| $a_p$ | 0,1 mm | 0,1 mm |
| $a_e$ | 3,0 mm | 3,0 mm |
| Coolant | min. lubrication | min. lubrication |
| Q | **0,45 mm³/min** | **0,24 mm³/min** |

## Material removal rate
## Zerspanungsleistung




### Short / Kurze Ausführung

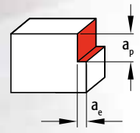
| Article Number / Artikelnummer | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
|---|---|---|---|---|---|---|---|---|---|
| VHMF 6 030 064 06 03 S | 3,0 | - | 6 | 64 | 3 | 10 | 0,05 | 6 | 15 |
| VHMF 6 040 064 06 03 S | 4,0 | - | 6 | 64 | 4 | 10 | 0,10 | 6 | 15 |
| VHMF 6 050 064 06 03 S | 5,0 | - | 6 | 64 | 5 | 15 | 0,15 | 6 | 15 |
| VHMF 6 060 064 06 03 S | 6,0 | - | 6 | 64 | 6 | 20 | 0,20 | 6 | - |
| VHMF 6 080 064 08 03 S | 8,0 | - | 8 | 64 | 8 | 20 | 0,30 | 6 | - |
| VHMF 6 100 070 10 03 S | 10,0 | - | 10 | 70 | 10 | 25 | 0,30 | 6 | - |
| VHMF 6 120 078 12 03 S | 12,0 | - | 12 | 78 | 12 | 25 | 0,30 | 6 | - |
| VHMF 6 160 089 16 03 S | 16,0 | - | 16 | 89 | 16 | 35 | 0,30 | 6 | - |
| VHMF 8 200 102 20 03 S | 20,0 | - | 20 | 102 | 20 | 40 | 0,30 | 8 | - |

### Standard

| Article Number / Artikelnummer | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
|---|---|---|---|---|---|---|---|---|---|
| VHMF 6 030 064 06 03 | 3,0 | - | 6 | 64 | 10 | - | - | 6 | 15 |
| VHMF 6 040 064 06 03 | 4,0 | - | 6 | 64 | 10 | - | - | 6 | 15 |
| VHMF 6 050 064 06 03 | 5,0 | - | 6 | 64 | 15 | - | - | 6 | 15 |
| VHMF 6 060 064 06 03 | 6,0 | - | 6 | 64 | 20 | - | - | 6 | - |
| VHMF 6 080 064 08 03 | 8,0 | - | 8 | 64 | 20 | - | - | 6 | - |
| VHMF 6 100 070 10 03 | 10,0 | - | 10 | 70 | 25 | - | - | 6 | - |
| VHMF 6 120 078 12 03 | 12,0 | - | 12 | 78 | 25 | - | - | 6 | - |
| VHMF 6 160 089 16 03 | 16,0 | - | 16 | 89 | 35 | - | - | 6 | - |
| VHMF 8 200 102 20 03 | 20,0 | - | 20 | 102 | 40 | - | - | 8 | - |

### Long / Lange Ausführung

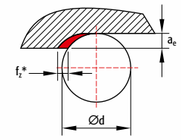
| Article Number / Artikelnummer | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
|---|---|---|---|---|---|---|---|---|---|
| VHMF 6 080 089 08 03 L | 8,0 | - | 8 | 89 | 35 | - | - | 6 | - |
| VHMF 6 100 100 10 03 L | 10,0 | - | 10 | 100 | 45 | - | - | 6 | - |
| VHMF 6 120 125 12 03 L | 12,0 | - | 12 | 125 | 55 | - | - | 6 | - |
| VHMF 6 160 150 16 03 L | 16,0 | - | 16 | 150 | 65 | - | - | 6 | - |




Hardened material
*Gehärtete Werkstoffe*
$a_p$ up to 2,00 x d
$a_e$ up to 0,03 x d

### Shoulder milling / Eckfräsen

| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 3,0 | < 3,0 | < 0,06 | 0,020 - 0,035 |
| 4,0 | < 6,0 | < 0,10 | 0,030 - 0,045 |
| 5,0 | < 7,5 | < 0,12 | 0,035 - 0,055 |
| 6,0 | < 12,0 | < 0,18 | 0,045 - 0,065 |
| 8,0 | < 16,0 | < 0,24 | 0,060 - 0,080 |
| 10,0 | < 20,0 | < 0,30 | 0,070 - 0,095 |
| 12,0 | < 24,0 | < 0,36 | 0,085 - 0,110 |
| 16,0 | < 32,0 | < 0,48 | 0,095 - 0,125 |
| 20,0 | < 40,0 | < 0,60 | 0,105 - 0,140 |

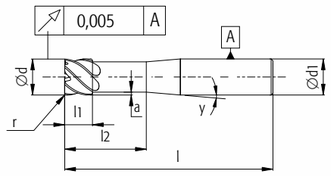



$$f_z^* = f_z \sqrt{\frac{d}{a_e}}$$

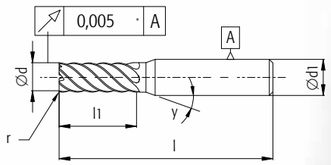
- At shoulder milling, feed per tooth $f_z$* for lower $a_e$ values should be converted according formula.
  Beim Eckfräsen ist der Vorschub $f_z$* von der Schnittbreite $a_e$ abhängig.
- Cutting conditions are based on standard VHMF length; when using VHMF Long version reduce $f_z$ with 30%.
  Die angegebenen Schnittdaten beziehen sich auf die Standardlänge VHMF; für die lange VHMF Ausführung muss der Zahnvorschub $f_z$ um 30% reduziert werden.

| $a_e$ | $f_z$*= |
|---|---|
| 0,10 x d | $f_z$ x 3 |
| 0,25 x d | $f_z$ x 2 |
| 0,50 x d | $f_z$ x 1 |

### Short / Kurze Ausführung




### Standard




* For endmills / für Schaftfräser L < 100 mm.

**For Coolant we advise:**
**Empfohlene Kühlung:**

- Minimum lubrication
  Minimalmengenschmierung
- Air Pressure
  Luft

| Material group | TSR (N/mm²) | Hardness HB | Cutting speed Vc m/min |
|---|---|---|---|
| Carbon Steel | < 750 | < 250 | **130 - 180** |
| Alloy Steel | < 1000 | < 300 | **100 - 160** |
| Tool Steel | > 850 | > 250 | **90 - 140** |
| | > 1000 | > 300 | **80 - 120** |
| Hardened steel | | 45-52 HRc | **80 - 140** |
| | | 50-60 HRc | **120 - 200** |
| | | 58-70 HRc | **100 - 180** |

**VHMF**
Recommended for Side milling.
Empfohlen für Stirnfräsen.

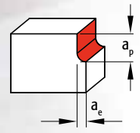
**VHMFR**
Recommended for Shoulder milling.
Empfohlen für Eckfräsen.

### Short / Kurze Ausführung

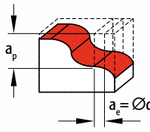
| Article Number / Artikelnummer | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
|---|---|---|---|---|---|---|---|---|---|
| VHMFR 6 030 064 06 03 030 S | 3,0 | 0,3 | 6 | 64 | 3 | 10 | 0,05 | 6 | 15 |
| VHMFR 6 040 064 06 03 030 S | 4,0 | 0,3 | 6 | 64 | 4 | 10 | 0,10 | 6 | 15 |
| VHMFR 6 050 064 06 03 030 S | 5,0 | 0,3 | 6 | 64 | 5 | 15 | 0,15 | 6 | 15 |
| VHMFR 6 050 064 06 03 050 S | 5,0 | 0,5 | 6 | 64 | 5 | 15 | 0,15 | 6 | 15 |
| VHMFR 6 060 064 06 03 050 S | 6,0 | 0,5 | 6 | 64 | 6 | 20 | 0,20 | 6 | - |
| VHMFR 6 060 064 06 03 100 S | 6,0 | 1,0 | 6 | 64 | 6 | 20 | 0,20 | 6 | - |
| VHMFR 6 080 064 08 03 050 S | 8,0 | 0,5 | 8 | 64 | 8 | 20 | 0,30 | 6 | - |
| VHMFR 6 080 064 08 03 100 S | 8,0 | 1,0 | 8 | 64 | 8 | 20 | 0,30 | 6 | - |
| VHMFR 6 100 070 10 03 050 S | 10,0 | 0,5 | 10 | 70 | 10 | 25 | 0,30 | 6 | - |
| VHMFR 6 100 070 10 03 100 S | 10,0 | 1,0 | 10 | 70 | 10 | 25 | 0,30 | 6 | - |
| VHMFR 6 100 070 10 03 150 S | 10,0 | 1,5 | 10 | 70 | 10 | 25 | 0,30 | 6 | - |
| VHMFR 6 120 078 12 03 050 S | 12,0 | 0,5 | 12 | 78 | 12 | 25 | 0,30 | 6 | - |
| VHMFR 6 120 078 12 03 100 S | 12,0 | 1,0 | 12 | 78 | 12 | 25 | 0,30 | 6 | - |
| VHMFR 6 120 078 12 03 200 S | 12,0 | 2,0 | 12 | 78 | 12 | 25 | 0,30 | 6 | - |
| VHMFR 6 160 089 16 03 100 S | 16,0 | 1,0 | 16 | 89 | 16 | 35 | 0,30 | 6 | - |
| VHMFR 6 160 089 16 03 200 S | 16,0 | 2,0 | 16 | 89 | 16 | 35 | 0,30 | 6 | - |
| VHMFR 8 200 102 20 03 100 S | 20,0 | 1,0 | 20 | 102 | 20 | 40 | 0,30 | 8 | - |
| VHMFR 8 200 102 20 03 200 S | 20,0 | 2,0 | 20 | 102 | 20 | 40 | 0,30 | 8 | - |

### Standard

| Article Number / Artikelnummer | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
|---|---|---|---|---|---|---|---|---|---|
| VHMFR 6 030 064 06 03 030 | 3,0 | 0,3 | 6 | 64 | 10 | - | - | 6 | 15 |
| VHMFR 6 040 064 06 03 030 | 4,0 | 0,3 | 6 | 64 | 10 | - | - | 6 | 15 |
| VHMFR 6 050 064 06 03 030 | 5,0 | 0,3 | 6 | 64 | 15 | - | - | 6 | 15 |
| VHMFR 6 050 064 06 03 050 | 5,0 | 0,5 | 6 | 64 | 15 | - | - | 6 | 15 |
| VHMFR 6 060 064 06 03 050 | 6,0 | 0,5 | 6 | 64 | 20 | - | - | 6 | - |
| VHMFR 6 060 064 06 03 100 | 6,0 | 1,0 | 6 | 64 | 20 | - | - | 6 | - |
| VHMFR 6 080 064 08 03 050 | 8,0 | 0,5 | 8 | 64 | 20 | - | - | 6 | - |
| VHMFR 6 080 064 08 03 100 | 8,0 | 1,0 | 8 | 64 | 20 | - | - | 6 | - |
| VHMFR 6 100 070 10 03 050 | 10,0 | 0,5 | 10 | 70 | 25 | - | - | 6 | - |
| VHMFR 6 100 070 10 03 100 | 10,0 | 1,0 | 10 | 70 | 25 | - | - | 6 | - |
| VHMFR 6 100 070 10 03 150 | 10,0 | 1,5 | 10 | 70 | 25 | - | - | 6 | - |
| VHMFR 6 120 078 12 03 050 | 12,0 | 0,5 | 12 | 78 | 25 | - | - | 6 | - |
| VHMFR 6 120 078 12 03 100 | 12,0 | 1,0 | 12 | 78 | 25 | - | - | 6 | - |
| VHMFR 6 120 078 12 03 200 | 12,0 | 2,0 | 12 | 78 | 25 | - | - | 6 | - |
| VHMFR 6 160 089 16 03 100 | 16,0 | 1,0 | 16 | 89 | 35 | - | - | 6 | - |
| VHMFR 6 160 089 16 03 200 | 16,0 | 2,0 | 16 | 89 | 35 | - | - | 6 | - |
| VHMFR 8 200 102 20 03 100 | 20,0 | 1,0 | 20 | 102 | 40 | - | - | 8 | - |
| VHMFR 8 200 102 20 03 200 | 20,0 | 2,0 | 20 | 102 | 40 | - | - | 8 | - |




Hardened material
*Gehärtete Werkstoffe*
$a_p$ up to 2,00 x d
$a_e$ up to 0,03 x d



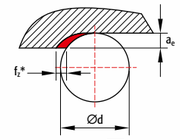

Hardened material
*Gehärtete Werkstoffe*
$a_p$ up to 2,00 x d
$a_e$ up to 0,03 x d

### Shoulder milling / Eckfräsen

| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 3,0 | < 3,0 | < 0,06 | 0,020 - 0,035 |
| 4,0 | < 6,0 | < 0,10 | 0,030 - 0,045 |
| 5,0 | < 7,5 | < 0,12 | 0,035 - 0,055 |
| 6,0 | < 12,0 | < 0,18 | 0,045 - 0,065 |
| 8,0 | < 16,0 | < 0,24 | 0,060 - 0,080 |
| 10,0 | < 20,0 | < 0,30 | 0,070 - 0,095 |
| 12,0 | < 24,0 | < 0,36 | 0,085 - 0,110 |
| 16,0 | < 32,0 | < 0,48 | 0,095 - 0,125 |
| 20,0 | < 40,0 | < 0,60 | 0,105 - 0,140 |

### Profile milling / Profilfräsen

| $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|
| < 3,0 | < 0,06 | 0,020 - 0,035 |
| < 6,0 | < 0,10 | 0,030 - 0,045 |
| < 7,5 | < 0,12 | 0,035 - 0,055 |
| < 12,0 | < 0,18 | 0,045 - 0,065 |
| < 16,0 | < 0,24 | 0,060 - 0,080 |
| < 20,0 | < 0,30 | 0,070 - 0,095 |
| < 24,0 | < 0,36 | 0,085 - 0,110 |
| < 32,0 | < 0,48 | 0,095 - 0,125 |
| < 40,0 | < 0,60 | 0,105 - 0,140 |

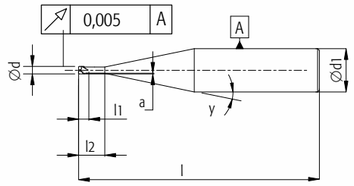



$$f_z^* = f_z \sqrt{\frac{d}{a_e}}$$

- At shoulder milling, feed per tooth $f_z$* for lower $a_e$ values should be converted according formula.
  Beim Eckfräsen ist der Vorschub $f_z$* von der Schnittbreite $a_e$ abhängig.
- Cutting conditions are based on standard VHMFR length.
  Die angegebenen Schnittdaten beziehen sich auf die Standardlänge VHMFR.

| $a_e$ | $f_z$*= |
|---|---|
| 0,10 x d | $f_z$ x 3 |
| 0,25 x d | $f_z$ x 2 |
| 0,50 x d | $f_z$ x 1 |

***Standard***

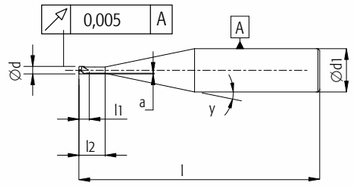


| Article Number<br>*Artikelnummer* | Ød<br>(mm) | r<br>(mm) | Ød1<br>(mm) | L<br>(mm) | L1<br>(mm) | L2<br>(mm) | a<br>(mm) | z | γ<br>(°) |
|---|---|---|---|---|---|---|---|---|---|
| VHMS 2 001 064 06 03 L0015 | 0,1 | - | 6 | 64 | 0,15 | 0,15 | - | 2 | 10 |
| VHMS 2 002 064 06 03 L003 | 0,2 | - | 6 | 64 | 0,30 | 0,30 | - | 2 | 10 |
| VHMS 2 003 064 06 03 L006 | 0,3 | - | 6 | 64 | 0,50 | 0,60 | - | 2 | 11 |
| VHMS 2 003 064 06 03 L015 | 0,3 | - | 6 | 64 | 0,50 | 1,50 | 0,010 | 2 | 11 |
| VHMS 2 003 064 06 03 L030 | 0,3 | - | 6 | 64 | 0,50 | 3,00 | 0,010 | 2 | 12 |
| VHMS 2 004 064 06 03 L008 | 0,4 | - | 6 | 64 | 0,60 | 0,80 | - | 2 | 11 |
| VHMS 2 004 064 06 03 L020 | 0,4 | - | 6 | 64 | 0,60 | 2,00 | 0,010 | 2 | 11 |
| VHMS 2 004 064 06 03 L040 | 0,4 | - | 6 | 64 | 0,60 | 4,00 | 0,010 | 2 | 13 |
| VHMS 2 005 064 06 03 L010 | 0,5 | - | 6 | 64 | 0,80 | 1,00 | - | 2 | 11 |
| VHMS 2 005 064 06 03 L030 | 0,5 | - | 6 | 64 | 0,80 | 3,00 | 0,015 | 2 | 12 |
| VHMS 2 005 064 06 03 L060 | 0,5 | - | 6 | 64 | 0,80 | 6,00 | 0,015 | 2 | 15 |
| VHMS 2 005 064 06 03 L080 | 0,5 | - | 6 | 64 | 0,80 | 8,00 | 0,015 | 2 | 15 |
| VHMS 2 005 064 06 03 L100 | 0,5 | - | 6 | 64 | 0,80 | 10,00 | 0,015 | 2 | 15 |
| VHMS 2 006 064 06 03 L012 | 0,6 | - | 6 | 64 | 0,90 | 1,20 | - | 2 | 10 |
| VHMS 2 006 064 06 03 L020 | 0,6 | - | 6 | 64 | 0,90 | 2,00 | 0,025 | 2 | 11 |
| VHMS 2 006 064 06 03 L040 | 0,6 | - | 6 | 64 | 0,90 | 4,00 | 0,025 | 2 | 13 |
| VHMS 2 006 064 06 03 L060 | 0,6 | - | 6 | 64 | 0,90 | 6,00 | 0,025 | 2 | 15 |
| VHMS 2 006 064 06 03 L080 | 0,6 | - | 6 | 64 | 0,90 | 8,00 | 0,025 | 2 | 15 |
| VHMS 2 006 064 06 03 L100 | 0,6 | - | 6 | 64 | 0,90 | 10,00 | 0,025 | 2 | 15 |
| VHMS 2 008 064 06 03 L016 | 0,8 | - | 6 | 64 | 1,20 | 1,60 | - | 2 | 10 |
| VHMS 2 008 064 06 03 L025 | 0,8 | - | 6 | 64 | 1,20 | 2,50 | 0,025 | 2 | 11 |
| VHMS 2 008 064 06 03 L050 | 0,8 | - | 6 | 64 | 1,20 | 5,00 | 0,025 | 2 | 13 |
| VHMS 2 008 064 06 03 L080 | 0,8 | - | 6 | 64 | 1,20 | 8,00 | 0,025 | 2 | 15 |
| VHMS 2 008 064 06 03 L100 | 0,8 | - | 6 | 64 | 1,20 | 10,00 | 0,025 | 2 | 15 |
| VHMS 2 010 064 06 03 L020 | 1,0 | - | 6 | 64 | 1,50 | 2,00 | - | 2 | 10 |
| VHMS 2 010 064 06 03 L040 | 1,0 | - | 6 | 64 | 1,50 | 4,00 | 0,025 | 2 | 12 |
| VHMS 2 010 064 06 03 L060 | 1,0 | - | 6 | 64 | 1,50 | 6,00 | 0,025 | 2 | 14 |
| VHMS 2 010 064 06 03 L100 | 1,0 | - | 6 | 64 | 1,50 | 10,00 | 0,025 | 2 | 15 |
| VHMS 2 010 064 06 03 L150 | 1,0 | - | 6 | 64 | 1,50 | 15,00 | 0,025 | 2 | 15 |
| VHMS 2 010 064 06 03 L200 | 1,0 | - | 6 | 64 | 1,50 | 20,00 | 0,025 | 2 | 15 |
| VHMS 2 010 064 06 03 L250 | 1,0 | - | 6 | 64 | 1,50 | 25,00 | 0,025 | 2 | 15 |



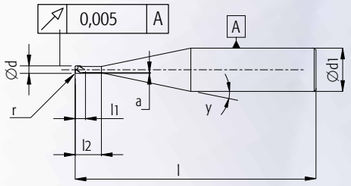


***Standard***



| Article Number<br>*Artikelnummer* | Ød<br>(mm) | r<br>(mm) | Ød1<br>(mm) | L<br>(mm) | L1<br>(mm) | L2<br>(mm) | a<br>(mm) | z | γ<br>(°) |
|---|---|---|---|---|---|---|---|---|---|
| VHMS 2 012 064 06 03 L024 | 1,2 | - | 6 | 64 | 1,8 | 2,4 | - | 2 | 10 |
| VHMS 2 012 064 06 03 L040 | 1,2 | - | 6 | 64 | 1,8 | 4,0 | 0,025 | 2 | 11 |
| VHMS 2 012 064 06 03 L060 | 1,2 | - | 6 | 64 | 1,8 | 6,0 | 0,025 | 2 | 14 |
| VHMS 2 012 064 06 03 L080 | 1,2 | - | 6 | 64 | 1,8 | 8,0 | 0,025 | 2 | 15 |
| VHMS 2 012 064 06 03 L120 | 1,2 | - | 6 | 64 | 1,8 | 12,0 | 0,025 | 2 | 15 |
| VHMS 2 012 064 06 03 L160 | 1,2 | - | 6 | 64 | 1,8 | 16,0 | 0,025 | 2 | 15 |
| VHMS 2 015 064 06 03 L030 | 1,5 | - | 6 | 64 | 2,3 | 3,0 | - | 2 | 10 |
| VHMS 2 015 064 06 03 L060 | 1,5 | - | 6 | 64 | 2,3 | 6,0 | 0,025 | 2 | 13 |
| VHMS 2 015 064 06 03 L100 | 1,5 | - | 6 | 64 | 2,3 | 10,0 | 0,025 | 2 | 15 |
| VHMS 2 015 064 06 03 L150 | 1,5 | - | 6 | 64 | 2,3 | 15,0 | 0,025 | 2 | 15 |
| VHMS 2 015 064 06 03 L200 | 1,5 | - | 6 | 64 | 2,3 | 20,0 | 0,025 | 2 | 15 |
| VHMS 2 015 064 06 03 L250 | 1,5 | - | 6 | 64 | 2,3 | 25,0 | 0,025 | 2 | 15 |
| VHMS 2 020 064 06 03 L030 | 2,0 | - | 6 | 64 | 3,0 | 3,0 | - | 2 | 9 |
| VHMS 2 020 064 06 03 L060 | 2,0 | - | 6 | 64 | 3,0 | 6,0 | 0,050 | 2 | 11 |
| VHMS 2 020 064 06 03 L100 | 2,0 | - | 6 | 64 | 3,0 | 10,0 | 0,050 | 2 | 15 |
| VHMS 2 020 064 06 03 L160 | 2,0 | - | 6 | 64 | 3,0 | 16,0 | 0,050 | 2 | 15 |
| VHMS 2 020 064 06 03 L200 | 2,0 | - | 6 | 64 | 3,0 | 20,0 | 0,050 | 2 | 15 |
| VHMS 2 020 064 06 03 L250 | 2,0 | - | 6 | 64 | 3,0 | 25,0 | 0,050 | 2 | 15 |
| VHMS 2 020 064 06 03 L300 | 2,0 | - | 6 | 64 | 3,0 | 30,0 | 0,050 | 2 | 15 |
| VHMS 2 025 064 06 03 L030 | 2,5 | - | 6 | 64 | 3,0 | 3,0 | - | 2 | 8 |
| VHMS 2 025 064 06 03 L060 | 2,5 | - | 6 | 64 | 3,0 | 6,0 | 0,050 | 2 | 10 |
| VHMS 2 025 064 06 03 L100 | 2,5 | - | 6 | 64 | 3,0 | 10,0 | 0,050 | 2 | 15 |
| VHMS 2 025 064 06 03 L160 | 2,5 | - | 6 | 64 | 3,0 | 16,0 | 0,050 | 2 | 15 |
| VHMS 2 025 064 06 03 L200 | 2,5 | - | 6 | 64 | 3,0 | 20,0 | 0,050 | 2 | 15 |
| VHMS 2 025 064 06 03 L250 | 2,5 | - | 6 | 64 | 3,0 | 25,0 | 0,050 | 2 | 15 |
| VHMS 2 030 064 06 03 L030 | 3,0 | - | 6 | 64 | 3,0 | 3,0 | - | 2 | 7 |
| VHMS 2 030 064 06 03 L060 | 3,0 | - | 6 | 64 | 3,0 | 6,0 | 0,050 | 2 | 9 |
| VHMS 2 030 064 06 03 L100 | 3,0 | - | 6 | 64 | 3,0 | 10,0 | 0,050 | 2 | 14 |
| VHMS 2 030 064 06 03 L160 | 3,0 | - | 6 | 64 | 3,0 | 16,0 | 0,050 | 2 | 15 |
| VHMS 2 030 064 06 03 L200 | 3,0 | - | 6 | 64 | 3,0 | 20,0 | 0,050 | 2 | 15 |
| VHMS 2 030 064 06 03 L250 | 3,0 | - | 6 | 64 | 3,0 | 25,0 | 0,050 | 2 | 15 |
| VHMS 2 030 064 06 03 L300 | 3,0 | - | 6 | 64 | 3,0 | 30,0 | 0,050 | 2 | 15 |

## Standard

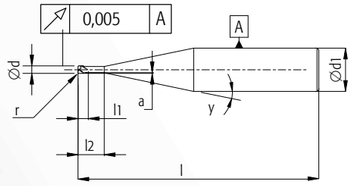


| Article Number<br>*Artikelnummer* | Ød<br>(mm) | r<br>(mm) | Ød1<br>(mm) | L<br>(mm) | L1<br>(mm) | L2<br>(mm) | a<br>(mm) | z | γ<br>(°) |
|---|---|---|---|---|---|---|---|---|---|
| VHMSR 2 003 Z64 06 03 L006 | 0,3 | 0,05 | 6 | 64 | 0,5 | 0,6 | - | 2 | 11 |
| VHMSR 2 003 Z64 06 03 L015 | 0,3 | 0,05 | 6 | 64 | 0,5 | 1,5 | 0,010 | 2 | 11 |
| VHMSR 2 003 Z64 06 03 L030 | 0,3 | 0,05 | 6 | 64 | 0,5 | 3,0 | 0,010 | 2 | 12 |
| VHMSR 2 004 Z64 06 03 L008 | 0,4 | 0,05 | 6 | 64 | 0,6 | 0,8 | - | 2 | 11 |
| VHMSR 2 004 Z64 06 03 L020 | 0,4 | 0,05 | 6 | 64 | 0,6 | 2,0 | 0,010 | 2 | 11 |
| VHMSR 2 004 Z64 06 03 L040 | 0,4 | 0,05 | 6 | 64 | 0,6 | 4,0 | 0,010 | 2 | 13 |
| VHMSR 2 005 Z64 06 03 L010 | 0,5 | 0,05 | 6 | 64 | 0,8 | 1,0 | - | 2 | 11 |
| VHMSR 2 005 Z64 06 03 L030 | 0,5 | 0,05 | 6 | 64 | 0,8 | 3,0 | 0,015 | 2 | 12 |
| VHMSR 2 005 Z64 06 03 L060 | 0,5 | 0,05 | 6 | 64 | 0,8 | 6,0 | 0,015 | 2 | 15 |
| VHMSR 2 005 Z64 06 03 L080 | 0,5 | 0,05 | 6 | 64 | 0,8 | 8,0 | 0,015 | 2 | 15 |
| VHMSR 2 005 Z64 06 03 L100 | 0,5 | 0,05 | 6 | 64 | 0,8 | 10,0 | 0,015 | 2 | 15 |
| VHMSR 2 006 Z64 06 03 L012 | 0,6 | 0,05 | 6 | 64 | 0,9 | 1,2 | - | 2 | 10 |
| VHMSR 2 006 Z64 06 03 L020 | 0,6 | 0,05 | 6 | 64 | 0,9 | 2,0 | 0,025 | 2 | 11 |
| VHMSR 2 006 Z64 06 03 L040 | 0,6 | 0,05 | 6 | 64 | 0,9 | 4,0 | 0,025 | 2 | 13 |
| VHMSR 2 006 Z64 06 03 L060 | 0,6 | 0,05 | 6 | 64 | 0,9 | 6,0 | 0,025 | 2 | 15 |
| VHMSR 2 006 Z64 06 03 L080 | 0,6 | 0,05 | 6 | 64 | 0,9 | 8,0 | 0,025 | 2 | 15 |
| VHMSR 2 006 Z64 06 03 L100 | 0,6 | 0,05 | 6 | 64 | 0,9 | 10,0 | 0,025 | 2 | 15 |
| VHMSR 2 008 Z64 06 03 L016 | 0,8 | 0,05 | 6 | 64 | 1,2 | 1,6 | - | 2 | 10 |
| VHMSR 2 008 Z64 06 03 L025 | 0,8 | 0,05 | 6 | 64 | 1,2 | 2,5 | 0,025 | 2 | 11 |
| VHMSR 2 008 Z64 06 03 L050 | 0,8 | 0,05 | 6 | 64 | 1,2 | 5,0 | 0,025 | 2 | 13 |
| VHMSR 2 008 Z64 06 03 L080 | 0,8 | 0,05 | 6 | 64 | 1,2 | 8,0 | 0,025 | 2 | 15 |
| VHMSR 2 008 Z64 06 03 L100 | 0,8 | 0,05 | 6 | 64 | 1,2 | 10,0 | 0,025 | 2 | 15 |
| VHMSR 2 010 Y64 06 03 L020 | 1,0 | 0,10 | 6 | 64 | 1,5 | 2,0 | - | 2 | 10 |
| VHMSR 2 010 Y64 06 03 L040 | 1,0 | 0,10 | 6 | 64 | 1,5 | 4,0 | 0,025 | 2 | 12 |
| VHMSR 2 010 Y64 06 03 L060 | 1,0 | 0,10 | 6 | 64 | 1,5 | 6,0 | 0,025 | 2 | 14 |
| VHMSR 2 010 Y64 06 03 L100 | 1,0 | 0,10 | 6 | 64 | 1,5 | 10,0 | 0,025 | 2 | 15 |
| VHMSR 2 010 Y64 06 03 L150 | 1,0 | 0,10 | 6 | 64 | 1,5 | 15,0 | 0,025 | 2 | 15 |
| VHMSR 2 010 Y64 06 03 L200 | 1,0 | 0,10 | 6 | 64 | 1,5 | 20,0 | 0,025 | 2 | 15 |
| VHMSR 2 010 Y64 06 03 L250 | 1,0 | 0,10 | 6 | 64 | 1,5 | 25,0 | 0,025 | 2 | 15 |
| VHMSR 2 012 Y64 06 03 L024 | 1,2 | 0,10 | 6 | 64 | 1,8 | 2,4 | - | 2 | 10 |
| VHMSR 2 012 Y64 06 03 L040 | 1,2 | 0,10 | 6 | 64 | 1,8 | 4,0 | 0,025 | 2 | 11 |
| VHMSR 2 012 Y64 06 03 L060 | 1,2 | 0,10 | 6 | 64 | 1,8 | 6,0 | 0,025 | 2 | 14 |
| VHMSR 2 012 Y64 06 03 L080 | 1,2 | 0,10 | 6 | 64 | 1,8 | 8,0 | 0,025 | 2 | 15 |
| VHMSR 2 012 Y64 06 03 L120 | 1,2 | 0,10 | 6 | 64 | 1,8 | 12,0 | 0,025 | 2 | 15 |
| VHMSR 2 012 Y64 06 03 L160 | 1,2 | 0,10 | 6 | 64 | 1,8 | 16,0 | 0,025 | 2 | 15 |



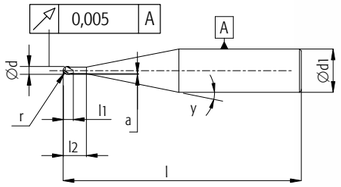


## Standard



| Article Number<br>*Artikelnummer* | Ød<br>(mm) | r<br>(mm) | Ød1<br>(mm) | L<br>(mm) | L1<br>(mm) | L2<br>(mm) | a<br>(mm) | z | γ<br>(°) |
|---|---|---|---|---|---|---|---|---|---|
| VHMSR 2 015 X64 06 03 L030 | 1,5 | 0,15 | 6 | 64 | 2,3 | 3,0 | - | 2 | 10 |
| VHMSR 2 015 X64 06 03 L060 | 1,5 | 0,15 | 6 | 64 | 2,3 | 6,0 | 0,025 | 2 | 13 |
| VHMSR 2 015 X64 06 03 L100 | 1,5 | 0,15 | 6 | 64 | 2,3 | 10,0 | 0,025 | 2 | 15 |
| VHMSR 2 015 X64 06 03 L150 | 1,5 | 0,15 | 6 | 64 | 2,3 | 15,0 | 0,025 | 2 | 15 |
| VHMSR 2 015 X64 06 03 L200 | 1,5 | 0,15 | 6 | 64 | 2,3 | 20,0 | 0,025 | 2 | 15 |
| VHMSR 2 015 X64 06 03 L250 | 1,5 | 0,15 | 6 | 64 | 2,3 | 25,0 | 0,025 | 2 | 15 |
| VHMSR 2 020 W64 06 03 L030 | 2,0 | 0,20 | 6 | 64 | 3,0 | 3,0 | - | 2 | 9 |
| VHMSR 2 020 W64 06 03 L060 | 2,0 | 0,20 | 6 | 64 | 3,0 | 6,0 | 0,050 | 2 | 11 |
| VHMSR 2 020 W64 06 03 L100 | 2,0 | 0,20 | 6 | 64 | 3,0 | 10,0 | 0,050 | 2 | 15 |
| VHMSR 2 020 W64 06 03 L160 | 2,0 | 0,20 | 6 | 64 | 3,0 | 16,0 | 0,050 | 2 | 15 |
| VHMSR 2 020 W64 06 03 L200 | 2,0 | 0,20 | 6 | 64 | 3,0 | 20,0 | 0,050 | 2 | 15 |
| VHMSR 2 020 W64 06 03 L250 | 2,0 | 0,20 | 6 | 64 | 3,0 | 25,0 | 0,050 | 2 | 15 |
| VHMSR 2 020 W64 06 03 L300 | 2,0 | 0,20 | 6 | 64 | 3,0 | 30,0 | 0,050 | 2 | 15 |
| VHMSR 2 025 W64 06 03 L030 | 2,5 | 0,20 | 6 | 64 | 3,0 | 3,0 | - | 2 | 8 |
| VHMSR 2 025 W64 06 03 L060 | 2,5 | 0,20 | 6 | 64 | 3,0 | 6,0 | 0,050 | 2 | 10 |
| VHMSR 2 025 W64 06 03 L100 | 2,5 | 0,20 | 6 | 64 | 3,0 | 10,0 | 0,050 | 2 | 15 |
| VHMSR 2 025 W64 06 03 L160 | 2,5 | 0,20 | 6 | 64 | 3,0 | 16,0 | 0,050 | 2 | 15 |
| VHMSR 2 025 W64 06 03 L200 | 2,5 | 0,20 | 6 | 64 | 3,0 | 20,0 | 0,050 | 2 | 15 |
| VHMSR 2 025 W64 06 03 L250 | 2,5 | 0,20 | 6 | 64 | 3,0 | 25,0 | 0,050 | 2 | 15 |
| VHMSR 2 030 U64 06 03 L030 | 3,0 | 0,30 | 6 | 64 | 3,0 | 3,0 | - | 2 | 7 |
| VHMSR 2 030 U64 06 03 L060 | 3,0 | 0,30 | 6 | 64 | 3,0 | 6,0 | 0,050 | 2 | 9 |
| VHMSR 2 030 U64 06 03 L100 | 3,0 | 0,30 | 6 | 64 | 3,0 | 10,0 | 0,050 | 2 | 14 |
| VHMSR 2 030 U64 06 03 L160 | 3,0 | 0,30 | 6 | 64 | 3,0 | 16,0 | 0,050 | 2 | 15 |
| VHMSR 2 030 U64 06 03 L200 | 3,0 | 0,30 | 6 | 64 | 3,0 | 20,0 | 0,050 | 2 | 15 |
| VHMSR 2 030 U64 06 03 L250 | 3,0 | 0,30 | 6 | 64 | 3,0 | 25,0 | 0,050 | 2 | 15 |
| VHMSR 2 030 U64 06 03 L300 | 3,0 | 0,30 | 6 | 64 | 3,0 | 30,0 | 0,050 | 2 | 15 |

