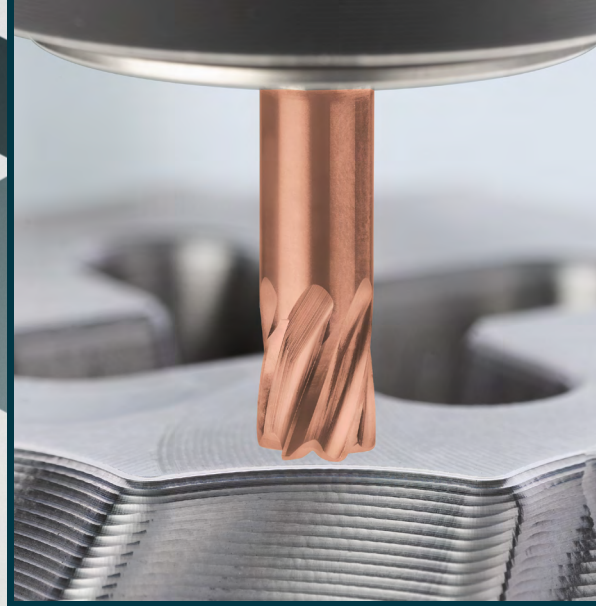




# End Mills Schaftfräser

[www.lmt-tools.com](http://www.lmt-tools.com)

**LMT•TOOLS**  
BELIN  
FETTE  
KIENINGER  
ONSRUD

## **Imprint**

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For readability reasons, the masculine form is used for personal designations and personal nouns for a general understanding. Corresponding terms apply to all genders for the purpose of equal treatment.

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|   |                                                                         |
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## EASYMill

**The universal end mill for all milling operations**

**Der Allrounder für alle Fräsoperationen**



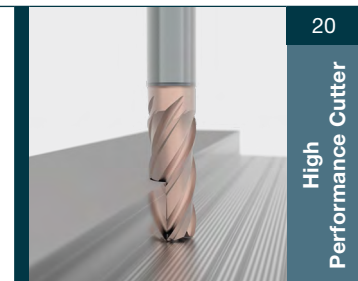
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EASYMill

## High Performance Cutter

**Our series for the highest productivity requirements**

**Unsere Serie für höchste Anforderungen an Produktivität**



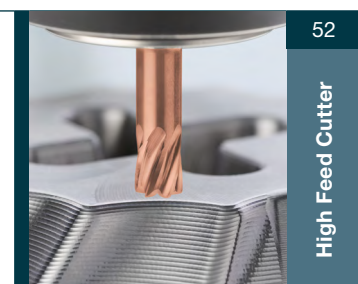
20

High Performance Cutter

## High Feed Cutter

**Our complete program for high feed milling**

**Unser Komplettdprogramm für das Hochvorschubfräsen**



52

High Feed Cutter

## High Speed Cutter

**A new benchmark for surface quality and reliability**

**Ein neuer Standard für Oberflächenqualität und Zuverlässigkeit**



70

High Speed Cutter

## Trochoidal Performance Cutter

**The perfect solution for trochoidal milling**

**Die perfekte Lösung für trochoidales Fräsen**



120

Trochoidal Performance Cutter

## Micro Milling Cutter

**Precision at its best**

**Präzision in Perfektion**



126

Micro Milling Cutter

LMT Tools is one of the leading experts in the development and production of precision tools.

With its passionate commitment to precision, the company ensures that its customers in industry apply superior quality at the crucial interface between machine and workpiece.

With more than 1,000 employees worldwide, LMT Tools bundles its expertise in the brands LMT Fette, LMT Kieninger, LMT Onsrud and LMT Belin. The company's main product areas are milling & threading, rolling systems, gear cutting and advanced tools.

LMT Tools ist einer der führenden Experten für die Entwicklung und Produktion von Präzisionswerkzeugen.

Das Unternehmen sorgt mit seinem leidenschaftlichen Einsatz für Präzision dafür, dass seine Kunden in der Industrie an der entscheidenden Schnittstelle zwischen Maschine und Werkstück überlegene Qualität zum Einsatz bringen.

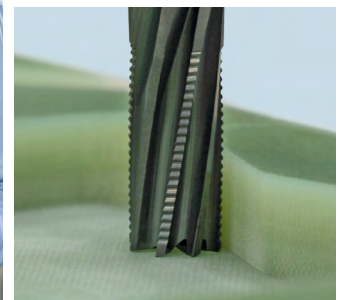
Mit weltweit mehr als 1.000 Mitarbeitenden bündelt LMT Tools die Kompetenzen in den Marken LMT Fette, LMT Kieninger, LMT Onsrud und LMT Belin. Dabei bedient das Unternehmen die Produktschwerpunkte Fräsen & Gewinden, Rollsysteme, Verzahnen und Advanced Tools.

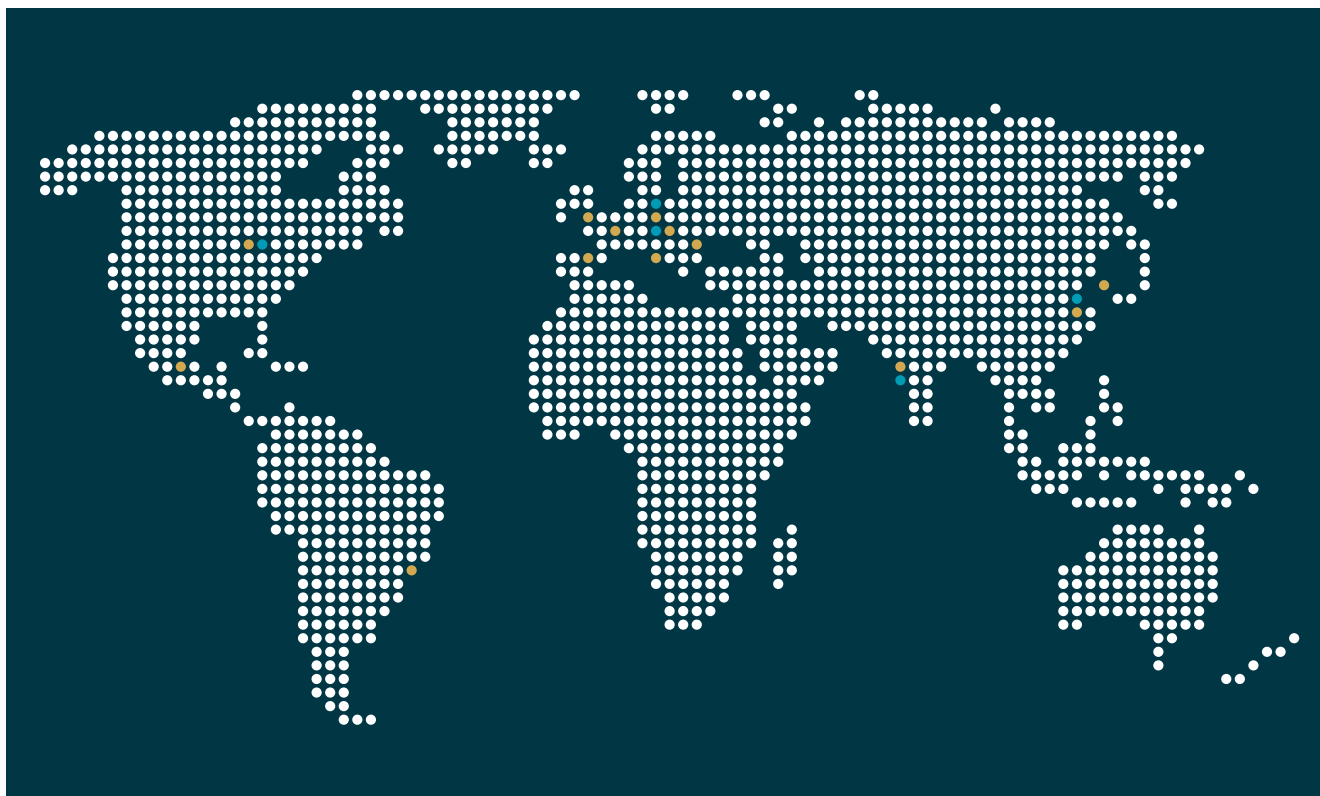
**Our core competences:**

- Milling and Tapping
- Rolling systems
- Gear cutting
- Advanced Tools

**Unsere Kernkompetenzen:**

- Fräsen und Gewinden
- Rollsysteme
- Verzahnen
- Advanced Tools





● **LMT Tools production sites:**

Germany: Lahr, Schwarzenbek  
USA: Waukegan  
India: Pune  
China: Nanjing

● **LMT Tools Produktionsstandorte:**

Deutschland: Lahr, Schwarzenbek  
USA: Waukegan  
Indien: Pune  
China: Nanjing

● **LMT Tools has its own sales representations in the following countries:**

**Europe:** Czech Republic, France, Germany, Italy, Romania, Spain, United Kingdom.

**Americas:** Brazil, Mexico, USA.

**Asia-Pacific:** China, India, Korea.

● **LMT Tools ist mit eigenen Vertriebsgesellschaften in folgenden Ländern vertreten:**

**Europa:** Deutschland, Frankreich, Italien, Rumänien, Spanien, Tschechische Republik, Vereinigtes Königreich.

**Amerika:** Brasilien, Mexiko, USA.

**Asien-Pazifik:** China, Indien, Korea.

**We are committed to you worldwide!**

Contact us and our experts: [www.lmt-tools.com](http://www.lmt-tools.com)

**Wir sind weltweit für Sie da!**

Nehmen Sie Kontakt zu uns und unseren Experten auf:  
[www.lmt-tools.com](http://www.lmt-tools.com)

The key element of the services at LMT Tools is our eye for detail and passion for precision to help our customers implement their visions, ideas and needs.

We see precision tools as the key to bringing ideas to life. These ideas then go on to become market successes, driven forward by efficiency and innovative power.

The extensive product range combines the competence of the LMT Belin, LMT Fette, LMT Kieninger and LMT Onsrud brands. It offers perfect solutions for various applications in different industries:

- Transportation & Transmission: automotive, trucks, ships, railway, aerospace industry
- Stationary: cranes, wind energy, gear boxes and drives
- Mould & Die
- Pump and Valve
- General machining

Kern der Leistung von LMT Tools ist es, die Visionen, Ideen und Anforderungen unserer Kunden mit dem Blick fürs Detail und der Leidenschaft für Präzision umsetzen zu helfen.

Wir sehen Präzisionswerkzeuge als Schlüssel dazu, Ideen zum Leben zu erwecken. Und aus diesen Ideen mit Innovationskraft und Effizienz Markterfolge zu machen.

Mit unseren umfangreichen Produktprogramm bündeln wir die Kompetenzen der Marken LMT Belin, LMT Fette, LMT Kieninger und LMT Onsrud. Es bietet perfekte Lösungen für eine Vielzahl an Anwendungen in unterschiedlichen Industrien:

- Transport und Antriebe: Automobil, LKW, Schiffe, Schienenfahrzeuge, Luft- und Raumfahrt
- Stationar: Kräne, Windenergie, Getriebe und Antriebe
- Werkzeug & Formenbau
- Pumpen und Ventile
- Allgemeiner Maschinenbau





Our Academy is the central training and further education unit of the corporate group. At the LMT Tools Training Center, holistic knowledge in theory and practice is passed on to our employees and customers worldwide in order to quickly provide knowledge in response to continuous global market changes in products and production processes.

The training courses take place in online webinars or live training sessions on site and are conducted by experienced and specialized employees or by experts from industry and academia.

The program offers expert knowledge for our employees for existing products and processes and new products. With the necessary application knowledge about our tools we can optimally support the machining requirements of our customers.

The training offer for our customers and business partners includes tool demonstrations or seminars, tailor-made specifically to meet their application demands.

Unsere Academy ist die zentrale Schulungs- und Weiterbildungseinheit der Unternehmensgruppe. Im LMT Tools Training Center wird ganzheitliches Wissen in der Theorie und Praxis weltweit an unsere Mitarbeiter und Kunden weitergegeben, um so schnell auf kontinuierliche globale Marktveränderungen bei Produkten und Produktionsprozessen Wissen zu vermitteln.

Die Schulungen finden in Webinaren online oder in Live-Trainings vor Ort statt und werden von erfahrenen und spezialisierten Mitarbeitern oder auch von Experten aus Industrie und Wissenschaft durchgeführt.

Das Angebot für unsere Mitarbeiter umfasst Expertenwissen für bestehende Produkte und Verfahren und Neuprodukte. Dank aktuellem Anwendungswissen über unsere Werkzeuge können wir optimal die Bearbeitungsanforderungen unserer Kunden unterstützen.

Das Schulungsangebot für unsere Kunden und Geschäftspartner umfasst Werkzeugvorführungen oder Seminare, um speziell und maßgeschneidert auf ihre Anwendungssituationen einzugehen.



|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |   |   |    |   |    |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|---|---|----|---|----|
| E | M | - | H | P | C | 0 | 1 | M | 4 | . | 0 | x | 3 | . | 5 | / | 3 | 2 | 4 | C | 0 | .  | 2 | H | A  | - | I  |
| 1 |   |   | 2 |   |   | 3 |   | 4 |   | 5 |   |   | 6 |   |   |   | 7 |   |   | 8 | 9 | 10 |   |   | 11 |   | 12 |

**1** **EM** = Schaftfräser End Mill

**2** **Typ Type**

|            |                                 |
|------------|---------------------------------|
| <b>HPC</b> | = High Performance Cutter       |
| <b>HFC</b> | = High Feed Cutter              |
| <b>HSC</b> | = High Speed Cutter             |
| <b>TPC</b> | = Trochoidal Performance Cutter |
| <b>UMC</b> | = Universal Milling Cutter      |
| <b>AMC</b> | = Aluminium Milling Cutter      |
| <b>RMC</b> | = Radial Milling Cutter         |
| <b>EMC</b> | = EASYMill                      |
| <b>CBC</b> | = Chip Breaker Cutter           |

**3** **01** = Generation Generation

**4** **Hauptanwendung Primary application**

|          |                                                     |
|----------|-----------------------------------------------------|
| <b>P</b> | = Stahl Steel                                       |
| <b>M</b> | = Rostfreier Stahl Stainless steel                  |
| <b>K</b> | = Gusseisen Cast iron                               |
| <b>N</b> | = Nichteisenmetalle Non-ferrous metals              |
| <b>S</b> | = Hitzebeständige Legierungen Heat-resistant alloys |
| <b>H</b> | = Gehärteter Stahl Hardened steel                   |
| <b>U</b> | = Universal Universal                               |

**5** Schneidendurchmesser in mm ( $d_1$ )  
Cutting diameter in mm ( $d_1$ )

**6** Schneidenlänge in mm ( $l_2$ ) Cutting length in mm ( $l_2$ )

**7** max. Nutzlänge in mm ( $l_3$ ) Effective length in mm ( $l_3$ )

**8** Zähnezahl (z) Number of teeth (z)

**9** **Stirngeometrie Front geometry**

|          |                                            |
|----------|--------------------------------------------|
| <b>C</b> | = Kantenschutzfase Edge protection chamfer |
| <b>R</b> | = Eckenradius Corner radius                |
| <b>B</b> | = Kugelstirn Ball nose                     |
| <b>S</b> | = Gerade Stirn Straight corner             |

**10** Eckenradius (r)/Kantenschutzfase (c) in mm  
Corner radius (r)/Edge protection chamfer (c) in mm

**11** **Schaftform Shank form**

|           |                                                         |
|-----------|---------------------------------------------------------|
| <b>HA</b> | = Zylindrischer Schaft Cylindrical shank<br>DIN 6535 HA |
| <b>HB</b> | = Gerader Schaft Straight shank DIN 6535 HB             |

**12** Innenkühlung Internal cooling

**Erklärung LMT-Code Micro HSline**  
**Explanation LMT-Code Micro HSline**

|   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|---|---|---|---|---|
| E | M | - | M | I | C | 0 | 1 | P | 0 | 0 | 5 | x | 0 | 1 | 5 | / | 0 | 2 | 2 | 0 | 2  | B | 0 | 0 | 2 | 5 |
| 1 |   |   | 2 |   |   | 3 |   | 4 |   | 5 |   | 6 |   |   |   | 7 |   |   | 8 | 9 | 10 |   |   |   |   |   |

**1** **EM** = Schaftfräser End Mill

**2** **Typ Type**

|            |                            |
|------------|----------------------------|
| <b>MIC</b> | = Mikrofräser Micro cutter |
|------------|----------------------------|

**3** **01** = Generation Generation

**4** **Hauptanwendung Primary application**

|          |                                                     |
|----------|-----------------------------------------------------|
| <b>P</b> | = Stahl Steel                                       |
| <b>M</b> | = Rostfreier Stahl Stainless steel                  |
| <b>K</b> | = Gusseisen Cast iron                               |
| <b>N</b> | = Nichteisenmetalle Non-ferrous metals              |
| <b>S</b> | = Hitzebeständige Legierungen Heat-resistant alloys |
| <b>H</b> | = Gehärteter Stahl Hardened steel                   |
| <b>U</b> | = Universal Universal                               |

**5** Schneidendurchmesser in mm ( $d_1 = 1/10$  mm)  
Cutting diameter in mm ( $d_1 = 1/10$  mm)

**6** Schneidenlänge in mm ( $l_2 = 1/10$  mm)  
Cutting length in mm ( $l_2 = 1/10$  mm)

**7** max. Nutzlänge in mm ( $l_3 = 1/10$  mm)  
Effective length in mm ( $l_3 = 1/10$  mm)

**8** Zähnezahl (z) Number of teeth (z)

**9** **Stirngeometrie Front geometry**

|          |                                            |
|----------|--------------------------------------------|
| <b>C</b> | = Kantenschutzfase Edge protection chamfer |
| <b>R</b> | = Eckenradius Corner radius                |
| <b>B</b> | = Kugelstirn Ball nose                     |
| <b>S</b> | = Gerade Stirn Straight corner             |

**10** Eckenradius/Kugelkopfradius (r) in 1/100 mm  
Corner radius/Ball nose radius (r) in 1/100 mm

Für Schneidstoff- und Beschichtungssorten hat die LMT einen anwenderbezogenen Sortenschlüssel entwickelt. Hiermit wird es dem Anwender ermöglicht, gemäß seiner spezifischen Applikation immer den richtigen LMT Schneidstoff auszuwählen.

Die Empfehlung basiert auf dem international verwendeten ISO Schlüssel der Werkstückstoffe.

LMT has developed a user-oriented grades index for the new LMT cutting material and coating grades to ensure that users always select the correct LMT cutting material for their applications.

This recommendation is based on the internationally used ISO key for workpiece materials.

| L C K P 3 0 M 1 |                                                                                                                                                                                                                                                                                                                                                                                                                    |   |   |   |   |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|
| 1               | 2                                                                                                                                                                                                                                                                                                                                                                                                                  | 3 | 4 | 5 | 6 |
| 1               | Marke LMT LMT brand                                                                                                                                                                                                                                                                                                                                                                                                |   |   |   |   |
| 2               | <b>Schneidstoff Cutting material</b><br><b>A</b> = HSS<br><b>B</b> = CBN<br><b>C</b> = Hartmetall, beschichtet Carbide, coated<br><b>D</b> = PKD PCD<br><b>E</b> = Monokristalliner Diamant Monocrystalline diamond<br><b>T</b> = Cermet<br><b>W</b> = Hartmetall, unbeschichtet Carbide, uncoated<br><b>X</b> = Keramik Ceramics                                                                                  |   |   |   |   |
| 3               | <b>Werkstückstoff (ISO 513 – Haupt- und Nebenanwendung)</b><br><b>Workpiece material (ISO 513 – Primary and auxiliary application)</b><br><b>P</b> = Stahl Steel<br><b>M</b> = Rostfreier Stahl Stainless steel<br><b>K</b> = Gusseisen Cast iron<br><b>N</b> = Nichteisenmetalle Non-ferrous metals<br><b>S</b> = Hitzebeständige Legierungen Heat-resistant alloys<br><b>H</b> = Gehärteter Stahl Hardened steel |   |   |   |   |
| 4               | <b>Zähigkeit (ISO 513)</b><br><b>Toughness (ISO 513)</b>                                                                                                                                                                                                                                                                                                                                                           |   |   |   |   |
| 5               | <b>Bearbeitung Machining</b><br><b>B</b> = Bohren Boring/Drilling<br><b>C</b> = Kurbelwellenfräsen Crankshaft<br><b>D</b> = Gewinden Tapping/Threading<br><b>F</b> = Reiben Reaming<br><b>G</b> = Einstechen Grooving<br><b>H</b> = Verzahnen High feed geometry<br><b>M</b> = Fräsen Milling<br><b>R</b> = Rollen Rolling<br><b>T</b> = Drehen Turning                                                            |   |   |   |   |
| 6               | <b>Versionsnummer (wahlweise möglich)</b><br><b>Version number (optional)</b>                                                                                                                                                                                                                                                                                                                                      |   |   |   |   |

Die bisherigen Sortenbezeichnungen behalten bis auf weiteres ihre Gültigkeit.