***Standard***

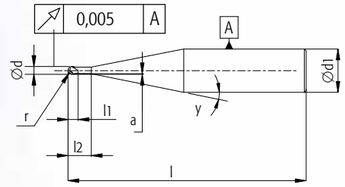


| Article Number<br>*Artikelnummer* | Ød<br>(mm) | r<br>(mm) | Ød1<br>(mm) | L<br>(mm) | L1<br>(mm) | L2<br>(mm) | a<br>(mm) | z | γ<br>(°) | |
|---|---|---|---|---|---|---|---|---|---|---|
| VHMSK 2 001 060 04 03 L001 | 0,1 | 0,05 | 4 | 60 | 0,25 | - | - | 2 | 10 | new/neu |
| VHMSK 2 002 064 06 03 L003 | 0,2 | 0,10 | 6 | 64 | 0,30 | 0,3 | - | 2 | 10 | |
| VHMSK 2 003 064 06 03 L006 | 0,3 | 0,15 | 6 | 64 | 0,50 | 0,6 | - | 2 | 11 | |
| VHMSK 2 003 064 06 03 L015 | 0,3 | 0,15 | 6 | 64 | 0,50 | 1,5 | 0,010 | 2 | 11 | |
| VHMSK 2 003 064 06 03 L030 | 0,3 | 0,15 | 6 | 64 | 0,50 | 3,0 | 0,010 | 2 | 12 | |
| VHMSK 2 004 064 06 03 L008 | 0,4 | 0,20 | 6 | 64 | 0,60 | 0,8 | - | 2 | 11 | |
| VHMSK 2 004 064 06 03 L020 | 0,4 | 0,20 | 6 | 64 | 0,60 | 2,0 | 0,010 | 2 | 11 | |
| VHMSK 2 004 064 06 03 L040 | 0,4 | 0,20 | 6 | 64 | 0,60 | 4,0 | 0,010 | 2 | 13 | |
| VHMSK 2 005 064 06 03 L010 | 0,5 | 0,25 | 6 | 64 | 0,80 | 1,0 | - | 2 | 11 | |
| VHMSK 2 005 064 06 03 L030 | 0,5 | 0,25 | 6 | 64 | 0,80 | 3,0 | 0,015 | 2 | 12 | |
| VHMSK 2 005 064 06 03 L060 | 0,5 | 0,25 | 6 | 64 | 0,80 | 6,0 | 0,015 | 2 | 15 | |
| VHMSK 2 005 064 06 03 L080 | 0,5 | 0,25 | 6 | 64 | 0,80 | 8,0 | 0,015 | 2 | 15 | |
| VHMSK 2 005 064 06 03 L100 | 0,5 | 0,25 | 6 | 64 | 0,80 | 10,0 | 0,015 | 2 | 15 | |
| VHMSK 2 006 064 06 03 L012 | 0,6 | 0,30 | 6 | 64 | 0,90 | 1,2 | - | 2 | 10 | |
| VHMSK 2 006 064 06 03 L020 | 0,6 | 0,30 | 6 | 64 | 0,90 | 2,0 | 0,025 | 2 | 11 | |
| VHMSK 2 006 064 06 03 L040 | 0,6 | 0,30 | 6 | 64 | 0,90 | 4,0 | 0,025 | 2 | 13 | |
| VHMSK 2 006 064 06 03 L060 | 0,6 | 0,30 | 6 | 64 | 0,90 | 6,0 | 0,025 | 2 | 15 | |
| VHMSK 2 006 064 06 03 L080 | 0,6 | 0,30 | 6 | 64 | 0,90 | 8,0 | 0,025 | 2 | 15 | |
| VHMSK 2 006 064 06 03 L100 | 0,6 | 0,30 | 6 | 64 | 0,90 | 10,0 | 0,025 | 2 | 15 | |
| VHMSK 2 008 064 06 03 L016 | 0,8 | 0,40 | 6 | 64 | 1,20 | 1,6 | - | 2 | 10 | |
| VHMSK 2 008 064 06 03 L025 | 0,8 | 0,40 | 6 | 64 | 1,20 | 2,5 | 0,025 | 2 | 11 | |
| VHMSK 2 008 064 06 03 L050 | 0,8 | 0,40 | 6 | 64 | 1,20 | 5,0 | 0,025 | 2 | 13 | |
| VHMSK 2 008 064 06 03 L080 | 0,8 | 0,40 | 6 | 64 | 1,20 | 8,0 | 0,025 | 2 | 15 | |
| VHMSK 2 008 064 06 03 L100 | 0,8 | 0,40 | 6 | 64 | 1,20 | 10,0 | 0,025 | 2 | 15 | |
| VHMSK 2 010 064 06 03 L020 | 1,0 | 0,50 | 6 | 64 | 1,50 | 2,0 | - | 2 | 10 | |
| VHMSK 2 010 064 06 03 L040 | 1,0 | 0,50 | 6 | 64 | 1,50 | 4,0 | 0,025 | 2 | 12 | |
| VHMSK 2 010 064 06 03 L060 | 1,0 | 0,50 | 6 | 64 | 1,50 | 6,0 | 0,025 | 2 | 14 | |
| VHMSK 2 010 064 06 03 L100 | 1,0 | 0,50 | 6 | 64 | 1,50 | 10,0 | 0,025 | 2 | 15 | |
| VHMSK 2 010 064 06 03 L150 | 1,0 | 0,50 | 6 | 64 | 1,50 | 15,0 | 0,025 | 2 | 15 | |
| VHMSK 2 010 064 06 03 L200 | 1,0 | 0,50 | 6 | 64 | 1,50 | 20,0 | 0,025 | 2 | 15 | |
| VHMSK 2 010 064 06 03 L250 | 1,0 | 0,50 | 6 | 64 | 1,50 | 25,0 | 0,025 | 2 | 15 | |
| VHMSK 2 012 064 06 03 L024 | 1,2 | 0,60 | 6 | 64 | 1,80 | 2,4 | - | 2 | 10 | |
| VHMSK 2 012 064 06 03 L040 | 1,2 | 0,60 | 6 | 64 | 1,80 | 4,0 | 0,025 | 2 | 11 | |
| VHMSK 2 012 064 06 03 L060 | 1,2 | 0,60 | 6 | 64 | 1,80 | 6,0 | 0,025 | 2 | 14 | |
| VHMSK 2 012 064 06 03 L080 | 1,2 | 0,60 | 6 | 64 | 1,80 | 8,0 | 0,025 | 2 | 15 | |
| VHMSK 2 012 064 06 03 L120 | 1,2 | 0,60 | 6 | 64 | 1,80 | 12,0 | 0,025 | 2 | 15 | |
| VHMSK 2 012 064 06 03 L160 | 1,2 | 0,60 | 6 | 64 | 1,80 | 16,0 | 0,025 | 2 | 15 | |





***Standard***



| Article Number<br>*Artikelnummer* | Ød<br>(mm) | r<br>(mm) | Ød1<br>(mm) | L<br>(mm) | L1<br>(mm) | L2<br>(mm) | a<br>(mm) | z | γ<br>(°) |
|---|---|---|---|---|---|---|---|---|---|
| VHMSK 2 015 064 06 03 L030 | 1,5 | 0,75 | 6 | 64 | 2,3 | 3,0 | - | 2 | 10 |
| VHMSK 2 015 064 06 03 L060 | 1,5 | 0,75 | 6 | 64 | 2,3 | 6,0 | 0,025 | 2 | 13 |
| VHMSK 2 015 064 06 03 L100 | 1,5 | 0,75 | 6 | 64 | 2,3 | 10,0 | 0,025 | 2 | 15 |
| VHMSK 2 015 064 06 03 L150 | 1,5 | 0,75 | 6 | 64 | 2,3 | 15,0 | 0,025 | 2 | 15 |
| VHMSK 2 015 064 06 03 L200 | 1,5 | 0,75 | 6 | 64 | 2,3 | 20,0 | 0,025 | 2 | 15 |
| VHMSK 2 015 064 06 03 L250 | 1,5 | 0,75 | 6 | 64 | 2,3 | 25,0 | 0,025 | 2 | 15 |
| VHMSK 2 020 064 06 03 L030 | 2,0 | 1,00 | 6 | 64 | 3,0 | 3,0 | - | 2 | 9 |
| VHMSK 2 020 064 06 03 L060 | 2,0 | 1,00 | 6 | 64 | 3,0 | 6,0 | 0,050 | 2 | 11 |
| VHMSK 2 020 064 06 03 L100 | 2,0 | 1,00 | 6 | 64 | 3,0 | 10,0 | 0,050 | 2 | 15 |
| VHMSK 2 020 064 06 03 L160 | 2,0 | 1,00 | 6 | 64 | 3,0 | 16,0 | 0,050 | 2 | 15 |
| VHMSK 2 020 064 06 03 L200 | 2,0 | 1,00 | 6 | 64 | 3,0 | 20,0 | 0,050 | 2 | 15 |
| VHMSK 2 020 064 06 03 L250 | 2,0 | 1,00 | 6 | 64 | 3,0 | 25,0 | 0,050 | 2 | 15 |
| VHMSK 2 020 064 06 03 L300 | 2,0 | 1,00 | 6 | 64 | 3,0 | 30,0 | 0,050 | 2 | 15 |
| VHMSK 2 025 064 06 03 L030 | 2,5 | 1,25 | 6 | 64 | 3,0 | 3,0 | - | 2 | 8 |
| VHMSK 2 025 064 06 03 L060 | 2,5 | 1,25 | 6 | 64 | 3,0 | 6,0 | 0,050 | 2 | 10 |
| VHMSK 2 025 064 06 03 L100 | 2,5 | 1,25 | 6 | 64 | 3,0 | 10,0 | 0,050 | 2 | 15 |
| VHMSK 2 025 064 06 03 L160 | 2,5 | 1,25 | 6 | 64 | 3,0 | 16,0 | 0,050 | 2 | 15 |
| VHMSK 2 025 064 06 03 L200 | 2,5 | 1,25 | 6 | 64 | 3,0 | 20,0 | 0,050 | 2 | 15 |
| VHMSK 2 025 064 06 03 L250 | 2,5 | 1,25 | 6 | 64 | 3,0 | 25,0 | 0,050 | 2 | 15 |
| VHMSK 2 030 064 06 03 L030 | 3,0 | 1,50 | 6 | 64 | 3,0 | 3,0 | - | 2 | 7 |
| VHMSK 2 030 064 06 03 L060 | 3,0 | 1,50 | 6 | 64 | 3,0 | 6,0 | 0,050 | 2 | 9 |
| VHMSK 2 030 064 06 03 L100 | 3,0 | 1,50 | 6 | 64 | 3,0 | 10,0 | 0,050 | 2 | 14 |
| VHMSK 2 030 064 06 03 L160 | 3,0 | 1,50 | 6 | 64 | 3,0 | 16,0 | 0,050 | 2 | 15 |
| VHMSK 2 030 064 06 03 L200 | 3,0 | 1,50 | 6 | 64 | 3,0 | 20,0 | 0,050 | 2 | 15 |
| VHMSK 2 030 064 06 03 L250 | 3,0 | 1,50 | 6 | 64 | 3,0 | 25,0 | 0,050 | 2 | 15 |
| VHMSK 2 030 064 06 03 L300 | 3,0 | 1,50 | 6 | 64 | 3,0 | 30,0 | 0,050 | 2 | 15 |

| Material group | TSR (N/mm²) | Hardness HB | Cutting speed Vc m/min |
|---|---|---|---|
| Carbon steel | < 750 | < 250 | **< 150** |
| Alloy steel | < 1000 | < 300 | **< 125** |
| Tool steel | > 850 | > 250 | **< 110** |
| | > 1000 | > 300 | **< 90** |
| Stainless Steel | < 600 | < 200 | **90 - 120** |
| | < 850 | < 250 | **60 - 80** |
| High temp. alloys | < 900 | < 300 | **30 - 50** |
| Titanium alloys | < 900 | < 300 | **35 - 60** |
| Hardened steel | | 45-52 HRc | **120 - 200** |
| | | 50-60 HRc | **200 - 250** |
| | | 58-70 HRc | **220 - 270** |

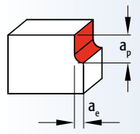
**For Coolant we advise:**
**Empfohlene Kühlung:**

- Minimum lubrication
  Minimalmengenschmierung
- Air Pressure
  Luft

**VHMSK20500640603L030**
**Material** 1.2343 (52HRc)

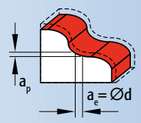
| | |
|---|---|
| $v_c$ | 56 m/min |
| n | 36000 rpm |
| $f_z$ | 0,006 mm/t |
| vf | 432 mm/min |
| $a_p$ | 0,01 mm |
| $a_e$ | 0,01 mm |
| **Coolant** | min. lubrication |

- Finishing application.
  Schlichtbearbeitung.
- Excellent surface finsish.
  Ausgezeichnete Oberflächenqualität.
- Save a polishing opperation.
  Erspart Nachpolieren.




Material < 45HRc
$a_p$ up to 0,75 x d
$a_e$ up to 0,05 x d

Hardened material
$a_p$ up to 0,50 x d
$a_e$ up to 0,02 x d




Material < 45HRc
$a_p$ up to 0,100 x d
$a_e$ up to 0,025 x d

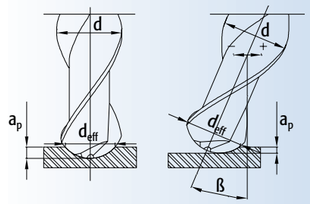
Hardened material
$a_p$ up to 0,04 x d
$a_e$ up to 0,01 x d

***Shoulder milling / Stirnfräsen***

| Ød (mm) | $a_p$ max. (mm) < 45 HRc | $a_e$ max. (mm) < 45 HRc | $a_p$ max. (mm) > 45 HRc | $a_e$ max. (mm) > 45 HRc | fz (mm/tooth) |
|---|---|---|---|---|---|
| 0,1 | < 0,05 | < 0,005 | < 0,03 | < 0,002 | 0,001 - 0,003 |
| 0,2 | < 0,08 | < 0,007 | < 0,05 | < 0,004 | 0,002 - 0,004 |
| 0,3 | < 0,11 | < 0,011 | < 0,10 | < 0,006 | 0,003 - 0,006 |
| 0,4 | < 0,15 | < 0,015 | < 0,14 | < 0,008 | 0,004 - 0,008 |
| 0,5 | < 0,20 | < 0,019 | < 0,18 | < 0,010 | 0,005 - 0,009 |
| 0,6 | < 0,30 | < 0,022 | < 0,25 | < 0,012 | 0,006 - 0,010 |
| 0,8 | < 0,40 | < 0,030 | < 0,35 | < 0,016 | 0,006 - 0,012 |
| 1,0 | < 0,75 | < 0,045 | < 0,50 | < 0,020 | 0,008 - 0,015 |
| 1,2 | < 0,90 | < 0,054 | < 0,60 | < 0,024 | 0,010 - 0,016 |
| 1,5 | < 1,13 | < 0,067 | < 0,75 | < 0,030 | 0,012 - 0,018 |
| 2,0 | < 1,50 | < 0,090 | < 1,00 | < 0,040 | 0,016 - 0,022 |
| 2,5 | < 1,90 | < 0,110 | < 1,25 | < 0,050 | 0,016 - 0,025 |
| 3,0 | < 2,25 | < 0,130 | < 1,50 | < 0,060 | 0,019 - 0,028 |

***Profile milling / Profilfräsen***

| $a_p$ max. (mm) < 45 HRc | $a_e$ max. (mm) < 45 HRc | $a_p$ max. (mm) > 45 HRc | $a_e$ max. (mm) > 45 HRc | fz (mm/tooth) |
|---|---|---|---|---|
| < 0,01 | <0,003 | < 0,005 | <0,002 | 0,001 - 0,003 |
| < 0,02 | < 0,004 | < 0,008 | < 0,002 | 0,002 - 0,004 |
| < 0,03 | < 0,006 | < 0,012 | < 0,003 | 0,003 - 0,006 |
| < 0,04 | < 0,008 | < 0,016 | < 0,004 | 0,004 - 0,008 |
| < 0,05 | < 0,010 | < 0,020 | < 0,005 | 0,005 - 0,009 |
| < 0,06 | < 0,012 | < 0,024 | < 0,006 | 0,006 - 0,010 |
| < 0,08 | < 0,016 | < 0,032 | < 0,008 | 0,006 - 0,012 |
| < 0,10 | < 0,025 | < 0,040 | < 0,010 | 0,008 - 0,015 |
| < 0,12 | < 0,030 | < 0,048 | < 0,012 | 0,010 - 0,016 |
| < 0,15 | < 0,040 | < 0,060 | < 0,015 | 0,012 - 0,018 |
| < 0,20 | < 0,050 | < 0,080 | < 0,020 | 0,016 - 0,022 |
| < 0,25 | < 0,060 | < 0,100 | < 0,025 | 0,016 - 0,025 |
| < 0,30 | < 0,075 | < 0,120 | < 0,030 | 0,019 - 0,028 |




ß = 0: $d_{eff} = 2 \bullet \sqrt{d \bullet a_p - a_p^2}$

ß ≠ 0: $d_{eff} = d \bullet \sin\left[ß \pm \arccos\left(\frac{d - 2a_p}{d}\right)\right]$

- Cutting speed Vc is based on max. 40.000 rpm.
  Schnittgeschwindigkeit Vc bezieht sich auf max. 40.000 U/min.
- When using endmills with longer L2-length, reduce $f_z$ according table.
  Beim Einsatz von Schaftfräsern mit größerem L2-Maß, Vorschub $f_z$ gemäß Tabellenangaben reduzieren.

| L2-Length | Reduction |
|---|---|
| 1-5 x d | 0% |
| 5-10 x d | 30% |
| 10 ~ | 50% |





# Keep the tool cool!

It's recommend to use coolant (emulsion, minimum lubrication, or air) if possible. Coolant contributes to improve toollife, surface finish and chip evacuation.
Wenn möglich, empfehlen wir grundsätzlich mit Kühlung zu arbeiten (Emulsion, Minimalmengenschmierung oder Luft). Eine entsprechende Kühlung fördert die Späneabfuhr, verlängert die Werkzeugstandzeit und ermöglicht bessere Oberflächenqualitäten.

1. From the front into the flutes for direct cooling.
   Direkte Kühlmittelzufuhr an die Schneiden für den Kühlungseffekt.
2. Pointed from the right hand side in the flutes to evacuate the chips.
   Kühlmittelzufuhr von rechts in die Spankammern für die Spanabfuhr.

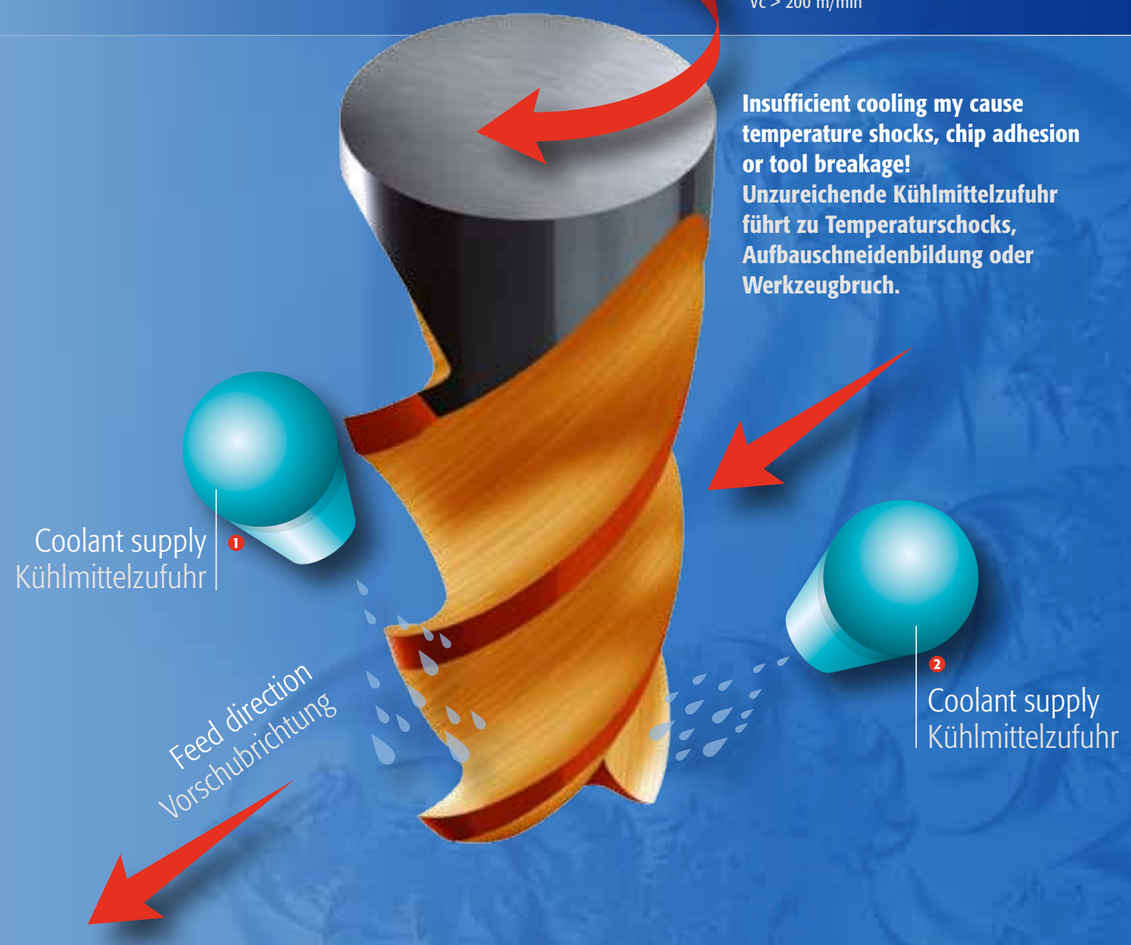
## When to use, what kind of coolant:
## Wann wird welches Kühlmedium eingesetzt:

**Emulsion**
**Emulsion**
- Hardness less than 50 HRc
  Härte bis 50 HRc
- Vc < 200 m/min
  Vc < 200 m/min
- Aluminium
  Aluminium

- Exotic materials (Stainless Steel, Titanium, Hastelloy)
  Exotische Werkstoffe (Nichtrostender Stahl, Titan, Hastelloy)
- Copper
  Kupfer

**Minimum Lubrication (Preference) Or Air**
**Minimalmengen-schmierung (1. Wahl) oder Luft**
- Hardness over 50 HRc
  Härte ab 50 HRc
- Vc > 200 m/min
  Vc > 200 m/min

- Graphite
  Graphit
- Synthetics
  Kunststoffe



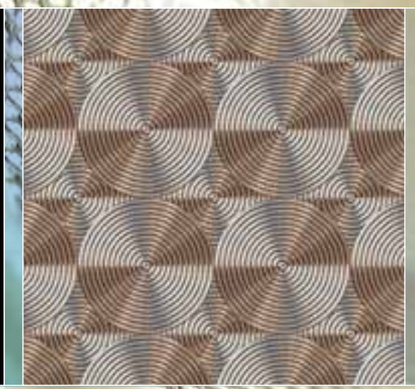

**Insufficient cooling my cause temperature shocks, chip adhesion or tool breakage!**
**Unzureichende Kühlmittelzufuhr führt zu Temperaturschocks, Aufbauschneidenbildung oder Werkzeugbruch.**

# Milling exotic materials

## Fräsen exotischer Werkstoffe

**Most common problems to face / Häufig auftretende Probleme:**

- Abrasiveness of the material.
  Abrasivität des Materials.
- Resonance of the machine and/or workpiece.
  Maschinen- und/oder Werkstückschwingungen.
- Vibrations of the workpiece and/or tool.
  Werkstück- und/oder Werkzeugvibrationen.



## How to handle / Korrekturmaßnahmen:

- **Stable clamping of tool and material**
  **Stabile Werkzeug- und Werkstückspannung**

- **Coolant**
  **Kühlung**
  - Try to have as much coolant on the tool as possible (see page 43).
    Kühlmittel so gut wie möglich aufs Werkzeug richten (siehe Seite 43).
  - For materials as mentioned above; recommended oil percentage of the emulsion coolant if possible between 8-12% (grease).
    Für o. a. Werkstoffe wird eine fettige 8-12%ige Emulsion empfohlen.

- **Chip flow**
  **Spänefluss**
  - Try to have a smooth chip-flow so the chip can leave the flute easily.
    Glatte Spannkammern erleichtern die Spanabfuhr.

## Van Hoorn vs competitor

**Workpiece Material:** 1.4462 (Duplex)
**DIN:** X2CrNiMoN22-5-3
**Endmill:** VHVTRW52501202503

| | Van Hoorn | Competitor |
|---|---|---|
| $v_c$ | 60 m/min | 25 m/min |
| n | 765 rpm | 318 rpm |
| $F_z$ | 0,07 mm/t | 0,03 mm/t |
| $v_f$ | 265 mm/min | 40 mm/min |
| $a_p$ | 42 mm | 2 mm |
| $a_e$ | 2 mm | 28 mm |
| Coolant | emulsion | emulsion |
| Q | **22260 mm³/min** | **2240 mm³/min** |

**10 TIMES HIGHER Q**



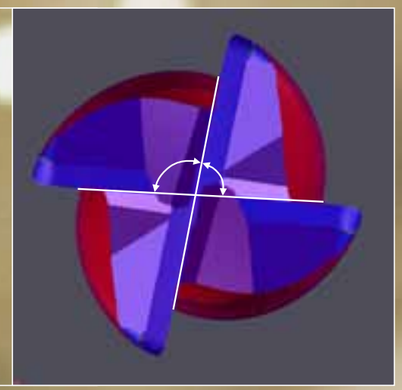
# VHC new generation endmills for machining exotic materials:

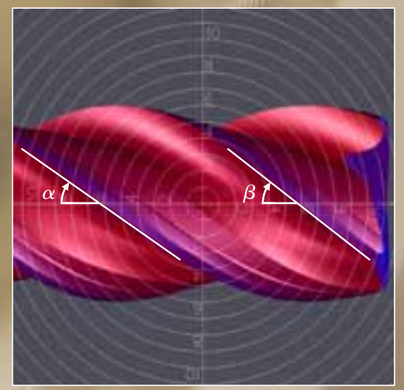
## VHC neue Schaftfräser-Generation für die Bearbeitung exotischer

- VHVTR: 4 Flute for roughing/Semi finishing.
  VHVTR: 4 Schneiden für Schrupp- / mittlere Bearbeitung.
- HABM: Ball Nose for finishing/Semi finishing.
  HABM: Vollradius für Schlicht- / mittlere Bearbeitung.
- HAMF (L-XL): Multiple flute finishing.
  HAMF (L-XL): Mehrschneidenfräser.

### VHVTR

- **Sharp geometry**
  Scharfe Schneidengeometrie
- **Polished flutes**
  Polierte Spankammern
- **Coating with low friction coefficient**
  Beschichtung mit geringem Reibungskoeffizient





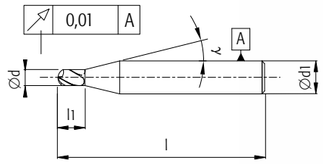

Unequal tooth spacing
Ungleiche Zahnteilung

- Stainless steels
  Nichtrostender Stahl
- Titanium
  Titan
- Inconel
  Inconel

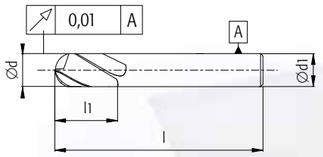
Variable helix
Ungleicher Spiralwinkel

- Duplex
  Duplex
- Hastelloy
  Hastelloy
- Nickel based materials
  Nickelbasis-Legierungen

### Micro




### Standard




* For endmills / für Schaftfräser L < 100 mm.

**For Coolant we advise:**
**Empfohlene Kühlung:**

- Emulsion
  Emulsion

| Material group | TSR (N/mm²) | Hardness HB | Cutting speed Vc m/min |
|---|---|---|---|
| Carbon steel | < 750 | < 250 | **150 - 250** |
| Alloy steel | < 1000 | < 300 | **120 - 200** |
| Tool steel | > 850 | > 250 | **100 - 160** |
| | > 1000 | > 300 | **90 - 140** |
| Stainless steel | < 600 | < 200 | **90 - 120** |
| | < 850 | < 250 | **60 - 80** |
| High temp. alloys | < 900 | < 300 | **30 - 50** |
| Titanium alloys | < 900 | < 300 | **35 - 60** |
| Hardened steel | | 45-52 HRc | **120 - 200** |
| | | 50-60 HRc | |
| | | 58-70 HRc | |
| Cast iron | | < 260 | **100 - 160** |

NEW GENERATION

**HABM20801000803**
**Material** 1.4462 Duplex

| | |
|---|---|
| **$v_c$** | 120 m/min |
| **n** | 4775 rpm |
| **$f_z$** | 0,04 mm/t |
| **vf** | 385 mm/min |
| **$a_p$** | 0,1 mm |
| **$a_e$** | 0,1 mm |
| **Coolant** | emulsion |
| **Toollife** | **2,5 Hours** |

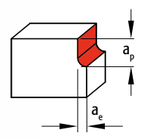
- Improved toollife.
  Erhöhte Standzeit.
- Better surface finish.
  Bessere Oberflächenqualität.

### HABM Micro

| Article Number<br>*Artikelnummer* | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
|---|---|---|---|---|---|---|---|---|---|
| HABM 2 004 051 04 03 | 0,4 | 0,20 | 4 | 51 | 0,6 | - | - | 2 | 10 |
| HABM 2 005 051 04 03 | 0,5 | 0,25 | 4 | 51 | 0,9 | - | - | 2 | 10 |
| HABM 2 006 051 04 03 | 0,6 | 0,30 | 4 | 51 | 1,2 | - | - | 2 | 10 |
| HABM 2 008 051 04 03 | 0,8 | 0,40 | 4 | 51 | 1,5 | - | - | 2 | 10 |
| HABM 2 010 051 04 03 | 1,0 | 0,50 | 4 | 51 | 2,0 | - | - | 2 | 15 |
| HABM 2 015 051 04 03 | 1,5 | 0,75 | 4 | 51 | 3,0 | - | - | 2 | 15 |
| HABM 2 020 051 04 03 | 2,0 | 1,00 | 4 | 51 | 4,0 | - | - | 2 | 15 |
| HABM 2 030 051 04 03 | 3,0 | 1,50 | 4 | 51 | 6,0 | - | - | 2 | 15 |

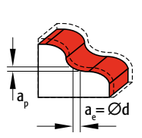
### HABM

| Article Number<br>*Artikelnummer* | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) | |
|---|---|---|---|---|---|---|---|---|---|---|
| HABM 2 040 057 06 03 | 4,0 | 2,00 | 6 | 57 | 8,0 | - | - | 2 | 15 | new/neu |
| HABM 2 050 057 06 03 | 5,0 | 2,50 | 6 | 57 | 10,0 | - | - | 2 | 15 | new/neu |
| HABM 2 060 057 06 03 | 6,0 | 3,00 | 6 | 57 | 12,0 | - | - | 2 | - | new/neu |
| HABM 2 080 063 08 03 | 8,0 | 4,00 | 8 | 63 | 16,0 | - | - | 2 | - | new/neu |
| HABM 2 100 072 10 03 | 10,0 | 5,00 | 10 | 72 | 20,0 | - | - | 2 | - | new/neu |
| HABM 2 120 083 12 03 | 12,0 | 6,00 | 12 | 83 | 24,0 | - | - | 2 | - | new/neu |




Material < 45HRc
$a_p$ up to 1,00 x d
$a_e$ up to 0,50 mm

Hardened material
*Gehärtete Werkstoffe*
$a_p$ up to 0,50 x d
$a_e$ up to 0,03 x d




Material < 45HRc
$a_p$ up to 0,10 x d
$a_e$ up to 0,50 mm

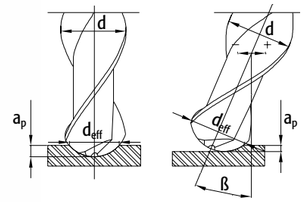
Hardened material
*Gehärtete Werkstoffe*
$a_p$ up to 0,10 x d
$a_e$ up to 0,03 x d

### Shoulder milling / Stirnfräsen

| Ød (mm) | $a_p$ max. (mm) < 45 HRc | $a_e$ max. (mm) < 45 HRc | $a_p$ max. (mm) > 45 HRc | $a_e$ max. (mm) > 45 HRc | fz (mm/tooth) |
|---|---|---|---|---|---|
| 0,4 | < 0,1 | < 0,03 | < 0,1 | < 0,02 | 0,007 - 0,015 |
| 0,5 | < 0,1 | < 0,03 | < 0,1 | < 0,02 | 0,010 - 0,020 |
| 0,6 | < 0,2 | < 0,04 | < 0,2 | < 0,03 | 0,012 - 0,021 |
| 0,8 | < 0,2 | < 0,04 | < 0,2 | < 0,03 | 0,014 - 0,023 |
| 1,0 | < 0,3 | < 0,04 | < 0,3 | < 0,03 | 0,015 - 0,025 |
| 1,5 | < 0,6 | < 0,06 | < 0,5 | < 0,05 | 0,020 - 0,030 |
| 2,0 | < 0,8 | < 0,08 | < 0,7 | < 0,07 | 0,025 - 0,035 |
| 3,0 | < 1,5 | < 0,11 | < 1,0 | < 0,10 | 0,025 - 0,040 |
| 4,0 | < 2,5 | < 0,17 | < 2,0 | < 0,13 | 0,030 - 0,045 |
| 5,0 | < 3,5 | < 0,21 | < 2,5 | < 0,17 | 0,035 - 0,050 |
| 6,0 | < 5,0 | < 0,25 | < 3,0 | < 0,20 | 0,040 - 0,055 |
| 8,0 | < 8,0 | < 0,34 | < 4,0 | < 0,24 | 0,050 - 0,065 |
| 10,0 | < 10,0 | < 0,42 | < 5,0 | < 0,27 | 0,055 - 0,080 |
| 12,0 | < 12,0 | < 0,50 | < 6,0 | < 0,30 | 0,065 - 0,090 |

### Profile milling / Profilfräsen

| $a_p$ max. (mm) < 45 HRc | $a_e$ max. (mm) < 45 HRc | $a_p$ max. (mm) > 45 HRc | $a_e$ max. (mm) > 45 HRc | fz (mm/tooth) |
|---|---|---|---|---|
| < 0,01 | < 0,03 | < 0,01 | < 0,02 | 0,007 - 0,015 |
| < 0,01 | < 0,03 | < 0,01 | < 0,02 | 0,010 - 0,020 |
| < 0,02 | < 0,04 | < 0,02 | < 0,03 | 0,012 - 0,021 |
| < 0,02 | < 0,04 | < 0,02 | < 0,03 | 0,014 - 0,023 |
| < 0,03 | < 0,04 | < 0,03 | < 0,03 | 0,015 - 0,025 |
| < 0,06 | < 0,06 | < 0,06 | < 0,05 | 0,020 - 0,030 |
| < 0,08 | < 0,08 | < 0,08 | < 0,07 | 0,025 - 0,035 |
| < 0,15 | < 0,11 | < 0,15 | < 0,10 | 0,025 - 0,040 |
| < 0,25 | < 0,17 | < 0,25 | < 0,13 | 0,030 - 0,045 |
| < 0,35 | < 0,21 | < 0,35 | < 0,17 | 0,035 - 0,050 |
| < 0,50 | < 0,25 | < 0,50 | < 0,20 | 0,040 - 0,055 |
| < 0,80 | < 0,34 | < 0,80 | < 0,24 | 0,050 - 0,065 |
| < 1,00 | < 0,42 | < 1,00 | < 0,27 | 0,055 - 0,080 |
| < 1,20 | < 0,50 | < 1,20 | < 0,30 | 0,065 - 0,090 |

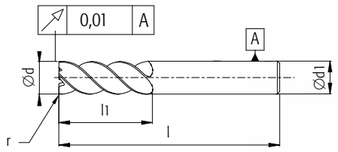



- For the cutting speed Vc calculation the effective cutting diameter $d_{eff}$ has to be taken into account. See formula.
- Für die Berechnung der Schnittgeschwindigkeit muss der effektive Durchmesser $d_{eff}$ berücksichtigt werden (siehe Formel).

ß = 0: $d_{eff} = 2 \bullet \sqrt{d \bullet a_p - a_p^2}$

ß ≠ 0: $d_{eff} = d \bullet \sin\left[ß \pm \arccos\left(\frac{d - 2a_p}{d}\right)\right]$

### Standard




* For endmills / für Schaftfräser L < 100 mm.

**For Coolant we advise:**
**Empfohlene Kühlung:**

- Emulsion
  Emulsion

| Material group | TSR (N/mm²) | Hardness HB | Cutting speed Vc m/min |
|---|---|---|---|
| Carbon steel | < 750 | < 250 | **100 - 130** |
| Alloy steel | < 1000 | < 300 | **75 - 120** |
| Tool steel | > 850 | > 250 | **75 - 120** |
| | > 1000 | > 300 | **70 - 100** |
| Stainless steel | < 600 | < 200 | **80 - 110** |
| | < 850 | < 250 | **50 - 70** |
| High temp. alloys | < 900 | < 300 | **25 - 40** |
| Titanium alloys | < 900 | < 300 | **30 - 50** |
| Hardened steel | | 45-52 HRc | **70 - 130** |
| | | 50-60 HRc | |
| | | 58-70 HRc | |
| Cast iron | | < 260 | **80 - 130** |

**HAMFL82001252003050**
**Material** 1.4401 stainless 316

| | |
|---|---|
| $v_c$ | 100 m/min |
| n | 3979 rpm |
| $f_z$ | 0,03 mm/t |
| $v_f$ | 950 mm/min |
| $a_p$ | 40 mm |
| $a_e$ | 0,2 mm |
| **Coolant** | emulsion |
| **Q** | **7,6 cm³/min** |

- Superior surface finish!
  Hervorragende Oberflächenqualität!
- Excellent straightness tolerances.
  Ausgezeichnete Plantoleranzen.
- Cutting length up to 6 x D.
  Schnitttiefen bis 6 x D.