The previously used grade designations remain valid until further notice.

|                             |                     |
|-----------------------------|---------------------|
| <b>Beispiel:</b>            | <b>Example:</b>     |
| <b>LCK10M</b>               | <b>LCK10M</b>       |
| L – LMT                     | L – LMT             |
| C – Hartmetall, beschichtet | C – Carbide, coated |
| K – Gusseisen               | K – Cast iron       |
| 10 – Zähigkeit              | 10 – Toughness      |
| M – Fräsen                  | M – Milling         |



**HPC Fräser**  
High performance cutter

|          |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                             |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>P</b> | <b>EASYMill</b> 16<br><br>Schaftfräser<br>End mill<br><br>Ø 3–20 mm<br>z = 4<br>                | <b>HPC01 Rougher 35/38P</b> 24<br><br>für hochlegierte Stähle und Guss<br>for high carbon steel and cast iron<br><br>Ø 1–20 mm<br>z = 4<br>                                    | <b>HPC01 Rougher 35/38 H</b> 36<br><br>für gehärtete Stähle ≤ 55 HRC<br>for hard materials ≤ 55 HRC<br><br>Ø 6–20 mm<br>z = 4<br>     | <b>HPC01 Rougher 33/35/37 UNI</b> 32<br><br>Vollnutfräser mit großem Spanraum<br>für die universelle Anwendung<br>Slot mill with large room for chips<br>for universal applications<br><br>Ø 4–20 mm<br>z = 3<br>     |
|          | <b>EASYMill</b> 16<br><br>Schaftfräser<br>End mill<br><br>Ø 3–20 mm<br>z = 4<br>                | <b>HPC01 Rougher 41/44M</b> 28<br><br>für austenitische Stähle,<br>NE-Metalle und Titan<br>for stainless steels, non-ferrous<br>and titanium<br><br>Ø 4–20 mm<br>z = 4<br>     |                                                                                                                                                                                                                                                                                                          | <b>HPC01 Rougher 33/35/37 UNI</b> 32<br><br>Vollnutfräser mit großem Spanraum<br>für die universelle Anwendung<br>Slot mill with large room for chips<br>for universal applications<br><br>Ø 4–20 mm<br>z = 3<br>     |
|          |                                                                                                                                                                                                                                                                   | <b>HPC01 Rougher 35/38P</b> 24<br><br>für hochlegierte Stähle und Guss<br>for high carbon steel and cast iron<br><br>Ø 1–20 mm<br>z = 4<br>                                 | <b>HPC01 Rougher 35/38 H</b> 36<br><br>für gehärtete Stähle ≤ 55 HRC<br>for hard materials ≤ 55 HRC<br><br>Ø 6–20 mm<br>z = 4<br>  | <b>HPC01 Rougher 33/35/37 UNI</b> 32<br><br>Vollnutfräser mit großem Spanraum<br>für die universelle Anwendung<br>Slot mill with large room for chips<br>for universal applications<br><br>Ø 4–20 mm<br>z = 3<br>  |
|          | <b>AMC01 Finisher 37 N</b> 42<br><br>Schaftfräser<br>End mill<br><br>Ø 3–20 mm<br>z = 3<br> | <b>HPC01 Rougher 41/44M</b> 28<br><br>für austenitische Stähle,<br>NE-Metalle und Titan<br>for stainless steels, non-ferrous<br>and titanium<br><br>Ø 4–20 mm<br>z = 4<br> | <b>Airline</b> 49<br><br>Schaftfräser<br>End mill<br><br>Ø 4–25 mm<br>z = 3<br>                                                   | <b>HPC01 Rougher 33/35/37 UNI</b> 32<br><br>Vollnutfräser mit großem Spanraum<br>für die universelle Anwendung<br>Slot mill with large room for chips<br>for universal applications<br><br>Ø 4–20 mm<br>z = 3<br> |
| <b>S</b> |                                                                                                                                                                                                                                                                   | <b>HPC01 Rougher 41/44M</b> 28<br><br>für austenitische Stähle,<br>NE-Metalle und Titan<br>for stainless steels, non-ferrous<br>and titanium<br><br>Ø 4–20 mm<br>z = 4<br> |                                                                                                                                                                                                                                                                                                          | <b>HPC01 Rougher 33/35/37 UNI</b> 32<br><br>Vollnutfräser mit großem Spanraum<br>für die universelle Anwendung<br>Slot mill with large room for chips<br>for universal applications<br><br>Ø 4–20 mm<br>z = 3<br> |
|          |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                  | <b>HPC01 Rougher 35/38 H</b> 36<br><br>für gehärtete Stähle ≤ 55 HRC<br>for hard materials ≤ 55 HRC<br><br>Ø 6–20 mm<br>z = 4<br> |                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>H</b> |                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                             |



|  <b>Hochvorschubfräsen</b><br>High feed milling                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                         |  <b>Trochoidales Fräsen</b><br>Trochoidal milling                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>HFC01 Rougher P</b> <span>55</span><br><br>für hochlegierte Stähle<br>for high alloy steels<br><br>Ø 2–16 mm<br>z = 2–4<br>    | <b>HFC01 Rougher H</b> <span>63</span><br><br>für gehärtete Stähle bis 65 HRC<br>for hardened steels up to 65 HRC<br><br>Ø 4–20 mm<br>z = 6–8<br>     | <b>HFC01 Rougher UNI</b> <span>66</span><br><br>Universeller Hochvorschubfräser<br>Universal high feed end mills<br><br>Ø 1–20 mm<br>z = 2<br>     | <b>TPC 01 Rougher 45 P</b> <span>122</span><br><br>Schafffräser<br>End mill<br><br>Ø 6–20 mm<br>z = 5<br>     |
| <b>HFC01 Rougher M</b> <span>59</span><br><br>für austenitische Stähle<br>for austenitic steels<br><br>Ø 4–16 mm<br>z = 4<br>     |                                                                                                                                                                                                                                                                                                                         | <b>HFC01 Rougher UNI</b> <span>66</span><br><br>Universeller Hochvorschubfräser<br>Universal high feed end mills<br><br>Ø 1–20 mm<br>z = 2<br>     | <b>TPC 01 Rougher 35 M</b> <span>123</span><br><br>Schafffräser<br>End mill<br><br>Ø 6–20 mm<br>z = 5<br>     |
| <b>HFC01 Rougher P</b> <span>55</span><br><br>für hochlegierte Stähle<br>for high alloy steels<br><br>Ø 2–16 mm<br>z = 2–4<br> | <b>HFC01 Rougher H</b> <span>63</span><br><br>für gehärtete Stähle bis 65 HRC<br>for hardened steels up to 65 HRC<br><br>Ø 4–20 mm<br>z = 6–8<br>  | <b>HFC01 Rougher UNI</b> <span>66</span><br><br>Universeller Hochvorschubfräser<br>Universal high feed end mills<br><br>Ø 1–20 mm<br>z = 2<br>  | <b>TPC 01 Rougher 45 P</b> <span>122</span><br><br>Schafffräser<br>End mill<br><br>Ø 6–20 mm<br>z = 5<br>  |
| <b>HFC01 Rougher M</b> <span>59</span><br><br>für austenitische Stähle<br>for austenitic steels<br><br>Ø 4–16 mm<br>z = 4<br> |                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                      | <b>TPC 01 Rougher 35 M</b> <span>123</span><br><br>Schafffräser<br>End mill<br><br>Ø 6–20 mm<br>z = 5<br> |
|                                                                                                                                                                                                                                                                                                  | <b>HFC01 Rougher H</b> <span>63</span><br><br>für gehärtete Stähle bis 65 HRC<br>for hardened steels up to 65 HRC<br><br>Ø 4–20 mm<br>z = 6–8<br> | <b>HFC01 Rougher UNI</b> <span>66</span><br><br>Universeller Hochvorschubfräser<br>Universal high feed end mills<br><br>Ø 1–20 mm<br>z = 2<br> |                                                                                                                                                                                                                                                                                     |



**Mikrofräsen**  
Mikro milling

|                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <div>MIC 01 Finisher 30 U128</div> <div></div> <div>3-schneidig, kurz<br/>3 flute, short</div> <div>Ø 0,5–3 mm<br/>z = 2</div> <div></div> <div></div>     | <div>MIC 01 Finisher 30 PH132</div> <div></div> <div>2-schneidig, kurz/lang<br/>2 flute, short/long</div> <div>Ø 0,3–2,5 mm<br/>z = 3</div> <div></div> <div></div>     | <div>MIC 01 Ball-Nose-Finisher 30 PH136</div> <div></div> <div>Kugelpopf, kurz<br/>Ball nose, short</div> <div>Ø 0,5–3 mm<br/>z = 2</div> <div></div> <div></div>     | <div>MIC 01 Ball-Nose-Finisher 30 PH137</div> <div></div> <div>mit Halsfreistellung<br/>with neck relief</div> <div>Ø 0,3–3 mm<br/>z = 2</div> <div></div> <div></div>   | <div>MIC 01 Ball-Nose-Finisher 30 PH138</div> <div></div> <div>mit Halsfreistellung<br/>with neck relief</div> <div>Ø 1–4 mm<br/>z = 2</div> <div></div> <div></div>       |
| <div>MIC 01 Finisher 30 U128</div> <div></div> <div>3-schneidig, kurz<br/>3 flute, short</div> <div>Ø 0,5–3 mm<br/>z = 2</div> <div></div> <div></div>     |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                  |
| <div>MIC 01 Finisher 30 U128</div> <div></div> <div>3-schneidig, kurz<br/>3 flute, short</div> <div>Ø 0,5–3 mm<br/>z = 2</div> <div></div> <div></div>  |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                         | <div>MIC 01 Ball-Nose-Finisher 30 PH136</div> <div></div> <div>Kugelpopf, kurz<br/>Ball nose, short</div> <div>Ø 0,5–3 mm<br/>z = 2</div> <div></div> <div></div>      |                                                                                                                                                                                                                                                                                                                                                  |
| <div>MIC 01 Finisher 30 U128</div> <div></div> <div>3-schneidig, kurz<br/>3 flute, short</div> <div>Ø 0,5–3 mm<br/>z = 2</div> <div></div> <div></div> |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                                                                                                                                                                                                                                                           | <div>MIC 01 Finisher 30 PH132</div> <div></div> <div>2-schneidig, kurz/lang<br/>2 flute, short/long</div> <div>Ø 0,3–2,5 mm<br/>z = 2</div> <div></div> <div></div> | <div>MIC 01 Ball-Nose-Finisher 30 PH136</div> <div></div> <div>Kugelpopf, kurz<br/>Ball nose, short</div> <div>Ø 0,5–3 mm<br/>z = 2</div> <div></div> <div></div> | <div>MIC 01 Ball-Nose-Finisher 30 PH137</div> <div></div> <div>mit Halsfreistellung<br/>with neck relief</div> <div>Ø 1–4 mm<br/>z = 2</div> <div></div> <div></div> | <div>MIC 01 Ball-Nose-Finisher 30 PH138</div> <div></div> <div>mit Halsfreistellung<br/>with neck relief</div> <div>Ø 0,3–3 mm<br/>z = 2</div> <div></div> <div></div> |

1. Wählen Sie Ihre Anwendung  
Choose your application

|                                                                                  |                                       |                                                                                   |                                         |
|----------------------------------------------------------------------------------|---------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------|
|  | Eckfräsen<br>Corner milling           |  | Trochoidalfräsen<br>Trochoidal milling  |
|  | Eck-/Nutfräsen<br>Corner/Slot milling |  | HSC Mikrofräser<br>HSC Micro cutters    |
|  | Kopierfräsen<br>Copying               |  | Hochvorschubfräsen<br>High feed milling |

2. Wählen Sie das Anwendungsfeld/Materialfeld  
für Ihre Anwendung aus  
Choose your application area/material for your application

|          |                                                                                                                                                      |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>P</b> | Stahl, Stahlguss, rostfreier Stahl,<br>ferritisch und martensitisch<br>Steel, cast steel, stainless steel,<br>ferritic and martensitic               |
| <b>M</b> | Rostfreier Stahl und Stahlguss,<br>austenitisch und austenitisch/ferritisch<br>Stainless steel and cast steel,<br>austenitic and austenitic/ferritic |
| <b>K</b> | Grauguss, Sphäroguss, Temperguss<br>Grey cast iron, cast iron with spheroidal graphite,<br>malleable cast iron                                       |
| <b>N</b> | Aluminium und andere Nichteisenmetalle,<br>Kunststoffe, Graphit<br>Aluminium and other non ferrous metals,<br>plastic, graphite                      |
| <b>S</b> | Hochwarmfeste Stähle, Super- und Titanlegierungen<br>High temperature alloys, super and titanium alloys                                              |
| <b>H</b> | Gehärteter Stahl und Stahlguss<br>Hardened steel and cast steel                                                                                      |

3. Wählen Sie die von Ihnen benötigte Stirngeometrie,  
Spiralwinkel, Länge sowie Zähnezahl  
Choose your front geometry, helix angle and number  
of teeth

|                                                                                    |                                  |                                                                                     |                                         |
|------------------------------------------------------------------------------------|----------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------|
|  | Eckenradius (R)<br>Corner radius |  | Hochvorschub (F)<br>High feed           |
|  | Kugelstirn (B)<br>Ball nose      |  | Kantenschutzfase (E)<br>Edge protection |
|  | Gerade (S)<br>Straight corner    |                                                                                     |                                         |

4. Für mehr Details gelangen Sie mit dem Seitenverweis  
auf die entsprechende Katalogseite  
For further details see the page reference for the  
corresponding catalog page

|          |                                   |                                                                                                                                                                                                                                                                                                                |                                                                                     |
|----------|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| <b>1</b> | Eckenausführung<br>Corner version | <b>HPC01 Rougher 41/44M</b>                                                                                                                                                                                                                                                                                    | <b>28</b>                                                                           |
| <b>2</b> | Hauptanwendung<br>First choice    | <br>für austenitische Stähle,<br>NE-Metalle und Titan<br>for stainless steels, non-ferrous<br>and titanium<br><br>Ø 4–20 mm<br>z = 4<br> |  |
|          |                                   | <b>1</b>                                                                                                                                                                                                                                                                                                       | <b>2</b>                                                                            |

# Tool Guide

## Tool guide

### 1. Wählen Sie Ihre Anwendung

Choose your application

|                                                                                   |                                       |                                                                                   |                                         |
|-----------------------------------------------------------------------------------|---------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------|
|  | Eckfräsen<br>Corner milling           |  | Trochoidalfräsen<br>Trochoidal milling  |
|  | Eck-/Nutfräsen<br>Corner/Slot milling |  | HSC Mikrofräser<br>HSC Micro cutters    |
|  | Kopierfräsen<br>Copying               |  | Hochvorschubfräsen<br>High feed milling |

### 2. Wählen Sie das Anwendungsfeld/Materialfeld für Ihre Anwendung aus

Choose your application area/material for your application

|          |                                                                                                                                                |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>P</b> | Stahl, Stahlguss, rostfreier Stahl, ferritisch und martensitisch<br>Steel, cast steel, stainless steel, ferritic and martensitic               |
| <b>M</b> | Rostfreier Stahl und Stahlguss, austenitisch und austenitisch/ferritisch<br>Stainless steel and cast steel, austenitic and austenitic/ferritic |
| <b>K</b> | Grauguss, Sphäroguss, Temperguss<br>Grey cast iron, cast iron with spheroidal graphite, malleable cast iron                                    |
| <b>N</b> | Aluminium und andere Nichteisenmetalle, Kunststoffe, Graphit<br>Aluminium and other non ferrous metals, plastic, graphite                      |
| <b>S</b> | Hochwarmfeste Stähle, Super- und Titanlegierungen<br>High temperature alloys, super and titanium alloys                                        |
| <b>H</b> | Gehärteter Stahl und Stahlguss<br>Hardened steel and cast steel                                                                                |

### 3. Wählen Sie die von Ihnen benötigte Stirngeometrie, Spiralwinkel, Länge sowie Zähnezahl

Choose your front geometry, helix angle and number of teeth

|                                                                                     |                                  |                                                                                     |                                         |
|-------------------------------------------------------------------------------------|----------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------|
|  | Eckenradius (R)<br>Corner radius |  | Hochvorschub (F)<br>High feed           |
|  | Kugelstirn (B)<br>Ball nose      |  | Kantenschutzfase (E)<br>Edge protection |
|  | Gerade (S)<br>Straight corner    |                                                                                     |                                         |

### 4. Für mehr Details gelangen Sie mit dem Seitenverweis auf die entsprechende Katalogseite

For further details see the page reference for the corresponding catalog page

|          |                                   |                                                                                                                                                                                                                                                                                              |           |
|----------|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>1</b> | Eckenausführung<br>Corner version | <b>HSC01<br/>Finisher 50 H</b>                                                                                                                                                                                                                                                               | <b>73</b> |
| <b>2</b> | Hauptanwendung<br>First choice    |  <p>hochgedrallt mit Kantenschutzfase<br/>high helix angle with edge protection chamfer<br/>Ø 4–20 mm<br/>z = 4–8</p>  |           |
|          |                                   | <b>1</b>                                                                                                                                                                                                                                                                                     | <b>2</b>  |





## Kopierfräsen Copying

|   |                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                             |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| P | <b>HSC01 Finisher 50 H</b> 73<br><br>hochgedrallt mit Kantenschutzfase<br>high helix angle with edge protection chamfer<br>Ø 4–20 mm<br>z = 4–8<br>     | <b>HSC01 Finisher 50 H</b> 74<br><br>hochgedrallt mit Eckenradius<br>high helix angle with corner radius<br>Ø 4–20 mm<br>z = 4–8<br>     | <b>HSC Toric-Finisher 30 H</b> 78<br><br>Schaftfräser, torisch<br>End mills, toric<br>Ø 1–10 mm<br>z = 2<br>     | <b>HSC Toric-Finisher 30 H</b> 79<br><br>Schaftfräser, torisch<br>End mills, toric<br>Ø 6–10 mm<br>z = 4<br>     | <b>HSC01 Finisher 30 H</b> 82<br><br>mit Kantenschutz-fase<br>with edge protection chamfer<br>Ø 3–20 mm<br>z = 4<br>     | <b>HSC01 Ball-Nose-Finisher 30 H</b> 87<br><br>Kugel-Kopierfräser<br>Ball nose end mill<br>Ø 1–12 mm<br>z = 2<br>     | <b>HSC01 Ball-Nose-Finisher 30 H</b> 89<br><br>Kugel-Kopierfräser<br>Ball nose end mill<br>Ø 4–12 mm<br>z = 4<br>     |
|   |                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                             |
| M |                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                             |
| K | <b>HSC01 Finisher 50 H</b> 73<br><br>hochgedrallt mit Kantenschutzfase<br>high helix angle with edge protection chamfer<br>Ø 4–20 mm<br>z = 4–8<br>  | <b>HSC01 Finisher 50 H</b> 74<br><br>hochgedrallt mit Eckenradius<br>high helix angle with corner radius<br>Ø 4–20 mm<br>z = 4–8<br>  | <b>HSC Toric-Finisher 30 H</b> 78<br><br>Schaftfräser, torisch<br>End mills, toric<br>Ø 1–10 mm<br>z = 2<br> | <b>HSC Toric-Finisher 30 H</b> 79<br><br>Schaftfräser, torisch<br>End mills, toric<br>Ø 6–10 mm<br>z = 4<br> | <b>HSC01 Finisher 30 H</b> 82<br><br>mit Kantenschutz-fase<br>with edge protection chamfer<br>Ø 3–20 mm<br>z = 4<br>  | <b>HSC01 Ball-Nose-Finisher 30 H</b> 87<br><br>Kugel-Kopierfräser<br>Ball nose end mill<br>Ø 1–12 mm<br>z = 2<br> | <b>HSC01 Ball-Nose-Finisher 30 H</b> 89<br><br>Kugel-Kopierfräser<br>Ball nose end mill<br>Ø 4–12 mm<br>z = 4<br> |
|   |                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                             |
| N |                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                             |
| S |                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                             |
| H | <b>HSC01 Finisher 50 H</b> 73<br><br>hochgedrallt mit Kantenschutzfase<br>high helix angle with edge protection chamfer<br>Ø 4–20 mm<br>z = 4–8<br> | <b>HSC01 Finisher 50 H</b> 74<br><br>hochgedrallt mit Eckenradius<br>high helix angle with corner radius<br>Ø 4–20 mm<br>z = 4–8<br> | <b>HSC Toric-Finisher 30 H</b> 78<br><br>Schaftfräser, torisch<br>End mills, toric<br>Ø 1–10 mm<br>z = 2<br> | <b>HSC Toric-Finisher 30 H</b> 79<br><br>Schaftfräser, torisch<br>End mills, toric<br>Ø 6–10 mm<br>z = 4<br> | <b>HSC01 Finisher 30 H</b> 82<br><br>mit Kantenschutz-fase<br>with edge protection chamfer<br>Ø 3–20 mm<br>z = 4<br> | <b>HSC01 Ball-Nose-Finisher 30 H</b> 87<br><br>Kugel-Kopierfräser<br>Ball nose end mill<br>Ø 1–12 mm<br>z = 2<br> | <b>HSC01 Ball-Nose-Finisher 30 H</b> 89<br><br>Kugel-Kopierfräser<br>Ball nose end mill<br>Ø 4–12 mm<br>z = 4<br> |
|   |                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                             |

|                                                                                                                                                                                                                                                                                                                                      |    |                                                                                                                                                                                                                                                                                                                            |    |                                                                                                                                                                                                                                                                                                                                         |    |                                                                                                                                                                                                                                                                                                                                      |     |                                                                                                                                                                                                                                                                                                                                     |     |                                                                                                                                                                                                                                                                                                                                               |     |                                                                                                                                                                                                                                                                                                                                            |     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <div>HSC01</div> <div>Ball-Nose-Finisher 30 H</div> <div></div> <div>Kugel-Kopierfräser<br/>Ball nose end mill</div> <div>Ø 1–12 mm<br/>z = 2–4</div> <div></div>     | 92 | <div>HSC01</div> <div>Finisher 20 P</div> <div></div> <div>mit Eckenradius<br/>with corner radius</div> <div>Ø 1–16 mm<br/>z = 2–4</div> <div></div>     | 96 | <div>HSC01</div> <div>Ball-Nose-Finisher 20 P</div> <div></div> <div>Kugel-Kopierfräser<br/>Ball nose end mill</div> <div>Ø 1–16 mm<br/>z = 2–4</div> <div></div>     | 98 | <div>HSC 01</div> <div>Ball-Nose-Finisher 15 H</div> <div></div> <div>mit konischem Hals<br/>with conical head</div> <div>Ø 1–4 mm<br/>z = 2</div> <div></div>     | 104 | <div>HSC 01</div> <div>Toric-Finisher 20 H</div> <div></div> <div>mit Halsfreistellung<br/>with neck relief</div> <div>Ø 4–12 mm<br/>z = 4</div> <div></div>     | 102 | <div>HSC 01</div> <div>Ball-Nose-Finisher 30 H</div> <div></div> <div>mit 240° Schneide<br/>with 240° cutting edge</div> <div>Ø 2–12 mm<br/>z = 2</div> <div></div>     | 108 | <div>HSC 01</div> <div>Ball-Nose-Finisher 20 H</div> <div></div> <div>mit Halsfreistellung<br/>with neck relief</div> <div>Ø 2–12 mm<br/>z = 2</div> <div></div>     | 105 |
|                                                                                                                                                                                                                                                                                                                                      |    | <div>HSC01</div> <div>Finisher 20 P</div> <div></div> <div>mit Eckenradius<br/>with corner radius</div> <div>Ø 1–16 mm<br/>z = 2–4</div> <div></div>     | 96 | <div>HSC01</div> <div>Ball-Nose-Finisher 20 P</div> <div></div> <div>Kugel-Kopierfräser<br/>Ball nose end mill</div> <div>Ø 1–16 mm<br/>z = 2–4</div> <div></div>     | 98 |                                                                                                                                                                                                                                                                                                                                      |     |                                                                                                                                                                                                                                                                                                                                     |     |                                                                                                                                                                                                                                                                                                                                               |     |                                                                                                                                                                                                                                                                                                                                            |     |
| <div>HSC01</div> <div>Ball-Nose-Finisher 30 H</div> <div></div> <div>Kugel-Kopierfräser<br/>Ball nose end mill</div> <div>Ø 1–12 mm<br/>z = 2–4</div> <div></div> | 92 | <div>HSC01</div> <div>Finisher 20 P</div> <div></div> <div>mit Eckenradius<br/>with corner radius</div> <div>Ø 1–16 mm<br/>z = 2–4</div> <div></div> | 96 | <div>HSC01</div> <div>Ball-Nose-Finisher 20 P</div> <div></div> <div>Kugel-Kopierfräser<br/>Ball nose end mill</div> <div>Ø 1–16 mm<br/>z = 2–4</div> <div></div> | 98 |                                                                                                                                                                                                                                                                                                                                      |     |                                                                                                                                                                                                                                                                                                                                     |     |                                                                                                                                                                                                                                                                                                                                               |     |                                                                                                                                                                                                                                                                                                                                            |     |
|                                                                                                                                                                                                                                                                                                                                      |    | <div>HSC01</div> <div>Finisher 20 P</div> <div></div> <div>mit Eckenradius<br/>with corner radius</div> <div>Ø 1–16 mm<br/>z = 2–4</div> <div></div> | 96 | <div>HSC01</div> <div>Ball-Nose-Finisher 20 P</div> <div></div> <div>Kugel-Kopierfräser<br/>Ball nose end mill</div> <div>Ø 1–16 mm<br/>z = 2–4</div> <div></div> | 98 |                                                                                                                                                                                                                                                                                                                                      |     |                                                                                                                                                                                                                                                                                                                                     |     |                                                                                                                                                                                                                                                                                                                                               |     |                                                                                                                                                                                                                                                                                                                                            |     |
|                                                                                                                                                                                                                                                                                                                                      |    | <div>HSC01</div> <div>Finisher 20 P</div> <div></div> <div>mit Eckenradius<br/>with corner radius</div> <div>Ø 1–16 mm<br/>z = 2–4</div> <div></div> | 96 | <div>HSC01</div> <div>Ball-Nose-Finisher 20 P</div> <div></div> <div>Kugel-Kopierfräser<br/>Ball nose end mill</div> <div>Ø 1–16 mm<br/>z = 2–4</div> <div></div> | 98 |                                                                                                                                                                                                                                                                                                                                      |     |                                                                                                                                                                                                                                                                                                                                     |     |                                                                                                                                                                                                                                                                                                                                               |     |                                                                                                                                                                                                                                                                                                                                            |     |
| <div>HSC01</div> <div>Ball-Nose-Finisher 30 H</div> <div></div> <div>Kugel-Kopierfräser<br/>Ball nose end mill</div> <div>Ø 1–12 mm<br/>z = 2–4</div> <div></div> | 92 | <div>HSC01</div> <div>Finisher 20 P</div> <div></div> <div>mit Eckenradius<br/>with corner radius</div> <div>Ø 1–16 mm<br/>z = 2–4</div> <div></div> | 96 | <div>HSC01</div> <div>Ball-Nose-Finisher 20 P</div> <div></div> <div>Kugel-Kopierfräser<br/>Ball nose end mill</div> <div>Ø 1–16 mm<br/>z = 2–4</div> <div></div> | 98 | <div>HSC 01</div> <div>Ball-Nose-Finisher 15 H</div> <div></div> <div>mit konischem Hals<br/>with conical head</div> <div>Ø 1–4 mm<br/>z = 2</div> <div></div> | 104 | <div>HSC 01</div> <div>Toric-Finisher 20 H</div> <div></div> <div>mit Halsfreistellung<br/>with neck relief</div> <div>Ø 4–12 mm<br/>z = 4</div> <div></div> | 102 | <div>HSC 01</div> <div>Ball-Nose-Finisher 30 H</div> <div></div> <div>mit 240° Schneide<br/>with 240° cutting edge</div> <div>Ø 2–12 mm<br/>z = 2</div> <div></div> | 108 | <div>HSC 01</div> <div>Ball-Nose-Finisher 20 H</div> <div></div> <div>mit Halsfreistellung<br/>with neck relief</div> <div>Ø 2–12 mm<br/>z = 2</div> <div></div> | 105 |

|                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>HSC 01</b><br><b>Ball-Nose-</b><br><b>Finisher 30 H</b><br><br>Kugel-Kopierfräser<br>Ball nose end mill<br><br>Ø 3–12 mm<br>z = 2<br>     | <b>HSC 01</b><br><b>Ball-Nose-</b><br><b>Finisher 30 H</b><br><br>mit konischem Hals<br>with conical neck<br><br>Ø 3–10 mm<br>z = 4<br>     | <b>RMC-B01</b><br><b>Finisher 30 UNI</b><br><br>mit Tonnenprofil<br>with barrel shape<br><br>Ø 10 mm<br>z = 4<br>     | <b>RMC-L01</b><br><b>Finisher 35/36</b><br><b>UNI</b><br><br>mit Linsenprofil<br>with lens shape<br><br>Ø 16 mm<br>z = 4<br>     | <b>RMC-CTA01</b><br><b>Finisher 30 UNI</b><br><br>mit konischem Profil<br>Form A<br>with conical taper<br>shape A<br>Ø 6–16 mm<br>z = 4<br>     | <b>RMC-CTB01</b><br><b>Finisher 40 UNI</b><br><br>mit konischem Profil<br>Form B<br>with conical taper<br>shape B<br>Ø 10 mm<br>z = 2<br>     | <b>RMC-O01</b><br><b>Finisher 30 UNI</b><br><br>mit Tropfenprofil<br>with oval shape<br><br>Ø 6–12 mm<br>z = 4<br>     |
|                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                               | <b>RMC-B01</b><br><b>Finisher 30 UNI</b><br><br>mit Tonnenprofil<br>with barrel shape<br><br>Ø 10 mm<br>z = 4<br>     | <b>RMC-L01</b><br><b>Finisher 35/36</b><br><b>UNI</b><br><br>mit Linsenprofil<br>with lens shape<br><br>Ø 16 mm<br>z = 4<br>     | <b>RMC-CTA01</b><br><b>Finisher 30 UNI</b><br><br>mit konischem Profil<br>Form A<br>with conical taper<br>shape A<br>Ø 6–16 mm<br>z = 4<br>     | <b>RMC-CTB01</b><br><b>Finisher 40 UNI</b><br><br>mit konischem Profil<br>Form B<br>with conical taper<br>shape B<br>Ø 10 mm<br>z = 2<br>     | <b>RMC-O01</b><br><b>Finisher 30 UNI</b><br><br>mit Tropfenprofil<br>with oval shape<br><br>Ø 6–12 mm<br>z = 4<br>     |
|                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                               | <b>RMC-B01</b><br><b>Finisher 30 UNI</b><br><br>mit Tonnenprofil<br>with barrel shape<br><br>Ø 10 mm<br>z = 4<br>  | <b>RMC-L01</b><br><b>Finisher 35/36</b><br><b>UNI</b><br><br>mit Linsenprofil<br>with lens shape<br><br>Ø 16 mm<br>z = 4<br>  | <b>RMC-CTA01</b><br><b>Finisher 30 UNI</b><br><br>mit konischem Profil<br>Form A<br>with conical taper<br>shape A<br>Ø 6–16 mm<br>z = 4<br>  | <b>RMC-CTB01</b><br><b>Finisher 40 UNI</b><br><br>mit konischem Profil<br>Form B<br>with conical taper<br>shape B<br>Ø 10 mm<br>z = 2<br>  | <b>RMC-O01</b><br><b>Finisher 30 UNI</b><br><br>mit Tropfenprofil<br>with oval shape<br><br>Ø 6–12 mm<br>z = 4<br>  |
|                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                               | <b>RMC-B01</b><br><b>Finisher 30 UNI</b><br><br>mit Tonnenprofil<br>with barrel shape<br><br>Ø 10 mm<br>z = 4<br> | <b>RMC-L01</b><br><b>Finisher 35/36</b><br><b>UNI</b><br><br>mit Linsenprofil<br>with lens shape<br><br>Ø 16 mm<br>z = 4<br> | <b>RMC-CTA01</b><br><b>Finisher 30 UNI</b><br><br>mit konischem Profil<br>Form A<br>with conical taper<br>shape A<br>Ø 6–16 mm<br>z = 4<br> | <b>RMC-CTB01</b><br><b>Finisher 40 UNI</b><br><br>mit konischem Profil<br>Form B<br>with conical taper<br>shape B<br>Ø 10 mm<br>z = 2<br> | <b>RMC-O01</b><br><b>Finisher 30 UNI</b><br><br>mit Tropfenprofil<br>with oval shape<br><br>Ø 6–12 mm<br>z = 4<br> |
|                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                               | <b>RMC-B01</b><br><b>Finisher 30 UNI</b><br><br>mit Tonnenprofil<br>with barrel shape<br><br>Ø 10 mm<br>z = 4<br> | <b>RMC-L01</b><br><b>Finisher 35/36</b><br><b>UNI</b><br><br>mit Linsenprofil<br>with lens shape<br><br>Ø 16 mm<br>z = 4<br> | <b>RMC-CTA01</b><br><b>Finisher 30 UNI</b><br><br>mit konischem Profil<br>Form A<br>with conical taper<br>shape A<br>Ø 6–16 mm<br>z = 4<br> | <b>RMC-CTB01</b><br><b>Finisher 40 UNI</b><br><br>mit konischem Profil<br>Form B<br>with conical taper<br>shape B<br>Ø 10 mm<br>z = 2<br> | <b>RMC-O01</b><br><b>Finisher 30 UNI</b><br><br>mit Tropfenprofil<br>with oval shape<br><br>Ø 6–12 mm<br>z = 4<br> |
| <b>HSC 01</b><br><b>Ball-Nose-</b><br><b>Finisher 30 H</b><br><br>Kugel-Kopierfräser<br>Ball nose end mill<br><br>Ø 3–12 mm<br>z = 2<br> | <b>HSC 01</b><br><b>Ball-Nose-</b><br><b>Finisher 30 H</b><br><br>mit konischem Hals<br>with conical neck<br><br>Ø 3–10 mm<br>z = 4<br> | <b>RMC-B01</b><br><b>Finisher 30 UNI</b><br><br>mit Tonnenprofil<br>with barrel shape<br><br>Ø 10 mm<br>z = 4<br> | <b>RMC-L01</b><br><b>Finisher 35/36</b><br><b>UNI</b><br><br>mit Linsenprofil<br>with lens shape<br><br>Ø 16 mm<br>z = 4<br> | <b>RMC-CTA01</b><br><b>Finisher 30 UNI</b><br><br>mit konischem Profil<br>Form A<br>with conical taper<br>shape A<br>Ø 6–16 mm<br>z = 4<br> | <b>RMC-CTB01</b><br><b>Finisher 40 UNI</b><br><br>mit konischem Profil<br>Form B<br>with conical taper<br>shape B<br>Ø 10 mm<br>z = 2<br> | <b>RMC-O01</b><br><b>Finisher 30 UNI</b><br><br>mit Tropfenprofil<br>with oval shape<br><br>Ø 6–12 mm<br>z = 4<br> |



**EASY.**

# EASYMill

Der neue Allrounder

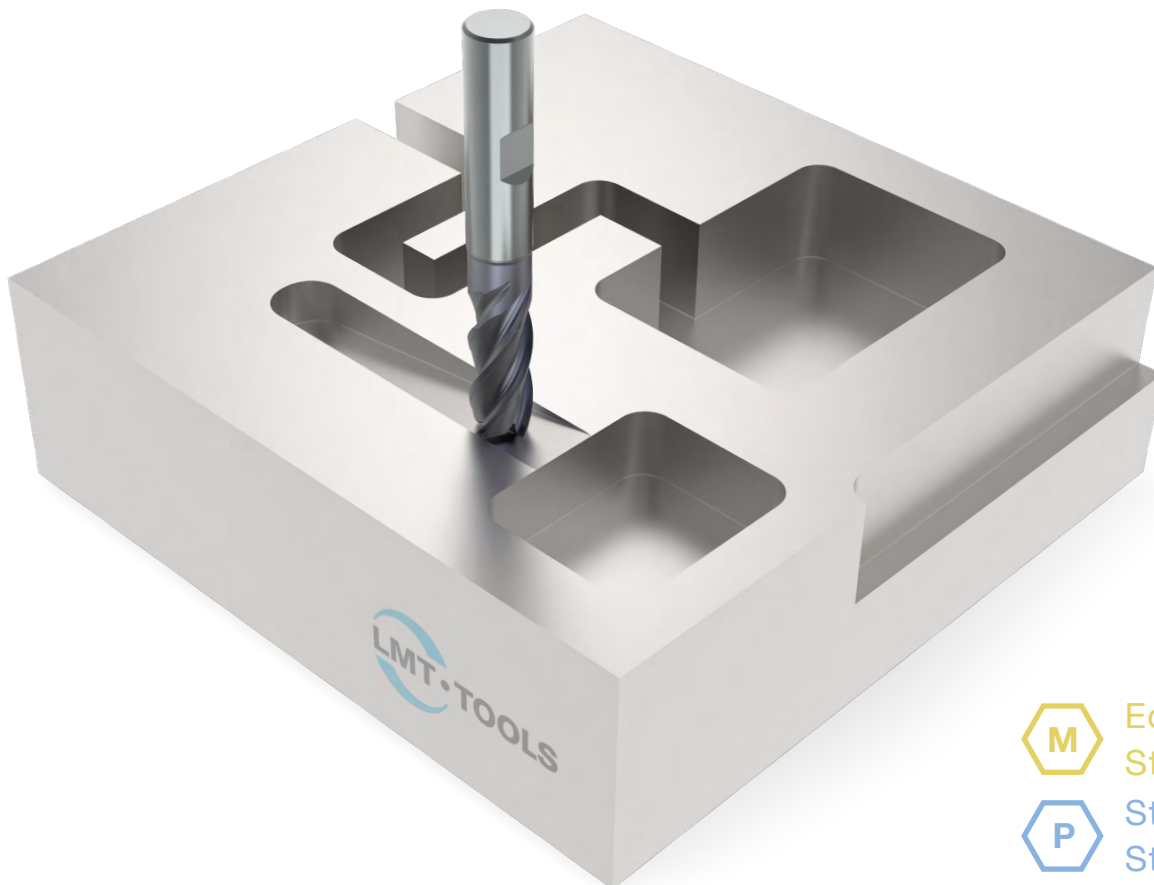
The New Universal Endmill

# **EASY.**

Die Produktreihe für  
höchste Effizienz und  
universelle Anwendung.  
Einfach in der Hand-  
habung.