### HAMF

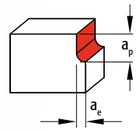
| Article Number<br>*Artikelnummer* | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
|---|---|---|---|---|---|---|---|---|---|
| HAMF 6 060 064 06 03 030 | 6 | 0,3 | 6 | 64 | 15 | - | - | 6 | - |
| HAMF 6 080 064 08 03 050 | 8 | 0,5 | 8 | 64 | 20 | - | - | 6 | - |
| HAMF 6 100 078 10 03 050 | 10 | 0,5 | 10 | 78 | 22 | - | - | 6 | - |
| HAMF 6 120 078 12 03 050 | 12 | 0,5 | 12 | 78 | 28 | - | - | 6 | - |
| HAMF 6 160 089 16 03 050 | 16 | 0,5 | 16 | 89 | 34 | - | - | 6 | - |
| HAMF 8 200 102 20 03 050 | 20 | 0,5 | 20 | 102 | 42 | - | - | 8 | - |

### HAMFL

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| HAMFL 6 060 064 06 03 030 | 6 | 0,3 | 6 | 64 | 20 | - | - | 6 | - |
| HAMFL 6 080 078 08 03 050 | 8 | 0,5 | 8 | 78 | 30 | - | - | 6 | - |
| HAMFL 6 100 089 10 03 050 | 10 | 0,5 | 10 | 89 | 35 | - | - | 6 | - |
| HAMFL 6 120 102 12 03 050 | 12 | 0,5 | 12 | 102 | 40 | - | - | 6 | - |
| HAMFL 6 160 102 16 03 050 | 16 | 0,5 | 16 | 102 | 50 | - | - | 6 | - |
| HAMFL 8 200 125 20 03 050 | 20 | 0,5 | 20 | 125 | 60 | - | - | 8 | - |

### HAMFXL

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| HAMFXL 6 080 102 08 03 050 | 8 | 0,5 | 8 | 102 | 40 | - | - | 6 | - |
| HAMFXL 6 100 125 10 03 050 | 10 | 0,5 | 10 | 125 | 60 | - | - | 6 | - |
| HAMFXL 6 120 150 12 03 050 | 12 | 0,5 | 12 | 150 | 65 | - | - | 6 | - |
| HAMFXL 6 160 150 16 03 050 | 16 | 0,5 | 16 | 150 | 75 | - | - | 6 | - |
| HAMFXL 8 200 150 20 03 050 | 20 | 0,5 | 20 | 150 | 80 | - | - | 8 | - |

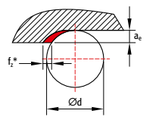



**Material < 45HRc**
**$a_p$ up to 4,00 x d**
**$a_e$ up to 0,05 x d**

**Hardened material**
***Gehärtete Werkstoffe***
**$a_p$ up to 4,00 x d**
**$a_e$ up to 0,015 x d**

### Shoulder milling / Eckfräsen

| Ød (mm) | $a_p$ max. (mm) < 45 HRc | $a_e$ max. (mm) < 45 HRc | $a_p$ max. (mm) > 45 HRc | $a_e$ max. (mm) > 45 HRc | fz (mm/tooth) |
|---|---|---|---|---|---|
| 8,0 | < 35,0 | < 0,20 | < 28,0 | < 0,06 | 0,015 - 0,025 |
| 10,0 | < 40,0 | < 0,25 | < 35,0 | < 0,08 | 0,025 - 0,035 |
| 12,0 | < 50,0 | < 0,30 | < 42,0 | < 0,10 | 0,035 - 0,050 |
| 16,0 | < 65,0 | < 0,40 | < 55,0 | < 0,12 | 0,050 - 0,080 |
| 20,0 | < 75,0 | < 0,50 | < 70,0 | < 0,15 | 0,080 - 0,110 |

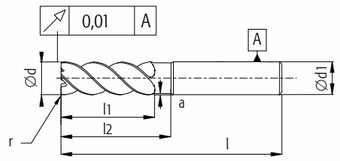



$$f_z^* = f_z \sqrt{\frac{d}{a_e}}$$

- At shoulder milling, feed per tooth $f_z$* for lower $a_e$ values should be converted according formula.
  Beim Eckfräsen ist der Vorschub $f_z$* von der Schnittbreite $a_e$ abhängig.

| $a_e$ | $f_z$*= |
|---|---|
| 0,10 x d | $f_z$ x 3 |
| 0,25 x d | $f_z$ x 2 |
| 0,50 x d | $f_z$ x 1 |

### Standard



NEW GENERATION

**For Coolant we advise:**
**Empfohlene Kühlung:**

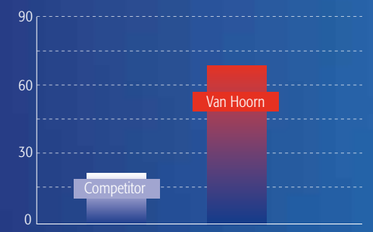
- Emulsion
  Emulsion

| Material group | TSR (N/mm²) | Hardness HB | Cutting speed Vc m/min |
|---|---|---|---|
| Carbon Steel | < 750 | < 250 | **130 - 160** |
| Alloy Steel | < 1000 | < 300 | **90 - 120** |
| Tool Steel | > 850 | > 250 | **90 - 140** |
| | > 1000 | > 300 | **70 - 110** |
| Stainless Steel | < 600 | < 200 | **80 - 150** |
| | < 850 | < 250 | **60 - 120** |
| High Temp. Alloys | < 900 | < 300 | **25 - 50** |
| Titanium Alloys | < 900 | < 300 | **70 - 100** |
| Hardened steel | | 45-52 HRc | **100 - 180** |
| | | 50-60 HRc | |
| | | 58-70 HRc | |
| Cast Iron | | < 260 | **90 - 140** |

**VHVTRW41600891603**
**Workpiece Material:** 3.7165
**Hardness:** Ti6AL4V

| | Van Hoorn | Competitor |
|---|---|---|
| $v_c$ | 85 m/min | 38 m/min |
| n | 1691 rpm | 600 rpm |
| $F_z$ | 0,08 mm/t | 0,027 mm/t |
| $v_f$ | 540 mm/min | 80 mm/min |
| $a_p$ | 8,0 mm | 16,0 mm |
| $a_e$ | 16,0 mm | 16,0 mm |
| **Coolant** | emulsion | emulsion |
| **Q** | **69,1 mm³/min** | **20,5 mm³/min** |

### Material removal rate

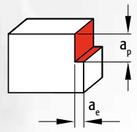



### Short / Kurze Ausführung

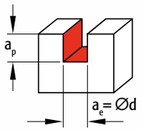
| Article Number / Artikelnummer | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) | |
|---|---|---|---|---|---|---|---|---|---|---|
| VHVTR 4 030 039 03 03 S | 3,0 | 0,20 | 3 | 39 | 5 | 7 | 0,1 | 4 | - | |
| VHVTR 4 040 051 04 03 S | 4,0 | 0,20 | 4 | 51 | 6 | 9 | 0,1 | 4 | - | |
| VHVTR 4 050 051 05 03 S | 5,0 | 0,20 | 5 | 51 | 7 | 11 | 0,2 | 4 | - | |
| VHVTR 4 060 064 06 03 S | 6,0 | 0,30 | 6 | 64 | 8 | 13 | 0,2 | 4 | - | |
| VHVTR 4 060 064 06 03 050 S | 6,0 | 0,50 | 6 | 64 | 8 | 13 | 0,2 | 4 | - | new/neu |
| VHVTR 4 060 064 06 03 100 S | 6,0 | 1,00 | 6 | 64 | 8 | 13 | 0,2 | 4 | - | new/neu |
| VHVTR 4 080 064 08 03 | 8,0 | 0,50 | 8 | 64 | 11 | 18 | 0,3 | 4 | - | |
| VHVTR 4 080 064 08 03 100 S | 8,0 | 1,00 | 8 | 64 | 11 | 18 | 0,3 | 4 | - | new/neu |
| VHVTR 4 100 070 10 03 | 10,0 | 0,50 | 10 | 70 | 13 | 22 | 0,3 | 4 | - | |
| VHVTR 4 100 070 10 03 100 S | 10,0 | 1,00 | 10 | 70 | 13 | 22 | 0,3 | 4 | - | new/neu |
| VHVTR 4 120 078 12 03 050 S | 12,0 | 0,50 | 12 | 78 | 13 | 22 | 0,3 | 4 | - | new/neu |
| VHVTR 4 120 078 12 03 S | 12,0 | 1,00 | 12 | 78 | 15 | 25 | 0,3 | 4 | - | |
| VHVTR 4 140 089 14 03 S | 14,0 | 1,00 | 14 | 89 | 17 | 30 | 0,3 | 4 | - | |
| VHVTR 4 160 089 16 03 S | 16,0 | 1,00 | 16 | 89 | 19 | 35 | 0,3 | 4 | - | |
| VHVTR 5 160 089 16 03 S | 16,0 | 1,00 | 16 | 89 | 19 | 35 | 0,3 | 5 | - | |
| VHVTR 4 200 102 20 03 S | 20,0 | 1,00 | 20 | 102 | 23 | 42 | 0,4 | 4 | - | |
| VHVTR 5 200 102 20 03 S | 20,0 | 1,00 | 20 | 102 | 23 | 42 | 0,4 | 5 | - | |
| VHVTR 4 250 120 25 03 S | 25,0 | 1,00 | 25 | 120 | 28 | 45 | 0,4 | 4 | - | |
| VHVTR 5 250 120 25 03 S | 25,0 | 1,00 | 25 | 120 | 28 | 45 | 0,4 | 5 | - | |

### Standard

| Article Number / Artikelnummer | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) | |
|---|---|---|---|---|---|---|---|---|---|---|
| VHVTR 4 030 039 03 03 | 3,0 | 0,20 | 3 | 39 | 7 | - | - | 4 | - | |
| VHVTR 4 040 051 04 03 | 4,0 | 0,20 | 4 | 51 | 9 | - | - | 4 | - | |
| VHVTR 4 050 051 05 03 | 5,0 | 0,20 | 5 | 51 | 11 | - | - | 4 | - | |
| VHVTR 4 060 064 06 03 | 6,0 | 0,30 | 6 | 64 | 13 | - | - | 4 | - | |
| VHVTR 4 060 064 06 03 050 | 6,0 | 0,50 | 6 | 64 | 13 | - | - | 4 | - | new/neu |
| VHVTR 4 060 064 06 03 100 | 6,0 | 1,00 | 6 | 64 | 13 | - | - | 4 | - | new/neu |
| VHVTR 4 080 064 08 03 | 8,0 | 0,50 | 8 | 64 | 18 | - | - | 4 | - | |
| VHVTR 4 080 064 08 03 100 | 8,0 | 1,00 | 8 | 64 | 18 | - | - | 4 | - | new/neu |
| VHVTR 4 100 070 10 03 | 10,0 | 0,50 | 10 | 70 | 22 | - | - | 4 | - | |
| VHVTR 4 100 070 10 03 100 | 10,0 | 1,00 | 10 | 70 | 22 | - | - | 4 | - | new/neu |
| VHVTR 4 120 078 12 03 050 | 12,0 | 0,50 | 12 | 78 | 25 | - | - | 4 | - | new/neu |
| VHVTR 4 120 078 12 03 | 12,0 | 1,00 | 12 | 78 | 25 | - | - | 4 | - | |
| VHVTR 4 140 089 14 03 | 14,0 | 1,00 | 14 | 89 | 30 | - | - | 4 | - | |
| VHVTR 4 160 089 16 03 | 16,0 | 1,00 | 16 | 89 | 35 | - | - | 4 | - | |
| VHVTR 5 160 089 16 03 | 16,0 | 1,00 | 16 | 89 | 35 | - | - | 5 | - | |
| VHVTR 4 200 102 20 03 | 20,0 | 1,00 | 20 | 102 | 42 | - | - | 4 | - | |
| VHVTR 5 200 102 20 03 | 20,0 | 1,00 | 20 | 102 | 42 | - | - | 5 | - | |
| VHVTR 4 250 120 25 03 | 25,0 | 1,00 | 25 | 120 | 45 | - | - | 4 | - | |
| VHVTR 5 250 120 25 03 | 25,0 | 1,00 | 25 | 120 | 45 | - | - | 5 | - | |




$a_p$ up to 2,00 x d
$a_e$ up to 0,50 x d



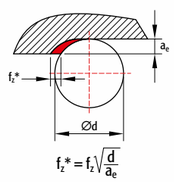

$a_p$ up to 1,00 x d

### Shoulder milling / Eckfräsen

| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 3,0 | < 4,0 | < 0,5 | 0,01 - 0,02 |
| 4,0 | < 7,0 | < 0,8 | 0,02 - 0,03 |
| 5,0 | < 9,0 | < 1,2 | 0,02 - 0,03 |
| 6,0 | < 12,0 | < 2,0 | 0,02 - 0,04 |
| 8,0 | < 16,0 | < 3,0 | 0,03 - 0,05 |
| 10,0 | < 20,0 | < 4,0 | 0,04 - 0,07 |
| 12,0 | < 24,0 | < 6,0 | 0,05 - 0,08 |
| 16,0 | < 32,0 | < 8,0 | 0,06 - 0,10 |
| 20,0 | < 38,0 | < 10,0 | 0,08 - 0,12 |
| 25,0 | < 42,0 | < 12,5 | 0,10 - 0,15 |

### Slot milling / Nutenfräsen

| $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|
| < 2,0 | < 3,0 | 0,01 - 0,02 |
| < 3,0 | < 4,0 | 0,02 - 0,03 |
| < 4,0 | < 5,0 | 0,02 - 0,03 |
| < 5,0 | < 6,0 | 0,02 - 0,04 |
| < 6,0 | < 8,0 | 0,03 - 0,05 |
| < 8,0 | < 10,0 | 0,04 - 0,07 |
| < 10,0 | < 12,0 | 0,05 - 0,08 |
| < 12,0 | <16,0 | 0,06 - 0,10 |
| < 16,0 | < 20,0 | 0,08 - 0,12 |
| < 20,0 | < 25,0 | 0,10 - 0,15 |




- At shoulder milling, feed per tooth $f_z$* for lower $a_e$ values should be converted according table.

  Beim Eckfräsen ist der Vorschub $f_z$* von der Schnittbreite $a_e$ abhängig.

# High volume milling or roughing?

## HVM oder Schruppen?

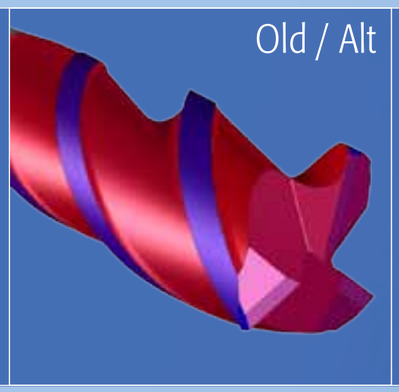
Van Hoorn Carbide designed a program of HVM or roughing on a wide spectrum of applications and materials: Steels up to 48HRc, alloy steels, tools steels, stainless steels, carbon steel, cast iron as well as materials that contain Chrome (Cr) or Nickel (Ni).

Van Hoorn Carbide deckt mit seinem Produktprogramm ein weites Anwendungsspektrum in der HVM- und Schruppbearbeitung ab: Stähle bis 48 HRc, legierte Stähle, Werkzeugstähle, nichtrostende Stähle, Kohlenstoffstahl, Guss sowie Werkstoffe mit Chrom (Cr) oder Nickel (Ni) Anteilen.

# VHC High volume milling and roughing:

## VHC HVM und Schruppbearbeitung:

- VHVF: Sharp corner geometry.
  VHVF: Scharfe Schneidkantengeometrie.
- VHVFR: Corner radius.
  VHVFR: Eckenradius.
- VHVFF: 3 and 4 flute, with chamfer.
  VHVFF: 3 und 4 Schneiden, mit Kantenfase.
- VHRFF: Chamfer and with ripper profile.
  VHRFF: Kantenfase und Kordelprofil.



Improved geometry to optimize chip flow and reduce cutting forces

Verbesserte Schneidengeometrie für optimale Spanabfuhr und Reduzierung der Schnittkräfte

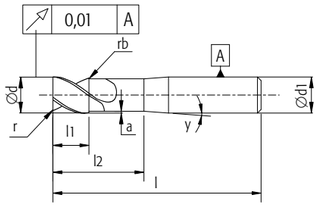
## Additional recommendations to optimize performance:
## Zusätzliche Einsatzempfehlungen zur Leistungsoptimierung:

- Use coolant when available.
  Kühlmitteleinsatz, wenn vorhanden.
- Stable clamping of tool and work piece.
  Stabile Werkzeug- und Werkstückspannung.
- Use with correct cutting conditions, based on VHC application guidelines.
  Schnittwertempfehlungen gemäß den VHC-Vorgaben beachten.

## Advantages / Vorteile:

- Smooth cutting
  Weiches Schneiden
- Optimized surface finish
  Optimale Oberflächenqualität
- High feed rate capabilities
  Hohe Vorschubgeschwindigkeiten
- Reduction of operation times and tooling costs
  Reduzierung der Prozess- und Werkzeugkosten
- Slot milling up to 1,5xD
  Nutenfräsen bis 1,5xD
- Side milling: Ae= 0,5xD with Ap=2xD
  Eckfräsen: Ae = 0,5xD mit Ap = 2xD

### Standard



**For Coolant we advise:**
**Empfohlene Kühlung:**

- Emulsion
  Emulsion
- Air Pressure
  Luft

| *Material group* | *TSR* (N/mm²) | *Hardness* HB | *Cutting speed* Vc m/min |
|---|---|---|---|
| Carbon steel | < 750 | < 250 | **130 - 160** |
| Alloy steel | < 1000 | < 300 | **90 - 120** |
| Tool steel | > 850 | > 250 | **90 - 140** |
| | > 1000 | > 300 | **70 - 110** |
| Stainless steel | < 600 | < 200 | **90 - 120** |
| | < 850 | < 250 | **50 - 70** |
| High temp. alloys | < 900 | < 300 | **30 - 50** |
| Titanium alloys | < 900 | < 300 | **50 - 80** |
| Hardened steel | | 45-52 HRc | **100 - 180** |
| | | 50-60 HRc | |
| | | 58-70 HRc | |
| Cast iron | | < 260 | **90 - 140** |
| Copper | < 350 | < 100 | |
| Brass, bronze | < 700 | < 200 | **130 - 200** |

**VHVFR30400510603**
**Workpiece Material:** 1.4104
**Hardness:** 430F

| | Van Hoorn | Van Hoorn |
|---|---|---|
| $v_c$ | 130 m/min | 120 m/min |
| n | 10350 rpm | 4774 rpm |
| $F_z$ | 0,05 mm/t | 0,035 mm/t |
| $v_f$ | 1552 mm/min | 500 mm/min |
| $a_p$ | 1,0 mm | 8,0 mm |
| $a_e$ | 4,0 mm | 1,0 mm |
| **Coolant** | emulsion | emulsion |
| **Q** | **6,2 mm³/min** | **4,0 mm³/min** |

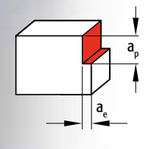
- Optimized chip removal.
  Optimierte Spanabfuhr!
- Excellent Toollife!
  Hervorragende Standzeit!
- Geometry for roughing - semi finishing.
  Schneidengeometrien für Schrupp- und mittlere Bearbeitung.

### Standard

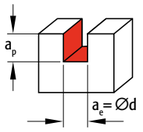
| Article Number<br>*Artikelnummer* | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
|---|---|---|---|---|---|---|---|---|---|
| VHVFR 3 020 039 03 03 | 2,0 | 0,2 | 3 | 39 | 3 | 10 | 0,05 | 3 | 15 |
| VHVFR 3 030 039 03 03 | 3,0 | 0,2 | 3 | 39 | 4 | 10 | 0,05 | 3 | - |
| VHVFR 3 040 051 06 03 | 4,0 | 0,2 | 6 | 51 | 5 | 12 | 0,10 | 3 | 15 |
| VHVFR 3 040 064 06 03 | 4,0 | 0,2 | 6 | 64 | 5 | 12 | 0,10 | 3 | 15 |
| VHVFR 3 050 051 06 03 | 5,0 | 0,2 | 6 | 51 | 6 | 14 | 0,15 | 3 | 15 |
| VHVFR 3 050 064 06 03 | 5,0 | 0,2 | 6 | 64 | 6 | 14 | 0,15 | 3 | 15 |
| VHVFR 3 060 064 06 03 | 6,0 | 0,3 | 6 | 64 | 7 | 16 | 0,20 | 3 | - |
| VHVFR 3 080 064 08 03 | 8,0 | 0,5 | 8 | 64 | 9 | 20 | 0,30 | 3 | - |
| VHVFR 3 100 070 10 03 | 10,0 | 0,5 | 10 | 70 | 12 | 25 | 0,30 | 3 | - |
| VHVFR 3 120 078 12 03 | 12,0 | 0,5 | 12 | 78 | 15 | 30 | 0,30 | 3 | - |
| VHVFR 3 160 089 16 03 | 16,0 | 0,5 | 16 | 89 | 18 | 38 | 0,30 | 3 | - |

### with Weldon / mit Weldon

| Article Number<br>*Artikelnummer* | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
|---|---|---|---|---|---|---|---|---|---|
| VHVFRW 3 060 064 06 03 | 6,0 | 0,3 | 6 | 64 | 7 | 16 | 0,20 | 3 | - |
| VHVFRW 3 080 064 08 03 | 8,0 | 0,5 | 8 | 64 | 9 | 20 | 0,30 | 3 | - |
| VHVFRW 3 100 070 10 03 | 10,0 | 0,5 | 10 | 70 | 12 | 25 | 0,30 | 3 | - |
| VHVFRW 3 120 078 12 03 | 12,0 | 0,5 | 12 | 78 | 15 | 30 | 0,30 | 3 | - |
| VHVFRW 3 160 089 16 03 | 16,0 | 0,5 | 16 | 89 | 18 | 38 | 0,30 | 3 | - |




$a_p$ up to 1,00 x d
$a_e$ up to 0,50 x d



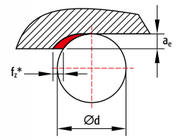

$a_p$ up to 1,00 x d

### Shoulder milling / Eckfräsen

| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 2,0 | < 2,0 | < 0,25 | 0,010 - 0,020 |
| 3,0 | < 3,0 | < 0,40 | 0,015 - 0,025 |
| 4,0 | < 4,0 | < 0,80 | 0,020 - 0,030 |
| 5,0 | < 5,0 | < 1,00 | 0,020 - 0,030 |
| 6,0 | < 6,0 | < 2,25 | 0,025 - 0,040 |
| 8,0 | < 8,0 | < 3,00 | 0,030 - 0,050 |
| 10,0 | < 10,0 | < 3,75 | 0,035 - 0,065 |
| 12,0 | < 12,0 | < 6,00 | 0,045 - 0,070 |
| 16,0 | < 16,0 | < 8,00 | 0,060 - 0,100 |

### Slot milling / Nutenfräsen

| $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|
| < 2,0 | < 2,0 | 0,010 - 0,020 |
| < 3,0 | < 3,0 | 0,015 - 0,025 |
| < 4,0 | < 4,0 | 0,020 - 0,030 |
| < 5,0 | < 5,0 | 0,020 - 0,030 |
| < 6,0 | < 6,0 | 0,025 - 0,040 |
| < 8,0 | < 8,0 | 0,030 - 0,050 |
| < 10,0 | < 10,0 | 0,035 - 0,065 |
| < 12,0 | < 12,0 | 0,045 - 0,070 |
| < 16,0 | < 16,0 | 0,060 - 0,100 |

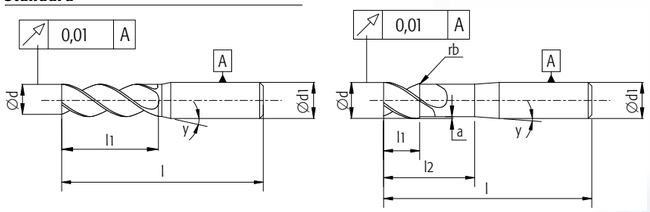



$f_z^* = f_z \sqrt{\frac{d}{a_e}}$

- At shoulder milling, feed per tooth $f_z$* for lower $a_e$ values should be converted according table.
  Beim Eckfräsen ist der Vorschub $f_z$* von der Schnittbreite $a_e$ abhängig.
- For finishing application Vc may be increased up to 20%.
  Bei Schlichtoperationen sollte die Schnittgeschwindigkeit Vc um 20% erhöht werden.

| $a_e$ | $f_z$*= |
|---|---|
| 0,10 x d | $f_z$ x 3 |
| 0,25 x d | $f_z$ x 2 |
| 0,50 x d | $f_z$ x 1 |

### Standard



**For Coolant we advise:**
**Empfohlene Kühlung:**

- Emulsion
  Emulsion
- Air Pressure
  Luft

| Material group | TSR (N/mm²) | Hardness HB | Cutting speed Vc m/min |
|---|---|---|---|
| Carbon steel | < 750 | < 250 | **130 - 160** |
| Alloy steel | < 1000 | < 300 | **90 - 120** |
| Tool steel | > 850 | > 250 | **90 - 140** |
| | > 1000 | > 300 | **70 - 110** |
| Stainless steel | < 600 | < 200 | **80 - 110** |
| | < 850 | < 250 | **50 - 70** |
| High temp. alloys | < 900 | < 300 | **30 - 50** |
| Titanium alloys | < 900 | < 300 | **50 - 80** |
| Hardened steel | | 45-52 HRc | **100 - 150** |
| | | 50-60 HRc | |
| | | 58-70 HRc | |
| Cast iron | | < 260 | **90 - 140** |
| Copper | < 350 | < 100 | |
| Brass, bronze | < 700 | < 200 | **130 - 200** |

**VHVF30300390303**
**Material** 1.2311 not hardened

| | |
|---|---|
| $v_c$ | 90 m/min |
| n | 9550 rpm |
| $f_z$ | 0,008 mm/t |
| $v_f$ | 230 mm/min |
| $a_p$ | 2,5 mm |
| $a_e$ | 3 mm |
| **Coolant** | emulsion |
| **Q** | **1,73 cm³/min** |

- Improved toollife.
  Erhöhte Standzeit.
- No burrs.
  Gratfrei.
- Optimized surface finish.
  Optimierte Oberflächenqualität.

### Short / Kurze Ausführung

| Article Number / Artikelnummer | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) | |
|---|---|---|---|---|---|---|---|---|---|---|
| VHVF 3 020 039 03 03 S | 2,0 | - | 3 | 39 | 4 | 8 | 0,05 | 3 | 15 | new/neu |
| VHVF 3 030 039 03 03 S | 3,0 | - | 3 | 39 | 5 | 10 | 0,05 | 3 | - | new/neu |
| VHVF 3 040 051 04 03 S | 4,0 | - | 4 | 51 | 6 | 12 | 0,10 | 3 | - | new/neu |
| VHVF 3 050 051 05 03 S | 5,0 | - | 5 | 51 | 7 | 14 | 0,15 | 3 | - | new/neu |
| VHVF 3 060 064 06 03 S | 6,0 | - | 6 | 64 | 8 | 16 | 0,20 | 3 | - | new/neu |
| VHVF 3 080 064 08 03 S | 8,0 | - | 8 | 64 | 11 | 20 | 0,30 | 3 | - | new/neu |
| VHVF 3 100 070 10 03 S | 10,0 | - | 10 | 70 | 13 | 22 | 0,30 | 3 | - | new/neu |
| VHVF 3 120 078 12 03 S | 12,0 | - | 12 | 78 | 15 | 25 | 0,30 | 3 | - | new/neu |
| VHVF 3 160 089 16 03 S | 16,0 | - | 16 | 89 | 19 | 35 | 0,30 | 3 | - | new/neu |

### Standard

| Article Number / Artikelnummer | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
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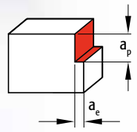
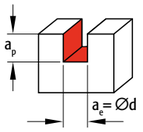
| VHVF 3 030 039 03 03 | 3,0 | - | 3 | 39 | 10 | - | - | 3 | - |
| VHVF 3 040 051 04 03 | 4,0 | - | 4 | 51 | 12 | - | - | 3 | - |
| VHVF 3 050 051 05 03 | 5,0 | - | 5 | 51 | 14 | - | - | 3 | - |
| VHVF 3 060 064 06 03 | 6,0 | - | 6 | 64 | 16 | - | - | 3 | - |
| VHVF 3 080 064 08 03 | 8,0 | - | 8 | 64 | 20 | - | - | 3 | - |
| VHVF 3 100 070 10 03 | 10,0 | - | 10 | 70 | 22 | - | - | 3 | - |
| VHVF 3 120 078 12 03 | 12,0 | - | 12 | 78 | 25 | - | - | 3 | - |
| VHVF 3 160 089 16 03 | 16,0 | - | 16 | 89 | 35 | - | - | 3 | - |

### with Weldon / mit Weldon

| Article Number / Artikelnummer | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
|---|---|---|---|---|---|---|---|---|---|
| VHVFW 3 060 064 06 03 | 6,0 | - | 6 | 64 | 16 | - | - | 3 | - |
| VHVFW 3 080 064 08 03 | 8,0 | - | 8 | 64 | 20 | - | - | 3 | - |
| VHVFW 3 100 070 10 03 | 10,0 | - | 10 | 70 | 22 | - | - | 3 | - |
| VHVFW 3 120 078 12 03 | 12,0 | - | 12 | 78 | 25 | - | - | 3 | - |
| VHVFW 3 160 089 16 03 | 16,0 | - | 16 | 89 | 35 | - | - | 3 | - |




$a_p$ up to 2,00 x d
$a_e$ up to 0,50 x d




$a_p$ up to 1,50 x d

### Shoulder milling / Eckfräsen

| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 2,0 | < 3,0 | < 0,25 | 0,010 - 0,020 |
| 3,0 | < 4,0 | < 0,40 | 0,015 - 0,025 |
| 4,0 | < 5,0 | < 0,80 | 0,020 - 0,030 |
| 5,0 | < 7,5 | < 1,00 | 0,020 - 0,030 |
| 6,0 | < 9,0 | < 2,25 | 0,025 - 0,040 |
| 8,0 | < 16,0 | < 3,00 | 0,030 - 0,050 |
| 10,0 | < 20,0 | < 3,75 | 0,035 - 0,065 |
| 12,0 | < 24,0 | < 6,00 | 0,045 - 0,070 |
| 16,0 | < 32,0 | < 8,00 | 0,060 - 0,100 |

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| < 4,0 | < 4,0 | 0,020 - 0,030 |
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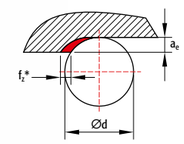
| < 6,0 | < 6,0 | 0,025 - 0,040 |
| < 10,0 | < 8,0 | 0,030 - 0,050 |
| < 12,0 | < 10,0 | 0,035 - 0,065 |
| < 18,0 | < 12,0 | 0,045 - 0,070 |
| < 24,0 | < 16,0 | 0,060 - 0,100 |




$$f_z^* = f_z \sqrt{\frac{d}{a_e}}$$

- At shoulder milling, feed per tooth $f_z$* for lower $a_e$ values should be converted according table.
  Beim Eckfräsen ist der Vorschub $f_z$* von der Schnittbreite $a_e$ abhängig.
- Given conditions are based on VHVFF endmills with chamfer. VHVF is with sharp corner.
  Angegebene Schnittdaten beziehen sich auf VHFF Schaftfräser mit Kantenfase. VHVF Ausführung hat scharfe Schneidkanten.
- For finishing application Vc may be increased up to 20%.
  Bei Schlichtoperationen sollte die Schnittgeschwindigkeit Vc um 20% erhöht werden.

| $a_e$ | $f_z$*= |
|---|---|
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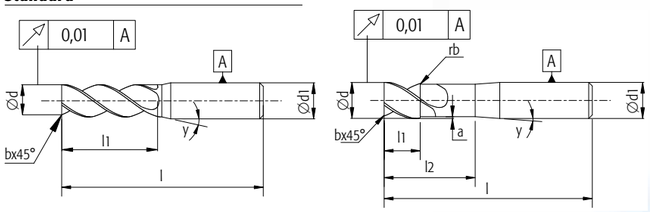
| 0,50 x d | $f_z$ x 1 |

### Standard



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  Emulsion
- Air Pressure
  Luft

| Material group | TSR (N/mm²) | Hardness HB | Cutting speed Vc m/min |
|---|---|---|---|
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| Titanium alloys | < 900 | < 300 | **50 - 80** |
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| | | 50-60 HRc | |
| | | 58-70 HRc | |
| Cast iron | | < 260 | **90 - 140** |
| Copper | < 350 | < 100 | |
| Brass, bronze | < 700 | < 200 | **130 - 200** |

**VHVFFW30800640803**
**Hardness:** Stainless 304

| | |
|---|---|
| $v_c$ | 90 m/min |
| n | 3580 rpm |
| $f_z$ | 0,038 mm/t |
| $v_f$ | 408 mm/min |
| $a_p$ | 10,0 mm |
| $a_e$ | 8,0 mm |
| Coolant | emulsion |
| Q | 32,6 cm³/min |

- Slotting application.
  Nutenfräsen.
- No burrs.
  Gratfrei.
- Excellent surface finish!
  Ausgezeichnete Oberflächenqualität.