The product range for  
highest efficiency and  
universal application.  
Easy to handle.





## Ein Fräser, volle Flexibilität für alle Fräsoperationen One Milling Cutter, Full Flexibility For All Milling Operations

Beim Fräsen von kleinen und mittleren Serien ist große Flexibilität der Werkzeuge gefragt. Ob Schrupp- oder Schlichtbearbeitung, Nuten ins Volle, Rampen oder helikales Eintauchen. Mit dem EASYMill lassen sich alle gängigen Fräsoperationen perfekt abdecken. Mit einem Werkzeug in allen weich-zähen Stahl- und Edelstahl Werkstoffen prozesssicher und effizient fräsen.

With the EASYMill, all common milling operations can be perfectly covered, such as roughing, finishing, slotting, ramping or helical plunging. The EASYMill can efficiently be used in steel and stainless steel materials.



Eckfräsen  
Corner milling



Nutenfräsen  
Slot milling



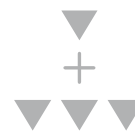
Außenkonturfräsen  
Contour milling



Taschenfräsen  
Pocket milling



Zirkularfräsen  
Circular milling



Schruppen und Schlichten  
Roughing and finishing

Mit seiner für Stahl und Edelstahl perfekt optimierten Geometrie fräst sich der EASYMill problemlos durch alle weich-zähen Werkstoffe. Schnittdruck und Zerspankräfte werden durch die ungleiche Drallsteigung effektiv reduziert. Dadurch ist der EASYMill auch bestens für den Einsatz an angetriebenen Werkzeugen auf Dreh-Fräsmaschinen qualifiziert.

Durch die angepasste, scharfe Schneidkante wird ein Aufkleben der Späne und dadurch ein Spänestau und Werkzeugbruch effektiv vermieden. So gelingt die prozesssichere Bearbeitung von weich-zähen Werkstoffen wie z. B. Bau- und Einsatzstählen und austenitischen Edelstählen (CrNi-Stähle). Dabei ist eine Zugfestigkeit von 300–900 N/mm<sup>2</sup> besonders geeignet.

With its geometry perfectly optimized for steel and stainless steel, the EASYMill cuts through all materials without any problems. Cutting pressure and cutting forces are effectively reduced by the unequal helix pitch. This makes the EASYMill ideally suited for use on turning-milling machines.

The adapted sharp cutting edge effectively prevents chip build up and tool breakage. This enables reliable machining of materials such as construction steels, case-hardened steels and austenitic stainless steels (CrNi steels). A malleable strength of 300–900 N/mm<sup>2</sup> is particularly suitable.

#### **Merkmale:**

##### **Features:**

Zylinderschaft – mit und ohne Spannfläche  
Cylindrical shank – with and without clamping surface

Halsfreischliff  
Neck relief

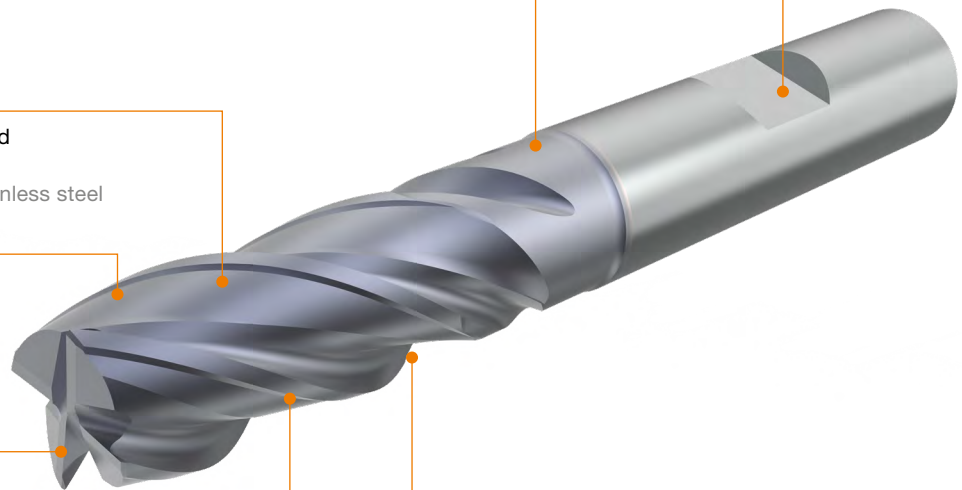
Beschichtung optimiert für Stahl und  
nichtrostenden Stahl  
Coating optimised for steel and stainless steel

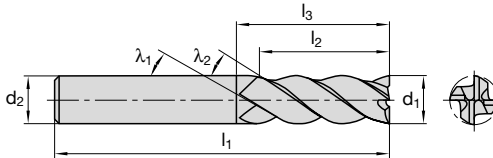
Ungleiche Drallsteigung  
Different helix angles

Bis Mitte schneidend  
Cutting to the centre

Erhöhte Stabilität durch Verstärkung des „Rücken“  
Increased stability through reinforcement of the „back“

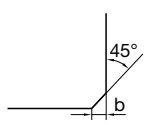
Positive Schneidenausführung, für weiche und zähe Stähle der Klasse  
ISO P, ISO M  
Positive cutting edge geometry, for soft and tough steels of class  
ISO P, ISO M



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                      |                      |                      |                      |          |                                                                                     |                               |                         |                               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|----------------------|----------------------|----------------------|----------|-------------------------------------------------------------------------------------|-------------------------------|-------------------------|-------------------------------|
|       |                      |                      |                      |                      |          |                                                                                     |                               |                         |                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                            |                      |                      |                      |                      |          |    |                               |                         |                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                      |                      |                      |                      |          |  |                               |                         |                               |
| <b>Katalog-Nr. Cat.-No.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |                      |                      |                      |          | <b>EMC01-PM A</b>                                                                   |                               |                         |                               |
| <b>P</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                      |                      |                      |                      |          | ■                                                                                   |                               |                         |                               |
| <b>M</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                      |                      |                      |                      |          | ■                                                                                   |                               |                         |                               |
| <b>K</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                      |                      |                      |                      |          |                                                                                     |                               |                         |                               |
| <b>N</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                      |                      |                      |                      |          |                                                                                     |                               |                         |                               |
| <b>S</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                      |                      |                      |                      |          |                                                                                     |                               |                         |                               |
| <b>H</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                      |                      |                      |                      |          |                                                                                     |                               |                         |                               |
| <b>d<sub>1</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>l<sub>2</sub></b> | <b>l<sub>1</sub></b> | <b>l<sub>3</sub></b> | <b>d<sub>2</sub></b> | <b>z</b> | <b>Ident No.</b>                                                                    | <b>LMT-Code</b>               | <b>Ident No.</b>        | <b>LMT-Code</b>               |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 6                    | 54                   | 9                    | 6                    | 4        | <a href="#">7429329</a>                                                             | EM-EMC01 PM3.0x6/9 4C0.075HA  | <a href="#">7429338</a> | EM-EMC01 PM3.0x6/9 4C0.075HB  |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 8                    | 54                   | 12                   | 6                    | 4        | <a href="#">7429330</a>                                                             | EM-EMC01 PM4.0x8/12 4C0.1HA   | <a href="#">7429339</a> | EM-EMC01 PM4.0x8/12 4C0.1HB   |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 10                   | 54                   | 15                   | 6                    | 4        | <a href="#">7429331</a>                                                             | EM-EMC01 PM5.0x10/15 4C0.15HA | <a href="#">7429340</a> | EM-EMC01 PM5.0x10/15 4C0.15HB |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 13                   | 57                   | 21                   | 6                    | 4        | <a href="#">7429332</a>                                                             | EM-EMC01 PM6.0x13/21 4C0.2HA  | <a href="#">7429341</a> | EM-EMC01 PM6.0x13/21 4C0.2HB  |
| 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 19                   | 63                   | 27                   | 8                    | 4        | <a href="#">7429333</a>                                                             | EM-EMC01 PM8.0x19/27 4C0.2HA  | <a href="#">7429342</a> | EM-EMC01 PM8.0x19/27 4C0.2HB  |
| 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 22                   | 72                   | 32                   | 10                   | 4        | <a href="#">7429334</a>                                                             | EM-EMC01 PM10.0x22/32 4C0.2HA | <a href="#">7429343</a> | EM-EMC01 PM10.0x22/32 4C0.2HB |
| 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 26                   | 83                   | 38                   | 12                   | 4        | <a href="#">7429335</a>                                                             | EM-EMC01 PM12.0x26/38 4C0.2HA | <a href="#">7429344</a> | EM-EMC01 PM12.0x26/38 4C0.2HB |
| 16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 32                   | 92                   | 44                   | 16                   | 4        | <a href="#">7429336</a>                                                             | EM-EMC01 PM16.0x32/44 4C0.3HA | <a href="#">7429345</a> | EM-EMC01 PM16.0x32/44 4C0.3HB |
| 20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 38                   | 104                  | 54                   | 20                   | 4        | <a href="#">7429337</a>                                                             | EM-EMC01 PM20.0x38/54 4C0.3HA | <a href="#">7429346</a> | EM-EMC01 PM20.0x38/54 4C0.3HB |

■ = Hauptanwendung First choice  
□ = Nebenanwendung Second choice

Schnittwertempfehlungen ab Seite 18  
Cutting data recommendations starting page 18

| <b>Kantenschutzfase</b><br>Edge protection chamfer                                  | <b>d<sub>1</sub></b> | <b>b</b> |
|-------------------------------------------------------------------------------------|----------------------|----------|
|  | 3                    | 0,075    |
|                                                                                     | 4                    | 0,1      |
|                                                                                     | 5                    | 0,15     |
|                                                                                     | 6                    | 0,2      |
|                                                                                     | 8                    | 0,2      |
|                                                                                     | 10                   | 0,2      |
|                                                                                     | 12                   | 0,2      |
|                                                                                     | 16                   | 0,3      |
|                                                                                     | 20                   | 0,3      |



| Werkstoff | Material                                                       | Werkstoff-Nr.<br>Material No.             | R <sub>m</sub> /UTS<br>(N/mm <sup>2</sup> ) | DIN Bezeichnung<br>DIN Description | Kühlung<br>Coolant                                                                  |
|-----------|----------------------------------------------------------------|-------------------------------------------|---------------------------------------------|------------------------------------|-------------------------------------------------------------------------------------|
| <b>P</b>  | Unlegierter Stahl                                              | Plain carbon steel                        | -700                                        | 11SMn30                            |  |
|           | Automatenstahl                                                 | Free cutting steel                        |                                             | S355J2+N                           |                                                                                     |
|           | Niedrig legierter Stahl                                        | Low alloy steel                           |                                             | C50E                               |                                                                                     |
|           | Einsatzstähle                                                  | Case hardening steel                      |                                             | 16MnCr5                            |                                                                                     |
|           |                                                                |                                           |                                             | 20MnCr5                            |                                                                                     |
|           | Vergütungsstahl,<br>mittelfest                                 | Heat-treatment steel,<br>medium strength  | -900                                        | C45E                               |                                                                                     |
|           |                                                                |                                           |                                             | 26CrMo4                            |                                                                                     |
|           |                                                                |                                           |                                             | 15NiCr13                           |                                                                                     |
|           |                                                                |                                           |                                             | 42CrMo4                            |                                                                                     |
|           |                                                                |                                           |                                             | 100Cr6                             |                                                                                     |
| <b>M</b>  | Rost- und säurebeständiger<br>Stahl, austenitisch              | Stainless steel, austenitic               | -700                                        | X5CrNi18-10                        |  |
|           |                                                                |                                           |                                             | X6CrNiMoTi17-12-2                  |                                                                                     |
|           |                                                                |                                           |                                             | X2CrNiMo17-12-2                    |                                                                                     |
|           | Rost- und säurebeständiger<br>Stahl, ferritisch, martensitisch | Stainless steel, ferritic,<br>martensitic | -900                                        | X39CrMo17-1                        |                                                                                     |
|           |                                                                |                                           |                                             | X15Cr13                            |                                                                                     |
|           |                                                                |                                           |                                             | X17CrNi16-2                        |                                                                                     |
|           |                                                                |                                           |                                             | X2CrTi12                           |                                                                                     |
|           |                                                                |                                           |                                             |                                    |                                                                                     |



Trockenbearbeitung, Pressluftkühlung ist vorteilhaft  
 Dry machining, air-blast cooling is advantageous



Nassbearbeitung, auf ausreichende Emulsionszuführung achten  
 Wet machining, sufficient emulsion volume required

## Berechnungsformeln und Vorschubkorrekturfaktoren

### Calculation formulas and feed correction factors

#### Drehzahl

Speed  $n$  (min<sup>-1</sup>):

$$n = \frac{v_c \cdot 1000}{\pi \cdot d_1}$$

#### Vorschubgeschwindigkeit

Feed rate  $v_f$  (mm/min):

$$v_f = f_z \cdot z \cdot n \cdot f_1$$

$a_e$  = Schnittbreite Width of cut in mm

$a_p$  = Schnitttiefe Depth of cut in mm

$d_1$  = Durchmesser Cutter diameter in mm

$f_1$  = Korrekturfaktor für Correction factor  $v_f$

$f_z$  = Vorschub pro Zahn Feed per tooth in mm

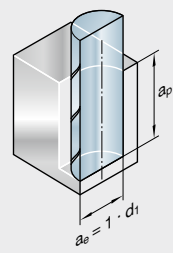
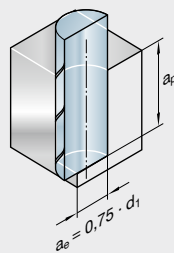
$n$  = Drehzahl Speed in min<sup>-1</sup>

$v_f$  = Vorschubgeschwindigkeit Feed rate in mm/min

$z$  = Anzahl der Schneiden No. of teeth

#### Vorschubkorrektur Feed correction $f_1$

| $a_e$            | $a_p$               | $f_1$ | $a_e$         | $a_p$               | $f_1$ |
|------------------|---------------------|-------|---------------|---------------------|-------|
| $0,75 \cdot d_1$ | $1 \times d_1$      | 0,8   | $1 \cdot d_1$ | $0,5 \times d_1$    | 0,6   |
|                  | $1,5 \times d_1$    | 0,7   |               | $1 \times d_1$      | 0,5   |
|                  | $2 \times d_1^{1)}$ | 0,6   |               | $2 \times d_1^{1)}$ | 0,4   |



<sup>1)</sup>  $1,8 \times d_1$  für Durchmesser for diameter 20



|  | Schnittgeschwindigkeit<br>Cutting speed<br>$v_c$ (m/min) | Fräserdurchmesser Cutting diameter (mm)                      |       |       |       |       |       |       |      |      |
|--|----------------------------------------------------------|--------------------------------------------------------------|-------|-------|-------|-------|-------|-------|------|------|
|  |                                                          | Vorschub pro Zahn Feed per tooth $f_z$ (mm/z.) <sup>1)</sup> |       |       |       |       |       |       |      |      |
|  |                                                          | Ø 3                                                          | Ø 4   | Ø 5   | Ø 6   | Ø 8   | Ø 10  | Ø 12  | Ø 16 | Ø 20 |
|  | 200                                                      | 0,03                                                         | 0,04  | 0,05  | 0,06  | 0,09  | 0,1   | 0,12  | 0,16 | 0,2  |
|  | 160                                                      | 0,025                                                        | 0,03  | 0,035 | 0,045 | 0,065 | 0,075 | 0,09  | 0,12 | 0,15 |
|  | 90                                                       | 0,02                                                         | 0,02  | 0,02  | 0,025 | 0,04  | 0,045 | 0,05  | 0,07 | 0,08 |
|  | 80                                                       | 0,015                                                        | 0,015 | 0,015 | 0,02  | 0,03  | 0,04  | 0,045 | 0,06 | 0,07 |

Die angegebenen Schnittwerte sind Startwerte und müssen auf die vorhandenen Bedingungen abgestimmt werden.  
The cutting data above are starting values and must be adjusted to the existing conditions.

| Tauchwinkel $\alpha$ für Rampen- und Helixfräsen<br>Plunge angle $\alpha$ for ramping and helix milling |                          |
|---------------------------------------------------------------------------------------------------------|--------------------------|
| Fräserdurchmesser<br>Cutting diameter (mm)                                                              | Winkel<br>Angle $\alpha$ |
| 3–10                                                                                                    | 3°                       |
| 12–20                                                                                                   | 5°                       |

## Anwendungsbeispiel Application example



### Kantenfräsen, schrappen Sidemilling, roughing

#### Werkzeug Tool:

EASYMill

$d_1 = 12$  mm,  $z = 4$

#### Werkstoff Material:

Vergütungsstahl Ck45 1.1191,  $R_m = 700$  N/mm<sup>2</sup>

Heat-treatable steel 1.1191/1045,  $R_m = 700$  N/mm<sup>2</sup>

#### Schnittwerte Cutting data:

$v_c = 180$  m/min

$n = 4800$  min<sup>-1</sup>

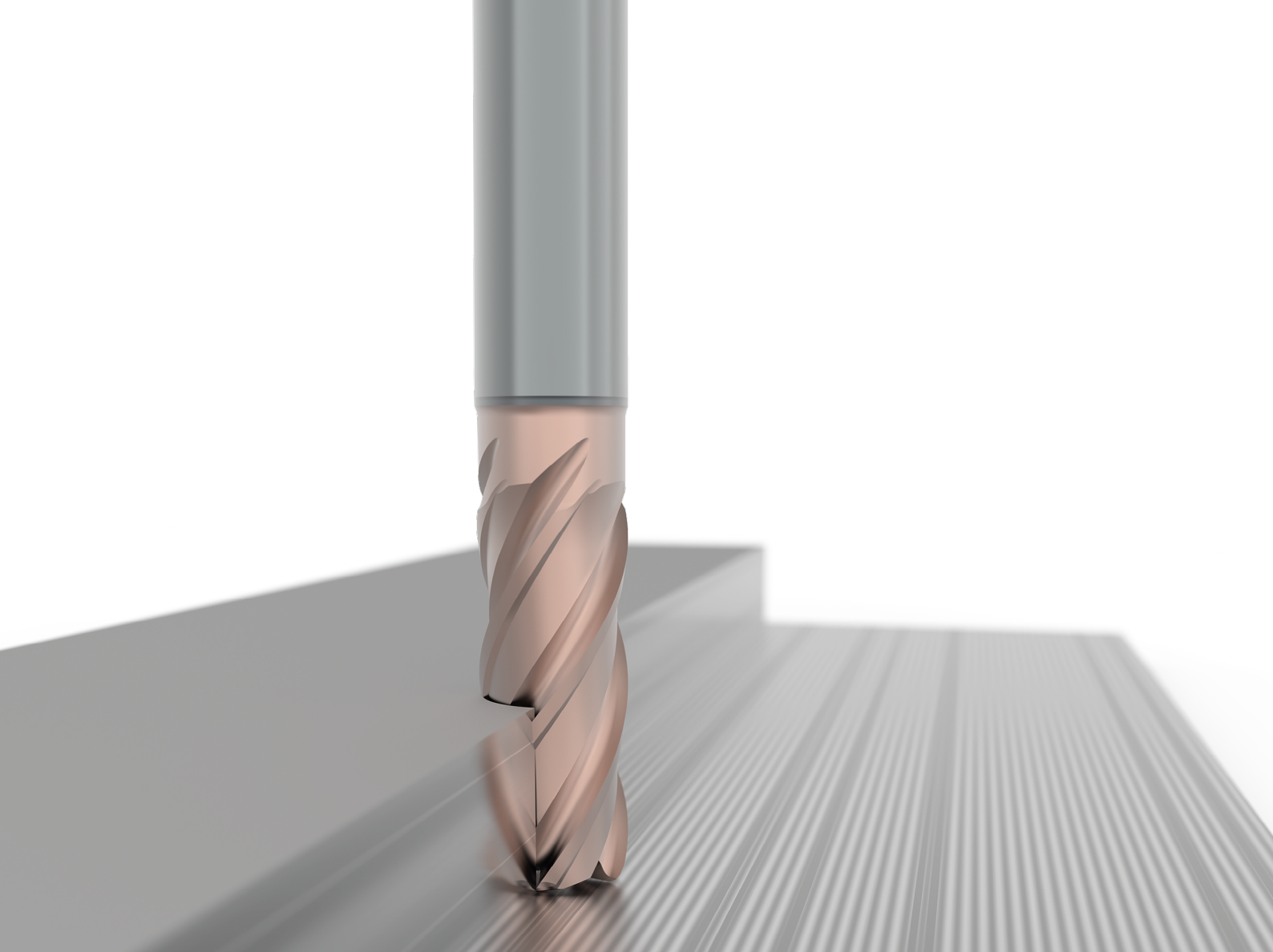
$f_z = 0,12$  mm

$h_m = 0,08$  mm

$v_f = 2300$  mm/min

$a_e = 6$  mm

$a_p = 18$  mm



# HPC – High Performance Cutter

Unsere Serie für höchste  
Anforderungen an Produktivität  
Our Series for the Highest  
Productivity Requirements

Die neue HPC-Familie vereint die bewährten Werkzeugserien DHC Premium, DHC INOX Premium, DHC Slot und DHC Hardline unter einem Dach. Als Hochleistungsprogramm bietet sie dabei zahlreiche Vorteile für ein breites Anwendungsspektrum. Die verbesserte Technologie und erhöhte Produktivität liefern Anwender:innen einen deutlichen Performance-Vorteil. Die Bearbeitung mit HPC eignet sich ideal für das Trochoidal-, Kanten-, Eck- und Nutenfräsen sowie Rampen bis 0,5 x Durchmesser.

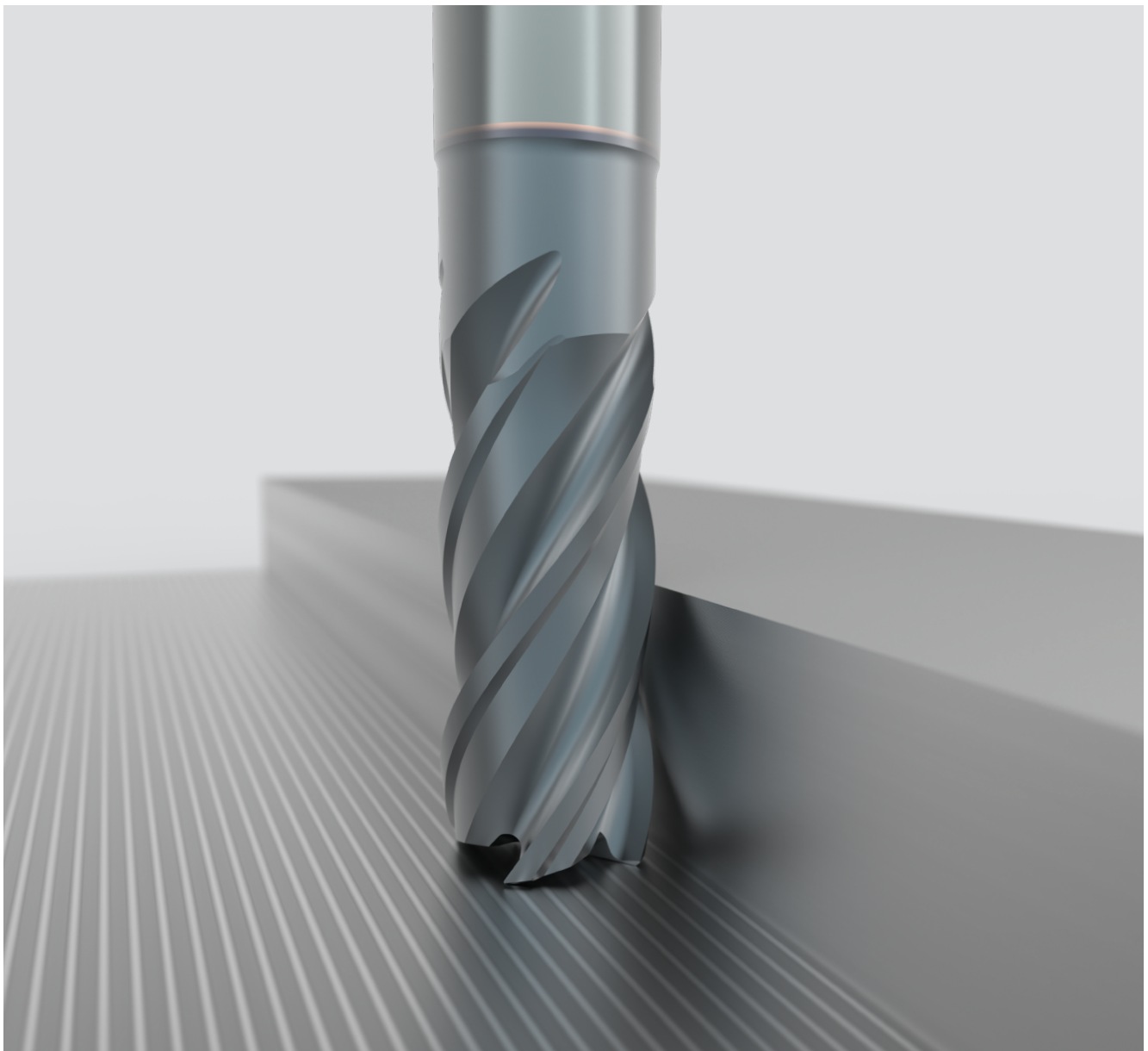
Durch die Optimierung der Produktionsprozesse und Verwendung modernster Beschichtungstechnologien konnten sowohl die Standzeiten als auch die Produktivität deutlich gesteigert werden. Mit ihren verschiedenen Schneidenlängen und Durchmessern kann die HPC-Familie unterschiedlichsten Anforderungen entgegenreten.

Entdecken Sie die Vorteile der HPC-Familie und erleben Sie die volle Leistungsstärke von LMT Tools!

The new HPC family combines the proven tool series DHC Premium, DHC INOX Premium, DHC Slot and DHC Hardline under one roof. As a high-performance program, it offers numerous advantages for a wide range of applications. The improved technology and increased productivity provide users with a clear performance advantage. Machining with HPC is ideal for trochoidal, edge, corner and slot milling as well as ramping up to 0.5 x diameter.

By optimizing the production processes and using the latest coating technologies, both tool life and productivity have been significantly increased. With its various cutting edge lengths and diameters, the HPC family can meet a wide range of requirements.

Discover the advantages of the HPC family and experience the full performance of LMT Tools.



Die HPC-Familie ist für eine breite Anwendungspalette konzipiert: Von der Bearbeitung höher legierter Stähle, Guss- und austenitischer Werkstoffe bis hin zur Bearbeitung hochfester Werkstoffe bis 1600 N/mm<sup>2</sup> und gehärteter Stähle bis 55 HRC. Die ungleiche Teilung sorgt für höchste Laufruhe und Prozesssicherheit, während die sehr gute Oberflächenqualität der bearbeiteten Werkstücke einen weiteren Vorteil darstellt.

**Ihre Vorteile:**

- Sehr gute Oberflächenqualität der bearbeiteten Werkstücke
- Standzeiterhöhung von bis zu 70 % im Vergleich zu bewährten Produkten der Vorgängerfamilien

The HPC family is designed for a wide range of applications: From machining higher alloy steels, cast and austenitic materials to machining high-strength materials up to 1600 N/mm<sup>2</sup> and hardened steel up to 55 HRC. The uneven pitch ensures maximum smoothness and process reliability, while obtaining great surface quality of the machined workpieces.

**Your advantages:**

- Great surface quality of the machined workpieces
- Tool life increase of up to 70% compared to proven products of previous families

**Merkmale:**

**Features:**

Zylinderschaft: Mit und ohne Spannfläche,  
sichere Drehmomentübertragung bzw. hohe Wuchtgüte  
Cylindrical shank: With and without clamping surface,  
Safe torque transmission and high balancing quality

Halsfreischliff  
Neck relief

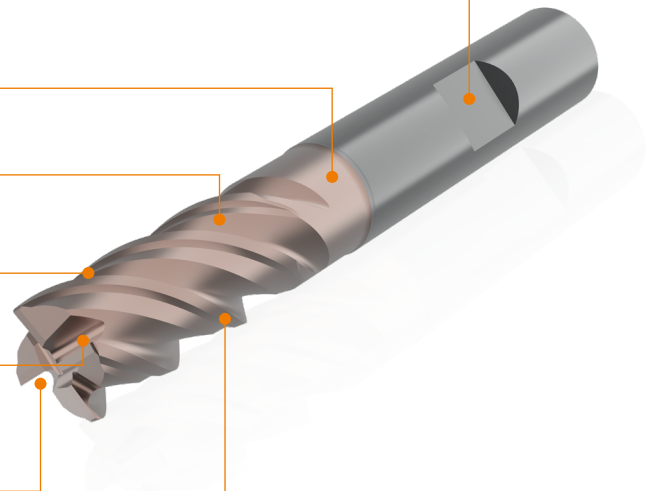
Mikroschneidkantenpräparation  
Micro edge preparation

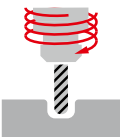
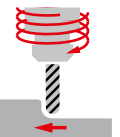
Besondere Laufruhe durch ungleiche Drallsteigung  
Smooth running due to different helix angles

Über Mitte schneidend, auch zum Schräg-Eintauchen geeignet  
Cross center cutting, also suitable for diagonal plunging

Optimierte Stirnauslückung für besseren Späneabtransport  
Optimized flute clearance for better chip removal

Modernste Beschichtung  
State-of-the-art coating



| HPC P                                                                             | HPC M                                                                                                    | HPC H                                                                                       | HPC U                                                                                                                                                |                                                                                   |                                                                                    |                                                                                     |                                                                                     |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |                         |           |                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |
| Für hochlegierte Stähle und Guss<br>For high alloy steels and cast iron           | Für austenitische Stähle, NE-Metalle und Titan<br>For austenitic steels, non-ferrous metals and titanium | Für gehärtete Stähle ≤ 45 bis 55 HRC<br>For hardened steels ≤ 45 to 55 HRC                  | Vollnutfräser mit großem Spanraum für die universelle Anwendung<br>Full flute milling cutter with large chip removal space for universal application |                                                                                   |                                                                                    |                                                                                     |                                                                                     |
| <div>P</div> <div>K</div>                                                         | <div>M</div> <div>S</div> <div>Nebenanwendung: <div>N</div></div> <div>Second choice:</div>              | <div>H</div> <div>P</div> <div>Nebenanwendung: <div>K</div></div> <div>Second choice:</div> | <div>P</div> <div>M</div> <div>K</div> <div>N</div> <div>S</div>                                                                                     |                                                                                   |                                                                                    |                                                                                     |                                                                                     |
|  |                         |            |                                                                     |  |  |  |  |
| Eckfräsen<br>Corner milling                                                       | Nutenfräsen<br>Slot milling                                                                              | Außenkonturfräsen<br>Contour milling                                                        | Taschenfräsen<br>Pocket milling                                                                                                                      | Rampen<br>Ramping                                                                 | Zirkularfräsen<br>Circular milling                                                 | Trochoidalfräsen<br>Trochoidal milling                                              | Schruppen und Schlichten<br>Roughing and finishing                                  |

## Anwendungsbeispiel Application example



### Schräg eintauchen Ramping

#### Werkzeug Tool:

HPC P

$d_1 = 12 \text{ mm}$ ,  $z = 4$

#### Werkstoff Material:

Vergütungsstahl 1.7225/42CrMo4,  $R_m = 950 \text{ N/mm}^2$

Heat-treatment steel 1.7225/42CrMo4,  $R_m = 950 \text{ N/mm}^2$

#### Schnittwerte Cutting data:

$v_c = 240 \text{ m/min}$

$n = 6350 \text{ min}^{-1}$

$f_z = 0,05 \text{ mm}$

$v_f = 1300 \text{ mm/min}$

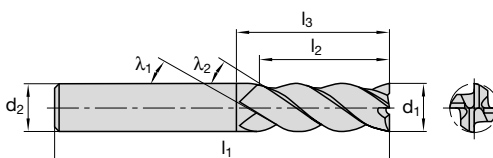
$a_e = 12 \text{ mm}$

$a_p = 8 \text{ mm}$

$\alpha = 20^\circ$

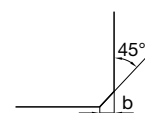


**HPC01 Rougher 35/38P**  
**High Performance Cutter für hochlegierte Stähle und Guss**  
**High Performance Cutter for high carbon steel and cast iron**

|                                |                |                |                |                |   |  |                               |  |                              |
|-----------------------------------------------------------------------------------------------------------------|----------------|----------------|----------------|----------------|---|-----------------------------------------------------------------------------------|-------------------------------|-------------------------------------------------------------------------------------|------------------------------|
| <div> <div>DIN 6527L</div> <div>35° 38°</div> <div>h10</div> <div>LCPK 30M</div> <div></div> <div></div> </div> |                |                |                |                |   | <div>DIN 6535 HA</div>                                                            |                               | <div>DIN 6535 HB</div>                                                              |                              |
| <b>Katalog-Nr. Cat.-No.</b>                                                                                     |                |                |                |                |   | <b>HPC01-P-A</b>                                                                  |                               | <b>HPC01-P-B</b>                                                                    |                              |
| <b>P</b>                                                                                                        |                |                |                |                |   | ■                                                                                 |                               | ■                                                                                   |                              |
| <b>M</b>                                                                                                        |                |                |                |                |   |                                                                                   |                               |                                                                                     |                              |
| <b>K</b>                                                                                                        |                |                |                |                |   | ■                                                                                 |                               | ■                                                                                   |                              |
| <b>N</b>                                                                                                        |                |                |                |                |   |                                                                                   |                               |                                                                                     |                              |
| <b>S</b>                                                                                                        |                |                |                |                |   |                                                                                   |                               |                                                                                     |                              |
| <b>H</b>                                                                                                        |                |                |                |                |   |                                                                                   |                               |                                                                                     |                              |
| d <sub>1</sub>                                                                                                  | l <sub>2</sub> | l <sub>1</sub> | l <sub>3</sub> | d <sub>2</sub> | z | Ident No.                                                                         | LMT-Code                      | Ident No.                                                                           | LMT-Code                     |
| <b>kurz short</b>                                                                                               |                |                |                |                |   |                                                                                   |                               |                                                                                     |                              |
| 1                                                                                                               | 1,5            | 40             | 2              | 4              | 4 | <a href="#">7426037</a>                                                           | EM-HPC01 P1.0x1.5/2 4C0.025HA | –                                                                                   | –                            |
| 2                                                                                                               | 3              | 40             | 4              | 4              | 4 | <a href="#">7426038</a>                                                           | EM-HPC01 P2.0x3/4 4C0.05HA    | –                                                                                   | –                            |
| 3                                                                                                               | 4              | 40             | 6              | 4              | 4 | <a href="#">7426039</a>                                                           | EM-HPC01 P3.0x4/6 4C0.075HA   | –                                                                                   | –                            |
| 4                                                                                                               | 5              | 54             | 8              | 6              | 4 | <a href="#">7426069</a>                                                           | EM-HPC01 P4.0x5/8 4C0.1HA     | <a href="#">7426040</a>                                                             | EM-HPC01 P4.0x5/8 4C0.1HB    |
| 5                                                                                                               | 6              | 54             | 10             | 6              | 4 | <a href="#">7426070</a>                                                           | EM-HPC01 P5.0x6/10 4C0.15HA   | <a href="#">7426041</a>                                                             | EM-HPC01 P5.0x6/10 4C0.15HB  |
| 6                                                                                                               | 7              | 54             | 16             | 6              | 4 | <a href="#">7426071</a>                                                           | EM-HPC01 P6.0x7/16 4C0.2HA    | <a href="#">7426042</a>                                                             | EM-HPC01 P6.0x7/16 4C0.2HB   |
| 8                                                                                                               | 9              | 58             | 20             | 8              | 4 | <a href="#">7426072</a>                                                           | EM-HPC01 P8.0x9/20 4C0.2HA    | <a href="#">7426043</a>                                                             | EM-HPC01 P8.0x9/20 4C0.2HB   |
| 10                                                                                                              | 11             | 66             | 24             | 10             | 4 | <a href="#">7426073</a>                                                           | EM-HPC01 P10.0x11/24 4C0.2HA  | <a href="#">7426044</a>                                                             | EM-HPC01 P10.0x11/24 4C0.2HB |
| 12                                                                                                              | 12             | 73             | 26             | 12             | 4 | <a href="#">7426074</a>                                                           | EM-HPC01 P12.0x12/26 4C0.2HA  | <a href="#">7426045</a>                                                             | EM-HPC01 P12.0x12/26 4C0.2HB |
| 14                                                                                                              | 14             | 75             | 28             | 14             | 4 | <a href="#">7426075</a>                                                           | EM-HPC01 P14.0x14/28 4C0.3HA  | <a href="#">7426046</a>                                                             | EM-HPC01 P14.0x14/28 4C0.3HB |
| 16                                                                                                              | 16             | 82             | 32             | 16             | 4 | <a href="#">7426076</a>                                                           | EM-HPC01 P16.0x16/32 4C0.3HA  | <a href="#">7426047</a>                                                             | EM-HPC01 P16.0x16/32 4C0.3HB |
| 18                                                                                                              | 18             | 84             | 34             | 18             | 4 | <a href="#">7426077</a>                                                           | EM-HPC01 P18.0x18/34 4C0.3HA  | <a href="#">7426048</a>                                                             | EM-HPC01 P18.0x18/34 4C0.3HB |
| 20                                                                                                              | 20             | 92             | 40             | 20             | 4 | <a href="#">7426078</a>                                                           | EM-HPC01 P20.0x20/40 4C0.3HA  | <a href="#">7426049</a>                                                             | EM-HPC01 P20.0x20/40 4C0.3HB |
| <b>lang long</b>                                                                                                |                |                |                |                |   |                                                                                   |                               |                                                                                     |                              |
| 1                                                                                                               | 2,5            | 40             | 3              | 4              | 4 | <a href="#">7426050</a>                                                           | EM-HPC01 P1.0x2.5/3 4C0.025HA | –                                                                                   | –                            |
| 2                                                                                                               | 4              | 40             | 6              | 4              | 4 | <a href="#">7426051</a>                                                           | EM-HPC01 P2.0x4/6 4C0.05HA    | –                                                                                   | –                            |
| 3                                                                                                               | 6              | 40             | 9              | 4              | 4 | <a href="#">7426052</a>                                                           | EM-HPC01 P3.0x6/9 4C0.075HA   | –                                                                                   | –                            |
| 4                                                                                                               | 8              | 54             | 12             | 6              | 4 | <a href="#">7426079</a>                                                           | EM-HPC01 P4.0x8/12 4C0.1HA    | <a href="#">7426053</a>                                                             | EM-HPC01 P4.0x8/12 4C0.1HB   |
| 5                                                                                                               | 10             | 54             | 15             | 6              | 4 | <a href="#">7426080</a>                                                           | EM-HPC01 P5.0x10/15 4C0.15HA  | <a href="#">7426054</a>                                                             | EM-HPC01 P5.0x10/15 4C0.15HB |
| 6                                                                                                               | 13             | 57             | 21             | 6              | 4 | <a href="#">7426081</a>                                                           | EM-HPC01 P6.0x13/21 4C0.2HA   | <a href="#">7426055</a>                                                             | EM-HPC01 P6.0x13/21 4C0.2HB  |
| 8                                                                                                               | 19             | 63             | 27             | 8              | 4 | <a href="#">7426082</a>                                                           | EM-HPC01 P8.0x19/27 4C0.2HA   | <a href="#">7426056</a>                                                             | EM-HPC01 P8.0x19/27 4C0.2HB  |
| 10                                                                                                              | 22             | 72             | 32             | 10             | 4 | <a href="#">7426083</a>                                                           | EM-HPC01 P10.0x22/32 4C0.2HA  | <a href="#">7426057</a>                                                             | EM-HPC01 P10.0x22/32 4C0.2HB |
| 12                                                                                                              | 26             | 83             | 38             | 12             | 4 | <a href="#">7426084</a>                                                           | EM-HPC01 P12.0x26/38 4C0.2HA  | <a href="#">7426058</a>                                                             | EM-HPC01 P12.0x26/38 4C0.2HB |
| 14                                                                                                              | 26             | 83             | 38             | 14             | 4 | <a href="#">7426085</a>                                                           | EM-HPC01 P14.0x26/38 4C0.3HA  | <a href="#">7426059</a>                                                             | EM-HPC01 P14.0x26/38 4C0.3HB |
| 16                                                                                                              | 32             | 92             | 44             | 16             | 4 | <a href="#">7426086</a>                                                           | EM-HPC01 P16.0x32/44 4C0.3HA  | <a href="#">7426060</a>                                                             | EM-HPC01 P16.0x32/44 4C0.3HB |
| 18                                                                                                              | 32             | 92             | 44             | 18             | 4 | <a href="#">7426087</a>                                                           | EM-HPC01 P18.0x32/44 4C0.3HA  | <a href="#">7426061</a>                                                             | EM-HPC01 P18.0x32/44 4C0.3HB |
| 20                                                                                                              | 38             | 104            | 54             | 20             | 4 | <a href="#">7426088</a>                                                           | EM-HPC01 P20.0x38/54 4C0.3HA  | <a href="#">7426062</a>                                                             | EM-HPC01 P20.0x38/54 4C0.3HB |