### Short / Kurze Ausführung

| Article Number<br>*Artikelnummer* | Ød (mm) | b (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) | |
|---|---|---|---|---|---|---|---|---|---|---|
| VHVFF 3 020 039 03 03 S | 2,0 | 0,10 | 3 | 39 | 4 | 8 | 0,05 | 3 | 15 | new/neu |
| VHVFF 3 030 039 03 03 S | 3,0 | 0,10 | 3 | 39 | 5 | 10 | 0,05 | 3 | - | new/neu |
| VHVFF 3 040 051 04 03 S | 4,0 | 0,10 | 4 | 51 | 6 | 12 | 0,10 | 3 | - | new/neu |
| VHVFF 3 050 051 05 03 S | 5,0 | 0,15 | 5 | 51 | 7 | 14 | 0,15 | 3 | - | new/neu |
| VHVFF 3 060 064 06 03 S | 6,0 | 0,15 | 6 | 64 | 8 | 16 | 0,20 | 3 | - | new/neu |
| VHVFF 3 080 064 08 03 S | 8,0 | 0,20 | 8 | 64 | 11 | 20 | 0,30 | 3 | - | new/neu |
| VHVFF 3 100 070 10 03 S | 10,0 | 0,20 | 10 | 70 | 13 | 22 | 0,30 | 3 | - | new/neu |
| VHVFF 3 120 078 12 03 S | 12,0 | 0,25 | 12 | 78 | 15 | 25 | 0,30 | 3 | - | new/neu |
| VHVFF 3 160 089 16 03 S | 16,0 | 0,25 | 16 | 89 | 19 | 35 | 0,30 | 3 | - | new/neu |

### Standard

| Article Number<br>*Artikelnummer* | Ød (mm) | b (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
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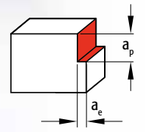
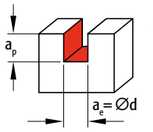
| VHVFF 3 030 039 03 03 | 3,0 | 0,10 | 3 | 39 | 10 | - | - | 3 | - |
| VHVFF 3 040 051 04 03 | 4,0 | 0,10 | 4 | 51 | 12 | - | - | 3 | - |
| VHVFF 3 050 051 05 03 | 5,0 | 0,15 | 5 | 51 | 14 | - | - | 3 | - |
| VHVFF 3 060 064 06 03 | 6,0 | 0,15 | 6 | 64 | 16 | - | - | 3 | - |
| VHVFF 3 080 064 08 03 | 8,0 | 0,20 | 8 | 64 | 20 | - | - | 3 | - |
| VHVFF 3 100 070 10 03 | 10,0 | 0,20 | 10 | 70 | 22 | - | - | 3 | - |
| VHVFF 3 120 078 12 03 | 12,0 | 0,25 | 12 | 78 | 25 | - | - | 3 | - |
| VHVFF 3 160 089 16 03 | 16,0 | 0,25 | 16 | 89 | 35 | - | - | 3 | - |

### with Weldon / mit Weldon

| Article Number<br>*Artikelnummer* | Ød (mm) | b (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
|---|---|---|---|---|---|---|---|---|---|
| VHVFFW 3 060 064 06 03 | 6,0 | 0,15 | 6 | 64 | 16 | - | - | 3 | - |
| VHVFFW 3 080 064 08 03 | 8,0 | 0,20 | 8 | 64 | 20 | - | - | 3 | - |
| VHVFFW 3 100 070 10 03 | 10,0 | 0,20 | 10 | 70 | 22 | - | - | 3 | - |
| VHVFFW 3 120 078 12 03 | 12,0 | 0,25 | 12 | 78 | 25 | - | - | 3 | - |
| VHVFFW 3 160 089 16 03 | 16,0 | 0,25 | 16 | 89 | 35 | - | - | 3 | - |




$a_p$ up to 2,00 x d
$a_e$ up to 0,50 x d



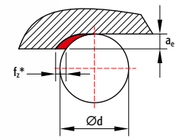

$a_p$ up to 1,50 x d

### Shoulder milling / Eckfräsen

| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 2,0 | < 3,0 | < 0,25 | 0,010 - 0,020 |
| 3,0 | < 4,0 | < 0,40 | 0,015 - 0,025 |
| 4,0 | < 5,0 | < 0,80 | 0,020 - 0,030 |
| 5,0 | < 7,5 | < 1,00 | 0,020 - 0,030 |
| 6,0 | < 9,0 | < 2,25 | 0,025 - 0,040 |
| 8,0 | < 16,0 | < 3,00 | 0,030 - 0,050 |
| 10,0 | < 20,0 | < 3,75 | 0,035 - 0,065 |
| 12,0 | < 24,0 | < 6,00 | 0,045 - 0,070 |
| 16,0 | < 32,0 | < 8,00 | 0,060 - 0,100 |

### Slot milling / Nutenfräsen

| $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|
| < 2,0 | < 2,0 | 0,010 - 0,020 |
| < 3,0 | < 3,0 | 0,015 - 0,025 |
| < 4,0 | < 4,0 | 0,020 - 0,030 |
| < 5,0 | < 5,0 | 0,020 - 0,030 |
| < 6,0 | < 6,0 | 0,025 - 0,040 |
| < 10,0 | < 8,0 | 0,030 - 0,050 |
| < 12,0 | < 10,0 | 0,035 - 0,065 |
| < 18,0 | < 12,0 | 0,045 - 0,070 |
| < 24,0 | < 16,0 | 0,060 - 0,100 |

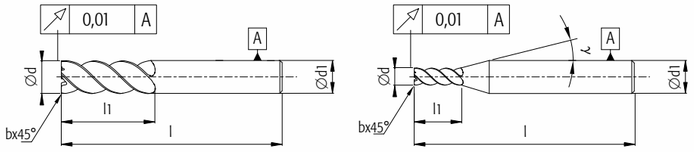



$$f_z^* = f_z \sqrt{\frac{d}{a_e}}$$

- At shoulder milling, feed per tooth $f_z$* for lower $a_e$ values should be converted according table.
  Beim Eckfräsen ist der Vorschub $f_z$* von der Schnittbreite $a_e$ abhängig.
- Given conditions are based on VHVFF endmills with chamfer. VHVF is with sharp corner.
  Angegebene Schnittdaten beziehen sich auf VHFF Schaftfräser mit Kantenfase. VHVF Ausführung hat scharfe Schneidkanten.
- For finishing application Vc may be increased up to 20%.
  Bei Schlichtoperationen sollte die Schnittgeschwindigkeit Vc um 20% erhöht werden.

| $a_e$ | $f_z$*= |
|---|---|
| 0,10 x d | $f_z$ x 3 |
| 0,25 x d | $f_z$ x 2 |
| 0,50 x d | $f_z$ x 1 |

### Standard



**For Coolant we advise:**
**Empfohlene Kühlung:**

- Emulsion
  Emulsion
- Air Pressure
  Luft

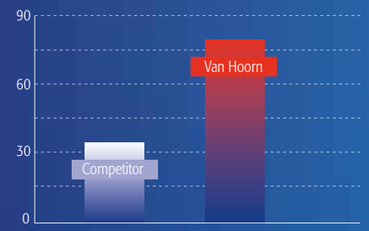
| *Material group* | *TSR* (N/mm²) | *Hardness* HB | *Cutting speed* Vc m/min |
|---|---|---|---|
| Carbon Steel | < 750 | < 250 | **130 - 160** |
| Alloy Steel | < 1000 | < 300 | **90 - 120** |
| Tool Steel | > 850 | > 250 | **90 - 140** |
| | > 1000 | > 300 | **70 - 110** |
| Stainless Steel | < 600 | < 200 | **80 - 110** |
| | < 850 | < 250 | **50 - 70** |
| High Temp. Alloys | < 900 | < 300 | **25 - 50** |
| Titanium Alloys | < 900 | < 300 | **50 - 80** |
| Hardened steel | | 45-52 HRc | **100 - 150** |
| | | 50-60 HRc | |
| | | 58-70 HRc | |
| Cast Iron | | < 260 | **90 - 140** |

**VHVFFW41000701003**
**Workpiece Material:** 1.2316

| | Van Hoorn | Competitor |
|---|---|---|
| $v_c$ | 140 m/min | 120 m/min |
| n | 4455 rpm | 3820 rpm |
| $F_z$ | 0,045 mm/t | 0,046 mm/t |
| $v_f$ | 800 mm/min | 700 mm/min |
| $a_p$ | 10,0 mm | 4,75 mm |
| $a_e$ | 10,0 mm | 10,0 mm |
| **Coolant** | emulsion | emulsion |
| **Q** | **80,0 mm³/min** | **33,25 mm³/min** |

**No burrs on workpiece**

## Material removal rate




### Short / Kurze Ausführung

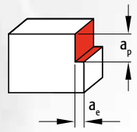
| Article Number<br>*Artikelnummer* | Ød (mm) | b (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | |
|---|---|---|---|---|---|---|---|---|---|
| VHVFF 4 040 051 04 03 S | 4,0 | 0,10 | 4 | 51 | 6 | 12 | 0,1 | 4 | new/neu |
| VHVFF 4 060 064 06 03 S | 6,0 | 0,15 | 6 | 64 | 7 | 14 | 0,2 | 4 | new/neu |
| VHVFF 4 080 064 08 03 S | 8,0 | 0,20 | 8 | 64 | 11 | 20 | 0,3 | 4 | new/neu |
| VHVFF 4 100 070 10 03 S | 10,0 | 0,20 | 10 | 70 | 13 | 22 | 0,3 | 4 | new/neu |
| VHVFF 4 120 078 12 03 S | 12,0 | 0,25 | 12 | 78 | 15 | 25 | 0,3 | 4 | new/neu |
| VHVFF 4 160 089 16 03 S | 16,0 | 0,25 | 16 | 89 | 19 | 35 | 0,3 | 4 | new/neu |
| VHVFF 4 200 102 20 03 S | 20,0 | 0,50 | 20 | 102 | 23 | 40 | 0,3 | 4 | new/neu |

### Standard

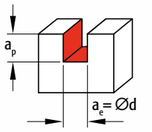
| Article Number<br>*Artikelnummer* | Ød (mm) | b (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z |
|---|---|---|---|---|---|---|---|---|
| VHVFF 4 040 051 04 03 | 4,0 | 0,10 | 4 | 51 | 12 | - | - | 4 |
| VHVFF 4 060 064 06 03 | 6,0 | 0,15 | 6 | 64 | 16 | - | - | 4 |
| VHVFF 4 080 064 08 03 | 8,0 | 0,20 | 8 | 64 | 20 | - | - | 4 |
| VHVFF 4 100 070 10 03 | 10,0 | 0,20 | 10 | 70 | 22 | - | - | 4 |
| VHVFF 4 120 078 12 03 | 12,0 | 0,25 | 12 | 78 | 25 | - | - | 4 |
| VHVFF 4 160 089 16 03 | 16,0 | 0,25 | 16 | 89 | 35 | - | - | 4 |
| VHVFF 4 200 102 20 03 | 20,0 | 0,50 | 20 | 102 | 40 | - | - | 4 |

### with Weldon / mit Weldon

| Article Number<br>*Artikelnummer* | Ød (mm) | b (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z |
|---|---|---|---|---|---|---|---|---|
| VHVFFW 4 060 064 06 03 | 6,0 | 0,15 | 6 | 64 | 16 | - | - | 4 |
| VHVFFW 4 080 064 08 03 | 8,0 | 0,20 | 8 | 64 | 20 | - | - | 4 |
| VHVFFW 4 100 070 10 03 | 10,0 | 0,20 | 10 | 70 | 22 | - | - | 4 |
| VHVFFW 4 120 078 12 03 | 12,0 | 0,25 | 12 | 78 | 25 | - | - | 4 |
| VHVFFW 4 160 089 16 03 | 16,0 | 0,25 | 16 | 89 | 35 | - | - | 4 |
| VHVFFW 4 200 102 20 03 | 20,0 | 0,25 | 20 | 102 | 40 | - | - | 4 |




$a_p$ up to 2,00 x d
$a_e$ up to 0,50 x d



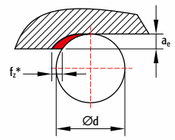

$a_p$ up to 1,50 x d

### Shoulder milling / Eckfräsen

| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 4,0 | < 5,0 | < 0,80 | 0,035 - 0,055 |
| 6,0 | < 9,0 | < 2,25 | 0,040 - 0,050 |
| 8,0 | < 16,0 | < 3,00 | 0,035 - 0,055 |
| 10,0 | < 20,0 | < 3,75 | 0,050 - 0,065 |
| 12,0 | < 24,0 | < 6,00 | 0,055 - 0,070 |
| 16,0 | < 32,0 | < 8,00 | 0,065 - 0,080 |
| 20,0 | < 38,0 | < 10,0 | 0,075 - 0,090 |

### Slot milling / Nutenfräsen

| $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|
| < 4,0 | < 4,0 | 0,035 - 0,045 |
| < 6,0 | < 6,0 | 0,040 - 0,050 |
| < 10,0 | < 8,0 | 0,045 - 0,055 |
| < 12,0 | < 10,0 | 0,050 - 0,065 |
| < 18,0 | < 12,0 | 0,055 - 0,070 |
| < 24,0 | < 16,0 | 0,065 - 0,080 |
| <30,0 | < 20,0 | 0,075 - 0,090 |



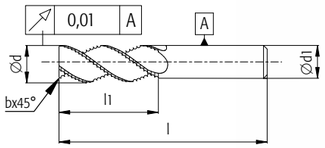

$f_z^* = f_z \sqrt{\frac{d}{a_e}}$

- At shoulder milling, feed per tooth $f_z$* for lower $a_e$ values should be converted according table.

  Beim Eckfräsen ist der Vorschub $f_z$* von der Schnittbreite $a_e$ abhängig.

| $a_e$ | $f_z$*= |
|---|---|
| 0,10 x d | $f_z$ x 3 |
| 0,25 x d | $f_z$ x 2 |
| 0,50 x d | $f_z$ x 1 |

### Standard



**For Coolant we advise:**
**Empfohlene Kühlung:**

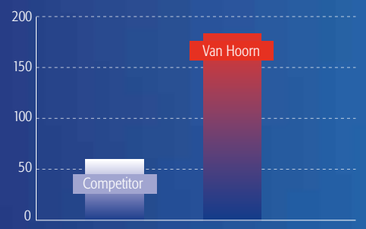
- Emulsion
  Emulsion
- Air Pressure
  Luft

| *Material group* | *TSR* (N/mm²) | *Hardness* HB | *Cutting speed* Vc m/min |
|---|---|---|---|
| Carbon steel | < 750 | < 250 | **180 - 250** |
| Alloy steel | < 1000 | < 300 | **150 - 200** |
| Tool steel | > 850 | > 250 | **150 - 180** |
| | > 1000 | > 300 | **110 - 150** |
| Cast iron | | < 260 | **110 - 170** |

**VHRFFW31600891603100**
**Workpiece Material:** 1.0718
**Hardness:** 170 HB

| | Van Hoorn | Competitor |
|---|---|---|
| $v_c$ | 250 m/min | 250 m/min |
| n | 4975 rpm | 4975 rpm |
| $F_z$ | 0,20 mm/t | 0,08 mm/t |
| $v_f$ | 3000 mm/min | 2000 mm/min |
| $a_p$ | 20,0 mm | 20,0 mm |
| $a_e$ | 3,0 mm | 1,5 mm |
| Coolant | emulsion | emulsion |
| Q | **180,0 mm³/min** | **60,0 mm³/min** |

**Material removal rate**

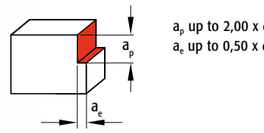



### Standard

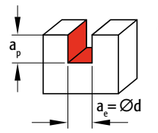
| Article Number<br>*Artikelnummer* | Ød (mm) | b (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z |
|---|---|---|---|---|---|---|---|---|
| VHRFF 3 060 064 06 03 025 | 6,0 | 0,25 | 6 | 64 | 16 | - | - | 3 |
| VHRFF 3 080 064 08 03 050 | 8,0 | 0,50 | 8 | 64 | 20 | - | - | 3 |
| VHRFF 3 100 070 10 03 050 | 10,0 | 0,50 | 10 | 70 | 22 | - | - | 3 |
| VHRFF 3 120 078 12 03 050 | 12,0 | 0,50 | 12 | 78 | 25 | - | - | 3 |
| VHRFF 3 140 089 14 03 100 | 14,0 | 1,00 | 14 | 89 | 25 | - | - | 3 |
| VHRFF 3 160 089 16 03 100 | 16,0 | 1,00 | 16 | 89 | 35 | - | - | 3 |
| VHRFF 4 200 102 20 03 100 | 20,0 | 1,00 | 20 | 102 | 40 | - | - | 4 |

### with Weldon / mit Weldon

| Article Number<br>*Artikelnummer* | Ød (mm) | b (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z |
|---|---|---|---|---|---|---|---|---|
| VHRFFW 3 060 064 06 03 025 | 6,0 | 0,25 | 6 | 64 | 16 | - | - | 3 |
| VHRFFW 3 080 064 08 03 050 | 8,0 | 0,50 | 8 | 64 | 20 | - | - | 3 |
| VHRFFW 3 100 070 10 03 050 | 10,0 | 0,50 | 10 | 70 | 22 | - | - | 3 |
| VHRFFW 3 120 078 12 03 050 | 12,0 | 0,50 | 12 | 78 | 25 | - | - | 3 |
| VHRFFW 3 140 089 14 03 100 | 14,0 | 1,00 | 14 | 89 | 25 | - | - | 3 |
| VHRFFW 3 160 089 16 03 100 | 16,0 | 1,00 | 16 | 89 | 35 | - | - | 3 |
| VHRFFW 4 200 102 20 03 100 | 20,0 | 1,00 | 20 | 102 | 40 | - | - | 4 |




$a_p$ up to 2,00 x d
$a_e$ up to 0,50 x d



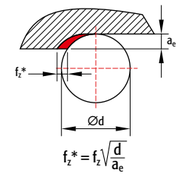

$a_p$ up to 2,00 x d

### Shoulder milling / Eckfräsen

| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 6,0 | < 9,0 | < 3,0 | 0,03 - 0,04 |
| 8,0 | < 16,0 | < 4,0 | 0,04 - 0,06 |
| 10,0 | < 20,0 | < 5,0 | 0,06 - 0,08 |
| 12,0 | < 24,0 | < 6,0 | 0,08 - 0,10 |
| 14,0 | < 28,0 | < 7,0 | 0,10 - 0,12 |
| 16,0 | < 32,0 | < 8,0 | 0,12 - 0,15 |
| 20,0 | < 40,0 | < 10,0 | 0,12 - 0,20 |

### Slot milling / Nutenfräsen

| $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|
| < 6,0 | < 6,0 | 0,03 - 0,04 |
| < 10,0 | < 8,0 | 0,04 - 0,06 |
| < 15,0 | < 10,0 | 0,06 - 0,08 |
| < 24,0 | < 12,0 | 0,08 - 0,10 |
| < 28,0 | < 14,0 | 0,10 - 0,12 |
| < 32,0 | < 16,0 | 0,12 - 0,15 |
| < 40,0 | < 20,0 | 0,12 - 0,20 |




- At shoulder milling, feed per tooth $f_z$* for lower $a_e$ values should be converted according table.reduce $f_z$ according to table.

  Beim Eckfräsen ist der Vorschub $f_z$* von der Schnittbreite $a_e$ abhängig. Vorschub $f_z$ ist gemäß Schnittwertempfehlungen zu reduzieren.

| $a_e$ | $f_z$*= |
|---|---|
| 0,10 x Ød | $f_z$ x 3 |
| 0,25 x Ød | $f_z$ x 2 |
| 0,50 x Ød | $f_z$ x 1 |

# Solutions for synthetics and composite materials

## Lösungen für die Bearbeitung von Kunst- und Verbundwerkstoffen

Years of experience and numerous tests in aerospace applications, provided the details required to develop an integral endmill high-end program for glass- and carbon fibre reinforced materials.

Jahrelange Erfahrung und zahlreiche Test in der Luft- und Raumfahrtindustrie ermöglichten die Entwicklung eines umfassenden High-End-Fräserprogramms für Glas- und Kohlefaserverstärkte Werkstoffe.

# Diamond tipped vs PCD

## Diamantbestückung vs PCD

- 2 To 5 times more toollife
  2 Bis 5-fache Standzeit
- More accuracy & a better surface finish
  Höhere Genauigkeit und bessere Oberflächenqualität
- Higher machine efficiency
  Höhere Maschineneffizienz

**Singleflute endmills for plastics and synthetic materials:**
**Einschneiden-Schaftfräser für Kunststoffe und Synthetische Werkstoffe:**
**Superior surface finish and high productivity!**
**Überragende Oberflächenqualität und hohe Produktivität!**

- Polish finish
  Poliert
- Low radial forces
  Geringe radiale Schnittkräfte
- Sharp & pre-balanced cutting geometry
  Scharfe und vorgewuchtete Schneidengeometrie

## VHC diamond coating: 100% perfect diamond coating, with a very smooth surface!

## VHC Diamant-Beschichtung: 100%ige Diamant-Beschichtung mit sehr glatter Oberfläche!

Optimized resistance against mechanical abrasion, less friction and minimized cutting edge roundness:
Erhöhte Verschleißfestigkeit bei mechanischer Beanspruchung, weniger Reibung und eine minimale Kantenverrundung:

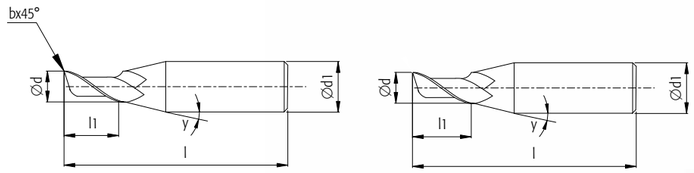
- Better toollife
  Erhöhte Standzeit
- Excellent surface finish
  Ausgezeichnete Oberflächenqualität
- Higher productivity
  Höhere Produktivität

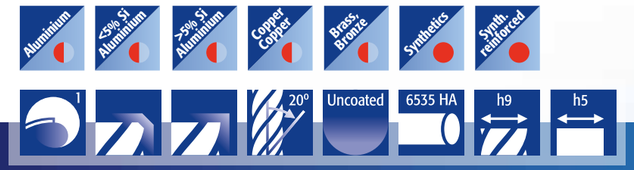
# Van Hoorn vs competitor

**Workpiece Material:** Glass Fibre Synthetic
**Endmill:** VHKE10200390310L030
Cilindrical Shank, Ø2, Z=1

| | Van Hoorn | Competitor |
|---|---|---|
| $v_c$ | 94 m/min | 94 m/min |
| n | 15.000 -/min | 15.000 -/min |
| $F_z$ | 0,06 mm/t | 0,05 mm/t |
| $v_f$ | 900 mm/min | 750 mm/min |
| $a_p$ | 2 mm | 1 mm |
| $a_e$ | 2 mm | 2 mm |
| **Coolant** | air | air |
| **Q** | **3600 mm³/min** | **1500 mm³/min** |

### Standard



**For Coolant we advise:**
**Empfohlene Kühlung:**

- Emulsion
  when available and allowed
  Emulsion
  Wenn möglich
- Air Pressure
  Luft

| Material group | TSR (N/mm²) | Hardness HB | Cutting speed Vc m/min |
|---|---|---|---|
| Aluminium | < 350 | < 100 | **< 600** |
| Aluminium < 5% Si | < 500 | < 150 | **< 400** |
| Aluminium > 5% Si | < 400 | < 120 | **< 300** |
| Copper | < 350 | < 100 | **< 350** |
| Brass, bronze | < 700 | < 200 | **< 250** |
| Synthetics | | | **< 700** |

**VHKE10300510610L060**

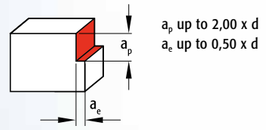
| | |
|---|---|
| **$v_c$** | 226 m/min |
| **n** | 24000 rpm |
| **$f_z$** | 0,167 mm/t |
| **$v_f$** | 4000 mm/min |
| **$a_p$** | 5,0 mm |
| **$a_e$** | 3,0 mm |
| **Coolant** | air |
| **Q** | **60,0 cm³/min** |

- No burrs!
  Gratfrei!
- Excellent chip evacuation!
  Ausgezeichnete Spanabfuhr!

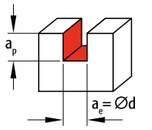
| Article Number<br>*Artikelnummer* | Ød (mm) | b (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) | |
|---|---|---|---|---|---|---|---|---|---|---|
| VHKE 1 010 039 03 10 L 020 | 1,0 | - | 3 | 39 | 2,0 | - | - | 1 | 15 | |
| VHKE 1 010 039 03 10 L 040 | 1,0 | - | 3 | 39 | 4,0 | - | - | 1 | 15 | |
| VHKE 1 015 039 03 10 L 025 | 1,5 | - | 3 | 39 | 2,5 | - | - | 1 | 15 | |
| VHKE 1 015 039 03 10 L 050 | 1,5 | - | 3 | 39 | 5,0 | - | - | 1 | 15 | |
| VHKE 1 020 039 03 10 L 030 | 2,0 | - | 3 | 39 | 3,0 | - | - | 1 | 15 | |
| VHKE 1 020 039 03 10 L 060 | 2,0 | - | 3 | 39 | 6,0 | - | - | 1 | 15 | |
| VHKE 1 025 039 03 10 L 040 | 2,5 | - | 3 | 39 | 4,0 | - | - | 1 | 15 | |
| VHKE 1 025 039 03 10 L 060 | 2,5 | - | 3 | 39 | 6,0 | - | - | 1 | 15 | |
| VHKE 1 030 051 06 10 L 040 | 3,0 | 0,05 | 6 | 51 | 4,0 | - | - | 1 | 15 | |
| VHKE 1 030 051 06 10 L 060 | 3,0 | 0,05 | 6 | 51 | 6,0 | - | - | 1 | 15 | |
| VHKE 1 030 051 06 10 L 080 | 3,0 | 0,05 | 6 | 51 | 8,0 | - | - | 1 | 15 | new/neu |
| VHKE 1 030 051 06 10 L 120 | 3,0 | 0,05 | 6 | 51 | 12,0 | - | - | 1 | 15 | new/neu |
| VHKE 1 040 051 06 10 L 050 | 4,0 | 0,05 | 6 | 51 | 5,0 | - | - | 1 | 15 | |
| VHKE 1 040 051 06 10 L 080 | 4,0 | 0,05 | 6 | 51 | 8,0 | - | - | 1 | 15 | |
| VHKE 1 040 051 06 10 L 100 | 4,0 | 0,05 | 6 | 51 | 10,0 | - | - | 1 | 15 | new/neu |
| VHKE 1 040 051 06 10 L 140 | 4,0 | 0,05 | 6 | 51 | 14,0 | - | - | 1 | 15 | new/neu |
| VHKE 1 050 051 06 10 L 060 | 5,0 | 0,08 | 6 | 51 | 6,0 | - | - | 1 | 15 | |
| VHKE 1 050 051 06 10 L 100 | 5,0 | 0,08 | 6 | 51 | 10,0 | - | - | 1 | 15 | |
| VHKE 1 050 051 06 10 L 120 | 5,0 | 0,08 | 6 | 51 | 12,0 | - | - | 1 | 15 | new/neu |
| VHKE 1 060 051 06 10 L 080 | 6,0 | 0,10 | 6 | 51 | 8,0 | - | - | 1 | - | |
| VHKE 1 060 051 06 10 L 120 | 6,0 | 0,10 | 6 | 51 | 12,0 | - | - | 1 | - | |
| VHKE 1 060 051 06 10 L 140 | 6,0 | 0,10 | 6 | 51 | 14,0 | - | - | 1 | - | new/neu |
| VHKE 1 080 060 08 10 L 100 | 8,0 | 0,12 | 8 | 60 | 10,0 | - | - | 1 | - | |
| VHKE 1 080 060 08 10 L 160 | 8,0 | 0,12 | 8 | 60 | 16,0 | - | - | 1 | - | |
| VHKE 1 100 070 10 10 L 120 | 10,0 | 0,15 | 10 | 70 | 12,0 | - | - | 1 | - | |
| VHKE 1 100 070 10 10 L 220 | 10,0 | 0,15 | 10 | 70 | 22,0 | - | - | 1 | - | |
| VHKE 1 120 078 12 10 L 150 | 12,0 | 0,20 | 12 | 78 | 15,0 | - | - | 1 | - | |

### *Long / Lange Ausführung*

| Article Number<br>*Artikelnummer* | Ød (mm) | b (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) | |
|---|---|---|---|---|---|---|---|---|---|---|
| VHKE 1 030 060 06 10 L 220 | 3,0 | - | 6 | 60 | 22 | - | - | 1 | 15 | new/neu |
| VHKE 1 040 060 06 10 L 220 | 4,0 | - | 6 | 60 | 22 | - | - | 1 | 15 | new/neu |
| VHKE 1 060 064 06 10 L 250 | 6,0 | - | 6 | 64 | 25 | - | - | 1 | - | new/neu |
| VHKE 1 060 070 06 10 L 320 | 6,0 | - | 6 | 70 | 32 | - | - | 1 | - | new/neu |
| VHKE 1 080 078 08 10 L 420 | 8,0 | - | 8 | 78 | 42 | - | - | 1 | - | new/neu |




$a_p$ up to 2,00 x d
$a_e$ up to 0,50 x d




$a_p$ up to 1,00 x d

### *Shoulder milling / Eckfräsen*

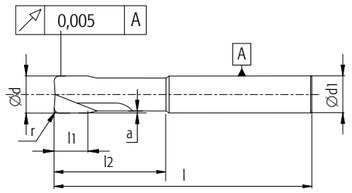
| Ød (mm) | ap max. (mm) | ae max. (mm) | fz (mm/tooth) |
|---|---|---|---|
| 1,0 | < 0,8 | < 0,25 | 0,015 - 0,020 |
| 1,5 | < 1,1 | < 0,38 | 0,023 - 0,027 |
| 2,0 | < 1,5 | < 0,50 | 0,030 - 0,043 |
| 2,5 | < 1,9 | < 0,63 | 0,034 - 0,060 |
| 3,0 | < 2,3 | < 0,75 | 0,045 - 0,070 |
| 4,0 | < 4,0 | < 2,0 | 0,050 - 0,080 |
| 5,0 | < 5,0 | < 2,5 | 0,060 - 0,100 |
| 6,0 | < 6,0 | < 3,0 | 0,075 - 0,120 |
| 8,0 | < 8,0 | < 4,0 | 0,095 - 0,150 |
| 10,0 | < 10,0 | < 5,0 | 0,115 - 0,185 |
| 12,0 | < 12,0 | < 6,0 | 0,140 - 0,230 |

### *Slot milling / Nutenfräsen*

| ap max. (mm) | ae max. (mm) | fz (mm/tooth) |
|---|---|---|
| < 0,8 | 1,0 | 0,015 - 0,020 |
| < 1,1 | 1,5 | 0,023 - 0,027 |
| < 1,5 | 2,0 | 0,030 - 0,043 |
| < 1,9 | 2,5 | 0,034 - 0,060 |
| < 2,3 | 3,0 | 0,045 - 0,070 |
| < 4,0 | 4,0 | 0,050 - 0,080 |
| < 5,0 | 5,0 | 0,060 - 0,100 |
| < 6,0 | 6,0 | 0,075 - 0,120 |
| < 8,0 | 8,0 | 0,095 - 0,150 |
| < 10,0 | 10,0 | 0,115 - 0,185 |
| < 12,0 | 12,0 | 0,140 - 0,230 |

- **Cutting speed Vc is based on max. 50.000 rpm.**
  Schnittgeschwindigkeit Vc bezogen auf max. 50.000 U/min.
- **Endmills can be used also for drilling with reduced cutting conditions.**
  Mit verringerten Schnittwerten können die Fräser auch zur Herstellung von Bohrungen verwendet werden.

### Standard



| Article Number<br>*Artikelnummer* | Ød<br>(mm) | r<br>(mm) | Ød1<br>(mm) | L<br>(mm) | L1<br>(mm) | L2<br>(mm) | a<br>(mm) | z | γ<br>(°) | |
|---|---|---|---|---|---|---|---|---|---|---|
| VHDT 2 030 078 030 L09 | 3,0 | 0,30 | 6 | 78 | 2,5 | 9 | 0,25 | 2 | 25 | new/neu |
| VHDT 2 030 078 030 L15 | 3,0 | 0,30 | 6 | 78 | 2,5 | 15 | 0,25 | 2 | 25 | new/neu |
| VHDT 2 030 078 050 L09 | 3,0 | 0,50 | 6 | 78 | 2,5 | 9 | 0,25 | 2 | 25 | new/neu |
| VHDT 2 030 078 050 L15 | 3,0 | 0,50 | 6 | 78 | 2,5 | 15 | 0,25 | 2 | 25 | new/neu |
| VHDT 2 040 078 030 L12 | 4,0 | 0,30 | 6 | 78 | 2,5 | 12 | 0,25 | 2 | 25 | new/neu |
| VHDT 2 040 078 030 L20 | 4,0 | 0,30 | 6 | 78 | 2,5 | 20 | 0,25 | 2 | 25 | new/neu |
| VHDT 2 040 078 050 L12 | 4,0 | 0,50 | 6 | 78 | 2,5 | 12 | 0,25 | 2 | 25 | new/neu |
| VHDT 2 040 078 050 L20 | 4,0 | 0,50 | 6 | 78 | 2,5 | 20 | 0,25 | 2 | 25 | new/neu |
| VHDT 2 050 078 030 L15 | 5,0 | 0,30 | 6 | 78 | 3,0 | 15 | 0,30 | 2 | 25 | new/neu |
| VHDT 2 050 078 030 L25 | 5,0 | 0,30 | 6 | 78 | 3,0 | 25 | 0,30 | 2 | 25 | new/neu |
| VHDT 2 050 078 050 L15 | 5,0 | 0,50 | 6 | 78 | 3,0 | 15 | 0,30 | 2 | 25 | new/neu |
| VHDT 2 050 078 050 L25 | 5,0 | 0,50 | 6 | 78 | 3,0 | 25 | 0,30 | 2 | 25 | new/neu |
| VHDT 2 060 102 030 L18 | 6,0 | 0,30 | 6 | 102 | 6,0 | 18 | 0,30 | 2 | - | new/neu |
| VHDT 2 060 102 030 L30 | 6,0 | 0,30 | 6 | 102 | 6,0 | 30 | 0,30 | 2 | - | new/neu |
| VHDT 2 060 102 050 L18 | 6,0 | 0,50 | 6 | 102 | 6,0 | 18 | 0,30 | 2 | - | new/neu |
| VHDT 2 060 102 050 L30 | 6,0 | 0,50 | 6 | 102 | 6,0 | 30 | 0,30 | 2 | - | new/neu |
| VHDT 2 060 102 100 L18 | 6,0 | 1,00 | 6 | 102 | 6,0 | 18 | 0,30 | 2 | - | new/neu |
| VHDT 2 060 102 100 L30 | 6,0 | 1,00 | 6 | 102 | 6,0 | 30 | 0,30 | 2 | - | new/neu |
| VHDT 2 080 102 030 L24 | 8,0 | 0,30 | 8 | 102 | 7,0 | 24 | 0,40 | 2 | - | new/neu |
| VHDT 2 080 102 050 L24 | 8,0 | 0,50 | 8 | 102 | 7,0 | 24 | 0,40 | 2 | - | new/neu |
| VHDT 2 080 102 100 L24 | 8,0 | 1,00 | 8 | 102 | 7,0 | 24 | 0,40 | 2 | - | new/neu |
| VHDT 2 100 102 050 L30 | 10,0 | 0,50 | 10 | 102 | 8,0 | 30 | 0,50 | 2 | - | new/neu |
| VHDT 2 100 102 100 L30 | 10,0 | 1,00 | 10 | 102 | 8,0 | 30 | 0,50 | 2 | - | new/neu |
| VHDT 2 120 107 050 L36 | 12,0 | 0,50 | 12 | 107 | 9,0 | 36 | 0,50 | 2 | - | new/neu |
| VHDT 2 120 107 100 L36 | 12,0 | 1,00 | 12 | 107 | 9,0 | 36 | 0,50 | 2 | - | new/neu |

### Long / Lange Ausführung

| Article Number<br>*Artikelnummer* | Ød<br>(mm) | r<br>(mm) | Ød1<br>(mm) | L<br>(mm) | L1<br>(mm) | L2<br>(mm) | a<br>(mm) | z | γ<br>(°) |
|---|---|---|---|---|---|---|---|---|---|
| VHDT 2 030 078 R03 | 3 | 0,30 | 6 | 78 | 3,0 | 9 | 0,10 | 2 | 15 |
| VHDT 2 030 078 R05 | 3 | 0,50 | 6 | 78 | 3,0 | 9 | 0,10 | 2 | 15 |
| VHDT 2 040 078 R03 | 4 | 0,30 | 6 | 78 | 4,0 | 12 | 0,10 | 2 | 15 |
| VHDT 2 040 078 R05 | 4 | 0,50 | 6 | 78 | 4,0 | 12 | 0,10 | 2 | 15 |
| VHDT 2 050 078 R05 | 5 | 0,50 | 6 | 78 | 5,0 | 15 | 0,10 | 2 | 15 |
| VHDT 2 050 078 R10 | 5 | 1,00 | 6 | 78 | 5,0 | 15 | 0,10 | 2 | 15 |
| VHDT 2 060 078 R05 | 6 | 0,50 | 6 | 78 | 6,0 | 18 | 0,10 | 2 | - |
| VHDT 2 060 078 R10 | 6 | 1,00 | 6 | 78 | 6,0 | 18 | 0,10 | 2 | - |
| VHDT 2 080 078 R05 | 8 | 0,50 | 8 | 78 | 8,0 | 24 | 0,10 | 2 | - |
| VHDT 2 080 078 R10 | 8 | 1,00 | 8 | 78 | 8,0 | 24 | 0,10 | 2 | - |
| VHDT 2 100 078 R10 | 10 | 1,00 | 10 | 78 | 10,0 | 30 | 0,10 | 2 | - |

Available in special dimensions on request.
Sondermaße auf Anfrage lieferbar.





**For Coolant we advise:**
**Empfohlene Kühlung:**

- Emulsion
  Emulsion
- Air Pressure
  Luft

**For coolant on graphite we advise:**
**Empfohlene Kühlung für die Graphit-Bearbeitung:**

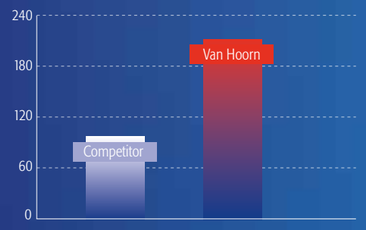
- Air Pressure
  Luft

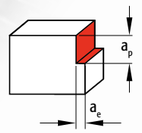
| *Material group* | *TSR*<br>(N/mm²) | *Hardness*<br>HB | *Cutting speed*<br>Vc m/min |
|---|---|---|---|
| Aluminium | < 350 | < 100 | **< 800** |
| Aluminium < 5% Si | < 500 | < 150 | **< 600** |
| Aluminium > 5% Si | < 400 | < 120 | **< 400** |
| Copper | < 350 | < 100 | **< 500** |
| Brass, bronze | < 700 | < 200 | **< 400** |
| Graphite | | | **< 800** |
| Synthetics | | | **< 600** |

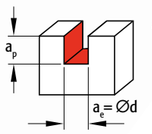
**VHDT2060078R05**
**Workpiece Material:** T800 M21
**Hardness:** Aerospace Material

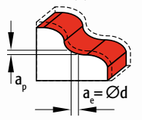
| | **Van Hoorn** | **Competitor** |
|---|---|---|
| $v_c$ | 283 m/min | 283 m/min |
| n | 15000 rpm | 15000 rpm |
| $F_z$ | 0,10 mm/t | 0,10 mm/t |
| $v_f$ | 3000 mm/min | 3000 mm/min |
| $a_p$ | 4,0 mm | 4,0 mm |
| $a_e$ | 6,0 mm | 6,0 mm |
| **Coolant** | emulsion | emulsion |
| **Q** | **72,0 mm³/min** | **72,0 mm³/min** |
| **Toollife** | **214 min** | **94 min** |

**Toollife**




### Shoulder milling / Eckfräsen

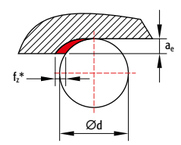
| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 3,0 | < 1,95 | < 1,20 | 0,020 - 0,030 |
| 4,0 | < 2,60 | < 1,60 | 0,030 - 0,045 |
| 5,0 | < 3,25 | < 2,00 | 0,040 - 0,060 |
| 6,0 | < 3,90 | < 2,40 | 0,050 - 0,070 |
| 8,0 | < 5,20 | < 3,20 | 0,060 - 0,080 |
| 10,0 | < 6,50 | < 4,00 | 0,070 - 0,100 |

### Slot milling / Nutenfräsen

| $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|
| < 0,60 | < 3,0 | 0,010 - 0,020 |
| < 0,80 | < 4,0 | 0,020 - 0,040 |
| < 1,00 | < 5,0 | 0,030 - 0,045 |
| < 1,20 | < 6,0 | 0,040 - 0,060 |
| < 1,60 | < 8,0 | 0,050 - 0,070 |
| < 2,00 | < 10,0 | 0,060 - 0,080 |

### Profile milling / Profilfräsen

| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 3,0 | < 0,60 | < 0,30 | 0,020 - 0,030 |
| 4,0 | < 0,80 | < 0,40 | 0,030 - 0,045 |
| 5,0 | < 1,00 | < 0,50 | 0,040 - 0,060 |
| 6,0 | < 1,20 | < 0,60 | 0,050 - 0,070 |
| 8,0 | < 1,60 | < 0,80 | 0,060 - 0,080 |
| 10,0 | < 2,00 | < 1,00 | 0,070 - 0,100 |

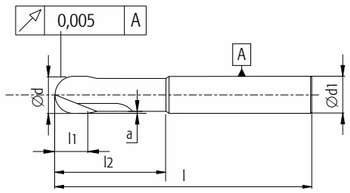


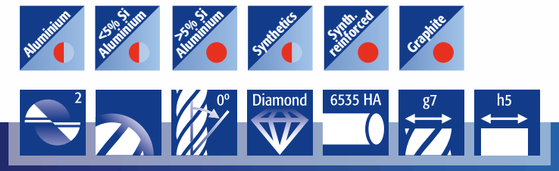

$$f_z^* = f_z \sqrt{\frac{d}{a_e}}$$

- At shoulder milling, feed per tooth $f_z$* for lower $a_e$ values should be converted according table.