■ = Hauptanwendung First choice  
 □ = Nebenanwendung Second choice

Schnittwertempfehlungen ab Seite 26  
 Cutting data recommendations starting page 26

| Kantenschutzfase<br>Edge protection chamfer                                         | d <sub>1</sub> | b     |
|-------------------------------------------------------------------------------------|----------------|-------|
|  | 1              | 0,025 |
|                                                                                     | 2              | 0,05  |
|                                                                                     | 3              | 0,075 |
|                                                                                     | 4              | 0,1   |
|                                                                                     | 5              | 0,15  |
|                                                                                     | 6–12           | 0,2   |
|                                                                                     | 14–20          | 0,3   |



**HPC01 Rougher 35/38P**  
**High Performance Cutter für hochlegierte Stähle und Guss**  
**High Performance Cutter for high carbon steel and cast iron**

|                              |                |                |                |                |   | DIN 6535 HA             |                              | DIN 6535 HB             |                              |
|------------------------------|----------------|----------------|----------------|----------------|---|-------------------------|------------------------------|-------------------------|------------------------------|
|                              |                |                |                |                |   |                         |                              |                         |                              |
| <b>Katalog-Nr. Cat.-No.</b>  |                |                |                |                |   | <b>HPC01-P-A</b>        |                              | <b>HPC01-P-B</b>        |                              |
| <b>P</b>                     |                |                |                |                |   | ■                       |                              | ■                       |                              |
| <b>M</b>                     |                |                |                |                |   |                         |                              |                         |                              |
| <b>K</b>                     |                |                |                |                |   | ■                       |                              | ■                       |                              |
| <b>N</b>                     |                |                |                |                |   |                         |                              |                         |                              |
| <b>S</b>                     |                |                |                |                |   |                         |                              |                         |                              |
| <b>H</b>                     |                |                |                |                |   |                         |                              |                         |                              |
| d <sub>1</sub>               | l <sub>2</sub> | l <sub>1</sub> | l <sub>3</sub> | d <sub>2</sub> | z | Ident No.               | LMT-Code                     | Ident No.               | LMT-Code                     |
| <b>extra lang extra long</b> |                |                |                |                |   |                         |                              |                         |                              |
| 6                            | 9              | 65             | 29             | 6              | 4 | <a href="#">7426089</a> | EM-HPC01 P6.0x9/29 4C0.2HA   | <a href="#">7426063</a> | EM-HPC01 P6.0x9/29 4C0.2HB   |
| 8                            | 12             | 75             | 39             | 8              | 4 | <a href="#">7426090</a> | EM-HPC01 P8.0x12/39 4C0.2HA  | <a href="#">7426064</a> | EM-HPC01 P8.0x12/39 4C0.2HB  |
| 10                           | 15             | 80             | 40             | 10             | 4 | <a href="#">7426091</a> | EM-HPC01 P10.0x15/40 4C0.2HA | <a href="#">7426065</a> | EM-HPC01 P10.0x15/40 4C0.2HB |
| 12                           | 18             | 93             | 48             | 12             | 4 | <a href="#">7426092</a> | EM-HPC01 P12.0x18/48 4C0.2HA | <a href="#">7426066</a> | EM-HPC01 P12.0x18/48 4C0.2HB |
| 16                           | 24             | 108            | 60             | 16             | 4 | <a href="#">7426093</a> | EM-HPC01 P16.0x24/60 4C0.3HA | <a href="#">7426067</a> | EM-HPC01 P16.0x24/60 4C0.3HB |
| 20                           | 30             | 126            | 76             | 20             | 4 | <a href="#">7426094</a> | EM-HPC01 P20.0x30/76 4C0.3HA | <a href="#">7426068</a> | EM-HPC01 P20.0x30/76 4C0.3HB |

■ = Hauptanwendung First choice  
 □ = Nebenanwendung Second choice

Schnittwertempfehlungen ab Seite 26  
 Cutting data recommendations starting page 26

| Kantenschutzfase<br>Edge protection chamfer | d <sub>1</sub> | b     |
|---------------------------------------------|----------------|-------|
|                                             | 1              | 0,025 |
|                                             | 2              | 0,05  |
|                                             | 3              | 0,075 |
|                                             | 4              | 0,1   |
|                                             | 5              | 0,15  |
|                                             | 6–12           | 0,2   |
|                                             | 14–20          | 0,3   |

# **HPC01 Rougher 35/38P** **Schnittwertempfehlungen** **Cutting data recommendations**

| Werkstoff | Material                                                            | Werkstoff-Nr.<br>Material No. | DIN<br>Bezeichnung Alt<br>DIN<br>Description Old | R <sub>m</sub> /UTS<br>(N/mm <sup>2</sup> ) | DIN<br>Bezeichnung Neu<br>DIN<br>Description New |
|-----------|---------------------------------------------------------------------|-------------------------------|--------------------------------------------------|---------------------------------------------|--------------------------------------------------|
| <b>P</b>  | Unlegierter Baustahl<br>+ Automatenstahl                            | 1.0570                        | St52-3                                           | -700                                        | S355J2G3                                         |
|           |                                                                     | 1.1730                        | C45                                              | -800                                        | C45U                                             |
|           |                                                                     | 1.0715                        | 9SMn28                                           | -700                                        | 11SMn30                                          |
|           |                                                                     | 1.1191                        | Ck45                                             | 500-950                                     | C45E                                             |
|           |                                                                     | 1.7219                        | 26CrMo4                                          |                                             | 26CrMo4-2                                        |
|           | Vergütungsstahl,<br>mittelfest                                      | 1.7225                        | 42CrMo4                                          | 500-950                                     | 42CrMo4                                          |
|           |                                                                     | 1.8159                        | 51CrV4                                           |                                             | 51CrV4                                           |
|           | Stahlguss                                                           | 1.0416                        | GS40                                             | -950                                        | GS40                                             |
|           | Einsatzstahl                                                        | 1.7131                        | 16MnCr5                                          | -950                                        | 16MnCr5                                          |
|           | Rost- und säurebe-<br>ständiger Stahl,<br>ferritisch, martensitisch | 1.4006                        | X10Cr13                                          | 500-950                                     | X12Cr13                                          |
|           |                                                                     | 1.4104                        | X12CrMoS17                                       |                                             | X14CrMoS17                                       |
|           |                                                                     | 1.4122                        | X35CrMo17                                        |                                             | X39CrMo17-1                                      |
|           | Vergütungsstahl,<br>hochfest                                        | 1.7225                        | 42CrMo4                                          | 950-1400                                    | 42CrMo4                                          |
|           |                                                                     | 1.6580                        | 30CrNiMo8                                        |                                             | 30CrNiMo8                                        |
|           | Nitrierstahl,<br>vergütet                                           | 1.8504                        | 34CrAl6                                          | 950-1400                                    | 34CrAl6                                          |
|           |                                                                     | 1.2344                        | X40CrMoV5.1                                      | -900                                        | X40CrMoV5-1                                      |
|           | Werkzeugstahl                                                       | 1.2379                        | X155CrVMo12 1                                    | 240-350 HB                                  | X153CrMoV12-1                                    |
|           |                                                                     | 1.2080                        | X210Cr12                                         |                                             | X210Cr12                                         |
|           |                                                                     | 1.2343                        | X38CrMoV5 1                                      | 950-1400                                    | X37CrMoV5-1                                      |
|           |                                                                     | 1.2358                        | 60CrMoV18-5                                      | 850-1000                                    | 60CrMoV18-5                                      |
|           |                                                                     | 1.2714                        | 55NiCrMoV7                                       | 1100-1350                                   | 55NiCrMoV7                                       |
|           |                                                                     | 1.2311                        | 40CrMnMo7                                        | -1100                                       | 40CrMnMo7                                        |
|           |                                                                     | 1.2312                        | 40CrMnNiMoS8.6                                   | -1150                                       | 40CrMnNiMoS8-6                                   |
|           |                                                                     | 1.2316                        | X38CrMo16                                        | -1100                                       | X38CrMo16                                        |
|           |                                                                     | 1.2738                        | 45CrMnNiMo8.6.4                                  | 950-1150                                    | 45CrMnNiMo8-6-4                                  |
| <b>K</b>  | Grauguss                                                            | 0.6025                        | GG25                                             | 100-400<br>(120-260 HB)                     | EN-GJL-250                                       |
|           | Legierter Grauguss                                                  | 0.6678                        | GGL-NiCr35 2                                     | 150-250<br>(160-230 HB)                     | EN-GJLA-XNiCr35-2                                |
|           | Sphäroguss                                                          | 0.7060                        | GGG60                                            | 400-800                                     | EN-GJS-600-3                                     |
|           | Temperguss                                                          | 0.7070                        | GGG70L                                           | (120-310 HB)                                | EN-GJS-700-2U                                    |
|           |                                                                     | 0.8155                        | GTS55                                            | 350-700<br>(150-280 HB)                     | EN-GJMB-550-4                                    |

## **Berechnungsformeln und Vorschubkorrekturfaktoren** **Calculation formulas and feed correction factors**

| <div>Drehzahl</div> <div>Speed <math>n</math> (min<sup>-1</sup>):</div> <div><math display="block">n = \frac{v_c \cdot 1000}{\pi \cdot d_1}</math></div> <div>Vorschubgeschwindigkeit</div> <div>Feed rate <math>v_f</math> (mm/min):</div> <div><math display="block">v_f = f_z \cdot z \cdot n \cdot f_1</math></div> <div>a<sub>e</sub> = Schnittbreite Width of cut in mm</div> <div>a<sub>p</sub> = Schnitttiefe Depth of cut in mm</div> <div>d<sub>1</sub> = Durchmesser Cutter diameter in mm</div> <div>f<sub>1</sub> = Korrekturfaktor für Correction factor for <math>v_f</math></div> <div>f<sub>z</sub> = Vorschub pro Zahn Feed per tooth in mm</div> <div>n = Drehzahl Speed in min<sup>-1</sup></div> <div>v<sub>f</sub> = Vorschubgeschwindigkeit Feed rate in mm/min</div> <div>z = Anzahl der Schneiden No. of teeth</div> | Vorschubkorrektur Feed correction $f_1$ |                                  |                       |                      |                                                                 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|----------------------------------|-----------------------|----------------------|-----------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                         |                                  | HPC01-P<br>kurz short | HPC01-P<br>lang long | HPC01-P<br>extra lang <sup>3)</sup><br>extra long <sup>3)</sup> |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | a <sub>e</sub>                          | a <sub>p</sub>                   | f <sub>1</sub>        | f <sub>1</sub>       | f <sub>1</sub>                                                  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0,1 · d <sub>1</sub>                    | 1 x d <sub>1</sub>               | 2,4                   | 2,2                  | 1,6                                                             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                         | 1,5 x d <sub>1</sub>             | –                     | 2                    | 1,5                                                             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                         | 2 x d <sub>1</sub> <sup>2)</sup> | –                     | 1,6                  | –                                                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0,25 · d <sub>1</sub>                   | 1 x d <sub>1</sub>               | 2,1                   | 1,6                  | 1,1                                                             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                         | 1,5 x d <sub>1</sub>             | –                     | 1,4                  | 1                                                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                         | 2 x d <sub>1</sub> <sup>2)</sup> | –                     | 1,2                  | –                                                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0,5 · d <sub>1</sub>                    | 1 x d <sub>1</sub>               | 1,6                   | 1,2                  | 0,7                                                             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                         | 1,5 x d <sub>1</sub>             | –                     | 1                    | 0,6                                                             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                         | 2 x d <sub>1</sub> <sup>2)</sup> | –                     | 0,8                  | –                                                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 0,75 · d <sub>1</sub>                   | 1 x d <sub>1</sub>               | 1,1                   | 0,8                  | 0,5                                                             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                         | 1,5 x d <sub>1</sub>             | –                     | 0,7                  | 0,4                                                             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                         | 2 x d <sub>1</sub> <sup>2)</sup> | –                     | 0,6                  | –                                                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1 · d <sub>1</sub> <sup>1)</sup>        | 0,5 x d <sub>1</sub>             | 0,8                   | 0,6                  | 0,5                                                             |
| 1 x d <sub>1</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                         | –                                | 0,5                   | 0,4                  |                                                                 |
| 2 x d <sub>1</sub> <sup>2)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                         | –                                | 0,4                   | –                    |                                                                 |

<sup>1)</sup> Für Durchmesser 1 bis 3: In langer Ausführung und a<sub>e</sub> = d<sub>1</sub> sollte a<sub>p</sub> 0,5 x d<sub>1</sub> nicht überschreiten  
For diameter 1 to 3: long version and a<sub>e</sub> = d<sub>1</sub> should not cross over a<sub>p</sub> 0.5 x d<sub>1</sub>

<sup>2)</sup> 1,8 x d<sub>1</sub> für Durchmesser 14, 18, 20  
1.8 x d<sub>1</sub> for diameter 14, 18, 20

<sup>3)</sup> Für extra lange Werkzeuge v<sub>c</sub> ggf. um 20 % reduzieren  
Reduce extra long tools cutting speed by 20 %

|                                                                                                                                                                                        | Kühlung<br>Coolant | Schnitt-<br>geschwindigkeit<br>Cutting speed<br>v <sub>c</sub> (m/min) | Fräserdurchmesser Cutting diameter (mm)                    |                 |                 |      |      |      |      |      |      |       |       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|------------------------------------------------------------------------|------------------------------------------------------------|-----------------|-----------------|------|------|------|------|------|------|-------|-------|
|                                                                                                                                                                                        |                    |                                                                        | Vorschub pro Zahn Feed per tooth<br>f <sub>z</sub> (mm/z.) |                 |                 |      |      |      |      |      |      |       |       |
|                                                                                                                                                                                        |                    |                                                                        | 1 <sup>1)</sup>                                            | 2 <sup>1)</sup> | 3 <sup>1)</sup> | 4    | 5    | 6    | 8    | 10   | 12   | 14–16 | 18–20 |
| <div><br/></div>     |                    | 230–275                                                                | 0,008                                                      | 0,016           | 0,025           | 0,05 | 0,06 | 0,07 | 0,10 | 0,12 | 0,14 | 0,19  | 0,24  |
|                                                                                                                                                                                        |                    | 230–275                                                                | 0,008                                                      | 0,016           | 0,025           | 0,05 | 0,06 | 0,07 | 0,10 | 0,12 | 0,14 | 0,19  | 0,24  |
|                                                                                                                                                                                        |                    | 200–240                                                                | 0,008                                                      | 0,014           | 0,02            | 0,04 | 0,06 | 0,07 | 0,09 | 0,11 | 0,13 | 0,18  | 0,22  |
|                                                                                                                                                                                        |                    | 200–240                                                                | 0,008                                                      | 0,014           | 0,02            | 0,04 | 0,06 | 0,07 | 0,09 | 0,11 | 0,13 | 0,18  | 0,22  |
|                                                                                                                                                                                        |                    | 160–200                                                                | 0,008                                                      | 0,014           | 0,02            | 0,04 | 0,06 | 0,07 | 0,09 | 0,11 | 0,13 | 0,18  | 0,22  |
|                                                                                                                                                                                        |                    | 120–150                                                                | 0,008                                                      | 0,014           | 0,02            | 0,04 | 0,05 | 0,06 | 0,08 | 0,10 | 0,11 | 0,15  | 0,19  |
|                                                                                                                                                                                        |                    | 140–180                                                                | 0,008                                                      | 0,014           | 0,02            | 0,04 | 0,05 | 0,06 | 0,08 | 0,10 | 0,11 | 0,15  | 0,19  |
|                                                                                                                                                                                        |                    | 140–180                                                                | 0,008                                                      | 0,014           | 0,02            | 0,04 | 0,05 | 0,06 | 0,08 | 0,10 | 0,11 | 0,15  | 0,19  |
|                                                                                                                                                                                        |                    | 110–140                                                                | 0,005                                                      | 0,013           | 0,02            | 0,03 | 0,04 | 0,05 | 0,07 | 0,09 | 0,10 | 0,14  | 0,17  |
|                                                                                                                                                                                        |                    | 100–120                                                                | 0,005                                                      | 0,013           | 0,02            | 0,03 | 0,04 | 0,05 | 0,07 | 0,09 | 0,10 | 0,14  | 0,17  |
|                                                                                                                                                                                        |                    | 100–120                                                                | 0,005                                                      | 0,013           | 0,02            | 0,03 | 0,04 | 0,05 | 0,06 | 0,08 | 0,10 | 0,13  | 0,16  |
|                                                                                                                                                                                        |                    |                                                                        |                                                            |                 |                 |      |      |      |      |      |      |       |       |
| <div><br/></div> |                    | 180–220                                                                | 0,012                                                      | 0,025           | 0,04            | 0,06 | 0,08 | 0,09 | 0,12 | 0,15 | 0,18 | 0,22  | 0,28  |
|                                                                                                                                                                                        |                    | 160–180                                                                | 0,011                                                      | 0,021           | 0,03            | 0,06 | 0,07 | 0,08 | 0,11 | 0,13 | 0,16 | 0,20  | 0,26  |
|                                                                                                                                                                                        |                    | 150–180                                                                | 0,01                                                       | 0,02            | 0,03            | 0,05 | 0,06 | 0,07 | 0,10 | 0,12 | 0,14 | 0,19  | 0,24  |
|                                                                                                                                                                                        |                    | 120–150                                                                | 0,01                                                       | 0,018           | 0,025           | 0,05 | 0,06 | 0,07 | 0,10 | 0,12 | 0,14 | 0,19  | 0,24  |

Die angegebenen Schnittwerte sind Startwerte und müssen auf die vorhandenen Bedingungen abgestimmt werden.  
The cutting data above are starting values and must be adjusted to the existing conditions.