  Beim Eckfräsen ist der Vorschub $f_z$* von der Schnittbreite $a_e$ abhängig.

### Standard



**For Coolant we advise:**
**Empfohlene Kühlung:**

- Emulsion
  Emulsion
- Air Pressure
  Luft

**For coolant on graphite we advise:**
**Empfohlene Kühlung für die Graphit-Bearbeitung:**

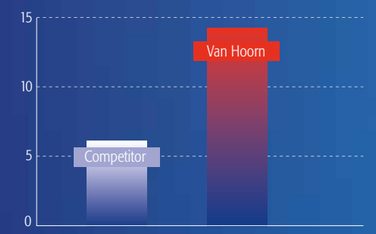
- Air Pressure
  Luft

| *Material group* | *TSR* (N/mm²) | *Hardness* HB | *Cutting speed* Vc m/min |
|---|---|---|---|
| Aluminium | < 350 | < 100 | **< 800** |
| Aluminium < 5% Si | < 500 | < 150 | **< 600** |
| Aluminium > 5% Si | < 400 | < 120 | **< 400** |
| Copper | < 350 | < 100 | **< 500** |
| Brass, bronze | < 700 | < 200 | **< 400** |
| Graphite | | | **< 800** |
| Synthetics | | | **< 600** |

**VHDB2100078**
**Workpiece Material:** Hextool
**Hardness:** Aerospace Material

| | Van Hoorn | Competitor |
|---|---|---|
| $v_c$ | 314 m/min | 377 m/min |
| n | 10000 rpm | 10000 rpm |
| $F_z$ | 0,15 mm/t | 0,10 mm/t |
| $v_f$ | 3000 mm/min | 2600 mm/min |
| $a_p$ | 0,35 mm | 0,35 mm |
| $a_e$ | 0,35 mm | 0,35 mm |
| **Coolant** | dry | dry |
| **Q** | **0,37 mm³/min** | **0,32 mm³/min** |
| **Toollife** | **14 h 10 min** | **5 h 33 min** |

**Toollife**

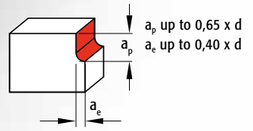


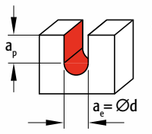

| Article Number *Artikelnummer* | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) | |
|---|---|---|---|---|---|---|---|---|---|---|
| VHDB 2 030 078 L09 | 3,0 | 1,50 | 6 | 78 | 2,5 | 9 | 0,250 | 2 | 25 | new/neu |
| VHDB 2 030 078 L15 | 3,0 | 1,50 | 6 | 78 | 2,5 | 15 | 0,250 | 2 | 25 | new/neu |
| VHDB 2 040 078 L12 | 4,0 | 2,00 | 6 | 78 | 2,5 | 12 | 0,250 | 2 | 25 | new/neu |
| VHDB 2 040 078 L20 | 4,0 | 2,00 | 6 | 78 | 2,5 | 20 | 0,250 | 2 | 25 | new/neu |
| VHDB 2 050 078 L15 | 5,0 | 2,50 | 6 | 78 | 3,0 | 15 | 0,300 | 2 | 25 | new/neu |
| VHDB 2 050 078 L25 | 5,0 | 2,50 | 6 | 78 | 3,0 | 25 | 0,300 | 2 | 25 | new/neu |
| VHDB 2 060 102 L18 | 6,0 | 3,00 | 6 | 102 | 6,0 | 18 | 0,300 | 2 | - | new/neu |
| VHDB 2 060 102 L30 | 6,0 | 3,00 | 6 | 102 | 6,0 | 30 | 0,300 | 2 | - | new/neu |
| VHDB 2 080 102 L24 | 8,0 | 4,00 | 8 | 102 | 7,0 | 24 | 0,400 | 2 | - | new/neu |
| VHDB 2 080 102 L40 | 8,0 | 4,00 | 8 | 102 | 7,0 | 40 | 0,400 | 2 | - | new/neu |
| VHDB 2 100 102 L30 | 10,0 | 5,00 | 10 | 102 | 8,0 | 30 | 0,500 | 2 | - | new/neu |
| VHDB 2 100 102 L50 | 10,0 | 5,00 | 10 | 102 | 8,0 | 50 | 0,500 | 2 | - | new/neu |
| VHDB 2 120 107 L36 | 12,0 | 6,00 | 12 | 107 | 9,0 | 36 | 0,500 | 2 | - | new/neu |
| VHDB 2 120 107 L60 | 12,0 | 6,00 | 12 | 107 | 9,0 | 60 | 0,500 | 2 | - | new/neu |

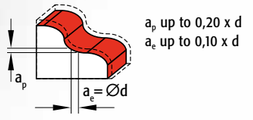
### Long / Lange Ausführung

| Article Number *Artikelnummer* | Ød (mm) | b (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
|---|---|---|---|---|---|---|---|---|---|
| VHDB 2 030 078 | 3 | 1,5 | 6 | 78 | 3 | 9 | 0,100 | 2 | 15 |
| VHDB 2 040 078 | 4 | 2,0 | 6 | 78 | 4 | 12 | 0,100 | 2 | 15 |
| VHDB 2 050 078 | 5 | 2,5 | 6 | 78 | 5 | 15 | 0,100 | 2 | 15 |
| VHDB 2 060 078 | 6 | 3,0 | 6 | 78 | 6 | 18 | 0,100 | 2 | - |
| VHDB 2 080 078 | 8 | 4,0 | 8 | 78 | 8 | 24 | 0,100 | 2 | - |
| VHDB 2 100 078 | 10 | 5,0 | 10 | 78 | 10 | 30 | 0,100 | 2 | - |

Available in special dimensions on request.
Sondermaße auf Anfrage lieferbar.




### Shoulder milling / Stirnfräsen

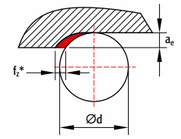
| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 3,0 | < 1,95 | < 1,20 | 0,020 - 0,030 |
| 4,0 | < 2,60 | < 1,60 | 0,030 - 0,045 |
| 5,0 | < 3,25 | < 2,00 | 0,040 - 0,060 |
| 6,0 | < 3,90 | < 2,40 | 0,050 - 0,070 |
| 8,0 | < 5,20 | < 3,20 | 0,060 - 0,080 |
| 10,0 | < 6,50 | < 4,00 | 0,070 - 0,100 |

### Slot milling / Nutenfräsen

| $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|
| < 0,60 | < 3,0 | 0,010 - 0,020 |
| < 0,80 | < 4,0 | 0,020 - 0,040 |
| < 1,00 | < 5,0 | 0,030 - 0,045 |
| < 1,20 | < 6,0 | 0,040 - 0,060 |
| < 1,60 | < 8,0 | 0,050 - 0,070 |
| < 2,00 | < 10,0 | 0,060 - 0,080 |

### Profile milling / Profilfräsen

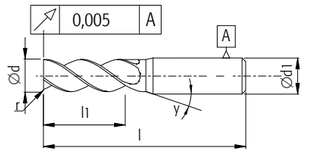
| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 3,0 | < 0,60 | < 0,30 | 0,020 - 0,030 |
| 4,0 | < 0,80 | < 0,40 | 0,030 - 0,045 |
| 5,0 | < 1,00 | < 0,50 | 0,040 - 0,060 |
| 6,0 | < 1,20 | < 0,60 | 0,050 - 0,070 |
| 8,0 | < 1,60 | < 0,80 | 0,060 - 0,080 |
| 10,0 | < 2,00 | < 1,00 | 0,070 - 0,100 |




- At shoulder milling, feed per tooth $f_z$* for lower $a_e$ values should be converted according table.

  Beim Eckfräsen ist der Vorschub $f_z$* von der Schnittbreite $a_e$ abhängig.

***Standard***



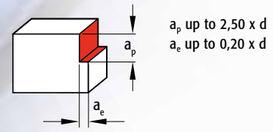
**For Coolant we advise:**
***Empfohlene Kühlung:***

- Minimum lubrication
  Minimalmengenschmierung
- Air Pressure
  Luft

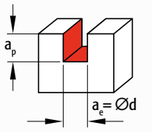
| *Material group* | *TSR* (N/mm²) | *Hardness* HB | *Cutting speed* Vc m/min |
|---|---|---|---|
| Synthetics | | | **100 - 180** |
| Synthetics Reinforced | | CFRP | **80 - 150** |
| | | GRP | **70 - 130** |

- New design for finishing application.
  Neue Fräsergeometrie für Schlichtbearbeitung.
- Low helix to avoid delamination.
  Flacher Drallwinkel verhindert Delamination.
- Superior diamond coating for CFRP and GFRP.
  Spezielle Diamantbeschichtung für
  CFK und GFK.

| Article Number<br>*Artikelnummer* | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) | |
|---|---|---|---|---|---|---|---|---|---|---|
| VHCF 4 060 064 06 02 | 6,0 | 0,20 | 6 | 64 | 18,0 | - | - | 4 | - | new/neu |
| VHCF 4 080 078 08 02 | 8,0 | 0,20 | 8 | 78 | 24,0 | - | - | 4 | - | new/neu |
| VHCF 4 100 078 10 02 | 10,0 | 0,20 | 10 | 78 | 30,0 | - | - | 4 | - | new/neu |
| VHCF 4 120 089 12 02 | 12,0 | 0,20 | 12 | 89 | 36,0 | - | - | 4 | - | new/neu |
| VHCF 4 160 100 16 02 | 16,0 | 0,20 | 16 | 100 | 45,0 | - | - | 4 | - | new/neu |
| VHCF 4 200 110 20 02 | 20,0 | 0,20 | 20 | 110 | 55,0 | - | - | 4 | - | new/neu |



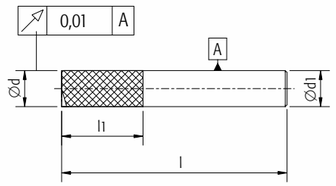

**$a_p$ up to 2,50 x d**
**$a_e$ up to 0,20 x d**

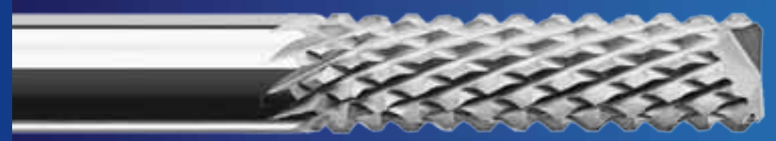



**$a_p$ up to 1,00 x d**
**$a_e$ up to 1,00 x d**

| | ***Shoulder milling / Eckfräsen*** | | | ***Slot milling / Nutenfräsen*** | | |
|---|---|---|---|---|---|---|
| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
| 6,0 | < 15,0 | < 1,0 | 0,020 - 0,035 | < 6,0 | < 6,0 | 0,020 - 0,035 |
| 8,0 | < 20,0 | < 1,5 | 0,030 - 0,045 | < 8,0 | < 8,0 | 0,030 - 0,045 |
| 10,0 | < 25,0 | < 2,0 | 0,040 - 0,060 | < 10,0 | < 10,0 | 0,040 - 0,060 |
| 12,0 | < 30,0 | < 2,4 | 0,045 - 0,070 | < 12,0 | < 12,0 | 0,045 - 0,070 |
| 16,0 | < 40,0 | < 3,0 | 0,060 - 0,090 | < 16,0 | < 16,0 | 0,060 - 0,090 |
| 20,0 | < 50,0 | < 4,0 | 0,070 - 0,110 | < 20,0 | < 20,0 | 0,070 - 0,110 |

***Standard***



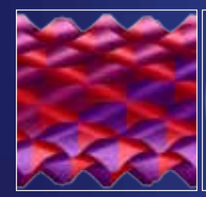


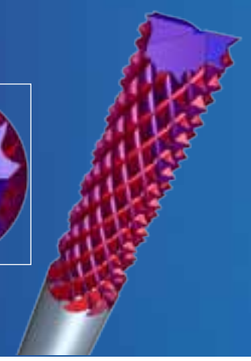
**For Coolant we advise:**
**Empfohlene Kühlung:**

- Minimum lubrication
  Minimalmengenschmierung
- Air Pressure
  Luft

| *Material group* | *TSR* (N/mm²) | *Hardness* HB | *Cutting speed* Vc m/min |
|---|---|---|---|
| Synthetics | | | **100 - 180** |
| Synthetics Reinforced | | CFRP | **120 - 200** |
| | | GRP | **70 - 120** |

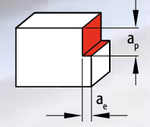
**VHCR**



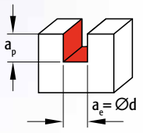


| Article Number<br>*Artikelnummer* | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) | |
|---|---|---|---|---|---|---|---|---|---|---|
| VHCR 2 030 039 03 02 | 3,0 | - | 3 | 39 | 12,0 | - | - | 2 | - | new/neu |
| VHCR 2 040 051 04 02 | 4,0 | - | 4 | 51 | 16,0 | - | - | 2 | - | new/neu |
| VHCR 2 050 051 05 02 | 5,0 | - | 5 | 51 | 16,0 | - | - | 2 | - | new/neu |
| VHCR 2 060 064 06 02 | 6,0 | - | 6 | 64 | 19,0 | - | - | 2 | - | new/neu |
| VHCR 2 080 064 08 02 | 8,0 | - | 8 | 64 | 25,0 | - | - | 2 | - | new/neu |
| VHCR 2 100 070 10 02 | 10,0 | - | 10 | 70 | 25,0 | - | - | 2 | - | new/neu |
| VHCR 2 120 089 12 02 | 12,0 | - | 12 | 89 | 36,0 | - | - | 2 | - | new/neu |
| VHCR 2 160 089 16 02 | 16,0 | - | 16 | 89 | 36,0 | - | - | 2 | - | new/neu |
| VHCR 2 200 102 20 02 | 20,0 | - | 20 | 102 | 45,0 | - | - | 2 | - | new/neu |

| Article Number<br>*Artikelnummer* | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) | |
|---|---|---|---|---|---|---|---|---|---|---|
| VHCR 2 030 039 03 10 | 3,0 | - | 3 | 39 | 12,0 | - | - | 2 | - | new/neu |
| VHCR 2 040 051 04 10 | 4,0 | - | 4 | 51 | 16,0 | - | - | 2 | - | new/neu |
| VHCR 2 050 051 05 10 | 5,0 | - | 5 | 51 | 16,0 | - | - | 2 | - | new/neu |
| VHCR 2 060 064 06 10 | 6,0 | - | 6 | 64 | 19,0 | - | - | 2 | - | new/neu |
| VHCR 2 080 064 08 10 | 8,0 | - | 8 | 64 | 25,0 | - | - | 2 | - | new/neu |
| VHCR 2 100 070 10 10 | 10,0 | - | 10 | 70 | 25,0 | - | - | 2 | - | new/neu |
| VHCR 2 120 089 12 10 | 12,0 | - | 12 | 89 | 36,0 | - | - | 2 | - | new/neu |
| VHCR 2 160 089 16 10 | 16,0 | - | 16 | 89 | 36,0 | - | - | 2 | - | new/neu |
| VHCR 2 200 102 20 10 | 20,0 | - | 20 | 102 | 45,0 | - | - | 2 | - | new/neu |




$a_p$ up to 2,00 x d
$a_e$ up to 0,25 x d




$a_p$ up to 1,00 x d
$a_e$ up to 1,00 x d

***Shoulder milling / Eckfräsen***

| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | Vf (mm/min) |
|---|---|---|---|
| 3,0 | < 3,0 | < 3,0 | 600 - 1200 |
| 4,0 | < 4,0 | < 4,0 | 700 - 1300 |
| 5,0 | < 5,0 | < 5,0 | 800 - 1500 |
| 6,0 | < 6,0 | < 6,0 | 1000 - 1800 |
| 8,0 | < 8,0 | < 8,0 | 1200 - 2200 |
| 10,0 | < 10,0 | < 10,0 | 1500 - 2500 |
| 12,0 | < 12,0 | < 12,0 | 1700 - 2800 |
| 16,0 | < 16,0 | < 16,0 | 1800 - 3000 |
| 20,0 | < 20,0 | < 20,0 | 2000 - 3500 |

***Slot milling / Nutenfräsen***

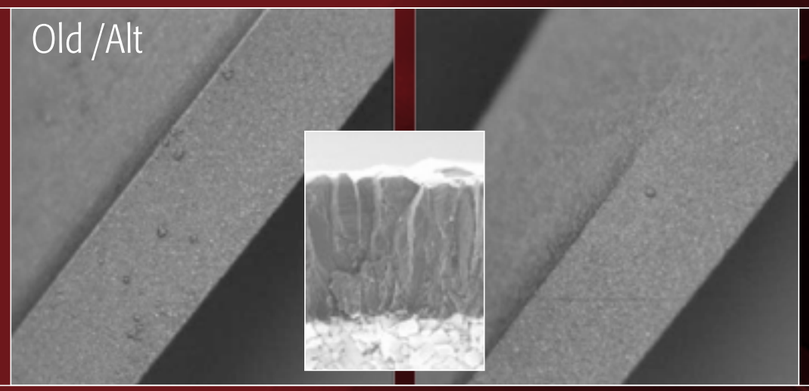
| $a_p$ max. (mm) | $a_e$ max. (mm) | Vf (mm/min) |
|---|---|---|
| < 6,0 | < 0,5 | 200 - 400 |
| < 8,0 | < 1,0 | 250 - 500 |
| < 10,0 | < 1,2 | 300 - 600 |
| < 12,0 | < 1,5 | 350 - 700 |
| < 16,0 | < 2,0 | 400 - 800 |
| < 20,0 | < 2,5 | 500 - 1000 |
| < 24,0 | < 2,7 | 550 - 1100 |
| < 32,0 | < 3,0 | 600 - 1200 |
| < 40,0 | < 4,0 | 800 - 1500 |

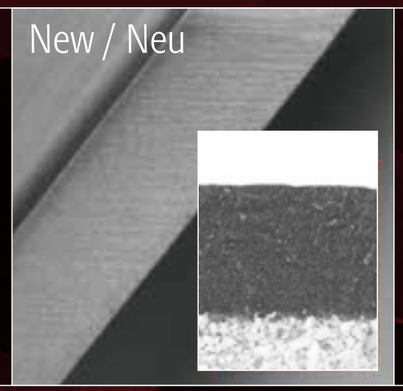
# End mills for graphite EDM Technology

## Schaftfräser für die Graphit-Bearbeitung in der Erodiertechnik (EDM)

The leading technology of Van Hoorn Carbide diamond coated end mills:
Van Hoorn Carbide's Technologieführung durch Diamant beschichtete Schaftfräser:

- Accuracy
  Genauigkeit
- Smooth surface finish
  Glatte Oberflächen
- Process times
  Bearbeitungszeiten
- Toollife
  Standzeit




## New developments / Neuentwicklungen:

- Technology to minimize droplets
  Verfahren zur Minimierung von Tröpfchenbildung
- Superior accuracy and tolerances
  Überragende Genauigkeiten und Toleranzen
- Improved performance and toollife
  Leistungssteigerungen und Standzeitverlängerung

# VHC diamond coated endmills for applications on graphite:

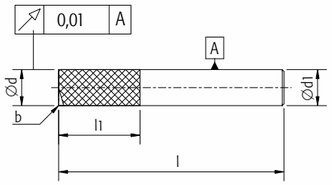
## VHC Diamant beschichtete Schaftfräser für die Graphit-Bearbeitung:

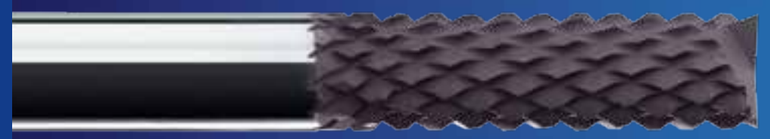
- VHGR: Roughing geometry.
  VHGR: Schrupp-Geometrie.
- VHGT: 40° helix sharp geometry.
  VHGT: 40° Spiralwinkel scharfer Schneidengeometrie.
- VHGTF: 40° helix geometry with corner radius.
  VHGTF: 40° Spiralwinkel mit Eckenradius.
- VHGKF: 40° helix ballnose geometry.
  VHGKF: 40° Spiralwinkel Radiusfräser.
- VHMG: Micro endmill with corner radius.
  VHMG: Mikro-Schaftfräser scharfer Schneidengometrie.
- VHMGK: Micro ballnose geometry.
  VHMGK: Mikro-Radiusfräser.

## Advantages / Vorteile:

- Better toollife
  Längere Standzeiten
- Excellent accuracy
  Ausgezeichnete Genauigkeiten
- High production efficiency
  Hohe Produktivität
- Excellent surface finish
  Hervorragende Oberflächenqualität

***Standard***





**For Coolant we advise:**
**Empfohlene Kühlung:**

- Air Pressure
  Luft

| *Material group* | *TSR* (N/mm²) | *Hardness* HB | *Cutting speed* Vc m/min |
|---|---|---|---|
| Graphite | | | **350 - 500** |
| Synthetics | | | **< 600** |

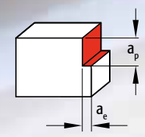
**VHGR21000781002**
**Material** EDM200
Graphite

| | |
|---|---|
| **$v_c$** | 628 m/min |
| **n** | 20000 rpm |
| **$f_z$** | * mm/t |
| **$v_f$** | 6000 mm/min |
| **$a_p$** | 12 mm |
| **$a_e$** | 2 mm |
| **Coolant** | air |
| **Q** | **144 cm³/min** |

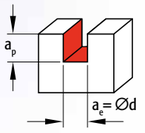
## VHGR for Roughing applications on Graphite:
## VHGR für Schruppbearbeitung in Graphit:

- High material removal rate.
  Hohe Zerspanungsleistung.
- Special Roughing pitch.
  Spezielle Schruppverzahnung.
- Designed for high feeds on graphite applications.
  Entwickelt für hohe Vorschübe in der Graphit-Bearbeitung.

| Article Number<br>*Artikelnummer* | Ød (mm) | b (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) | |
|---|---|---|---|---|---|---|---|---|---|---|
| VHGR 2 040 060 04 02 | 4,0 | 0,25 | 4 | 60 | 12,0 | - | - | 2 | - | |
| VHGR 2 060 078 06 02 | 6,0 | 0,30 | 6 | 78 | 18,0 | - | - | 2 | - | |
| VHGR 2 080 078 08 02 | 8,0 | 0,35 | 8 | 78 | 24,0 | - | - | 2 | - | |
| VHGR 2 100 078 10 02 | 10,0 | 0,40 | 10 | 78 | 30,0 | - | - | 2 | - | |
| VHGR 2 120 089 12 02 | 12,0 | 0,50 | 12 | 89 | 36,0 | - | - | 2 | - | |
| VHGR 2 120 150 12 02 | 12,0 | 0,50 | 12 | 150 | 36,0 | 50,0 | 0,30 | 2 | - | new/neu |
| VHGR 2 160 150 16 02 | 16,0 | 0,50 | 16 | 150 | 36,0 | 70,0 | 0,40 | 2 | - | new/neu |

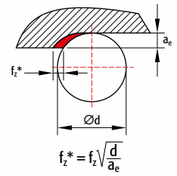



$a_p$ up to 2,50 x d
$a_e$ up to 0,50 x d




$a_p$ up to 1,00 x d

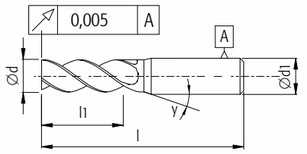
| Ød (mm) | *Shoulder milling / Eckfräsen* $a_p$ max. (mm) | $a_e$ max. (mm) | Vf (mm/min) | *Slot milling / Nutenfräsen* $a_p$ max. (mm) | $a_e$ max. (mm) | Vf (mm/min) |
|---|---|---|---|---|---|---|
| 4,0 | < 10,0 | < 2,0 | < 5000 | < 4,0 | < 4,0 | < 5000 |
| 6,0 | < 15,0 | < 3,0 | < 6000 | < 6,0 | < 6,0 | < 6000 |
| 8,0 | < 20,0 | < 4,0 | < 8000 | < 8,0 | < 8,0 | < 8000 |
| 10,0 | < 25,0 | < 5,0 | < 10000 | < 10,0 | < 10,0 | < 10000 |
| 12,0 | < 30,0 | < 6,0 | < 12000 | < 12,0 | < 12,0 | < 12000 |
| 16,0 | < 35,0 | < 8,0 | < 15000 | < 16,0 | < 16,0 | < 14000 |




- At shoulder milling, feed per tooth $f_z$* for lower $a_e$ values should be converted according table.
  Beim Eckfräsen ist der Vorschub $f_z$* von der Schnittbreite $a_e$ abhängig.

| $a_e$ | $f_z$*= |
|---|---|
| 0,10 x d | $f_z$ x 3 |
| 0,25 x d | $f_z$ x 2 |
| 0,50 x d | $f_z$ x 1 |

### Standard



**For Coolant we advise:**
**Empfohlene Kühlung:**

- Air Pressure
  Luft

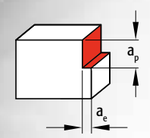
| *Material group* | *TSR* (N/mm²) | *Hardness* HB | *Cutting speed* Vc m/min |
|---|---|---|---|
| Aluminium | < 350 | < 100 | |
| Aluminium < 5% Si | < 500 | < 150 | |
| Aluminium > 5% Si | < 400 | < 120 | **< 400** |
| Graphite | | | **< 500** |

**VHGT30600780602**
**Workpiece Material:** Graphite

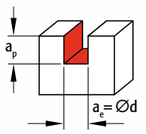
| | Van Hoorn | Competitor |
|---|---|---|
| $v_c$ | 547 m/min | 547 m/min |
| n | 29000 rpm | 29000 rpm |
| $F_z$ | 0,023 mm/t | 0,005 mm/t |
| $v_f$ | 2000 mm/min | 580 mm/min |
| $a_p$ | 3 mm | 3 mm |
| $a_e$ | 0,5 mm | 0,5 mm |
| **Coolant** | air | air |
| **Q** | **3,00 mm³/min** | **0,87 mm³/min** |
| **Toollife** | **7 h 14 min** | **2 h 37 min** |

- More accuracy
  Höhere Genauigkeit
- Smooth surface on the workpiece
  Glatte Werkstückoberflächen
- Better toollife
  Längere Standzeit

| Article Number<br>*Artikelnummer* | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
|---|---|---|---|---|---|---|---|---|---|
| VHGT 3 020 050 03 02 | 2,0 | - | 3 | 50 | 10 | - | - | 3 | 15 |
| VHGT 3 030 050 03 02 | 3,0 | - | 3 | 50 | 10 | - | - | 3 | - |
| VHGT 3 040 060 04 02 | 4,0 | - | 4 | 60 | 15 | - | - | 3 | - |
| VHGT 3 050 060 05 02 | 5,0 | - | 5 | 60 | 20 | - | - | 3 | - |
| VHGT 3 060 078 06 02 | 6,0 | - | 6 | 78 | 30 | - | - | 3 | - |
| VHGT 3 080 078 08 02 | 8,0 | - | 8 | 78 | 30 | - | - | 3 | - |
| VHGT 3 100 078 10 02 | 10,0 | - | 10 | 78 | 30 | - | - | 3 | - |
| VHGT 3 120 089 12 02 | 12,0 | - | 12 | 89 | 30 | - | - | 3 | - |




$a_p$ up to 2,0 x d
$a_e$ up to 0,2 x d



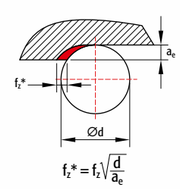

$a_p$ up to 1,00 x d

### *Shoulder milling / Eckfräsen*

| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 2,0 | < 3,0 | < 0,4 | 0,010 - 0,030 |
| 3,0 | < 5,0 | < 0,6 | 0,015 - 0,040 |
| 4,0 | < 7,0 | < 0,8 | 0,025 - 0,050 |
| 5,0 | <10,0 | < 1,0 | 0,035 - 0,060 |
| 6,0 | <12,0 | < 1,2 | 0,045 - 0,080 |
| 8,0 | < 16,0 | < 1,6 | 0,055 - 0,100 |
| 10,0 | < 20,0 | < 2,0 | 0,075 - 0,120 |
| 12,0 | < 24,0 | < 2,4 | 0,075 - 0,140 |

### *Slot milling / Nutenfräsen*

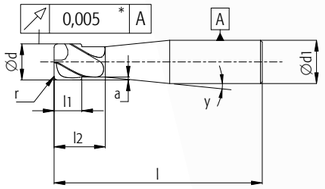
| $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|
| < 2,0 | < 2,0 | 0,010 - 0,030 |
| < 3,0 | < 3,0 | 0,015 - 0,040 |
| < 4,0 | < 4,0 | 0,025 - 0,050 |
| < 5,0 | < 5,0 | 0,035 - 0,060 |
| < 6,0 | < 6,0 | 0,045 - 0,080 |
| < 8,0 | < 8,0 | 0,055 - 0,100 |
| < 10,0 | < 10,0 | 0,075 - 0,120 |
| < 12,0 | < 12,0 | 0,075 - 0,140 |




$f_z^* = f_z \sqrt{\frac{d}{a_e}}$

- At shoulder milling, feed per tooth $f_z$* for lower $a_e$ values should be converted according table.
  Beim Eckfräsen ist der Vorschub $f_z$* von der Schnittbreite $a_e$ abhängig.

### Standard




* For endmills / für Schaftfräser L < 100 mm.

**For Coolant we advise:**
**Empfohlene Kühlung:**

- Air Pressure
  Luft

| *Material group* | *TSR* (N/mm²) | *Hardness* HB | *Cutting speed* Vc m/min |
|---|---|---|---|
| Aluminium | < 350 | < 100 | |
| Aluminium < 5% Si | < 500 | < 150 | |
| Aluminium > 5% Si | < 400 | < 120 | **< 400** |
| Graphite | | | **< 500** |

**VHGTF30400600402**
**Material** EDM-3 Graphite

| | |
|---|---|
| $v_c$ | 440 m/min |
| n | 35000 rpm |
| $f_z$ | 0,049 mm/t |
| $v_f$ | 5145 mm/min |
| $a_p$ | 0,8 mm |
| $a_e$ | 1,6 mm |
| **Coolant** | air |
| **Q** | **6,60 cm³/min** |

- More accuracy.
  Höhere Genauigkeit.
- Smooth surface on the workpiece.
  Glatte Werkstückoberflächen.
- Better toollife.
  Längere Standzeit.

### Short / Kurze Ausführung

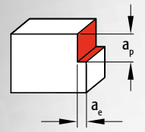
| Article Number / *Artikelnummer* | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) | |
|---|---|---|---|---|---|---|---|---|---|---|
| VHGTF 2 020 050 03 02 S | 2,0 | 0,10 | 3 | 50 | 3 | 10 | 0,10 | 2 | 15 | |
| VHGTF 2 030 051 06 02 S | 3,0 | 0,10 | 6 | 51 | 4 | 10 | 0,10 | 2 | 15 | |
| VHGTF 4 040 051 06 02 S | 4,0 | 0,20 | 6 | 51 | 4 | 10 | 0,10 | 4 | 15 | |
| VHGTF 4 050 051 06 02 S | 5,0 | 0,20 | 6 | 51 | 5 | 10 | 0,15 | 4 | 15 | |
| VHGTF 4 060 051 06 02 S | 6,0 | 0,30 | 6 | 51 | 6 | 10 | 0,20 | 4 | - | |
| VHGTF 4 080 064 08 02 S | 8,0 | 0,30 | 8 | 64 | 8 | 15 | 0,30 | 4 | - | |
| VHGTF 4 100 078 10 02 S | 10,0 | 0,30 | 10 | 78 | 10 | 20 | 0,30 | 4 | - | |
| VHGTF 4 120 078 12 02 S | 12,0 | 0,30 | 12 | 78 | 10 | 20 | 0,30 | 4 | - | |

### Standard

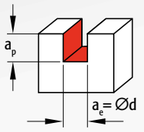
| Article Number / *Artikelnummer* | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) | |
|---|---|---|---|---|---|---|---|---|---|---|
| VHGTF 3 020 050 02 02 | 2,0 | 0,10 | 2 | 50 | 10 | - | - | 3 | - | |
| VHGTF 3 020 050 03 02 | 2,0 | 0,10 | 3 | 50 | 10 | - | - | 3 | 15 | |
| VHGTF 3 020 050 03 02 L150 | 2,0 | 0,10 | 3 | 50 | 10 | 15 | 0,10 | 3 | 10 | new/neu |
| VHGTF 3 020 065 03 02 L300 | 2,0 | 0,10 | 3 | 65 | 10 | 30 | 0,10 | 3 | 15 | new/neu |
| VHGTF 3 020 080 03 02 L300 | 2,0 | 0,10 | 3 | 80 | 10 | 30 | 0,10 | 3 | 15 | new/neu |
| VHGTF 3 030 050 03 02 | 3,0 | 0,10 | 3 | 50 | 10 | - | - | 3 | - | |
| VHGTF 3 030 065 03 02 L300 | 3,0 | 0,10 | 3 | 65 | 10 | 30 | 0,10 | 3 | - | new/neu |
| VHGTF 3 030 080 03 02 L300 | 3,0 | 0,10 | 3 | 80 | 10 | 30 | 0,10 | 3 | - | new/neu |
| VHGTF 3 040 060 04 02 | 4,0 | 0,20 | 4 | 60 | 15 | - | - | 3 | - | |
| VHGTF 3 050 060 05 02 | 5,0 | 0,20 | 5 | 60 | 20 | - | - | 3 | - | |
| VHGTF 3 060 078 06 02 | 6,0 | 0,30 | 6 | 78 | 30 | - | - | 3 | - | |
| VHGTF 3 080 078 08 02 | 8,0 | 0,30 | 8 | 78 | 30 | - | - | 3 | - | |
| VHGTF 3 100 078 10 02 | 10,0 | 0,30 | 10 | 78 | 30 | - | - | 3 | - | |
| VHGTF 3 120 089 12 02 | 12,0 | 0,30 | 12 | 89 | 30 | - | - | 3 | - | |

### Long / Lange Ausführung

| Article Number / *Artikelnummer* | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
|---|---|---|---|---|---|---|---|---|---|
| VHGTF 2 040 102 04 02 | 4,0 | 0,30 | 4 | 102 | 10 | - | - | 2 | - |
| VHGTF 2 050 102 05 02 | 5,0 | 0,50 | 5 | 102 | 13 | - | - | 2 | - |
| VHGTF 2 060 102 06 02 | 6,0 | 0,50 | 6 | 102 | 42 | - | - | 2 | - |
| VHGTF 2 060 150 06 02 | 6,0 | 0,50 | 6 | 150 | 26 | - | - | 2 | - |
| VHGTF 2 080 150 08 02 | 8,0 | 0,50 | 8 | 150 | 41 | - | - | 2 | - |
| VHGTF 2 100 150 10 02 | 10,0 | 0,50 | 10 | 150 | 42 | - | - | 2 | - |




$a_p$ up to 2,00 x d
$a_e$ up to 0,20 x d



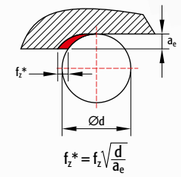

$a_p$ up to 1,00 x d

### Shoulder milling / Eckfräsen

| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 2,0 | < 2,0 | < 0,2 | 0,010 - 0,030 |
| 3,0 | < 3,0 | < 0,3 | 0,015 - 0,040 |
| 4,0 | < 6,0 | < 0,4 | 0,025 - 0,050 |
| 5,0 | < 7,5 | < 0,5 | 0,035 - 0,060 |
| 6,0 | < 9,0 | < 0,8 | 0,045 - 0,080 |
| 8,0 | < 12,0 | < 1,0 | 0,055 - 0,100 |
| 10,0 | < 15,0 | < 1,3 | 0,075 - 0,120 |
| 12,0 | < 24,0 | < 2,4 | 0,075 - 0,140 |

### Slot milling / Nutenfräsen

| $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|
| < 0,5 | < 2,0 | 0,010 - 0,030 |
| < 0,8 | < 3,0 | 0,015 - 0,040 |
| < 2,0 | < 4,0 | 0,025 - 0,050 |
| < 2,5 | < 5,0 | 0,035 - 0,060 |
| < 4,5 | < 6,0 | 0,045 - 0,080 |
| < 6,0 | < 8,0 | 0,055 - 0,100 |
| < 7,5 | < 10,0 | 0,075 - 0,120 |
| < 12,0 | < 12,0 | 0,075 - 0,140 |

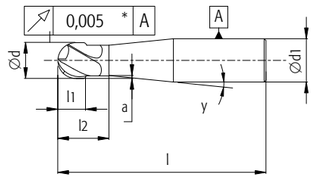



$f_z^* = f_z \sqrt{\frac{d}{a_e}}$

- Cutting speed Vc is based on max. 40.000 rpm
  Schnittgeschwindigkeit Vc bezogen auf max. 40.000 U/min.
- At shoulder milling, feed per tooth $f_z^*$ for lower $a_e$ values should be converted according formula.
  Beim Eckfräsen ist der Vorschub $f_z^*$ von der Schnittbreite $a_e$ abhängig.
- Given conditions are based on VHGTF standard endmills with z=3.
  Die angegebenen Schnittwerte beziehen sich auf den Standard Schaftfräser VHGTF mit 3 Schneiden.

| $a_e$ | $f_z^*$= |
|---|---|
| 0,10 x d | $f_z$ x 3 |
| 0,25 x d | $f_z$ x 2 |
| 0,50 x d | $f_z$ x 1 |

### Standard




* For endmills / für Schaftfräser L < 100 mm.