Trockenbearbeitung, Pressluftkühlung ist vorteilhaft  
Dry machining, air-blast cooling is advantageous



Nassbearbeitung, auf ausreichende Emulsionszuführung achten  
Wet machining, sufficient emulsion volume required

## Merkmale des HPC01-P Features of the HPC01-P

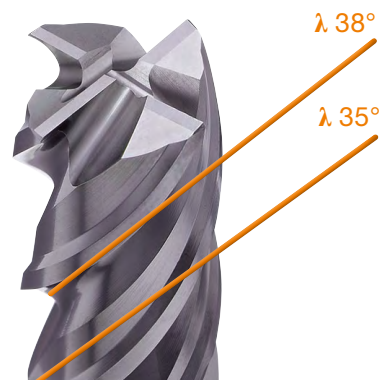
**Stabile Schneidkante mit Mikro-  
schneidkantenpräparation für  
gesteigerte Prozesssicherheit**  
Stable cutting edge with micro cut-  
ting edge preparation for increased  
process reliability



**Stirnlückenausführung in Radius-  
form für verbesserte Spanabfuhr**  
Front cutting edge cavity design  
in radius form for improved chip  
removal



**Kontinuierlich veränderte Schneiden-  
teilung für schwingungsarmes Fräsen  
bei hohen Vorschüben**  
Continuously variable cutting edge pitch  
for low-vibration milling with high feeds



# HPC01 Rougher 41/44M

High Performance Cutter für austenitische Stähle, NE-Metalle und Titan

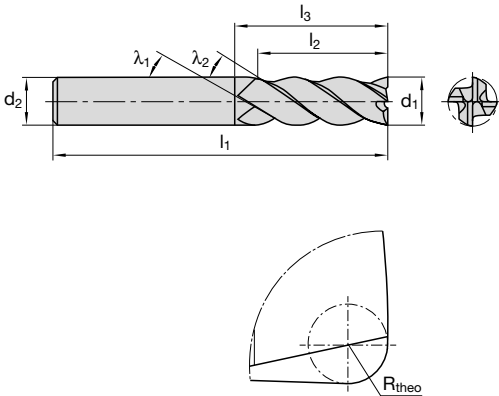
High Performance Cutter for stainless steels, non-ferrous and titanium

DIN  
6527L



DIN  
6535  
HA

DIN  
6535  
HB



| Katalog-Nr. Cat.-No. |                |                |                |                |                               |   | HPC01-M-A               |                              | HPC01-M-B               |                              |
|----------------------|----------------|----------------|----------------|----------------|-------------------------------|---|-------------------------|------------------------------|-------------------------|------------------------------|
| P                    |                |                |                |                |                               |   |                         | ■                            |                         | ■                            |
| M                    |                |                |                |                |                               |   |                         |                              |                         |                              |
| K                    |                |                |                |                |                               |   |                         |                              |                         |                              |
| N                    |                |                |                |                |                               |   |                         | □                            |                         | □                            |
| S                    |                |                |                |                |                               |   |                         | ■                            |                         | ■                            |
| H                    |                |                |                |                |                               |   |                         |                              |                         |                              |
| d <sub>1</sub>       | l <sub>2</sub> | l <sub>1</sub> | l <sub>3</sub> | d <sub>2</sub> | R <sub>theo</sub><br>(+ 0,05) | z | Ident No.               | LMT-Code                     | Ident No.               | LMT-Code                     |
| kurz short           |                |                |                |                |                               |   |                         |                              |                         |                              |
| 4                    | 5              | 54             | 8              | 6              | 0,15                          | 4 | <a href="#">7426779</a> | EM-HPC01 M4.0x5/8 4R0.15HA   | <a href="#">7426788</a> | EM-HPC01 M4.0x5/8 4R0.15HB   |
| 5                    | 6              | 54             | 10             | 6              | 0,2                           | 4 | <a href="#">7426780</a> | EM-HPC01 M5.0x6/10 4R0.2HA   | <a href="#">7426789</a> | EM-HPC01 M5.0x6/10 4R0.2HB   |
| 6                    | 7              | 54             | 16             | 6              | 0,3                           | 4 | <a href="#">7426781</a> | EM-HPC01 M6.0x7/16 4R0.3HA   | <a href="#">7426790</a> | EM-HPC01 M6.0x7/16 4R0.3HB   |
| 8                    | 9              | 58             | 20             | 8              | 0,3                           | 4 | <a href="#">7426782</a> | EM-HPC01 M8.0x9/20 4R0.3HA   | <a href="#">7426791</a> | EM-HPC01 M8.0x9/20 4R0.3HB   |
| 10                   | 11             | 66             | 24             | 10             | 0,3                           | 4 | <a href="#">7426783</a> | EM-HPC01 M10.0x11/24 4R0.3HA | <a href="#">7426792</a> | EM-HPC01 M10.0x11/24 4R0.3HB |
| 12                   | 12             | 73             | 26             | 12             | 0,3                           | 4 | <a href="#">7426784</a> | EM-HPC01 M12.0x12/26 4R0.3HA | <a href="#">7426793</a> | EM-HPC01 M12.0x12/26 4R0.3HB |
| 14                   | 14             | 75             | 28             | 14             | 0,4                           | 4 | <a href="#">7426785</a> | EM-HPC01 M14.0x14/28 4R0.4HA | <a href="#">7432295</a> | EM-HPC01 M14.0x14/28 4R0.4HB |
| 16                   | 16             | 82             | 32             | 16             | 0,4                           | 4 | <a href="#">7426786</a> | EM-HPC01 M16.0x16/32 4R0.4HA | <a href="#">7426794</a> | EM-HPC01 M16.0x16/32 4R0.4HB |
| 18                   | 18             | 84             | 34             | 18             | 0,4                           | 4 | <a href="#">7432294</a> | EM-HPC01 M18.0x18/34 4R0.4HA | <a href="#">7432296</a> | EM-HPC01 M18.0x18/34 4R0.4HB |
| 20                   | 20             | 92             | 40             | 20             | 0,4                           | 4 | <a href="#">7426787</a> | EM-HPC01 M20.0x20/40 4R0.4HA | <a href="#">7426795</a> | EM-HPC01 M20.0x20/40 4R0.4HB |
| lang long            |                |                |                |                |                               |   |                         |                              |                         |                              |
| 4                    | 8              | 54             | 12             | 6              | 0,15                          | 4 | <a href="#">7426796</a> | EM-HPC01 M4.0x8/12 4R0.15HA  | <a href="#">7426805</a> | EM-HPC01 M4.0x8/12 4R0.15HB  |
| 5                    | 10             | 54             | 15             | 6              | 0,2                           | 4 | <a href="#">7426797</a> | EM-HPC01 M5.0x10/15 4R0.2HA  | <a href="#">7426806</a> | EM-HPC01 M5.0x10/15 4R0.2HB  |
| 6                    | 13             | 57             | 21             | 6              | 0,3                           | 4 | <a href="#">7426798</a> | EM-HPC01 M6.0x13/21 4R0.3HA  | <a href="#">7426807</a> | EM-HPC01 M6.0x13/21 4R0.3HB  |
| 8                    | 19             | 63             | 27             | 8              | 0,3                           | 4 | <a href="#">7426799</a> | EM-HPC01 M8.0x19/27 4R0.3HA  | <a href="#">7426808</a> | EM-HPC01 M8.0x19/27 4R0.3HB  |
| 10                   | 22             | 72             | 32             | 10             | 0,3                           | 4 | <a href="#">7426800</a> | EM-HPC01 M10.0x22/32 4R0.3HA | <a href="#">7426809</a> | EM-HPC01 M10.0x22/32 4R0.3HB |
| 12                   | 26             | 83             | 38             | 12             | 0,3                           | 4 | <a href="#">7426801</a> | EM-HPC01 M12.0x26/38 4R0.3HA | <a href="#">7426810</a> | EM-HPC01 M12.0x26/38 4R0.3HB |
| 14                   | 26             | 83             | 38             | 14             | 0,4                           | 4 | <a href="#">7426802</a> | EM-HPC01 M14.0x26/38 4R0.4HA | <a href="#">7432298</a> | EM-HPC01 M14.0x26/38 4R0.4HB |
| 16                   | 32             | 92             | 44             | 16             | 0,4                           | 4 | <a href="#">7426803</a> | EM-HPC01 M16.0x32/44 4R0.4HA | <a href="#">7426811</a> | EM-HPC01 M16.0x32/44 4R0.4HB |
| 18                   | 32             | 92             | 44             | 18             | 0,4                           | 4 | <a href="#">7432297</a> | EM-HPC01 M18.0x32/44 4R0.4HA | <a href="#">7432299</a> | EM-HPC01 M18.0x32/44 4R0.4HB |
| 20                   | 38             | 104            | 54             | 20             | 0,4                           | 4 | <a href="#">7426804</a> | EM-HPC01 M20.0x38/54 4R0.4HA | <a href="#">7426812</a> | EM-HPC01 M20.0x38/54 4R0.4HB |

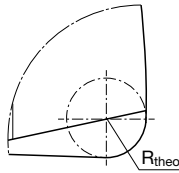
Schnittwertempfehlungen ab Seite 30

Cutting data recommendations starting page 30

■ = Hauptanwendung First choice

□ = Nebenanwendung Second choice

## High Performance Cutter for stainless steels, non-ferrous and titanium



| Katalog-Nr. Cat.-No. |                |                |                |                |                               |   | HPC01-M-B |                                |
|----------------------|----------------|----------------|----------------|----------------|-------------------------------|---|-----------|--------------------------------|
| P                    |                |                |                |                |                               |   |           |                                |
| M                    |                |                |                |                |                               |   | ■         |                                |
| K                    |                |                |                |                |                               |   |           |                                |
| N                    |                |                |                |                |                               |   | ■         |                                |
| S                    |                |                |                |                |                               |   | ■         |                                |
| H                    |                |                |                |                |                               |   |           |                                |
| d <sub>1</sub>       | l <sub>2</sub> | l <sub>1</sub> | l <sub>3</sub> | d <sub>2</sub> | R <sub>theo</sub><br>(+ 0,05) | z | Ident No. | LMT-Code                       |
| lang long            |                |                |                |                |                               |   |           |                                |
| 6                    | 13             | 57             | 21             | 6              | 0,3                           | 4 | 7426813   | EM-HPC01 M6.0x13/21 4R0.3HB-I  |
| 8                    | 19             | 63             | 27             | 8              | 0,3                           | 4 | 7426814   | EM-HPC01 M8.0x19/27 4R0.3HB-I  |
| 10                   | 22             | 72             | 32             | 10             | 0,3                           | 4 | 7426815   | EM-HPC01 M10.0x22/32 4R0.3HB-I |
| 12                   | 26             | 83             | 38             | 12             | 0,3                           | 4 | 7426816   | EM-HPC01 M12.0x26/38 4R0.3HB-I |
| 16                   | 32             | 92             | 44             | 16             | 0,4                           | 4 | 7426817   | EM-HPC01 M16.0x32/44 4R0.4HB-I |
| 20                   | 38             | 104            | 54             | 20             | 0,4                           | 4 | 7426818   | EM-HPC01 M20.0x38/54 4R0.4HB-I |
|                      |                |                |                |                |                               |   |           |                                |

Schnittwertempfehlungen ab Seite 30  
Cutting data recommendations starting page 30

■ = Hauptanwendung First choice  
□ = Nebenanwendung Second choice

# **HPC01 Rougher 41/44M** **Schnittwertempfehlungen** **Cutting data recommendations**

| Werkstoff                                                          |                                                                     | Material                                             | Werkstoff-Nr.<br>Material No. | DIN<br>Bezeichnung Alt<br>DIN<br>Description Old | R <sub>m</sub> /UTS<br>(N/mm <sup>2</sup> ) | DIN<br>Bezeichnung Neu<br>DIN<br>Description New |  |
|--------------------------------------------------------------------|---------------------------------------------------------------------|------------------------------------------------------|-------------------------------|--------------------------------------------------|---------------------------------------------|--------------------------------------------------|--|
| M                                                                  | Rost- und säure-<br>beständiger Stahl,<br>austenitisch              | Stainless steel,<br>austenitic                       | 1.4301                        | X2CrNiMo17-12-2                                  | 500–950                                     | X5CrNiMo18-10                                    |  |
|                                                                    |                                                                     |                                                      | 1.4404                        | X6CrNiMoTi17-12-2                                |                                             | X2CrNiMo17-12-2                                  |  |
|                                                                    |                                                                     |                                                      | 1.4571                        | X10CrNiMoTi18                                    |                                             | X10CrNiMoTi18                                    |  |
|                                                                    | Rost- und säure-<br>beständiger Stahl,<br>ferritisch, martensitisch | Stainless steel, ferritic,<br>martensitic            | 1.4024                        | X15Cr13                                          | 500–950                                     | X15Cr13                                          |  |
|                                                                    |                                                                     |                                                      | 1.4057                        | X17CrNi16-2                                      |                                             | X17CrNi16-2                                      |  |
|                                                                    |                                                                     |                                                      | 1.4122                        | X35CrMo17                                        |                                             | X35CrMo17                                        |  |
| Rost- und säurebe-<br>ständiger Stahl,<br>martensitisch aushärtbar | Stainless steel,<br>martensitic steel                               | 1.2709                                               | X3NiCoMoTi18-9-5              | 800–1000                                         | X3NiCoMoTi18-9-5                            |                                                  |  |
|                                                                    |                                                                     | 1.4542                                               | X5CrNrCuNb16-4                |                                                  | X5CrNrCuNb16-4                              |                                                  |  |
|                                                                    |                                                                     | 1.4568                                               | X7CrNiAl17-7                  |                                                  | X7CrNiAl17-7                                |                                                  |  |
| N                                                                  | Aluminium-Legierungen,<br>kurzspanend                               | Aluminium alloys,<br>short chipping                  | 3.2581                        | G-AlSi12                                         | –400                                        | G-IGK-AlSi12                                     |  |
|                                                                    | Kupfer-Legierungen,<br>kurzspanend                                  | Copper alloys,<br>short chipping                     | 2.0402                        | MS58                                             | –500                                        | CuZn40Pb2                                        |  |
| S                                                                  | Titan-Legierungen,<br>mittelfest                                    | Titanium alloys,<br>medium strength                  | 3.7164                        | TiAl6V4                                          | –950                                        | Ti6AlV4                                          |  |
|                                                                    |                                                                     |                                                      | 3.7115                        | TiAl5Sn2,5                                       |                                             | TiAl5Sn2-5                                       |  |
|                                                                    | Titan-Legierungen,<br>hochfest                                      | Titanium alloys,<br>high strength                    | 3.7174                        | TiAl6Sn2                                         | 900–1400                                    | TiAl6V6Sn2                                       |  |
|                                                                    | Nickelbasis-Legierungen,<br>mittelfest                              | Nickel based alloys,<br>medium strength              | 2.4670                        | NiCr12Al6MoNb                                    | –950                                        | NiCr12Al6MoNb                                    |  |
|                                                                    | Nickelbasis-Legierungen,<br>hochwarmfest                            | Heat resistant nickel based<br>alloys, high strength | 2.4668                        | NiCr19Fe19NbMo                                   | 900–1400                                    | Inconel 718<br>NiCr19Fe19Nb5Mo3                  |  |

Die angegebenen Schnittwerte sind Startwerte und müssen auf die vorhandenen Bedingungen abgestimmt werden.  
The cutting data indicated are starting values and must be adjusted to the prevailing conditions.

## **Berechnungsformeln und Vorschubkorrekturfaktoren** **Calculation formula and feed correction factors**

| Drehzahl<br>Speed $n$ (min <sup>-1</sup> ):<br>$n = \frac{v_c \cdot 1000}{\pi \cdot d_1}$<br><br>Vorschubgeschwindigkeit<br>Feed rate $v_f$ (mm/min):<br>$v_f = f_z \cdot z \cdot n \cdot f_1$<br><br>$a_e$ = Schnittbreite Width of cut in mm<br>$a_p$ = Schnitttiefe Depth of cut in mm<br>$d_1$ = Durchmesser Cutter diameter in mm<br>$f_1$ = Korrekturfaktor für Correction factor $v_f$<br>$f_z$ = Vorschub pro Zahn Feed per tooth in mm<br>$n$ = Drehzahl Speed in min <sup>-1</sup><br>$v_f$ = Vorschubgeschwindigkeit Feed rate in mm/min<br>$z$ = Anzahl der Schneiden No. of teeth | Vorschubkorrektur Feed correction $f_1$ |                         |                                |                               | $v_c$                                   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-------------------------|--------------------------------|-------------------------------|-----------------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | $a_e$                                   | $a_p$                   | HPC01-M<br>kurz short<br>$f_1$ | HPC01-M<br>lang long<br>$f_1$ |                                         |
| 0,1 · $d_1$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1 x $d_1$                               | 1,5 x $d_1$             | 2                              | 1,8                           | um 30 % erhöhen<br>increase by 30 %     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         | 2 x $d_1$ <sup>1)</sup> | –                              | 1,7                           |                                         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         | 1 x $d_1$               | –                              | 1,6                           |                                         |
| 0,25 · $d_1$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1 x $d_1$                               | 1,5 x $d_1$             | 1,7                            | 1,4                           |                                         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         | 2 x $d_1$ <sup>1)</sup> | –                              | 1,3                           |                                         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         | 1 x $d_1$               | –                              | 1,2                           |                                         |
| 0,5 · $d_1$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1 x $d_1$                               | 1,5 x $d_1$             | 1,3                            | 1,1                           |                                         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         | 2 x $d_1$ <sup>1)</sup> | –                              | 1                             |                                         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         | 1 x $d_1$               | –                              | 0,8                           |                                         |
| 0,75 · $d_1$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1 x $d_1$                               | 1,5 x $d_1$             | 1                              | 0,8                           |                                         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         | 1 x $d_1$               | –                              | 0,7                           |                                         |
| 1 · $d_1$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0,75 x $d_1$                            | 0,7                     | 0,6                            | 0,6                           | um 20 %<br>reduzieren<br>reduce by 20 % |

<sup>1)</sup> 1,8 x  $d_1$  für Durchmesser 14, 18, 20  
1,8 x  $d_1$  for diameter 14, 18, 20



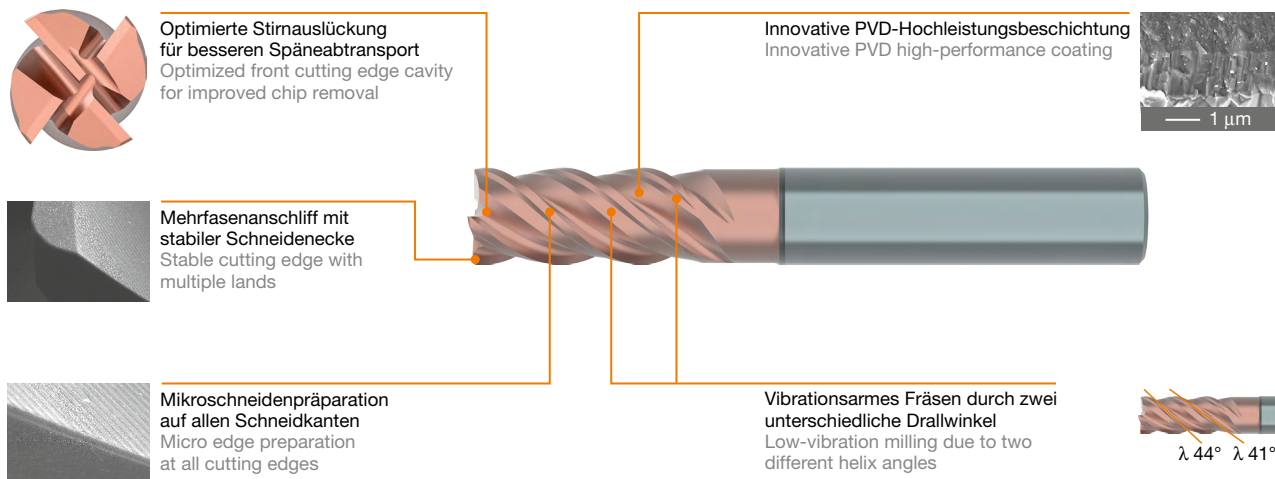
|  | Kühlung<br>Coolant                                                                | Schnitt-<br>geschwindigkeit<br>Cutting speed<br>$v_c$ (m/min) | Fräserdurchmesser Cutting diameter<br>(mm)        |      |       |
|--|-----------------------------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------|------|-------|
|  |                                                                                   |                                                               | Vorschub pro Zahn Feed per tooth<br>$f_z$ (mm/z.) |      |       |
|  |                                                                                   |                                                               | 4–6                                               | 8–12 | 14–20 |
|  |  | 100–110                                                       | 0,03                                              | 0,05 | 0,08  |
|  |                                                                                   | 100                                                           | 0,04                                              | 0,07 | 0,11  |
|  |                                                                                   | 120–130                                                       | 0,03                                              | 0,07 | 0,10  |
|  |                                                                                   | 300–330                                                       | 0,06                                              | 0,12 | 0,19  |
|  |                                                                                   | 250–275                                                       | 0,05                                              | 0,10 | 0,16  |
|  |                                                                                   | 80–90                                                         | 0,03                                              | 0,06 | 0,10  |
|  |                                                                                   | 80–90                                                         | 0,03                                              | 0,06 | 0,10  |
|  |                                                                                   | 60–65                                                         | 0,02                                              | 0,04 | 0,06  |
|  |                                                                                   | 40–45                                                         | 0,03                                              | 0,06 | 0,10  |
|  |                                                                                   | 30–35                                                         | 0,02                                              | 0,04 | 0,06  |