**For Coolant we advise:**
**Empfohlene Kühlung:**

- Air Pressure
  Luft

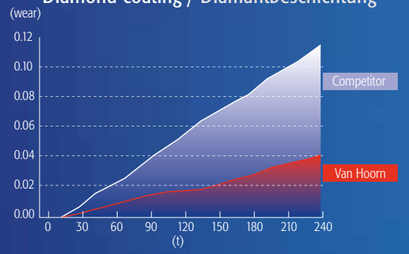


| Material group | TSR (N/mm²) | Hardness HB | Cutting speed Vc m/min |
|---|---|---|---|
| Aluminium | < 350 | < 100 | |
| Aluminium < 5% Si | < 500 | < 150 | |
| Aluminium > 5% Si | < 400 | < 120 | **< 400** |
| Graphite | | | **< 500** |

**VHGKF30400600402**
**Material** ISO 63

| | |
|---|---|
| $v_c$ | 276 m/min |
| n | 22000 rpm |
| $f_z$ | 0,121 mm/t |
| $v_f$ | 8000 mm/min |
| $a_p$ | 5,0 mm |
| $a_e$ | 0,1 mm |
| Coolant | air |
| Q | **4,0 cm³/min** |

### Wear / Verschleiß
Diamond coating / Diamantbeschichtung




### Short / Kurze Ausführung

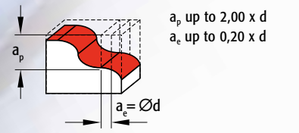
| Article Number / Artikelnummer | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
|---|---|---|---|---|---|---|---|---|---|
| VHGKF 2 020 050 03 02 S | 2,0 | 1,0 | 3 | 50 | 3 | 10 | 0,10 | 2 | 15 |
| VHGKF 2 030 051 06 02 S | 3,0 | 1,5 | 6 | 51 | 4 | 10 | 0,10 | 2 | 15 |
| VHGKF 4 040 051 06 02 S | 4,0 | 2,0 | 6 | 51 | 4 | 10 | 0,10 | 4 | 15 |
| VHGKF 4 050 051 06 02 S | 5,0 | 2,5 | 6 | 51 | 5 | 10 | 0,15 | 4 | 15 |
| VHGKF 4 060 051 06 02 S | 6,0 | 3,0 | 6 | 51 | 6 | 10 | 0,20 | 4 | - |
| VHGKF 4 080 064 08 02 S | 8,0 | 4,0 | 8 | 64 | 8 | 15 | 0,30 | 4 | - |
| VHGKF 4 100 078 10 02 S | 10,0 | 5,0 | 10 | 78 | 10 | 20 | 0,30 | 4 | - |
| VHGKF 4 120 078 12 02 S | 12,0 | 6,0 | 12 | 78 | 10 | 20 | 0,30 | 4 | - |

### Standard

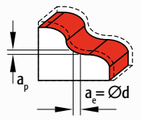
| Article Number / Artikelnummer | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
|---|---|---|---|---|---|---|---|---|---|
| VHGKF 3 020 050 02 02 | 2,0 | 1,0 | 2 | 50 | 10 | - | - | 3 | - |
| VHGKF 3 020 050 03 02 | 2,0 | 1,0 | 3 | 50 | 10 | - | - | 3 | 15 |
| VHGKF 3 030 050 03 02 | 3,0 | 1,5 | 3 | 50 | 10 | - | - | 3 | - |
| VHGKF 3 040 060 04 02 | 4,0 | 2,0 | 4 | 60 | 15 | - | - | 3 | - |
| VHGKF 3 050 060 05 02 | 5,0 | 2,5 | 5 | 60 | 20 | - | - | 3 | - |
| VHGKF 3 060 078 06 02 | 6,0 | 3,0 | 6 | 78 | 30 | - | - | 3 | - |
| VHGKF 3 080 078 08 02 | 8,0 | 4,0 | 8 | 78 | 30 | - | - | 3 | - |
| VHGKF 3 100 078 10 02 | 10,0 | 5,0 | 10 | 78 | 30 | - | - | 3 | - |
| VHGKF 3 120 089 12 02 | 12,0 | 6,0 | 12 | 89 | 30 | - | - | 3 | - |

### Long / Lange Ausführung

| Article Number / Artikelnummer | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
|---|---|---|---|---|---|---|---|---|---|
| VHGKF 2 020 102 03 02 | 2,0 | 1,0 | 3 | 102 | 6 | - | - | 2 | 15 |
| VHGKF 2 030 102 03 02 | 3,0 | 1,5 | 3 | 102 | 16 | - | - | 2 | - |
| VHGKF 2 040 102 04 02 | 4,0 | 2,0 | 4 | 102 | 16 | - | - | 2 | - |
| VHGKF 2 060 102 06 02 | 6,0 | 3,0 | 6 | 102 | 42 | - | - | 2 | - |
| VHGKF 2 060 150 06 02 | 6,0 | 3,0 | 6 | 150 | 42 | - | - | 2 | - |
| VHGKF 2 080 102 08 02 | 8,0 | 4,0 | 8 | 102 | 42 | - | - | 2 | - |
| VHGKF 2 080 150 08 02 | 8,0 | 4,0 | 8 | 150 | 42 | - | - | 2 | - |
| VHGKF 2 100 150 10 02 | 10,0 | 5,0 | 10 | 150 | 45 | - | - | 2 | - |




$a_p$ up to 2,00 x d
$a_e$ up to 0,20 x d



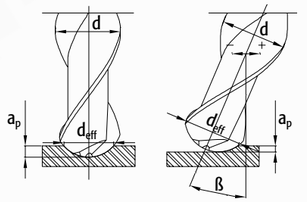

$a_p$ up to 0,20 x d
$a_e$ up to 0,10 x d

### Shoulder milling / Stirnfräsen

| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 2,0 | < 2,0 | < 0,2 | 0,010 - 0,030 |
| 3,0 | < 3,0 | < 0,3 | 0,015 - 0,040 |
| 4,0 | < 6,0 | < 0,4 | 0,025 - 0,050 |
| 5,0 | < 7,5 | < 0,5 | 0,035 - 0,060 |
| 6,0 | < 9,0 | < 0,8 | 0,045 - 0,080 |
| 8,0 | < 12,0 | < 1,0 | 0,055 - 0,100 |
| 10,0 | < 15,0 | < 1,3 | 0,075 - 0,120 |
| 12,0 | < 24,0 | < 2,4 | 0,075 - 0,140 |

### Profile milling / Profilfräsen

| $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|
| < 0,4 | < 0,1 | 0,010 - 0,030 |
| < 0,6 | < 0,2 | 0,015 - 0,040 |
| < 0,8 | < 0,3 | 0,025 - 0,050 |
| < 1,0 | < 0,4 | 0,035 - 0,060 |
| < 1,2 | < 0,5 | 0,045 - 0,080 |
| < 1,6 | < 0,7 | 0,055 - 0,100 |
| < 2,0 | < 0,9 | 0,075 - 0,120 |
| < 2,4 | < 1,2 | 0,075 - 0,140 |

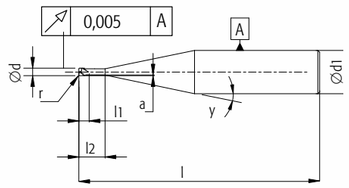


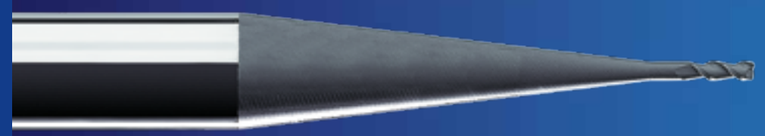

- Cutting speed Vc is based on max. 40.000 rpm.
  Schnittgeschwindigkeit Vc bezogen auf max. 50.000 U/min.
- Given conditions are based on VHGKF standard endmills with z=3.
  Die angegebenen Schnittwerte beziehen sich auf den Standard Schaftfräser VHGKF mit 3 Schneiden.
- VHGKF short have z=2 and 4, VHGKF long have z=2.
  VHGKF kurz z=2 und z=4, VHGKF lang z=2.

ß ≠ 0: $d_{eff} = d \bullet \sin\left[ß \pm \arccos\left(\frac{d - 2a_p}{d}\right)\right]$

ß = 0: $d_{eff} = 2 \bullet \sqrt{d \bullet a_p - a_p^2}$

***Standard***





**For Coolant we advise:**
**Empfohlene Kühlung:**

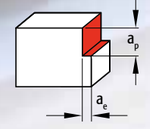
- Air Pressure
  Luft

| *Material group* | *TSR* (N/mm²) | *Hardness* HB | *Cutting speed* Vc m/min |
|---|---|---|---|
| Aluminium | < 350 | < 100 | |
| Aluminium < 5% Si | < 500 | < 150 | |
| Aluminium > 5% Si | < 400 | < 120 | **< 200** |
| Graphite | | | **< 200** |

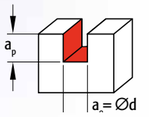
**VHC Diamond coated endmills:**
**VHC Diamant beschichtete Schaftfräser:**

- Excellent accuracy and tolerances.
  Ausgezeichnete Genauigkeiten und Toleranzen.
- Optimized surface finish on workpiece.
  Optimierte Werkstückoberflächen.
- Leading diamond coating technology.
  Führende Diamant-Beschichtungstechnologie.
- Superior toollife.
  Hervorragende Standzeiten.

| Article Number *Artikelnummer* | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) | |
|---|---|---|---|---|---|---|---|---|---|---|
| VHMG 2 003 064 06 02 L010 | 0,3 | 0,05 | 6 | 64 | 1,0 | 1,0 | - | 2 | 7 | |
| VHMG 2 003 064 06 02 L025 | 0,3 | 0,05 | 6 | 64 | 1,5 | 2,5 | 0,010 | 2 | 7 | |
| VHMG 2 003 064 06 02 | 0,3 | 0,05 | 6 | 64 | 1,5 | 5,0 | 0,010 | 2 | 8 | |
| VHMG 2 004 064 06 02 L010 | 0,4 | 0,05 | 6 | 64 | 1,0 | 1,0 | - | 2 | 6 | |
| VHMG 2 004 064 06 02 L025 | 0,4 | 0,05 | 6 | 64 | 1,5 | 2,5 | 0,010 | 2 | 7 | |
| VHMG 2 004 064 06 02 | 0,4 | 0,05 | 6 | 64 | 1,5 | 5,0 | 0,010 | 2 | 8 | |
| VHMG 2 005 064 06 02 L015 | 0,5 | 0,05 | 6 | 64 | 1,5 | 1,5 | - | 2 | 6 | |
| VHMG 2 005 064 06 02 L035 | 0,5 | 0,05 | 6 | 64 | 1,5 | 3,5 | 0,010 | 2 | 7 | |
| VHMG 2 005 064 06 02 | 0,5 | 0,05 | 6 | 64 | 1,5 | 7,0 | 0,010 | 2 | 8 | |
| VHMG 2 005 064 06 02 L100 | 0,5 | 0,05 | 6 | 64 | 1,5 | 10,0 | 0,010 | 2 | 10 | |
| VHMG 2 006 064 06 02 L015 | 0,6 | 0,05 | 6 | 64 | 1,5 | 1,5 | - | 2 | 6 | |
| VHMG 2 006 064 06 02 L035 | 0,6 | 0,05 | 6 | 64 | 2,0 | 3,5 | 0,025 | 2 | 7 | |
| VHMG 2 006 064 06 02 | 0,6 | 0,05 | 6 | 64 | 2,0 | 7,0 | 0,025 | 2 | 8 | |
| VHMG 2 006 064 06 02 L100 | 0,6 | 0,05 | 6 | 64 | 2,0 | 10,0 | 0,025 | 2 | 10 | |
| VHMG 2 008 064 06 02 L020 | 0,8 | 0,05 | 6 | 64 | 2,0 | 2,0 | - | 2 | 6 | |
| VHMG 2 008 064 06 02 L050 | 0,8 | 0,05 | 6 | 64 | 2,0 | 5,0 | 0,025 | 2 | 7 | |
| VHMG 2 008 064 06 02 L075 | 0,8 | 0,05 | 6 | 64 | 2,0 | 7,5 | 0,025 | 2 | 8 | |
| VHMG 2 008 064 06 02 | 0,8 | 0,05 | 6 | 64 | 2,0 | 10,0 | 0,025 | 2 | 9 | |
| VHMG 2 008 064 06 02 L150 | 0,8 | 0,05 | 6 | 64 | 2,0 | 15,0 | 0,025 | 2 | 13 | |
| VHMG 2 010 064 06 02 L025 | 1,0 | 0,05 | 6 | 64 | 2,5 | 2,5 | - | 2 | 6 | |
| VHMG 2 010 064 06 02 L050 | 1,0 | 0,05 | 6 | 64 | 3,0 | 5,0 | 0,025 | 2 | 7 | |
| VHMG 2 010 064 06 02 L075 | 1,0 | 0,05 | 6 | 64 | 3,0 | 7,5 | 0,025 | 2 | 8 | |
| VHMG 2 010 064 06 02 | 1,0 | 0,05 | 6 | 64 | 3,0 | 10,0 | 0,025 | 2 | 9 | |
| VHMG 2 010 064 06 02 L150 | 1,0 | 0,05 | 6 | 64 | 3,0 | 15,0 | 0,025 | 2 | 13 | |
| VHMG 2 010 064 06 02 L200 | 1,0 | 0,05 | 6 | 64 | 3,0 | 20,0 | 0,025 | 2 | 18 | new/neu |
| VHMG 2 012 064 06 02 L050 | 1,2 | 0,05 | 6 | 64 | 3,0 | 5,0 | 0,025 | 2 | 7 | |
| VHMG 2 012 064 06 02 | 1,2 | 0,05 | 6 | 64 | 3,0 | 10,0 | 0,025 | 2 | 9 | |
| VHMG 2 015 064 06 02 L050 | 1,5 | 0,05 | 6 | 64 | 3,0 | 5,0 | 0,025 | 2 | 6 | |
| VHMG 2 015 064 06 02 L075 | 1,5 | 0,05 | 6 | 64 | 3,0 | 7,5 | 0,025 | 2 | 7 | |
| VHMG 2 015 064 06 02 | 1,5 | 0,05 | 6 | 64 | 3,0 | 10,0 | 0,025 | 2 | 8 | |
| VHMG 2 015 064 06 02 L150 | 1,5 | 0,05 | 6 | 64 | 3,0 | 15,0 | 0,025 | 2 | 12 | |
| VHMG 2 015 064 06 02 L200 | 1,5 | 0,05 | 6 | 64 | 3,0 | 20,0 | 0,025 | 2 | 15 | |




$a_p$ up to 1,50 x d
$a_e$ up to 0,10 x d



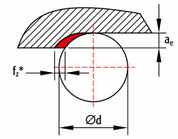

$a_p$ up to 0,50 x d

***Shoulder milling / Eckfräsen***

| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 0,3 | < 0,15 | < 0,03 | 0,006 - 0,012 |
| 0,4 | < 0,20 | < 0,04 | 0,008 - 0,015 |
| 0,5 | < 0,25 | < 0,04 | 0,010 - 0,020 |
| 0,6 | < 0,45 | < 0,05 | 0,012 - 0,022 |
| 0,8 | < 0,60 | < 0,07 | 0,015 - 0,025 |
| 1,0 | < 1,00 | < 0,10 | 0,018 - 0,030 |
| 1,2 | < 1,20 | < 0,12 | 0,020 - 0,035 |
| 1,5 | < 1,50 | < 0,15 | 0,025 - 0,040 |

***Slot milling / Nutenfräsen***

| $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|
| < 0,08 | < 0,3 | 0,006 - 0,012 |
| < 0,10 | < 0,4 | 0,008 - 0,015 |
| < 0,13 | < 0,5 | 0,010 - 0,020 |
| < 0,15 | < 0,6 | 0,012 - 0,022 |
| < 0,20 | < 0,8 | 0,015 - 0,025 |
| < 0,25 | < 1,0 | 0,018 - 0,030 |
| < 0,30 | < 1,2 | 0,020 - 0,035 |
| < 0,38 | < 1,5 | 0,025 - 0,040 |

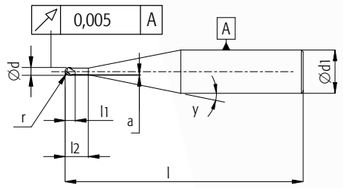


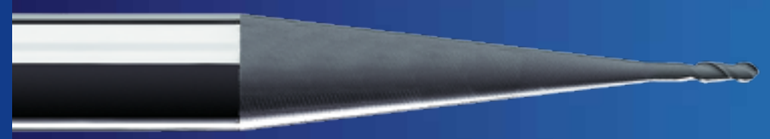

$$f_z^* = f_z \sqrt{\frac{d}{a_e}}$$

- Cutting speed Vc is based on max. 40.000 rpm.
  Schnittgeschwindigkeit Vc bezogen auf max. 40.000 U/min.
- Given conditions are based on VHMG short length endmills; when using endmills with longer L2-length, reduce $f_z$ according table.
  Die angegebenen Schnittwerte beziehen sich auf kurze VHMG Ausführung; beim Einsatz von Schaftfräsern mit größerem L2-Maß, Vorschub $f_z$ gemäß Tabellenangaben reduzieren.

| L2-Length | Reduction |
|---|---|
| 1-5 x d | 0% |
| 5-10 x d | 30% |
| 10 ~ | 50% |

### Standard





| Article Number<br>*Artikelnummer* | Ød<br>(mm) | r<br>(mm) | Ød1<br>(mm) | L<br>(mm) | L1<br>(mm) | L2<br>(mm) | a<br>(mm) | z | γ<br>(°) |
|---|---|---|---|---|---|---|---|---|---|
| VHMGK 2 003 064 06 02 L010 | 0,3 | 0,15 | 6 | 64 | 1,0 | - | - | 2 | 6 |
| VHMGK 2 003 064 06 02 L025 | 0,3 | 0,15 | 6 | 64 | 1,5 | 2,5 | 0,010 | 2 | 7 |
| VHMGK 2 003 064 06 02 | 0,3 | 0,15 | 6 | 64 | 1,5 | 5,0 | 0,010 | 2 | 8 |
| VHMGK 2 004 064 06 02 L010 | 0,4 | 0,20 | 6 | 64 | 1,0 | - | - | 2 | 6 |
| VHMGK 2 004 064 06 02 L025 | 0,4 | 0,20 | 6 | 64 | 1,5 | 2,5 | 0,010 | 2 | 7 |
| VHMGK 2 004 064 06 02 | 0,4 | 0,20 | 6 | 64 | 1,5 | 5,0 | 0,010 | 2 | 8 |
| VHMGK 2 005 064 06 02 L015 | 0,5 | 0,25 | 6 | 64 | 1,5 | - | - | 2 | 6 |
| VHMGK 2 005 064 06 02 L035 | 0,5 | 0,25 | 6 | 64 | 1,5 | 3,5 | 0,010 | 2 | 7 |
| VHMGK 2 005 064 06 02 | 0,5 | 0,25 | 6 | 64 | 1,5 | 7,0 | 0,010 | 2 | 8 |
| VHMGK 2 005 064 06 02 L100 | 0,5 | 0,25 | 6 | 64 | 1,5 | 10,0 | 0,010 | 2 | 10 |
| VHMGK 2 006 064 06 02 L015 | 0,6 | 0,30 | 6 | 64 | 1,5 | - | - | 2 | 6 |
| VHMGK 2 006 064 06 02 L035 | 0,6 | 0,30 | 6 | 64 | 2,0 | 3,5 | 0,025 | 2 | 7 |
| VHMGK 2 006 064 06 02 | 0,6 | 0,30 | 6 | 64 | 2,0 | 7,0 | 0,025 | 2 | 8 |
| VHMGK 2 006 064 06 02 L100 | 0,6 | 0,30 | 6 | 64 | 2,0 | 10,0 | 0,025 | 2 | 10 |
| VHMGK 2 008 064 06 02 L020 | 0,8 | 0,40 | 6 | 64 | 2,0 | - | - | 2 | 6 |
| VHMGK 2 008 064 06 02 L050 | 0,8 | 0,40 | 6 | 64 | 2,0 | 5,0 | 0,025 | 2 | 7 |
| VHMGK 2 008 064 06 02 L075 | 0,8 | 0,40 | 6 | 64 | 2,0 | 7,5 | 0,025 | 2 | 8 |
| VHMGK 2 008 064 06 02 | 0,8 | 0,40 | 6 | 64 | 2,0 | 10,0 | 0,025 | 2 | 9 |
| VHMGK 2 008 064 06 02 L150 | 0,8 | 0,40 | 6 | 64 | 2,0 | 15,0 | 0,025 | 2 | 13 |
| VHMGK 2 010 064 06 02 L025 | 1,0 | 0,50 | 6 | 64 | 2,5 | - | - | 2 | 6 |
| VHMGK 2 010 064 06 02 L050 | 1,0 | 0,50 | 6 | 64 | 3,0 | 5,0 | 0,025 | 2 | 7 |
| VHMGK 2 010 064 06 02 L075 | 1,0 | 0,50 | 6 | 64 | 3,0 | 7,5 | 0,025 | 2 | 8 |
| VHMGK 2 010 064 06 02 | 1,0 | 0,50 | 6 | 64 | 3,0 | 10,0 | 0,025 | 2 | 9 |
| VHMGK 2 010 064 06 02 L150 | 1,0 | 0,50 | 6 | 64 | 3,0 | 15,0 | 0,025 | 2 | 13 |
| VHMGK 2 010 064 06 02 L200 | 1,0 | 0,50 | 6 | 64 | 3,0 | 20,0 | 0,025 | 2 | 18 |
| VHMGK 2 012 064 06 02 L050 | 1,2 | 0,60 | 6 | 64 | 3,0 | 5,0 | 0,025 | 2 | 7 |
| VHMGK 2 012 064 06 02 | 1,2 | 0,60 | 6 | 64 | 3,0 | 10,0 | 0,025 | 2 | 9 |
| VHMGK 2 015 064 06 02 L050 | 1,5 | 0,75 | 6 | 64 | 3,0 | 5,0 | 0,025 | 2 | 6 |
| VHMGK 2 015 064 06 02 L075 | 1,5 | 0,75 | 6 | 64 | 3,0 | 7,5 | 0,025 | 2 | 7 |
| VHMGK 2 015 064 06 02 | 1,5 | 0,75 | 6 | 64 | 3,0 | 10,0 | 0,025 | 2 | 8 |
| VHMGK 2 015 064 06 02 L150 | 1,5 | 0,75 | 6 | 64 | 3,0 | 15,0 | 0,025 | 2 | 12 |
| VHMGK 2 015 064 06 02 L200 | 1,5 | 0,75 | 6 | 64 | 3,0 | 20,0 | 0,025 | 2 | 15 |

**For Coolant we advise:**
**Empfohlene Kühlung:**

- Air Pressure
  Luft

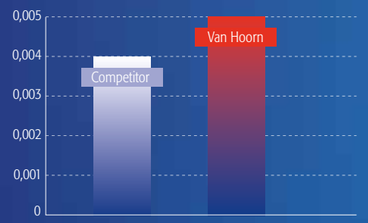
| *Material group* | *TSR*<br>(N/mm²) | *Hardness*<br>HB | *Cutting speed*<br>Vc m/min |
|---|---|---|---|
| Aluminium | < 350 | < 100 | |
| Aluminium < 5% Si | < 500 | < 150 | |
| Aluminium > 5% Si | < 400 | < 120 | **< 200** |
| Graphite | | | **< 200** |

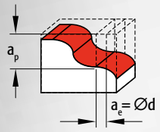
**VHMGK20100640602**
**Workpiece Material:** Poco Graphite
**Hardness:** 1700

| | Van Hoorn | Competitor |
|---|---|---|
| $v_c$ | 126 m/min | 126 m/min |
| n | 40000 rpm | 40000 rpm |
| $F_z$ | 0,013 mm/t | 0,010 mm/t |
| $v_f$ | 1000 mm/min | 800 mm/min |
| $a_p$ | 0,05 mm | 0,05 mm |
| $a_e$ | 0,10 mm | 0,10 mm |
| Coolant | air | air |
| **Q** | **0,005 mm³/min** | **0,004 mm³/min** |

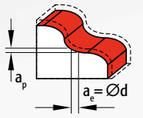
**Finishing application**

## Chip removal rate / Zeitspanvolumen




$a_p$ up to 1,00 x d
$a_e$ up to 0,10 x d



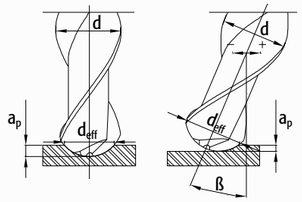

$a_p$ up to 0,20 x d
$a_e$ up to 0,10 x d

### *Shoulder milling / Stirnfräsen*

| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 0,3 | < 0,15 | < 0,03 | 0,006 - 0,012 |
| 0,4 | < 0,20 | < 0,04 | 0,008 - 0,015 |
| 0,5 | < 0,25 | < 0,04 | 0,010 - 0,020 |
| 0,6 | < 0,45 | < 0,05 | 0,012 - 0,022 |
| 0,8 | < 0,60 | < 0,07 | 0,015 - 0,025 |
| 1,0 | < 1,00 | < 0,10 | 0,018 - 0,030 |
| 1,2 | < 1,20 | < 0,12 | 0,020 - 0,035 |
| 1,5 | < 1,50 | < 0,15 | 0,025 - 0,040 |

### *Profile milling / Profilfräsen*

| $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|
| < 0,03 | < 0,02 | 0,006 - 0,012 |
| < 0,04 | < 0,03 | 0,008 - 0,015 |
| < 0,05 | < 0,03 | 0,010 - 0,020 |
| < 0,12 | < 0,04 | 0,012 - 0,022 |
| < 0,16 | < 0,05 | 0,015 - 0,025 |
| < 0,20 | < 0,09 | 0,018 - 0,030 |
| < 0,24 | < 0,10 | 0,020 - 0,035 |
| < 0,30 | < 0,13 | 0,025 - 0,040 |




- **Cutting speed Vc is based on max. 40.000 rpm.**
  Schnittgeschwindigkeit Vc bezogen auf max. 40.000 U/min.
- **Given conditions are based on VHMGK short length endmills; when using endmills with longer L2-length, reduce $f_z$ according table.**
  Die angegebenen Schnittwerte beziehen sich auf die kurze VHMGK Ausführung; beim Einsatz von Schaftfräsern mit größerem L2-Maß, Vorschub $f_z$ gemäß Tabellenangaben reduzieren.

| L2-Length | Reduction |
|---|---|
| 1-5 x d | 0% |
| 5-10 x d | 30% |
| 10 ~ | 50% |

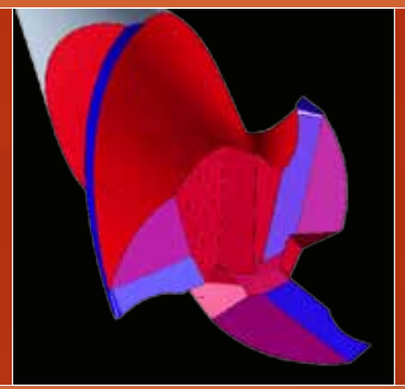
ß = 0: $d_{eff} = 2 \bullet \sqrt{d \bullet a_p - a_p^2}$

ß ≠ 0: $d_{eff} = d \bullet \sin\left[ß \pm \arccos\left(\frac{d - 2a_p}{d}\right)\right]$

# Endmills for copper and copper EDM technology

## Schaftfräser für die Kupfer-Bearbeitung in der Erodiertechnik (EDM)

The surface quality and minimizing burs are two of the most important demands on copper EDM applications. The combination of a sharp geometry, low axial forces and a superior low friction coating provide that!
Oberflächenqualität und Minimierung der Gratbildung stellen die beiden wichtigsten Anforderungen in der Elektroden-Herstellung (EDM) dar. Die Kombination einer scharfen Schneidengeometrie mit geringen axialen Schnittkräften und einer herausragenden Beschichtung mit niedrigem Reibungskoeffizienten ermöglicht hierbei die erfolgreiche Bearbeitung.



## Tips / Tipps:

To improve the surface quality and toollife:
Use emulsion
Für bessere Oberflächenqualitäten und längere Standzeiten bitte Emulsion verwenden.

- Side milling: small $a_e$ and large $a_p$
  Stirnfräsen: kleine $a_e$ und große $a_p$
- Slotting: small $a_p$
  Nutenfräsen: kleine $a_p$

## New developments / Neuentwicklungen:

- New coating
  Neue Beschichtung
- Low friction coefficient
  Geringer Reibungskoeffizient
- Extreme hardness
  Extreme Härte
- Ultra thin
  Ultra dünn
- VHC mirror finish grinding
  VHC Spiegelschliff



# VHC Endmill technology for applications on (EDM) copper

## VHC Frästechnologie für die Kupfer-Bearbeitung (EDM)

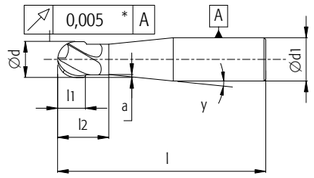
- VHKC: 4 flute ballnose geometry.
  VHKC: 4 Schneiden Radiusfräser.
- VHTC: 4 flute torus geometry.
  VHTC: 4 Schneiden Torusfräser.
- VHSC: 3 flute sharp geometry.
  VHSC: 3 Schneiden scharfkantig.
- VHSCR: 3 flute geometry with corner radius.
  VHSCR: 3 Schneiden mit Eckenradius.
- VHMC: Micro endmills for copper.
  VHMC: Mikro-Schaftfräser für Kupfer.
- VHMCK: Micro ballnose endmills for copper.
  VHMCK: Mikro-Radiusfräser für Kupfer.

## Advantages / Vorteile

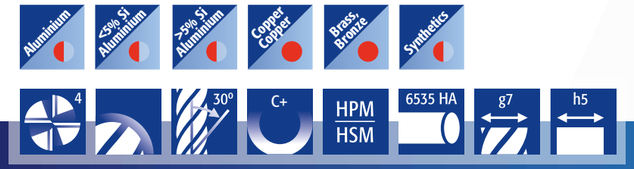
- Minimize or exclude burrs on work piece.
  Minimierung/Verhinderung der Gratbildung am Werkstück.
- Excellent surface quality & accuracy.
  Ausgezeichnete Oberflächenqualität und Genauigkeit.
- High feed rates.
  Hohe Vorschübe.

The Van Hoorn Carbide Copper program is also very well suited for milling synthetics.
Das Van Hoorn Carbide Kupfer Programm empfiehlt sich auch für die Kunststoffbearbeitung.

### Standard




* For endmills / für Schaftfräser L < 100 mm.



**For Coolant we advise:**
**Empfohlene Kühlung:**

- Emulsion
  Emulsion

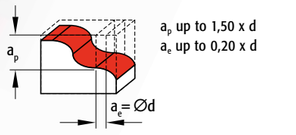
| *Material group* | *TSR* (N/mm²) | *Hardness* HB | *Cutting speed* Vc m/min |
|---|---|---|---|
| Aluminium | < 350 | < 100 | **< 600** |
| Aluminium < 5% Si | < 500 | < 150 | **< 400** |
| Aluminium > 5% Si | < 400 | < 120 | **< 300** |
| Copper | < 350 | < 100 | **< 350** |
| Brass, bronze | < 700 | < 200 | **< 250** |
| Synthetics | | | **< 500** |

**VHKC40400640631**
**Material** Copper 2.2140

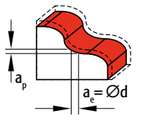
| | |
|---|---|
| $v_c$ | 325 m/min |
| n | 25900 rpm |
| $f_z$ | 0,015 mm/t |
| $v_f$ | 1600 mm/min |
| $a_p$ | 0,1 mm |
| $a_e$ | 0,1 mm |
| **Coolant** | emulsion |
| **Q** | **0,02 cm³/min** |

- Finishing application.
  Schlichtbearbeitung.
- No burrs.
  Gratfrei.

| Article Number<br>*Artikelnummer* | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
|---|---|---|---|---|---|---|---|---|---|
| VHKC 4 030 051 03 31 | 3,0 | 1,5 | 3 | 51 | 4 | 12 | 0,05 | 4 | - |
| VHKC 4 040 064 06 31 | 4,0 | 2,0 | 6 | 64 | 5 | 16 | 0,05 | 4 | 15 |
| VHKC 4 050 064 06 31 | 5,0 | 2,5 | 6 | 64 | 6 | 19 | 0,10 | 4 | 15 |
| VHKC 4 060 064 06 31 | 6,0 | 3,0 | 6 | 64 | 7 | 20 | 0,10 | 4 | - |
| VHKC 4 080 064 08 31 | 8,0 | 4,0 | 8 | 64 | 9 | 22 | 0,10 | 4 | - |
| VHKC 4 100 078 10 31 | 10,0 | 5,0 | 10 | 78 | 12 | 25 | 0,10 | 4 | - |
| VHKC 4 120 078 12 31 | 12,0 | 6,0 | 12 | 78 | 15 | 30 | 0,15 | 4 | - |
| VHKC 4 140 089 14 31 | 14,0 | 7,0 | 14 | 89 | 24 | 35 | 0,15 | 4 | - |
| VHKC 4 160 100 16 31 | 16,0 | 8,0 | 16 | 100 | 28 | 40 | 0,15 | 4 | - |

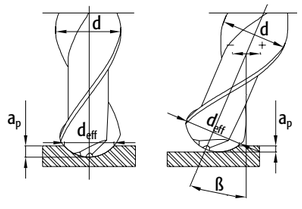



$a_p$ up to 1,50 x d
$a_e$ up to 0,20 x d




$a_p$ up to 0,10 x d
$a_e$ up to 0,10 x d

| Ød (mm) | *Shoulder milling / Stirnfräsen* $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) | *Profile milling / Profilfräsen* $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|---|---|---|
| 3,0 | < 3,0 | < 0,3 | 0,015 - 0,020 | < 0,30 | < 0,15 | 0,015 - 0,020 |
| 4,0 | < 6,0 | < 0,4 | 0,020 - 0,030 | < 0,40 | < 0,30 | 0,020 - 0,030 |
| 5,0 | < 7,5 | < 0,5 | 0,025 - 0,035 | < 0,50 | < 0,35 | 0,025 - 0,035 |
| 6,0 | < 9,0 | < 0,8 | 0,030 - 0,040 | < 0,60 | < 0,50 | 0,030 - 0,040 |
| 8,0 | < 12,0 | < 1,0 | 0,040 - 0,060 | < 0,80 | < 0,70 | 0,040 - 0,060 |
| 10,0 | < 15,0 | < 1,3 | 0,055 - 0,075 | < 1,00 | < 0,90 | 0,055 - 0,075 |
| 12,0 | < 18,0 | < 2,4 | 0,100 - 0,130 | < 1,20 | < 1,20 | 0,100 - 0,130 |
| 14,0 | < 21,0 | < 2,8 | 0,120 - 0,180 | < 1,40 | < 1,40 | 0,120 - 0,180 |
| 16,0 | < 24,0 | < 3,2 | 0,150 - 0,250 | < 1,60 | < 1,60 | 0,150 - 0,250 |

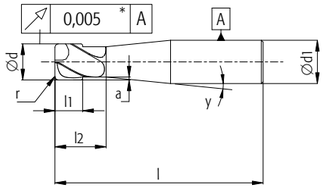



- For profile milling cutting speed Vc may be increased up to 30%.
  Beim Profilfräsen ist die Schnittgeschwindigkeit Vc um 30% zu erhöhen.

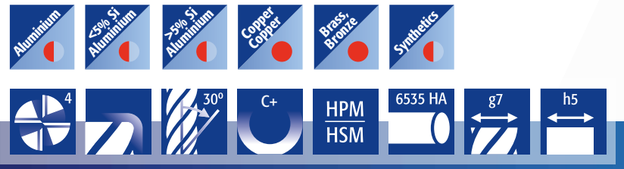
ß = 0: $d_{eff} = 2 \bullet \sqrt{d \bullet a_p - a_p^2}$

ß ≠ 0: $d_{eff} = d \bullet \sin\left[ß \pm \arccos\left(\frac{u - 2a_p}{d}\right)\right]$

***Standard***




* For endmills / für Schaftfräser L < 100 mm.



**For Coolant we advise:**
**Empfohlene Kühlung:**

- Emulsion
  Emulsion

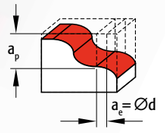
| *Material group* | *TSR* (N/mm²) | *Hardness* HB | *Cutting speed* Vc m/min |
|---|---|---|---|
| Aluminium | < 350 | < 100 | **< 600** |
| Aluminium < 5% Si | < 500 | < 150 | **< 400** |
| Aluminium > 5% Si | < 400 | < 120 | **< 300** |
| Copper | < 350 | < 100 | **< 350** |
| Brass, bronze | < 700 | < 200 | **< 250** |
| Synthetics | | | **< 500** |

**VHTC4060640631050**
**Material** Electrolytic copper

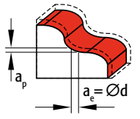
| | |
|---|---|
| $v_c$ | 123 m/min |
| n | 6500 rpm |
| $f_z$ | 0,096 mm/t |
| $v_f$ | 2500 mm/min |
| $a_p$ | 0,1 mm |
| $a_e$ | 0,1 mm |
| **Coolant** | emulsion |
| **Q** | **0,025 cm³/min** |

- Excellent surface finish.
  Hervorragende Oberflächenqualität.
- No burrs.
  Gratfrei.

| Article Number<br>*Artikelnummer* | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
|---|---|---|---|---|---|---|---|---|---|
| VHTC 4 030 051 03 31 050 | 3,0 | 0,5 | 3 | 51 | 4 | 12 | 0,05 | 4 | - |
| VHTC 4 040 064 06 31 050 | 4,0 | 0,5 | 6 | 64 | 5 | 16 | 0,05 | 4 | 15 |
| VHTC 4 050 064 06 31 050 | 5,0 | 0,5 | 6 | 64 | 6 | 19 | 0,10 | 4 | 15 |
| VHTC 4 060 064 06 31 050 | 6,0 | 0,5 | 6 | 64 | 7 | 20 | 0,10 | 4 | - |
| VHTC 4 060 064 06 31 100 | 6,0 | 1,0 | 6 | 64 | 7 | 20 | 0,10 | 4 | - |
| VHTC 4 080 064 08 31 050 | 8,0 | 0,5 | 8 | 64 | 9 | 25 | 0,10 | 4 | - |
| VHTC 4 080 064 08 31 100 | 8,0 | 1,0 | 8 | 64 | 9 | 25 | 0,10 | 4 | - |
| VHTC 4 100 078 10 31 050 | 10,0 | 0,5 | 10 | 78 | 12 | 25 | 0,10 | 4 | - |
| VHTC 4 100 078 10 31 100 | 10,0 | 1,0 | 10 | 78 | 12 | 25 | 0,10 | 4 | - |
| VHTC 4 120 078 12 31 100 | 12,0 | 1,0 | 12 | 78 | 15 | 30 | 0,15 | 4 | - |
| VHTC 4 140 089 14 31 100 | 14,0 | 1,0 | 14 | 89 | 24 | 35 | 0,15 | 4 | - |
| VHTC 4 160 100 16 31 100 | 16,0 | 1,0 | 16 | 100 | 28 | 40 | 0,15 | 4 | - |

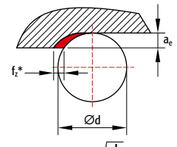



$a_p$ up to 1,50 x d
$a_e$ up to 0,20 x d




$a_p$ up to 0,10 x d
$a_e$ up to 0,10 x d

| Ød (mm) | ***Shoulder milling / Eckfräsen*** $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) | ***Profile milling / Profilfräsen*** $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|---|---|---|
| 3,0 | < 3,0 | < 0,3 | 0,015 - 0,020 | < 0,30 | < 0,15 | 0,015 - 0,020 |
| 4,0 | < 6,0 | < 0,4 | 0,020 - 0,030 | < 0,40 | < 0,30 | 0,020 - 0,030 |
| 5,0 | < 7,5 | < 0,5 | 0,025 - 0,035 | < 0,50 | < 0,35 | 0,025 - 0,035 |
| 6,0 | < 9,0 | < 0,8 | 0,030 - 0,040 | < 0,60 | < 0,50 | 0,030 - 0,040 |
| 8,0 | < 12,0 | < 1,0 | 0,040 - 0,060 | < 0,80 | < 0,70 | 0,040 - 0,060 |
| 10,0 | < 15,0 | < 1,3 | 0,055 - 0,075 | < 1,00 | < 0,90 | 0,055 - 0,075 |
| 12,0 | < 18,0 | < 2,4 | 0,100 - 0,130 | < 1,20 | < 1,20 | 0,100 - 0,130 |
| 14,0 | < 21,0 | < 2,8 | 0,120 - 0,180 | < 1,40 | < 1,40 | 0,120 - 0,180 |
| 16,0 | < 24,0 | < 3,2 | 0,150 - 0,250 | < 1,60 | < 1,60 | 0,150 - 0,250 |

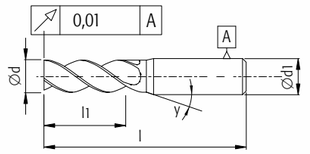


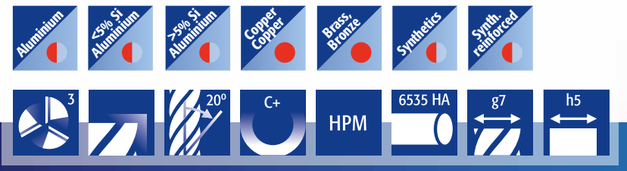

$$f_z^* = f_z \sqrt{\frac{d}{a_e}}$$

- At shoulder milling, feed per tooth $f_z$* for lower $a_e$ values should be converted according formula.
  Beim Eckfräsen ist der Vorschub $f_z$* von der Schnittbreite $a_e$ abhängig.
- For profile milling cutting speed Vc may be increased up to 30%
  Beim Profilfräsen ist die Schnittgeschwindigkeit Vc um 30% zu erhöhen

| $a_e$ | $f_z$*= |
|---|---|
| 0,10 x d | $f_z$ x 3 |
| 0,25 x d | $f_z$ x 2 |
| 0,50 x d | $f_z$ x 1 |

***Standard***



| Article Number<br>*Artikelnummer* | Ød<br>(mm) | r<br>(mm) | Ød1<br>(mm) | L<br>(mm) | L1<br>(mm) | L2<br>(mm) | a<br>(mm) | z | γ<br>(°) |
|---|---|---|---|---|---|---|---|---|---|
| VHSC 3 020 051 03 31 | 2,0 | - | 3 | 51 | 4 | 12 | 0,05 | 3 | 15 |
| VHSC 3 030 051 03 31 | 3,0 | - | 3 | 51 | 6 | 12 | 0,05 | 3 | - |
| VHSC 3 040 064 06 31 | 4,0 | - | 6 | 64 | 8 | 16 | 0,05 | 3 | 15 |
| VHSC 3 050 064 06 31 | 5,0 | - | 6 | 64 | 10 | 16 | 0,10 | 3 | 15 |
| VHSC 3 060 064 06 31 | 6,0 | - | 6 | 64 | 12 | 20 | 0,10 | 3 | - |
| VHSC 3 080 078 08 31 | 8,0 | - | 8 | 78 | 16 | 25 | 0,10 | 3 | - |
| VHSC 3 100 078 10 31 | 10,0 | - | 10 | 78 | 20 | 35 | 0,10 | 3 | - |
| VHSC 3 120 078 12 31 | 12,0 | - | 12 | 78 | 24 | 35 | 0,15 | 3 | - |
| VHSC 3 140 089 14 31 | 14,0 | - | 14 | 89 | 28 | 45 | 0,15 | 3 | - |
| VHSC 3 160 100 16 31 | 16,0 | - | 16 | 100 | 32 | 45 | 0,15 | 3 | - |

**For Coolant we advise:**
**Empfohlene Kühlung:**

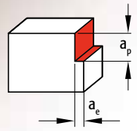
- Emulsion
  Emulsion

| *Material group* | *TSR*<br>(N/mm²) | *Hardness*<br>HB | *Cutting speed*<br>Vc m/min |
|---|---|---|---|
| Aluminium | < 350 | < 100 | **< 600** |
| Aluminium < 5% Si | < 500 | < 150 | **< 400** |
| Aluminium > 5% Si | < 400 | < 120 | **< 300** |
| Copper | < 350 | < 100 | **< 350** |
| Brass, bronze | < 700 | < 200 | |
| Synthetics | | | **< 500** |

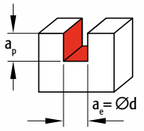
**VHSC30400640631**
**Material** Copper

| | |
|---|---|
| $v_c$ | 163 m/min |
| n | 13000 rpm |
| $f_z$ | 0,038 mm/t |
| $v_f$ | 1500 mm/min |
| $a_p$ | 0,3 mm |
| $a_e$ | 0,3 mm |
| **Coolant** | emulsion |
| **Q** | **0,135 cm³/min** |

- Optimized surface finish, no burrs.
  Optimierte Oberflächenqualität, gratfrei.
- Toollife > 9 houres!
  Standzeit > 9 Stunden!




$a_p$ up to 2,00 x d
$a_e$ up to 0,25 x d



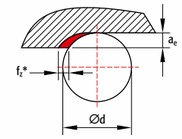

$a_p$ up to 0,10 x d

***Shoulder milling / Eckfräsen***

| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 2,0 | < 2,0 | < 0,2 | 0,010 - 0,015 |
| 3,0 | < 3,0 | < 0,3 | 0,015 - 0,020 |
| 4,0 | < 6,0 | < 0,5 | 0,020 - 0,030 |
| 5,0 | < 7,5 | < 0,7 | 0,025 - 0,035 |
| 6,0 | < 12,0 | < 1,2 | 0,030 - 0,040 |
| 8,0 | < 16,0 | < 1,6 | 0,040 - 0,060 |
| 10,0 | < 20,0 | < 2,0 | 0,055 - 0,075 |
| 12,0 | < 24,0 | < 3,0 | 0,100 - 0,130 |
| 14,0 | < 28,0 | < 3,5 | 0,120 - 0,180 |
| 16,0 | < 32,0 | < 4,0 | 0,150 - 0,250 |

***Slot milling / Nutenfräsen***

| $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|
| < 0,2 | < 2,0 | 0,010 - 0,015 |
| < 0,3 | < 3,0 | 0,015 - 0,020 |
| < 0,4 | < 4,0 | 0,020 - 0,025 |
| < 0,5 | < 5,0 | 0,020 - 0,030 |
| < 0,6 | < 6,0 | 0,025 - 0,035 |
| < 0,8 | < 8,0 | 0,035 - 0,050 |
| < 1,0 | < 10,0 | 0,055 - 0,065 |
| < 1,2 | < 12,0 | 0,060 - 0,100 |
| < 1,4 | < 14,0 | 0,080 - 0,150 |
| < 1,6 | < 16,0 | 0,090 - 0,180 |

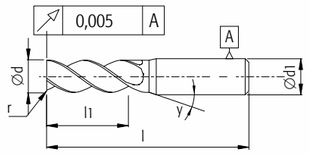


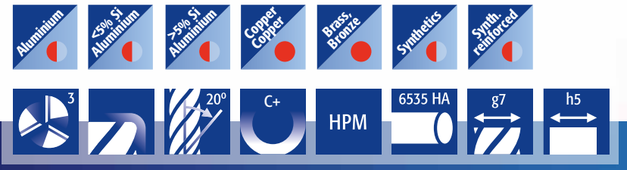

$$f_z^* = f_z \sqrt{\frac{d}{a_e}}$$

- At shoulder milling, feed per tooth $f_z$* for lower ae values should be converted according formula.
  Beim Eckfräsen ist der Vorschub $f_z$* von der Schnittbreite $a_e$ abhängig.
- Given conditions are based on VHSCR endmills.
  Angegebene Schnittwerte bezogen auf Schaftfräser VHSCR.
- VHSC is without corner radius.
  VHSC ohne Eckenradius.
- For shoulder milling cutting speed Vc may be increased up to 30%.
  Beim Eckfräsen kann die Schnittgeschwindigkeit Vc um 30% zu erhöht werden.

| $a_e$ | $f_z$*= |
|---|---|
| 0,10 x d | $f_z$ x 3 |
| 0,25 x d | $f_z$ x 2 |
| 0,50 x d | $f_z$ x 1 |

***Standard***



| Article Number<br>*Artikelnummer* | Ød<br>(mm) | r<br>(mm) | Ød1<br>(mm) | L<br>(mm) | L1<br>(mm) | L2<br>(mm) | a<br>(mm) | z | γ<br>(°) |
|---|---|---|---|---|---|---|---|---|---|
| VHSCR 3 020 051 03 31 | 2,0 | 0,1 | 3 | 51 | 4 | 12 | 0,05 | 3 | 15 |
| VHSCR 3 030 051 03 31 | 3,0 | 0,1 | 3 | 51 | 6 | 12 | 0,05 | 3 | - |
| VHSCR 3 040 064 06 31 | 4,0 | 0,1 | 6 | 64 | 8 | 16 | 0,05 | 3 | 15 |
| VHSCR 3 050 064 06 31 | 5,0 | 0,1 | 6 | 64 | 10 | 16 | 0,10 | 3 | 15 |
| VHSCR 3 060 064 06 31 | 6,0 | 0,2 | 6 | 64 | 12 | 20 | 0,10 | 3 | - |
| VHSCR 3 080 078 08 31 | 8,0 | 0,2 | 8 | 78 | 16 | 25 | 0,10 | 3 | - |
| VHSCR 3 100 078 10 31 | 10,0 | 0,2 | 10 | 78 | 20 | 35 | 0,10 | 3 | - |
| VHSCR 3 120 078 12 31 | 12,0 | 0,2 | 12 | 78 | 24 | 35 | 0,15 | 3 | - |
| VHSCR 3 140 089 14 31 | 14,0 | 0,2 | 14 | 89 | 28 | 45 | 0,15 | 3 | - |
| VHSCR 3 160 100 16 31 | 16,0 | 0,2 | 16 | 100 | 32 | 45 | 0,15 | 3 | - |

**For Coolant we advise:**
**Empfohlene Kühlung:**

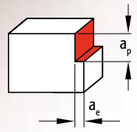
- Emulsion
  Emulsion

| ***Material group*** | ***TSR***<br>(N/mm²) | ***Hardness***<br>HB | ***Cutting speed***<br>Vc m/min |
|---|---|---|---|
| Aluminium | < 350 | < 100 | **< 600** |
| Aluminium < 5% Si | < 500 | < 150 | **< 400** |
| Aluminium > 5% Si | < 400 | < 120 | **< 300** |
| Copper | < 350 | < 100 | **< 350** |
| Brass, bronze | < 700 | < 200 | |
| Synthetics | | | **< 500** |

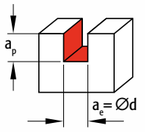
**VHSCR30800640831**
**Material** Copper 2.2140

| | |
|---|---|
| $v_c$ | 400 m/min |
| n | 21500 rpm |
| $f_z$ | 0,022 mm/t |
| $v_f$ | 1400 mm/min |
| $a_p$ | 8 mm |
| $a_e$ | 1,5 mm |
| **Coolant** | min. lubrication |
| **Q** | **16,8 cm³/min** |

- Very good surface finish.
  Sehr gute Oberflächenqualität.
- No burrs.
  Gratfrei.




$a_p$ up to 2,00 x d
$a_e$ up to 0,25 x d



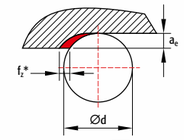

$a_p$ up to 0,10 x d

***Shoulder milling / Eckfräsen***

| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 2,0 | < 2,0 | < 0,2 | 0,010 - 0,015 |
| 3,0 | < 3,0 | < 0,3 | 0,015 - 0,020 |
| 4,0 | < 6,0 | < 0,5 | 0,020 - 0,030 |
| 5,0 | < 7,5 | < 0,7 | 0,025 - 0,035 |
| 6,0 | < 12,0 | < 1,2 | 0,030 - 0,040 |
| 8,0 | < 16,0 | < 1,6 | 0,040 - 0,060 |
| 10,0 | < 20,0 | < 2,0 | 0,055 - 0,075 |
| 12,0 | < 24,0 | < 3,0 | 0,100 - 0,130 |
| 14,0 | < 28,0 | < 3,5 | 0,120 - 0,180 |
| 16,0 | < 32,0 | < 4,0 | 0,150 - 0,250 |

***Slot milling / Nutenfräsen***

| $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|
| < 0,2 | < 2,0 | 0,010 - 0,015 |
| < 0,3 | < 3,0 | 0,015 - 0,020 |
| < 0,4 | < 4,0 | 0,020 - 0,025 |
| < 0,5 | < 5,0 | 0,020 - 0,030 |
| < 0,6 | < 6,0 | 0,025 - 0,035 |
| < 0,8 | < 8,0 | 0,035 - 0,050 |
| < 1,0 | < 10,0 | 0,055 - 0,065 |
| < 1,2 | < 12,0 | 0,060 - 0,100 |
| < 1,4 | < 14,0 | 0,080 - 0,150 |
| < 1,6 | < 16,0 | 0,090 - 0,180 |

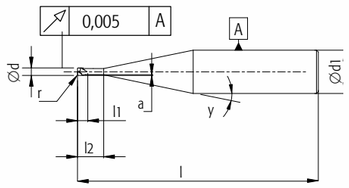


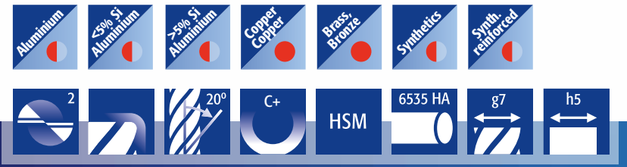

$$f_z^* = f_z \sqrt{\frac{d}{a_e}}$$

- At shoulder milling, feed per tooth $f_z$* for lower ae values should be converted according formula.
  Beim Eckfräsen ist der Vorschub $f_z$* von der Schnittbreite $a_e$ abhängig.
- Given conditions are based on VHSCR endmills.
  Angegebene Schnittwerte bezogen auf Schaftfräser VHSCR.
- VHSC is without corner radius.
  VHSC ohne Eckenradius.
- For shoulder milling cutting speed Vc may be increased up to 30%.
  Beim Eckfräsen kann die Schnittgeschwindigkeit Vc um 30% zu erhöht werden.

| $a_e$ | $f_z$*= |
|---|---|
| 0,10 x d | $f_z$ x 3 |
| 0,25 x d | $f_z$ x 2 |
| 0,50 x d | $f_z$ x 1 |

***Standard***



**For Coolant we advise:**
**Empfohlene Kühlung:**

- Emulsion
  Emulsion

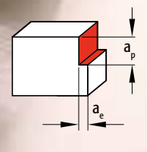
| *Material group* | *TSR* (N/mm²) | *Hardness* HB | *Cutting speed* Vc m/min |
|---|---|---|---|
| Aluminium | < 350 | < 100 | **< 400** |
| Aluminium < 5% Si | < 500 | < 150 | **< 400** |
| Aluminium > 5% Si | < 400 | < 120 | **< 400** |
| Copper | < 350 | < 100 | **< 350** |
| Brass, bronze | < 700 | < 200 | **< 250** |
| Synthetics | | | **< 350** |

**VHMC20150510631L080**
**Material** Electrolytic copper

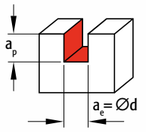
| | |
|---|---|
| **$v_c$** | 85 m/min |
| **n** | 18000 rpm |
| **$f_z$** | 0,035 mm/t |
| **$v_f$** | 1260 mm/min |
| **$a_p$** | 0,03 mm |
| **$a_e$** | 0,05 mm |
| **Coolant** | min. lubrication |
| **Q** | **0,0019 cm³/min** |

- Very good surface quality/finish.
  Sehr gute Oberflächenqualität.
- No burrs.
  Gratfrei.

| Article Number<br>*Artikelnummer* | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
|---|---|---|---|---|---|---|---|---|---|
| VHMC 2 003 051 06 31 L010 | 0,3 | 0,05 | 6 | 51 | 0,6 | 1,0 | 0,010 | 2 | 9 |
| VHMC 2 003 051 06 31 L025 | 0,3 | 0,05 | 6 | 51 | 0,6 | 2,5 | 0,010 | 2 | 9 |
| VHMC 2 004 051 06 31 L015 | 0,4 | 0,05 | 6 | 51 | 0,8 | 1,5 | 0,010 | 2 | 9 |
| VHMC 2 004 051 06 31 L032 | 0,4 | 0,05 | 6 | 51 | 0,8 | 3,2 | 0,010 | 2 | 9 |
| VHMC 2 005 051 06 31 L015 | 0,5 | 0,05 | 6 | 51 | 1,0 | 1,5 | 0,010 | 2 | 9 |
| VHMC 2 005 051 06 31 L040 | 0,5 | 0,05 | 6 | 51 | 1,0 | 4,0 | 0,010 | 2 | 10 |
| VHMC 2 006 051 06 31 L020 | 0,6 | 0,05 | 6 | 51 | 1,2 | 2,0 | 0,025 | 2 | 9 |
| VHMC 2 006 051 06 31 L050 | 0,6 | 0,05 | 6 | 51 | 1,2 | 5,0 | 0,025 | 2 | 10 |
| VHMC 2 008 051 06 31 L040 | 0,8 | 0,05 | 6 | 51 | 1,6 | 4,0 | 0,025 | 2 | 9 |
| VHMC 2 010 051 06 31 L050 | 1,0 | 0,05 | 6 | 51 | 2,0 | 5,0 | 0,025 | 2 | 10 |
| VHMC 2 012 051 06 31 L060 | 1,2 | 0,05 | 6 | 51 | 2,4 | 6,0 | 0,025 | 2 | 10 |
| VHMC 2 015 051 06 31 L080 | 1,5 | 0,05 | 6 | 51 | 3,0 | 8,0 | 0,025 | 2 | 10 |
| VHMC 2 020 051 06 31 L100 | 2,0 | 0,05 | 6 | 51 | 3,0 | 10,0 | 0,050 | 2 | 11 |
| VHMC 2 025 051 06 31 L120 | 2,5 | 0,05 | 6 | 51 | 3,0 | 12,0 | 0,050 | 2 | 12 |
| VHMC 2 030 051 06 31 L120 | 3,0 | 0,05 | 6 | 51 | 3,0 | 12,0 | 0,050 | 2 | 10 |




$a_p$ up to 1,00 x d
$a_e$ up to 0,10 x d




$a_p$ up to 0,10 x d

***Shoulder milling / Eckfräsen***

| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 0,3 | < 0,15 | < 0,03 | 0,005 - 0,009 |
| 0,4 | < 0,20 | < 0,03 | 0,007 - 0,010 |
| 0,5 | < 0,25 | < 0,04 | 0,009 - 0,015 |
| 0,6 | < 0,45 | < 0,05 | 0,010 - 0,017 |
| 0,8 | < 0,60 | < 0,07 | 0,013 - 0,020 |
| 1,0 | < 1,00 | < 0,10 | 0,016 - 0,025 |
| 1,2 | < 1,20 | < 0,12 | 0,020 - 0,030 |
| 1,5 | < 1,50 | < 0,15 | 0,030 - 0,035 |
| 2,0 | < 2,00 | < 0,20 | 0,035 - 0,050 |
| 2,5 | < 2,50 | < 0,25 | 0,040 - 0,060 |
| 3,0 | < 3,00 | < 0,30 | 0,050 - 0,075 |

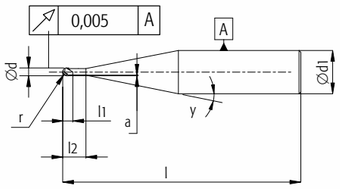
***Slot milling / Nutenfräsen***

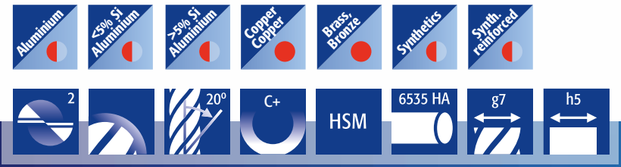
| $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|
| < 0,03 | < 0,3 | 0,005 - 0,009 |
| < 0,04 | < 0,4 | 0,007 - 0,010 |
| < 0,05 | < 0,5 | 0,009 - 0,012 |
| < 0,06 | < 0,6 | 0,010 - 0,015 |
| < 0,08 | < 0,8 | 0,012 - 0,017 |
| < 0,10 | < 1,0 | 0,013 - 0,020 |
| < 0,12 | < 1,2 | 0,015 - 0,025 |
| < 0,15 | < 1,5 | 0,017 - 0,030 |
| < 0,20 | < 2,0 | 0,020 - 0,040 |
| < 0,25 | < 2,5 | 0,022 - 0,045 |
| < 0,30 | < 3,0 | 0,025 - 0,055 |

- Cutting speed Vc is based on max. 40.000 rpm.
  Schnittgeschwindigkeit Vc bezogen auf max. 40.000 U/min.
- Given conditions are based on VHMC short length endmills.
  Die angegebenen Schnittwerte beziehen sich auf Schaftfräser VHMC kurz.

| L2-Length | Reduction |
|---|---|
| 1-5 x d | 0% |
| 5-10 x d | 30% |
| 10 ~ | 50% |

***Standard***



| Article Number<br>*Artikelnummer* | Ød<br>(mm) | r<br>(mm) | Ød1<br>(mm) | L<br>(mm) | L1<br>(mm) | L2<br>(mm) | a<br>(mm) | z | γ<br>(°) |
|---|---|---|---|---|---|---|---|---|---|
| VHMCK 2 003 051 06 31 L010 | 0,3 | 0,15 | 6 | 51 | 0,6 | 1,0 | 0,010 | 2 | 9 |
| VHMCK 2 003 051 06 31 L025 | 0,3 | 0,15 | 6 | 51 | 0,6 | 2,5 | 0,010 | 2 | 9 |
| VHMCK 2 004 051 06 31 L015 | 0,4 | 0,20 | 6 | 51 | 0,8 | 1,5 | 0,010 | 2 | 9 |
| VHMCK 2 004 051 06 31 L032 | 0,4 | 0,20 | 6 | 51 | 0,8 | 3,2 | 0,010 | 2 | 9 |
| VHMCK 2 005 051 06 31 L015 | 0,5 | 0,25 | 6 | 51 | 1,0 | 1,5 | 0,010 | 2 | 9 |
| VHMCK 2 005 051 06 31 L040 | 0,5 | 0,25 | 6 | 51 | 1,0 | 4,0 | 0,010 | 2 | 10 |
| VHMCK 2 006 051 06 31 L020 | 0,6 | 0,30 | 6 | 51 | 1,2 | 2,0 | 0,025 | 2 | 9 |
| VHMCK 2 006 051 06 31 L050 | 0,6 | 0,30 | 6 | 51 | 1,2 | 5,0 | 0,025 | 2 | 10 |
| VHMCK 2 008 051 06 31 L040 | 0,8 | 0,40 | 6 | 51 | 1,6 | 4,0 | 0,025 | 2 | 9 |
| VHMCK 2 010 051 06 31 L050 | 1,0 | 0,50 | 6 | 51 | 2,0 | 5,0 | 0,025 | 2 | 10 |
| VHMCK 2 012 051 06 31 L060 | 1,2 | 0,60 | 6 | 51 | 2,4 | 6,0 | 0,025 | 2 | 10 |
| VHMCK 2 015 051 06 31 L080 | 1,5 | 0,75 | 6 | 51 | 3,0 | 8,0 | 0,025 | 2 | 10 |
| VHMCK 2 020 051 06 31 L100 | 2,0 | 1,00 | 6 | 51 | 3,0 | 10,0 | 0,050 | 2 | 11 |
| VHMCK 2 025 051 06 31 L120 | 2,5 | 1,25 | 6 | 51 | 3,0 | 12,0 | 0,050 | 2 | 12 |
| VHMCK 2 030 051 06 31 L120 | 3,0 | 1,50 | 6 | 51 | 3,0 | 12,0 | 0,050 | 2 | 10 |

**For Coolant we advise:**
**Empfohlene Kühlung:**

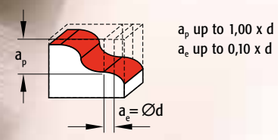
- Emulsion
  Emulsion

| *Material group* | *TSR*<br>(N/mm²) | *Hardness*<br>HB | *Cutting speed*<br>Vc m/min |
|---|---|---|---|
| Aluminium | < 350 | < 100 | **< 400** |
| Aluminium < 5% Si | < 500 | < 150 | **< 400** |
| Aluminium > 5% Si | < 400 | < 120 | **< 400** |
| Copper | < 350 | < 100 | **< 350** |
| Brass, bronze | < 700 | < 200 | **< 250** |
| Synthetics | | | **< 350** |

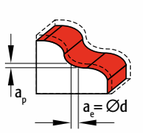
**VHMCK20300510631L120**
**Material** Electrolytic copper

| | |
|---|---|
| **$v_c$** | 170 m/min |
| **n** | 18000 rpm |
| **$f_z$** | 0,072 mm/t |
| **$v_f$** | 2600 mm/min |
| **$a_p$** | 0,05 mm |
| **$a_e$** | 0,05 mm |
| **Coolant** | min. lubrication |
| **Q** | **0,0065 cm³/min** |

- Very good surface quality/finish.
  Sehr gute Oberflächenqualität.
- No burrs.
  Gratfrei.




$a_p$ up to 1,00 x d
$a_e$ up to 0,10 x d




$a_p$ up to 0,10 x d
$a_e$ up to 0,05 x d

***Shoulder milling / Stirnfräsen***

| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 0,3 | < 0,15 | < 0,02 | 0,005 - 0,009 |
| 0,4 | < 0,20 | < 0,03 | 0,007 - 0,010 |
| 0,5 | < 0,25 | < 0,03 | 0,009 - 0,015 |
| 0,6 | < 0,45 | < 0,04 | 0,010 - 0,017 |
| 0,8 | < 0,60 | < 0,05 | 0,013 - 0,020 |
| 1,0 | < 1,00 | < 0,09 | 0,016 - 0,025 |
| 1,2 | < 1,20 | < 0,10 | 0,020 - 0,030 |
| 1,5 | < 1,50 | < 0,13 | 0,030 - 0,035 |
| 2,0 | < 2,00 | < 0,17 | 0,035 - 0,050 |
| 2,5 | < 2,50 | < 0,21 | 0,040 - 0,060 |
| 3,0 | < 3,00 | < 0,26 | 0,050 - 0,075 |

***Profile milling / Profilfräsen***

| $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|
| < 0,02 | < 0,01 | 0,005 - 0,010 |
| < 0,02 | < 0,02 | 0,007 - 0,015 |
| < 0,03 | < 0,02 | 0,010 - 0,017 |
| < 0,06 | < 0,02 | 0,015 - 0,020 |
| < 0,08 | < 0,03 | 0,017 - 0,025 |
| < 0,10 | < 0,05 | 0,020 - 0,030 |
| < 0,12 | < 0,06 | 0,025 - 0,035 |
| < 0,15 | < 0,07 | 0,030 - 0,045 |
| < 0,20 | < 0,10 | 0,035 - 0,060 |
| < 0,25 | < 0,12 | 0,045 - 0,070 |
| < 0,30 | < 0,15 | 0,055 - 0,080 |

- Cutting speed Vc is based on max. 40.000 rpm.
  Schnittgeschwindigkeit Vc bezogen auf max. 40.000 U/min.
- Given conditions are based on VHMCK short length endmills.
  Die angegebenen Schnittwerte beziehen sich auf Schaftfräser VHMCK kurz.

| L2-Length | Reduction |
|---|---|
| 1-5 x d | 0% |
| 5-10 x d | 30% |
| 10 ~ | 50% |

# Milling of aluminium... an absolute strength.

## Aluminiumfräsen... unsere Stärke.

With a number of superior endmills for applications on aluminium, we prove our strength every day: Now we expand the possibilities with the VHAD:

Mit einer großen Zahl an Top-Fräsern für die Aluminiumbearbeitung beweisen wir täglich aufs Neue unsere Stärke. Jetzt haben wir unsere Lösungen um den VHAD erweitert:

# Application demands on aluminium:

## Anforderungen in der Aluminium-Bearbeitung:

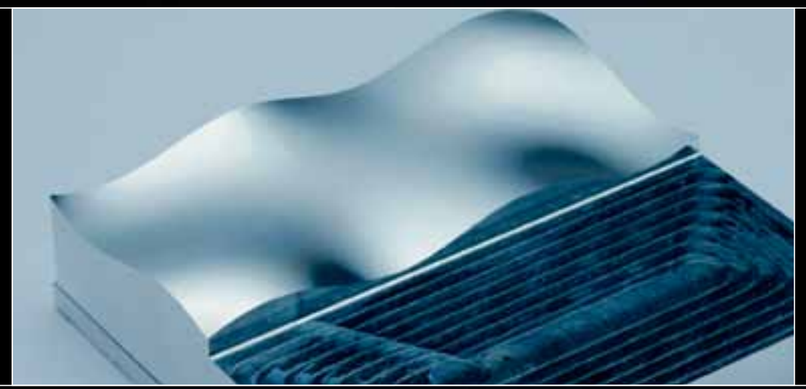
- Large chipping volumes: VHRAW (Improved geometry).
  großes Zeitspanvolumen: VHRAW (verbesserte Schneidengeometrie).
- Burr-free or thin wall applications: VHLAW and VHLA.
  Gratfreie oder Bearbeitung dünnwändiger. Werkstücke: VHLAW und VHLA.
- Operation flexibility: VHAE.
  Flexible Anwendung: VHAE.
- Multiple demands: VHAD.
  Wechselende Einsatzbedingungen: VHAD.

**Additional geometries for HSM**
**Zusätzliche HSM Ausführungen**

- **Torus geometry: VHTA.**
  Torusfräser: VHTA.
- **Ballnose geometry: VHKA.**
  Radiusfräser: VHKA.

## Advantages / Vorteile VHAD

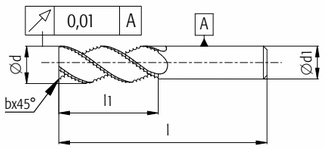
- Allround endmill
  Allround-Schaftfräser
- High material removal rates & a smooth surface finish
  Hohe Zerspanungsleistung und glatte Oberflächen
- Polished flutes for optimized chip evacuation
  Polierte Spannkammern für optimale Späneabfuhr

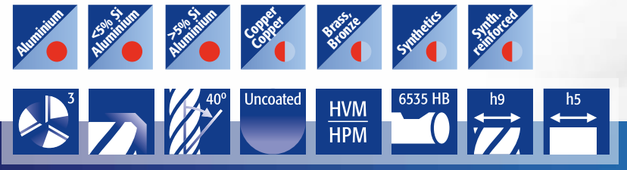


## The VHAE:

- Multiple applications
  Breites Anwendungsspektrum
- Milling, drilling, ramping at the same feed rate
  Fräsen, Bohren, Ramping mit gleichem Vorschub
- Excellent chip flow: high material removal rates
  Hervorragende Spanabfuhr: hohe Zerspanungsleistung
- Burr-free operations
  Gratfreie Bearbeitung

***Standard***




NEW GENERATION

**For Coolant we advise:**
**Empfohlene Kühlung:**

- Emulsion
  Emulsion
- Air Pressure
  Luft

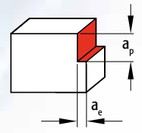
| *Material group* | *TSR* (N/mm²) | *Hardness* HB | *Cutting speed* Vc m/min |
|---|---|---|---|
| Aluminium | < 350 | < 100 | **< 600** |
| Aluminium < 5% Si | < 500 | < 150 | **< 400** |
| Aluminium > 5% Si | < 400 | < 120 | **< 300** |
| Copper | < 350 | < 100 | **< 350** |
| Brass, bronze | < 700 | < 200 | **< 250** |
| Synthetics | | | **< 500** |

**VHRAW31200781215**
**Material** 51ST Aluminium

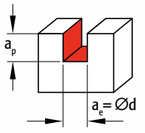
| | |
|---|---|
| **$v_c$** | 829 m/min |
| **n** | 22000 rpm |
| **$f_z$** | 0,067 mm/t |
| **$v_f$** | 4400 mm/min |
| **$a_p$** | 12 mm |
| **$a_e$** | 5,5 mm |
| **Coolant** | emulsion |
| **Q** | **290,4 cm³/min** |

***with Weldon / mit Weldon***

| Article Number *Artikelnummer* | Ød (mm) | b (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
|---|---|---|---|---|---|---|---|---|---|
| VHRAW 3 060 064 06 15 | 6,0 | 0,25 | 6 | 64 | 16 | - | - | 3 | - |
| VHRAW 3 080 064 08 15 | 8,0 | 0,50 | 8 | 64 | 20 | - | - | 3 | - |
| VHRAW 3 100 070 10 15 | 10,0 | 0,50 | 10 | 70 | 22 | - | - | 3 | - |
| VHRAW 3 120 078 12 15 | 12,0 | 0,50 | 12 | 78 | 25 | - | - | 3 | - |
| VHRAW 3 160 089 16 15 | 16,0 | 1,00 | 16 | 89 | 35 | - | - | 3 | - |
| VHRAW 3 200 102 20 15 | 20,0 | 1,00 | 20 | 102 | 40 | - | - | 3 | - |
| VHRAW 3 250 120 25 15 | 25,0 | 1,00 | 25 | 120 | 50 | - | - | 3 | - |

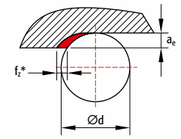



$a_p$ up to 2,00 x d
$a_e$ up to 0,50 x d




$a_p$ up to 1,50 x d

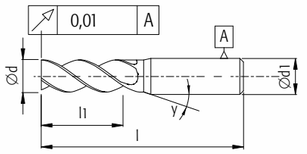
| Ød (mm) | ***Shoulder milling / Eckfräsen*** $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) | ***Slot milling / Nutenfräsen*** $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|---|---|---|
| 6,0 | < 12,0 | < 3,0 | 0,05 - 0,07 | < 9,0 | < 6,0 | 0,05 - 0,06 |
| 8,0 | < 16,0 | < 4,0 | 0,06 - 0,09 | < 12,0 | < 8,0 | 0,06 - 0,08 |
| 10,0 | < 20,0 | < 5,0 | 0,07 - 0,12 | < 15,0 | < 10,0 | 0,07 - 0,10 |
| 12,0 | < 24,0 | < 6,0 | 0,08 - 0,14 | < 18,0 | < 12,0 | 0,08 - 0,11 |
| 16,0 | < 32,0 | < 8,0 | 0,11 - 0,19 | < 24,0 | < 16,0 | 0,11 - 0,13 |
| 20,0 | < 38,0 | < 10,0 | 0,15 - 0,25 | < 30,0 | < 20,0 | 0,15 - 0,25 |
| 25,0 | < 48,0 | < 12,5 | 0,10 - 0,28 | < 35,0 | < 25,0 | 0,20 - 0,28 |

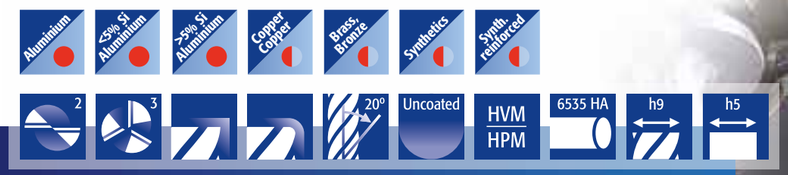



- At shoulder milling, feed per tooth $f_z$* for lower $a_e$ values should be converted according table.
  Beim Eckfräsen ist der Vorschub $f_z$* von der Schnittbreite $a_e$ abhängig.

| $a_e$ | $f_z$*= |
|---|---|
| 0,10 x d | $f_z$ x 3 |
| 0,25 x d | $f_z$ x 2 |
| 0,50 x d | $f_z$ x 1 |

### Standard



**For Coolant we advise:**
**Empfohlene Kühlung:**

- Emulsion
  Emulsion

| *Material group* | *TSR* (N/mm²) | *Hardness* HB | *Cutting speed* Vc m/min |
|---|---|---|---|
| Aluminium | < 350 | < 100 | **< 600** |
| Aluminium < 5% Si | < 500 | < 150 | **< 400** |
| Aluminium > 5% Si | < 400 | < 120 | **< 300** |
| Copper | < 350 | < 100 | **< 350** |
| Brass, bronze | < 700 | < 200 | **< 250** |
| Synthetics | | | **< 500** |

**VHLAW31000701015**
**Material** PA 6 PLM

| | |
|---|---|
| **$v_c$** | 550 m/min |
| **n** | 17500 rpm |
| **$f_z$** | 0,171 mm/t |
| **$v_f$** | 9000 mm/min |
| **$a_p$** | 20 mm |
| **$a_e$** | 10 mm |
| **Coolant** | air |
| **Q** | **1800 cm³/min** |

### VHLAW 3 flute

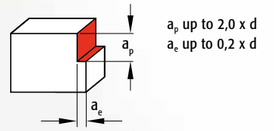
| Article Number<br>*Artikelnummer* | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) |
|---|---|---|---|---|---|---|---|---|---|
| VHLAW 2 040 064 06 15 | 4,0 | - | 6 | 64 | 11 | - | - | 2 | 15 |
| VHLAW 2 050 064 06 15 | 5,0 | - | 6 | 64 | 13 | - | - | 2 | 15 |
| VHLAW 3 060 064 06 15 | 6,0 | - | 6 | 64 | 13 | - | - | 3 | - |
| VHLAW 3 080 064 08 15 | 8,0 | - | 8 | 64 | 19 | - | - | 3 | - |
| VHLAW 3 100 070 10 15 | 10,0 | - | 10 | 70 | 22 | - | - | 3 | - |
| VHLAW 3 120 078 12 15 | 12,0 | - | 12 | 78 | 26 | - | - | 3 | - |
| VHLAW 3 160 089 16 15 | 16,0 | - | 16 | 89 | 32 | - | - | 3 | - |
| VHLAW 3 200 102 20 15 | 20,0 | - | 20 | 102 | 38 | - | - | 3 | - |
| VHLAW 3 250 120 25 15 | 25,0 | - | 25 | 120 | 45 | - | - | 3 | - |

### VHLA 2 flute

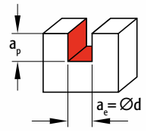
| Article Number<br>*Artikelnummer* | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) | |
|---|---|---|---|---|---|---|---|---|---|---|
| VHLA 2 020 039 03 15 | 2,0 | 0,1 | 3 | 39 | 3 | 6 | 0,05 | 2 | 15 | new/neu |
| VHLA 2 030 064 03 15 | 3,0 | 0,1 | 3 | 64 | 4 | 9 | 0,05 | 2 | - | new/neu |
| VHLA 2 040 064 04 15 | 4,0 | 0,1 | 4 | 64 | 5 | 12 | 0,10 | 2 | - | new/neu |
| VHLA 2 050 064 05 15 | 5,0 | 0,1 | 5 | 64 | 8 | 15 | 0,10 | 2 | - | new/neu |
| VHLA 2 060 064 06 15 | 6,0 | 0,1 | 6 | 64 | 8 | 18 | 0,10 | 2 | - | new/neu |
| VHLA 2 060 102 06 15 | 6,0 | 0,1 | 6 | 102 | 8 | 24 | 0,10 | 2 | - | new/neu |
| VHLA 2 080 070 08 15 | 8,0 | 0,1 | 8 | 70 | 10 | 24 | 0,10 | 2 | - | new/neu |
| VHLA 2 080 102 08 15 | 8,0 | 0,1 | 8 | 102 | 10 | 32 | 0,10 | 2 | - | new/neu |
| VHLA 2 100 102 10 15 | 10,0 | 0,1 | 10 | 102 | 14 | 30 | 0,15 | 2 | - | new/neu |
| VHLA 2 120 089 12 15 | 12,0 | 0,1 | 12 | 89 | 16 | 36 | 0,15 | 2 | - | new/neu |
| VHLA 2 120 125 12 15 | 12,0 | 0,1 | 12 | 125 | 16 | 48 | 0,15 | 2 | - | new/neu |
| VHLA 2 160 089 16 15 | 16,0 | 0,1 | 16 | 89 | 20 | 40 | 0,25 | 2 | - | new/neu |
| VHLA 2 200 102 20 15 | 20,0 | 0,1 | 20 | 102 | 25 | 50 | 0,25 | 2 | - | new/neu |

The endmills can also be supplied with various coatings:
Die Schaftfräser sind auch mit folgenden Beschichtungen lieferbar:

| | |
|---|---|
| * Pure Aluminium | DLC |
| * Rein-aluminium | DLC |
| * Aluminium Si ≤ 5% | DLC |
| * Aluminium Si ≤ 5% | DLC |
| * Aluminium Si > 5% | Diamond |
| * Aluminium Si > 5% | Diamant |

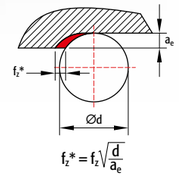



$a_p$ up to 2,0 x d
$a_e$ up to 0,2 x d




$a_p$ up to 1,0 x d

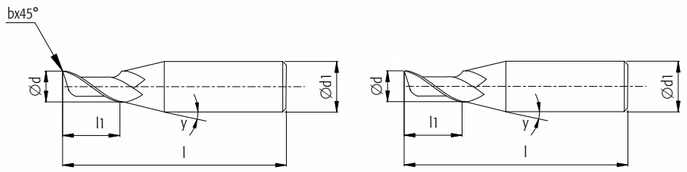
| Ød (mm) | *Shoulder milling / Eckfräsen* $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) | *Slot milling / Nutenfräsen* $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|---|---|---|
| 4,0 | < 8,0 | < 0,8 | 0,010 - 0,025 | < 4,0 | < 4,0 | 0,010 - 0,025 |
| 5,0 | < 10,0 | < 1,0 | 0,020 - 0,040 | < 5,0 | < 5,0 | 0,020 - 0,040 |
| 6,0 | < 12,0 | < 1,2 | 0,025 - 0,050 | < 6,0 | < 6,0 | 0,025 - 0,050 |
| 8,0 | < 16,0 | < 1,6 | 0,035 - 0,070 | < 8,0 | < 8,0 | 0,035 - 0,070 |
| 10,0 | < 20,0 | < 2,0 | 0,045 - 0,090 | < 10,0 | < 10,0 | 0,045 - 0,090 |
| 12,0 | < 24,0 | < 2,4 | 0,055 - 0,100 | < 12,0 | < 12,0 | 0,055 - 0,100 |
| 16,0 | < 30,0 | < 3,2 | 0,070 - 0,120 | < 16,0 | < 16,0 | 0,070 - 0,120 |
| 20,0 | < 38,0 | < 4,0 | 0,075 - 0,150 | < 20,0 | < 20,0 | 0,075 - 0,150 |
| 25,0 | < 40,0 | < 5,0 | 0,085 - 0,200 | < 25,0 | < 25,0 | 0,085 - 0,200 |
| | | | | | | |
| 2,0 | < 3,0 | < 0,4 | 0,005 - 0,015 | < 2,0 | < 2,0 | 0,005 - 0,015 |
| 3,0 | < 4,0 | < 0,6 | 0,008 - 0,020 | < 3,0 | < 3,0 | 0,008 - 0,020 |
| 4,0 | < 5,0 | < 0,8 | 0,010 - 0,025 | < 4,0 | < 4,0 | 0,010 - 0,025 |
| 5,0 | < 6,0 | < 1,0 | 0,020 - 0,040 | < 5,0 | < 5,0 | 0,020 - 0,040 |
| 6,0 | < 8,0 | < 1,2 | 0,025 - 0,050 | < 6,0 | < 6,0 | 0,025 - 0,050 |
| 8,0 | < 10,0 | < 1,6 | 0,035 - 0,070 | < 8,0 | < 8,0 | 0,035 - 0,070 |
| 10,0 | < 14,0 | < 2,0 | 0,045 - 0,090 | < 10,0 | < 10,0 | 0,045 - 0,090 |
| 12,0 | < 16,0 | < 2,4 | 0,055 - 0,100 | < 12,0 | < 12,0 | 0,055 - 0,100 |
| 16,0 | < 20,0 | < 3,2 | 0,070 - 0,120 | < 16,0 | < 16,0 | 0,070 - 0,120 |
| 20,0 | < 25,0 | < 4,0 | 0,075 - 0,150 | < 20,0 | < 20,0 | 0,075 - 0,150 |

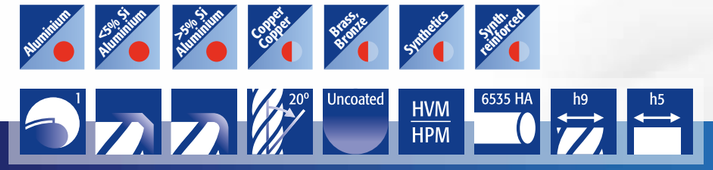



- At shoulder milling, feed per tooth $f_z$* for lower $a_e$ values should be converted according table.

  Beim Eckfräsen ist der Vorschub $f_z$* von der Schnittbreite $a_e$ abhängig.

### *Standard*



| Article Number<br>*Artikelnummer* | Ød<br>(mm) | b<br>(mm) | Ød1<br>(mm) | L<br>(mm) | L1<br>(mm) | L2<br>(mm) | a<br>(mm) | z | γ<br>(°) |
|---|---|---|---|---|---|---|---|---|---|
| VHAE 1 006 038 03 10 | 0,6 | - | 3 | 38 | 3 | - | - | 1 | 15 |
| VHAE 1 008 038 03 10 | 0,8 | - | 3 | 38 | 4 | - | - | 1 | 15 |
| VHAE 1 010 038 03 10 | 1,0 | - | 3 | 38 | 5 | - | - | 1 | 15 |
| VHAE 1 012 038 03 10 | 1,2 | - | 3 | 38 | 5 | - | - | 1 | 15 |
| VHAE 1 015 038 03 10 | 1,5 | - | 3 | 38 | 5 | - | - | 1 | 15 |
| VHAE 1 016 038 03 10 | 1,6 | - | 3 | 38 | 6 | - | - | 1 | 15 |
| VHAE 1 018 038 03 10 | 1,8 | - | 3 | 38 | 7 | - | - | 1 | 15 |
| VHAE 1 020 038 03 10 | 2,0 | - | 3 | 38 | 8 | - | - | 1 | 15 |
| VHAE 1 025 038 03 10 | 2,5 | - | 3 | 38 | 9 | - | - | 1 | 15 |
| VHAE 1 030 038 03 10 | 3,0 | 0,10 | 3 | 38 | 12 | - | - | 1 | - |
| VHAE 1 040 050 04 10 | 4,0 | 0,10 | 4 | 50 | 12 | - | - | 1 | - |
| VHAE 1 050 050 05 10 | 5,0 | 0,15 | 5 | 50 | 15 | - | - | 1 | - |
| VHAE 1 060 050 06 10 | 6,0 | 0,20 | 6 | 50 | 16 | - | - | 1 | - |
| VHAE 1 070 060 07 10 | 7,0 | 0,20 | 7 | 60 | 20 | - | - | 1 | - |
| VHAE 1 080 060 08 10 | 8,0 | 0,25 | 8 | 60 | 20 | - | - | 1 | - |
| VHAE 1 100 070 10 10 | 10,0 | 0,30 | 10 | 70 | 22 | - | - | 1 | - |
| VHAE 1 120 075 12 10 | 12,0 | 0,35 | 12 | 75 | 25 | - | - | 1 | - |

The endmills can also be supplied with various coatings:
Die Schaftfräser sind auch mit folgenden Beschichtungen lieferbar:

| | |
|---|---|
| *** Pure Aluminium** | **DLC** |
| * Rein-aluminium | DLC |
| *** Aluminium Si ≤ 5%** | **DLC** |
| * Aluminium Si ≤ 5% | DLC |
| *** Aluminium Si > 5%** | **Diamond** |
| * Aluminium Si > 5% | Diamant |





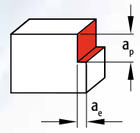
**For Coolant we advise:**
**Empfohlene Kühlung:**

- Emulsion
  Emulsion

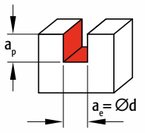
| *Material group* | *TSR*<br>(N/mm²) | *Hardness*<br>HB | *Cutting speed*<br>Vc m/min |
|---|---|---|---|
| Aluminium | < 350 | < 100 | **< 600** |
| Aluminium < 5% Si | < 500 | < 150 | **< 400** |
| Aluminium > 5% Si | < 400 | < 120 | **< 300** |
| Copper | < 350 | < 100 | **< 350** |
| Brass, bronze | < 700 | < 200 | **< 250** |
| Synthetics | | | **< 300** |

**VHAE11000701010**
**Material** Aluminium

| | |
|---|---|
| **$v_c$** | 471 m/min |
| **n** | 15000 rpm |
| **$f_z$** | 0,102 mm/t |
| **$v_f$** | 1525 mm/min |
| **$a_p$** | 10 mm |
| **$a_e$** | 10 mm |
| **Coolant** | emulsion |
| **Q** | **152,5 cm³/min** |




$a_p$ up to 1,00 x d
$a_e$ up to 0,50 x d




$a_p$ up to 1,00 x d

### *Shoulder milling / Eckfräsen*

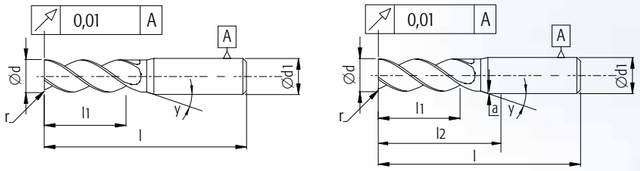
| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 0,6 | < 0,3 | < 0,08 | 0,010 - 0,015 |
| 0,8 | < 0,4 | < 0,10 | 0,014 - 0,018 |
| 1,0 | < 0,8 | < 0,25 | 0,015 - 0,020 |
| 1,2 | < 0,9 | < 0,30 | 0,018 - 0,023 |
| 1,5 | < 1,1 | < 0,38 | 0,023 - 0,027 |
| 1,6 | < 1,2 | < 0,40 | 0,025 - 0,032 |
| 1,8 | < 1,4 | < 0,45 | 0,027 - 0,036 |
| 2,0 | < 1,5 | < 0,50 | 0,030 - 0,043 |
| 2,5 | < 1,9 | < 0,63 | 0,034 - 0,060 |
| 3,0 | < 2,3 | < 0,75 | 0,045 - 0,070 |
| 4,0 | < 4,0 | < 2,0 | 0,050 - 0,080 |
| 5,0 | < 5,0 | < 2,5 | 0,060 - 0,100 |
| 6,0 | < 6,0 | < 3,0 | 0,075 - 0,120 |
| 7,0 | < 7,0 | < 3,5 | 0,080 - 0,135 |
| 8,0 | < 8,0 | < 4,0 | 0,095 - 0,150 |
| 10,0 | < 10,0 | < 5,0 | 0,115 - 0,185 |
| 12,0 | < 12,0 | < 6,0 | 0,140 - 0,230 |

### *Slot milling / Nutenfräsen*

| $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|
| < 0,3 | < 0,6 | 0,010 - 0,015 |
| < 0,4 | < 0,8 | 0,014 - 0,018 |
| < 0,8 | < 1,0 | 0,015 - 0,020 |
| < 0,9 | < 1,2 | 0,018 - 0,023 |
| < 1,1 | < 1,5 | 0,023 - 0,027 |
| < 1,2 | < 1,6 | 0,025 - 0,032 |
| < 1,4 | < 1,8 | 0,027 - 0,036 |
| < 1,5 | < 2,0 | 0,030 - 0,043 |
| < 1,9 | < 2,5 | 0,034 - 0,060 |
| < 2,3 | < 3,0 | 0,045 - 0,070 |
| < 4,0 | < 4,0 | 0,050 - 0,080 |
| < 5,0 | < 5,0 | 0,060 - 0,100 |
| < 6,0 | < 6,0 | 0,075 - 0,120 |
| < 7,0 | < 7,0 | 0,080 - 0,135 |
| < 8,0 | < 8,0 | 0,095 - 0,150 |
| < 10,0 | < 10,0 | 0,115 - 0,185 |
| < 12,0 | < 12,0 | 0,140 - 0,230 |

- **Cutting speed Vc is based on max. 20.000 rpm.**
  Schnittgeschwindigkeit Vc bezogen auf max. 20.000 U/min.
- **Conditions are based on pure aluminium for < 5% Si reduce feed per tooth $f_z$ up to 10% and for > 5% Si reduce $f_z$ up to 20%.**
  Schnittwerte sind auf die Bearbeitung von Rein-Aluminum ausgelegt. Für Aluminium < 5% Si den Zahnvorschub $f_z$ um 10%, für Aluminium > 5% Si um 20% reduzieren.
- **Endmills can be used also for drilling with the same cutting conditions.**
  Die Schaftfräser können mit gleichen Schnittwerten auch für die Herstellung von Bohrungen verwendet werden.

### *Standard*



| Article Number<br>*Artikelnummer* | Ød<br>(mm) | r<br>(mm) | Ød1<br>(mm) | L<br>(mm) | L1<br>(mm) | L2<br>(mm) | a<br>(mm) | z | γ<br>(°) | |
|---|---|---|---|---|---|---|---|---|---|---|
| VHAD 3 040 057 06 10 | 4,0 | 0,10 | 6 | 57 | 11,0 | - | - | 3 | 15 | new/neu |
| VHAD 3 050 057 06 10 | 5,0 | 0,20 | 6 | 57 | 13,0 | - | - | 3 | 15 | new/neu |
| VHAD 3 060 057 06 10 | 6,0 | 0,20 | 6 | 57 | 16,0 | - | - | 3 | - | new/neu |
| VHAD 3 080 063 08 10 | 8,0 | 0,20 | 8 | 63 | 19,0 | - | - | 3 | - | new/neu |
| VHAD 3 100 072 10 10 | 10,0 | 0,20 | 10 | 72 | 22,0 | - | - | 3 | - | new/neu |
| VHAD 3 120 083 12 10 | 12,0 | 0,20 | 12 | 83 | 26,0 | - | - | 3 | - | new/neu |
| VHAD 3 160 092 16 10 | 16,0 | 0,20 | 16 | 92 | 32,0 | - | - | 3 | - | new/neu |
| VHAD 3 200 104 20 10 | 20,0 | 0,20 | 20 | 104 | 38,0 | - | - | 3 | - | new/neu |





**For Coolant we advise:**
**Empfohlene Kühlung:**

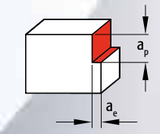
- Minimum lubrication
  Minimalmengenschmierung
- Air Pressure
  Luft

| *Material group* | *TSR*<br>(N/mm²) | *Hardness*<br>HB | *Cutting speed*<br>Vc m/min |
|---|---|---|---|
| Aluminium | < 350 | < 100 | **< 600** |
| Aluminium < 5% Si | < 500 | < 150 | **< 400** |
| Aluminium > 5% Si | < 400 | < 120 | **< 300** |

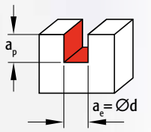
**VHAD30600570610**
**Workpiece Material:** 3.2315
**Hardness:** Aluminium 51ST

| | **Van Hoorn** | **Van Hoorn** |
|---|---|---|
| $v_c$ | 360 m/min | 360 m/min |
| n | 19099 rpm | 19099 rpm |
| $F_z$ | 0,060 mm/t | 0,060 mm/t |
| $v_f$ | 3443 mm/min | 3443 mm/min |
| $a_p$ | 10,0 mm | 10,0 mm |
| $a_e$ | 5,0 mm | 10,0 mm |
| **Coolant** | emulsion | emulsion |
| **Q** | **172,15 mm³/min** | **344,3 mm³/min** |
| | **Side-Milling** | **Slotting** |

**All-round Tool / Allround-Werkzeug**
**Side-Milling as well as Slotting / Umfangs- und Nutenfräsen**




$a_p$ up to1,5 x d
$a_e$ up to 0,5 x d




$a_p$ up to 1,0 x d

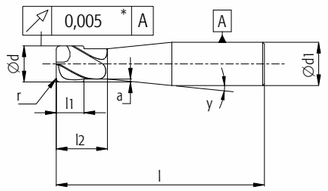
### *Shoulder milling / Eckfräsen*

| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|---|
| 4,0 | < 6,0 | < 2,0 | 0,020 - 0,040 |
| 5,0 | < 8,0 | < 2,5 | 0,025 - 0,050 |
| 6,0 | < 9,0 | < 3,0 | 0,030 - 0,060 |
| 8,0 | < 12,0 | < 4,0 | 0,040 - 0,080 |
| 10,0 | < 15,0 | < 5,0 | 0,050 - 0,100 |
| 12,0 | < 18,0 | < 6,0 | 0,060 - 0,110 |
| 16,0 | < 24,0 | < 8,0 | 0,065 - 0,130 |
| 20,0 | < 30,0 | < 10,0 | 0,075 - 0,150 |

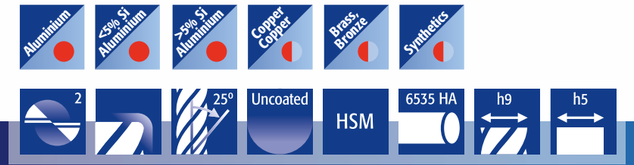
### *Slot milling / Nutenfräsen*

| $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
|---|---|---|
| < 4,0 | < 4,0 | 0,020 - 0,035 |
| < 5,0 | < 5,0 | 0,025 - 0,045 |
| < 6,0 | < 6,0 | 0,030 - 0,055 |
| < 8,0 | < 8,0 | 0,040 - 0,070 |
| < 10,0 | < 10,0 | 0,050 - 0,090 |
| < 12,0 | < 12,0 | 0,060 - 0,100 |
| < 16,0 | < 16,0 | 0,065 - 0,110 |
| < 20,0 | < 20,0 | 0,075 - 0,120 |

### *Standard*




* For endmills L < 100 mm.



**For Coolant we advise:**
**Empfohlene Kühlung:**

- Emulsion
  Emulsion
- Minimum lubrication
  Minimalmengenschmierung

| Article Number<br>*Artikelnummer* | Ød<br>(mm) | r<br>(mm) | Ød1<br>(mm) | L<br>(mm) | L1<br>(mm) | L2<br>(mm) | a<br>(mm) | z | γ<br>(°) | |
|---|---|---|---|---|---|---|---|---|---|---|
| VHTA 2 060 078 06 15 | 6,0 | 1,0 | 6 | 78 | 8 | 20 | 0,5 | 2 | - | new/neu |
| VHTA 2 080 078 08 15 | 8,0 | 1,0 | 8 | 78 | 10 | 20 | 0,5 | 2 | - | new/neu |
| VHTA 2 100 078 10 15 | 10,0 | 1,5 | 10 | 78 | 10 | 20 | 0,5 | 2 | - | new/neu |
| VHTA 2 120 078 12 15 | 12,0 | 1,5 | 12 | 78 | 12 | 35 | 0,5 | 2 | - | |
| VHTA 2 140 089 14 15 | 14,0 | 2,0 | 14 | 89 | 14 | 45 | 0,5 | 2 | - | |
| VHTA 2 160 089 16 15 | 16,0 | 2,0 | 16 | 89 | 16 | 45 | 0,5 | 2 | - | |
| VHTA 2 180 102 18 15 | 18,0 | 2,0 | 18 | 102 | 18 | 55 | 0,5 | 2 | - | |
| VHTA 2 200 102 20 15 | 20,0 | 2,0 | 20 | 102 | 20 | 55 | 0,5 | 2 | - | |
| VHTA 2 250 120 25 15 | 25,0 | 2,0 | 25 | 120 | 25 | 65 | 0,5 | 2 | - | |

The endmills can also be supplied with various coatings:
Die Schaftfräser sind auch mit folgenden Beschichtungen lieferbar:

*** Pure Aluminium** **DLC**
* Rein-aluminium DLC

*** Aluminium Si ≤ 5%** **DLC**
* Aluminium Si ≤ 5% DLC

*** Aluminium Si > 5%** **Diamond**
* Aluminium Si > 5% Diamant

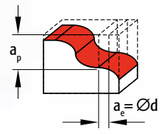




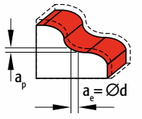
| *Material group* | *TSR*<br>(N/mm²) | *Hardness*<br>HB | *Cutting speed*<br>Vc m/min |
|---|---|---|---|
| Aluminium | < 350 | < 100 | **< 600** |
| Aluminium < 5% Si | < 500 | < 150 | **< 400** |
| Aluminium > 5% Si | < 400 | < 120 | **< 300** |
| Copper | < 350 | < 100 | **< 350** |
| Brass, bronze | < 700 | < 200 | **< 250** |
| Synthetics | | | **< 500** |

**VHTA21000781015**
**Material** 51ST Aluminium

| | |
|---|---|
| **$v_c$** | 1194 m/min |
| **n** | 38000 rpm |
| **$f_z$** | 0,25 mm/t |
| **$v_f$** | 19000 mm/min |
| **$a_p$** | 2,5 mm |
| **$a_e$** | 9 mm |
| **Coolant** | dry |
| **Q** | **427,5 cm³/min** |




**$a_p$ up to 1,00 x d**
**$a_e$ up to 0,20 x d**



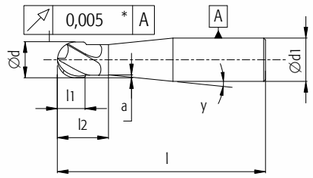

**$a_p$ up to 0,10 x d**
**$a_e$ up to 0,10 x d**

| | ***Shoulder milling / Eckfräsen*** | | | ***Profile milling / Profilfräsen*** | | |
|---|---|---|---|---|---|---|
| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
| 6,0 | < 6,0 | < 0,75 | 0,025 - 0,050 | < 0,6 | < 0,50 | 0,035 - 0,050 |
| 8,0 | < 8,0 | < 1,00 | 0,035 - 0,070 | < 0,8 | < 0,70 | 0,050 - 0,070 |
| 10,0 | < 10,0 | < 1,25 | 0,045 - 0,090 | < 1,0 | < 0,90 | 0,055 - 0,090 |
| 12,0 | < 12,0 | < 2,40 | 0,055 - 0,100 | < 1,2 | < 1,20 | 0,065 - 0,100 |
| 14,0 | < 14,0 | < 2,80 | 0,065 - 0,120 | < 1,4 | < 1,40 | 0,075 - 0,120 |
| 16,0 | < 16,0 | < 3,20 | 0,070 - 0,140 | < 1,6 | < 1,60 | 0,085 - 0,140 |
| 18,0 | < 18,0 | < 3,60 | 0,070 - 0,145 | < 1,8 | < 1,80 | 0,100 - 0,145 |
| 20,0 | < 20,0 | < 4,00 | 0,075 - 0,150 | < 2,0 | < 2,00 | 0,105 - 0,150 |
| 25,0 | < 25,0 | < 5,00 | 0,085 - 0,200 | < 2,5 | < 2,50 | 0,110 - 0,200 |

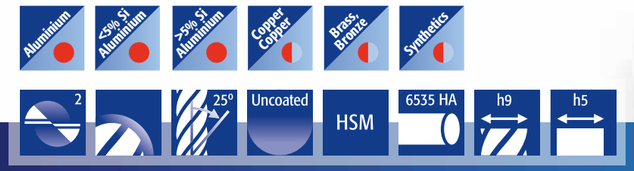
- **Conditions are based on pure aluminium for < 5% Si reduce feed per tooth $f_z$ up to 10% and for > 5% Si reduce $f_z$ up to 20%.**

  Schnittwerte sind auf die Bearbeitung von Rein-Aluminum ausgelegt. Für Aluminium < 5% Si den Zahnvorschub $f_z$ um 10%, für Aluminium > 5% Si um 20% reduzieren.

### Standard




* For endmills L < 100 mm.



**For Coolant we advise:**
**Empfohlene Kühlung:**

- Emulsion
  Emulsion
- Minimum lubrication
  Minimalmengenschmierung

| *Material group* | *TSR* (N/mm²) | *Hardness* HB | *Cutting speed* Vc m/min |
|---|---|---|---|
| Aluminium | < 350 | < 100 | **< 600** |
| Aluminium < 5% Si | < 500 | < 150 | **< 400** |
| Aluminium > 5% Si | < 400 | < 120 | **< 300** |
| Copper | < 350 | < 100 | **< 350** |
| Brass, bronze | < 700 | < 200 | **< 250** |
| Synthetics | | | **< 500** |

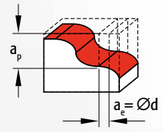
**VHKA21000781215**
**Material** Aluminium

| | |
|---|---|
| $v_c$ | 974 m/min |
| n | 31000 rpm |
| $f_z$ | 0,070 mm/t |
| $v_f$ | 4340 mm/min |
| $a_p$ | 0,5 mm |
| $a_e$ | 0,5 mm |
| **Coolant** | emulsion |
| **Q** | **1,09 cm³/min** |

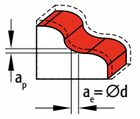
| Article Number<br>*Artikelnummer* | Ød (mm) | r (mm) | Ød1 (mm) | L (mm) | L1 (mm) | L2 (mm) | a (mm) | z | γ (°) | |
|---|---|---|---|---|---|---|---|---|---|---|
| VHKA 2 060 078 06 15 | 6,0 | 3,0 | 6 | 78 | 8 | 20 | 0,5 | 2 | - | new/neu |
| VHKA 2 080 078 08 15 | 8,0 | 4,0 | 8 | 78 | 10 | 20 | 0,5 | 2 | - | new/neu |
| VHKA 2 100 078 10 15 | 10,0 | 5,0 | 10 | 78 | 10 | 20 | 0,5 | 2 | - | new/neu |
| VHKA 2 120 078 12 15 | 12,0 | 6,0 | 12 | 78 | 12 | 35 | 0,5 | 2 | - | |
| VHKA 2 140 089 14 15 | 14,0 | 7,0 | 14 | 89 | 14 | 45 | 0,5 | 2 | - | |
| VHKA 2 160 089 16 15 | 16,0 | 8,0 | 16 | 89 | 16 | 45 | 0,5 | 2 | - | |
| VHKA 2 180 102 18 15 | 18,0 | 9,0 | 18 | 102 | 18 | 55 | 0,5 | 2 | - | |
| VHKA 2 200 102 20 15 | 20,0 | 10,0 | 20 | 102 | 20 | 55 | 0,5 | 2 | - | |
| VHKA 2 250 120 25 15 | 25,0 | 12,5 | 25 | 120 | 25 | 65 | 0,5 | 2 | - | |

The endmills can also be supplied with various coatings:
Die Schaftfräser sind auch mit folgenden Beschichtungen lieferbar:

| | |
|---|---|
| *** Pure Aluminium** | **DLC** |
| * Rein-aluminium | DLC |
| *** Aluminium Si ≤ 5%** | **DLC** |
| * Aluminium Si ≤ 5% | DLC |
| *** Aluminium Si > 5%** | **Diamond** |
| * Aluminium Si > 5% | Diamant |




$a_p$ up to 1,00 x d
$a_e$ up to 0,20 x d




$a_p$ up to 0,05 x d
$a_e$ up to 0,10 x d

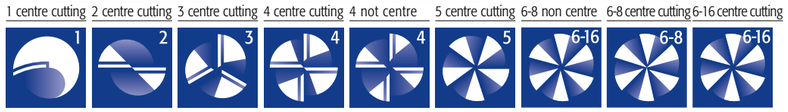
| | *Shoulder milling / Stirnfräsen* | | | *Profile milling / Profilfräsen* | | |
|---|---|---|---|---|---|---|
| Ød (mm) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) | $a_p$ max. (mm) | $a_e$ max. (mm) | $f_z$ (mm/tooth) |
| 6,0 | < 6,0 | < 0,75 | 0,025 - 0,050 | < 0,6 | < 0,50 | 0,035 - 0,050 |
| 8,0 | < 8,0 | < 1,00 | 0,035 - 0,070 | < 0,8 | < 0,70 | 0,050 - 0,070 |
| 10,0 | < 10,0 | < 1,25 | 0,045 - 0,090 | < 1,0 | < 0,90 | 0,055 - 0,090 |
| 12,0 | < 12,0 | < 2,40 | 0,055 - 0,100 | < 1,2 | < 1,20 | 0,065 - 0,100 |
| 14,0 | < 14,0 | < 2,80 | 0,065 - 0,120 | < 1,4 | < 1,40 | 0,075 - 0,120 |
| 16,0 | < 16,0 | < 3,20 | 0,070 - 0,140 | < 1,6 | < 1,60 | 0,085 - 0,140 |
| 18,0 | < 18,0 | < 3,60 | 0,070 - 0,145 | < 1,8 | < 1,80 | 0,100 - 0,145 |
| 20,0 | < 20,0 | < 4,00 | 0,075 - 0,150 | < 2,0 | < 2,00 | 0,105 - 0,150 |
| 25,0 | < 25,0 | < 5,00 | 0,085 - 0,200 | < 2,5 | < 2,50 | 0,110 - 0,200 |

- **Conditions are based on pure aluminium for < 5% Si reduce feed per tooth $f_z$ up to 10% and for > 5% Si reduce $f_z$ up to 20%.**

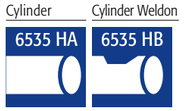
  Schnittwerte sind auf die Bearbeitung von Rein-Aluminum ausgelegt. Für Aluminium < 5% Si den Zahnvorschub $f_z$ um 10%, für Aluminium > 5% Si um 20% reduzieren.

# Symbols / Piktogramme

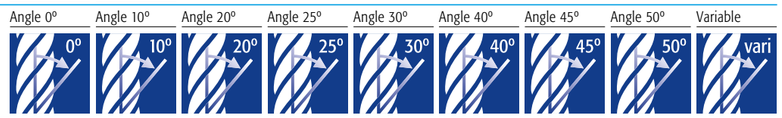
**Number of Flutes**
**Schneidenzahl**




**Shank**
**Schaftausführung**




**Helix angle**
**Spiralwinkel**

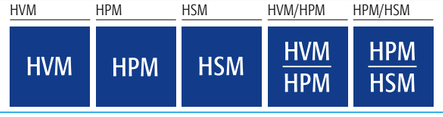



**Diameter Tolerance**
**Durchmessertoleranz**

**End face**
**Schneidengeometrie**

**Coating**
**Beschichtung**

**Strategy**
**Strategie**




***Tolerances / Toleranzen***

| Diameter range | Shank ∅d1-h5 | Cutting diameter ∅d-g7 | Cutting diameter ∅d-h9 | Cutting diameter ∅VHC |
|---|---|---|---|---|
| $d \leq 3$ | 0<br>-0,004 | -0,002<br>-0,012 | 0<br>-0,025 | 0<br>-0,015 |
| $3 < d \leq 6$ | 0<br>-0,005 | -0,004<br>-0,016 | 0<br>-0,030 | 0<br>-0,017 |
| $6 < d \leq 10$ | 0<br>-0,006 | -0,005<br>-0,020 | 0<br>-0,036 | 0<br>-0,020 |
| $10 < d \leq 18$ | 0<br>-0,008 | -0,006<br>-0,024 | 0<br>-0,043 | 0<br>-0,024 |
| $18 < d \leq 30$ | 0<br>-0,009 | -0,006<br>-0,024 | 0<br>-0,052 | 0<br>-0,028 |





# Test report

Application Details

VAN HOORN CARBIDE

| Machine Tool & Material | |
|---|---|
| Machine | |
| Spindle type | |
| Max RPM | |
| Power Kw | |
| Cutter holder | |
| Workpiece material | |
| Hardness | |

**Sketch**

| Application | | | |
|---|---|---|---|
| Side milling | | Up-milling | |
| Slotting | | Down-milling | |
| Profiling | | Ramping | |
| Plunging | | Circular | |

**Tests**

| Tool Details | | |
|---|---|---|
| Endmill supplier | | |
| Endmill description | | |
| Endmill diameter | Ød | mm |
| Number of teeth | z | |
| Carbide grade | | |

| Cutting Conditions & Parameters | | | | |
|---|---|---|---|---|
| Cutting speed | $V_c$ | m/min | | |
| Revolution | n | rpm | | |
| Feed per tooth | $f_z$ | mm | | |
| Table feed | $V_f$ | mm/min | | |
| Depth of cut | $a_p$ | mm | | |
| Width of cut | $a_e$ | mm | | |
| Length of cut | L | mm | | |
| Chip removal rate | Q | $cm^3$/min | | |
| Chip thickness | Hm | mm | | |
| Coolant type | | | dry / air / minimum lub / emulsion | dry / air / minimum lub / emulsion |
| Coolant pressure | | Bar | Internal: External: | Internal: External: |
| Cutting time / comp | $T_{comp.}$ min | | | |
| Toollife | $T_{total}$ min | min | | |
| Power consumption | P | Kw | | |
| Edge wear | $V_b$ | mm | | |

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