 Nassbearbeitung, auf ausreichende Emulsionszuführung achten  
Wet machining, sufficient emulsion volume required

## HPC01 Rougher 41/44M

### Merkmale und Vorteile

#### Features and benefits

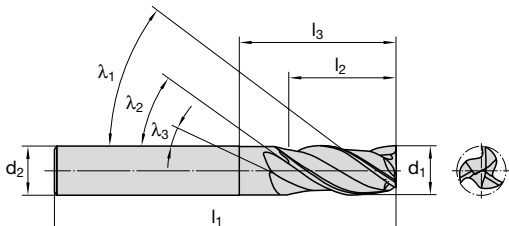


#### Vorteile:

- Min. 10 % höheres Zeitspanvolumen gegenüber der bisherigen Ausführung
- Gesteigerte Prozesssicherheit durch stabile Schneidkanten
- Schwingungsarm auf Grund unterschiedlicher Drallsteigung
- Multifunktional einsetzbar – Schruppen und Schlichten, Nuten fräsen und Ramping mit dem gleichen Werkzeug
- Gute Oberflächenqualität
- Großes Zeitspanvolumen, hohe Vorschübe
- Hohe Standzeit

#### Benefits:

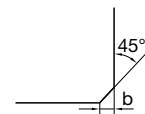
- At least 10 % more machining volume compared with the previous
- Increased process reliability thanks to stable cutting edges
- Low vibration due to variable helix angles
- Multi functional use – roughing and finishing, cutting of slots and ramping – all with one tool
- Excellent surface quality
- Large machining volume from high feed rates
- Longer tool life

|      |                |                |                |                |   | DIN 6535 HA                                                                       |                              | DIN 6535 HB                                                                         |                              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------|----------------|----------------|---|-----------------------------------------------------------------------------------|------------------------------|-------------------------------------------------------------------------------------|------------------------------|
|                                                                                                                                                                                                                                                                                                                                          |                |                |                |                |   |  |                              |  |                              |
| <b>Katalog-Nr. Cat.-No.</b>                                                                                                                                                                                                                                                                                                                                                                                               |                |                |                |                |   | <b>HPC01-U-A</b>                                                                  |                              | <b>HPC01-U-B</b>                                                                    |                              |
| <b>P</b>                                                                                                                                                                                                                                                                                                                                                                                                                  |                |                |                |                |   | ■                                                                                 |                              | ■                                                                                   |                              |
| <b>M</b>                                                                                                                                                                                                                                                                                                                                                                                                                  |                |                |                |                |   | ■                                                                                 |                              | ■                                                                                   |                              |
| <b>K</b>                                                                                                                                                                                                                                                                                                                                                                                                                  |                |                |                |                |   | ■                                                                                 |                              | ■                                                                                   |                              |
| <b>N</b>                                                                                                                                                                                                                                                                                                                                                                                                                  |                |                |                |                |   | ■                                                                                 |                              | ■                                                                                   |                              |
| <b>S</b>                                                                                                                                                                                                                                                                                                                                                                                                                  |                |                |                |                |   | ■                                                                                 |                              | ■                                                                                   |                              |
| <b>H</b>                                                                                                                                                                                                                                                                                                                                                                                                                  |                |                |                |                |   | ■                                                                                 |                              | ■                                                                                   |                              |
| d <sub>1</sub>                                                                                                                                                                                                                                                                                                                                                                                                            | l <sub>2</sub> | l <sub>1</sub> | l <sub>3</sub> | d <sub>2</sub> | z | Ident No.                                                                         | LMT-Code                     | Ident No.                                                                           | LMT-Code                     |
| <b>kurz short</b>                                                                                                                                                                                                                                                                                                                                                                                                         |                |                |                |                |   |                                                                                   |                              |                                                                                     |                              |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                         | 5              | 54             | 8              | 6              | 3 | <a href="#">7432428</a>                                                           | EM-HPC01 U4.0x5/8 3C0.1HA    | <a href="#">7432436</a>                                                             | EM-HPC01 U4.0x5/8 3C0.1HB    |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                         | 6              | 54             | 10             | 6              | 3 | <a href="#">7432429</a>                                                           | EM-HPC01 U5.0x6/10 3C0.15HA  | <a href="#">7432437</a>                                                             | EM-HPC01 U5.0x6/10 3C0.15HB  |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                         | 7              | 54             | 12             | 6              | 3 | <a href="#">7432430</a>                                                           | EM-HPC01 U6.0x7/12 3C0.2HA   | <a href="#">7432438</a>                                                             | EM-HPC01 U6.0x7/12 3C0.2HB   |
| 8                                                                                                                                                                                                                                                                                                                                                                                                                         | 9              | 58             | 16             | 8              | 3 | <a href="#">7432431</a>                                                           | EM-HPC01 U8.0x9/16 3C0.2HA   | <a href="#">7432439</a>                                                             | EM-HPC01 U8.0x9/16 3C0.2HB   |
| 10                                                                                                                                                                                                                                                                                                                                                                                                                        | 11             | 66             | 20             | 10             | 3 | <a href="#">7432432</a>                                                           | EM-HPC01 U10.0x11/20 3C0.2HA | <a href="#">7432440</a>                                                             | EM-HPC01 U10.0x11/20 3C0.2HB |
| 12                                                                                                                                                                                                                                                                                                                                                                                                                        | 12             | 73             | 24             | 12             | 3 | <a href="#">7432433</a>                                                           | EM-HPC01 U12.0x12/24 3C0.2HA | <a href="#">7432441</a>                                                             | EM-HPC01 U12.0x12/24 3C0.2HB |
| 16                                                                                                                                                                                                                                                                                                                                                                                                                        | 16             | 82             | 32             | 16             | 3 | <a href="#">7432434</a>                                                           | EM-HPC01 U16.0x16/32 3C0.3HA | <a href="#">7432442</a>                                                             | EM-HPC01 U16.0x16/32 3C0.3HB |
| 20                                                                                                                                                                                                                                                                                                                                                                                                                        | 20             | 92             | 40             | 20             | 3 | <a href="#">7432435</a>                                                           | EM-HPC01 U20.0x20/40 3C0.3HA | <a href="#">7432443</a>                                                             | EM-HPC01 U20.0x20/40 3C0.3HB |
| <b>lang long</b>                                                                                                                                                                                                                                                                                                                                                                                                          |                |                |                |                |   |                                                                                   |                              |                                                                                     |                              |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                         | 8              | 54             | 12             | 6              | 3 | <a href="#">7432444</a>                                                           | EM-HPC01 U4.0x8/12 3C0.1HA   | <a href="#">7432452</a>                                                             | EM-HPC01 U4.0x8/12 3C0.1HB   |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                         | 10             | 54             | 15             | 6              | 3 | <a href="#">7432445</a>                                                           | EM-HPC01 U5.0x10/15 3C0.15HA | <a href="#">7432453</a>                                                             | EM-HPC01 U5.0x10/15 3C0.15HB |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                         | 13             | 57             | 21             | 6              | 3 | <a href="#">7432446</a>                                                           | EM-HPC01 U6.0x13/21 3C0.2HA  | <a href="#">7432454</a>                                                             | EM-HPC01 U6.0x13/21 3C0.2HB  |
| 8                                                                                                                                                                                                                                                                                                                                                                                                                         | 19             | 63             | 27             | 8              | 3 | <a href="#">7432447</a>                                                           | EM-HPC01 U8.0x19/27 3C0.2HA  | <a href="#">7432455</a>                                                             | EM-HPC01 U8.0x19/27 3C0.2HB  |
| 10                                                                                                                                                                                                                                                                                                                                                                                                                        | 22             | 72             | 32             | 10             | 3 | <a href="#">7432448</a>                                                           | EM-HPC01 U10.0x22/32 3C0.2HA | <a href="#">7432456</a>                                                             | EM-HPC01 U10.0x22/32 3C0.2HB |
| 12                                                                                                                                                                                                                                                                                                                                                                                                                        | 26             | 83             | 38             | 12             | 3 | <a href="#">7432449</a>                                                           | EM-HPC01 U12.0x26/38 3C0.2HA | <a href="#">7432457</a>                                                             | EM-HPC01 U12.0x26/38 3C0.2HB |
| 16                                                                                                                                                                                                                                                                                                                                                                                                                        | 32             | 92             | 44             | 16             | 3 | <a href="#">7432450</a>                                                           | EM-HPC01 U16.0x32/44 3C0.3HA | <a href="#">7432458</a>                                                             | EM-HPC01 U16.0x32/44 3C0.3HB |
| 20                                                                                                                                                                                                                                                                                                                                                                                                                        | 38             | 104            | 54             | 20             | 3 | <a href="#">7432451</a>                                                           | EM-HPC01 U20.0x38/54 3C0.3HA | <a href="#">7432459</a>                                                             | EM-HPC01 U20.0x38/54 3C0.3HB |

■ = Hauptanwendung First choice  
 □ = Nebenanwendung Second choice

Schnittwertempfehlungen ab Seite 34

Cutting data recommendations starting page 34

| Kantenschutzfase<br>Edge protection chamfer                                         | d <sub>1</sub> | b    |
|-------------------------------------------------------------------------------------|----------------|------|
|  | 4              | 0,1  |
|                                                                                     | 5              | 0,15 |
|                                                                                     | 6 – 12         | 0,2  |
|                                                                                     | 14 – 20        | 0,3  |

Der HPC01 Rougher 33/35/37 UNI ist ein 3-schneidiger Fräser. Durch seine großen Spanräume und die sehr gute Spanabfuhr ist er optimal für das Nutenfräsen geeignet. Jede Schneide hat einen anderen Drallwinkel (33°/35°/37°).

Neben dem gesamten Spektrum für rost- und säurebeständige Stähle ist der HPC01 Rougher 33/35/37 UNI auch in der gesamten Stahlbearbeitung einsetzbar.

The HPC01 Rougher 33/35/37 UNI is a 3-flute end mill. It is ideally suited to slot milling work thanks to its large chip spaces and its extremely good chip removal. Each cutting edge has a different helix angle (33°/35°/37°).

Besides the entire range for stainless and acid-resistants steels, the HPC01 Rougher 33/35/37 UNI is also suitable for all steel applications.



## Berechnungsformeln und Vorschubkorrekturfaktoren

### Calculation formula and feed correction factors

| Drehzahl<br>Speed $n$ (min <sup>-1</sup> ):<br>$n = \frac{v_c \cdot 1000}{\pi \cdot d_1}$     | Vorschubkorrektur Feed correction $f_1$ |                         |                                |                               | $v_c$                                   |
|-----------------------------------------------------------------------------------------------|-----------------------------------------|-------------------------|--------------------------------|-------------------------------|-----------------------------------------|
|                                                                                               | $a_e$                                   | $a_p$                   | HPC01-U<br>kurz short<br>$f_1$ | HPC01-U<br>lang long<br>$f_1$ |                                         |
| Vorschubgeschwindigkeit<br>Feed rate $v_f$ (mm/min):<br>$v_f = f_z \cdot Z \cdot n \cdot f_1$ | 0,1 · $d_1$                             | 1 x $d_1$               | 2                              | 1,8                           | um 30 % erhöhen<br>increase by 30 %     |
|                                                                                               |                                         | 1,5 x $d_1$             | –                              | 1,7                           |                                         |
|                                                                                               |                                         | 2 x $d_1$ <sup>1)</sup> | –                              | 1,6                           |                                         |
|                                                                                               | 0,25 · $d_1$                            | 1 x $d_1$               | 2                              | 1,4                           |                                         |
|                                                                                               |                                         | 1,5 x $d_1$             | –                              | 1,3                           |                                         |
|                                                                                               |                                         | 2 x $d_1$ <sup>1)</sup> | –                              | 1,2                           |                                         |
|                                                                                               | 0,5 · $d_1$                             | 1 x $d_1$               | 1,3                            | 1,1                           |                                         |
|                                                                                               |                                         | 1,5 x $d_1$             | –                              | 1                             |                                         |
|                                                                                               |                                         | 2 x $d_1$ <sup>1)</sup> | –                              | 0,8                           |                                         |
|                                                                                               | 0,75 · $d_1$                            | 1 x $d_1$               | 1                              | 0,8                           |                                         |
|                                                                                               |                                         | 1,5 x $d_1$             | –                              | 0,7                           |                                         |
|                                                                                               |                                         | 2 x $d_1$               | –                              | 0,6                           |                                         |
|                                                                                               | 1 · $d_1$                               | 0,5 x $d_1$             | 0,9                            | 0,8                           | um 20 %<br>reduzieren<br>reduce by 20 % |
|                                                                                               |                                         | 1 x $d_1$               | 0,8                            | 0,7                           |                                         |
|                                                                                               |                                         | 1,5 x $d_1$             | –                              | 0,6                           |                                         |

<sup>1)</sup> 1,8 x  $d_1$  für Durchmesser 14, 18, 20  
 1.8 x  $d_1$  for diameter 14, 18, 20

**HPC01 Rougher 33/35/37 UNI**  
**Schnittwertempfehlungen**  
**Cutting data recommendations**

| Werkstoff |                                                                     | Material                                             | Werkstoff-Nr.<br>Material No. | DIN<br>Bezeichnung Alt<br>DIN<br>Description Old | R <sub>m</sub> /UTS<br>(N/mm <sup>2</sup> ) | DIN<br>Bezeichnung Neu<br>DIN<br>Description New |
|-----------|---------------------------------------------------------------------|------------------------------------------------------|-------------------------------|--------------------------------------------------|---------------------------------------------|--------------------------------------------------|
| P         | Unlegierter Baustahl<br>+ Automatenstahl                            | Plain carbon steel<br>+ free cutting steel           | 1.0570                        | St52-3                                           | -700                                        | S355J2G3                                         |
|           |                                                                     |                                                      | 1.1730                        | C45                                              | -800                                        | C45U                                             |
|           |                                                                     |                                                      | 1.0715                        | 9SMn28                                           | -700                                        | 11SMn30                                          |
|           |                                                                     |                                                      | 1.1191                        | Ck45                                             | 500-950                                     | C45E                                             |
|           | Vergütungsstahl,<br>mittelfest                                      | Heat-treatment steel,<br>medium strength             | 1.7219                        | 26CrMo4                                          |                                             | 26CrMo4-2                                        |
|           |                                                                     |                                                      | 1.7225                        | 42CrMo4                                          | 500-950                                     | 42CrMo4                                          |
|           | Stahlguss                                                           | Cast steel                                           | 1.8159                        | 51CrV4                                           |                                             | 51CrV4                                           |
|           |                                                                     |                                                      | 1.0416                        | GS40                                             | -950                                        | GS40                                             |
|           | Einsatzstahl                                                        | Case hardening steel                                 | 1.7131                        | 16MnCr5                                          | -950                                        | 16MnCr5                                          |
|           | Rost- und säurebeständiger<br>Stahl, ferritisch, martensi-<br>tisch | Stainless steel, ferritic,<br>martensitic            | 1.4006                        | X10Cr13                                          | 500-950                                     | X12Cr13                                          |
|           |                                                                     |                                                      | 1.4104                        | X12CrMoS17                                       |                                             | X14CrMoS17                                       |
|           |                                                                     |                                                      | 1.4122                        | X35CrMo17                                        |                                             | X39CrMo17-1                                      |
|           | Vergütungsstahl,<br>hochfest                                        | Heat-treatment steel,<br>high strength               | 1.7225                        | 42CrMo4                                          | 950-1400                                    | 42CrMo4                                          |
|           |                                                                     |                                                      | 1.6580                        | 30CrNiMo8                                        |                                             | 30CrNiMo8                                        |
|           | Nitrierstahl,<br>vergütet                                           | Nitriding steel,<br>heat treated                     | 1.8504                        | 34CrAl6                                          | 950-1400                                    | 34CrAl6                                          |
|           |                                                                     |                                                      | 1.2344                        | X40CrMoV5.1                                      | -900                                        | X40CrMoV5-1                                      |
|           | Werkzeugstahl                                                       | Tool steel                                           | 1.2343                        | X38CrMoV5 1                                      | 950-1400                                    | X37CrMoV5-1                                      |
|           |                                                                     |                                                      | 1.2379                        | X155CrVMo12 1                                    | -950                                        | X153CrMoV12-1                                    |
|           |                                                                     |                                                      | 1.2316                        | X38CrMo16                                        | -1100                                       | X38CrMo16                                        |
|           |                                                                     |                                                      | 1.2358                        | 60CrMoV18-5                                      | 850-1000                                    | 60CrMoV18-5                                      |
|           |                                                                     |                                                      | 1.2080                        | X210Cr12                                         | 950-1400                                    | X210Cr12                                         |
|           |                                                                     |                                                      | 1.2714                        | 55NiCrMoV7                                       | 1100-1350                                   | 55NiCrMoV7                                       |
|           |                                                                     |                                                      | 1.2311                        | 40CrMnMo7                                        | -1100                                       | 40CrMnMo7                                        |
|           |                                                                     |                                                      | 1.2312                        | 40CrMnNiMoS8.6                                   | -1150                                       | 40CrMnNiMoS8-6                                   |
|           |                                                                     |                                                      | 1.2738                        | 45CrMnNiMo8.6.4                                  | 950-1150                                    | 45CrMnNiMo8-6-4                                  |
| M         | Rost- und säurebeständiger<br>Stahl,<br>austenitisch                | Stainless steel,<br>austenitic                       | 1.4301                        | X2CrNiMo17-12-2                                  | 500-950                                     | X5CrNiMo18-10                                    |
|           |                                                                     |                                                      | 1.4404                        | X6CrNiMoTi17-12-2                                |                                             | X2CrNiMo17-12-2                                  |
|           |                                                                     |                                                      | 1.4571                        | X10CrNiMoTi18                                    |                                             | X10CrNiMoTi18                                    |
|           | Rost- und säurebestän-<br>diger Stahl, martensitisch<br>aushärtbar  | Stainless steel,<br>martensitic steel                | 1.2709                        | X3NiCoMoTi18-9-5                                 | 800-1000                                    | X3NiCoMoTi18-9-5                                 |
|           |                                                                     |                                                      | 1.4542                        | X5CrNiCuNb16-4                                   |                                             | X5CrNiCuNb16-4                                   |
| K         | Grauguss                                                            | Grey cast iron                                       | 0.6025                        | GG25                                             | 100-400<br>(120-260 HB)                     | EN-GJL-250                                       |
|           |                                                                     |                                                      | 0.6678                        | GGL-NiCr35 2                                     | 150-250<br>(160-230 HB)                     | EN-GJLA-XNiCr35-2                                |
|           | Sphäroguss                                                          | Nodular cast iron                                    | 0.7060                        | GGG60                                            | 400-800                                     | EN-GJS-600-3                                     |
|           | Temperguss                                                          | Malleable cast iron                                  | 0.7070                        | GGG70L                                           | (120-310 HB)                                | EN-GJS-700-2U                                    |
|           |                                                                     |                                                      | 0.8155                        | GTS55                                            | 350-700<br>(150-280 HB)                     | EN-GJMB-550-4                                    |
| N         | Aluminium-Legierungen,<br>kurzspanend                               | Aluminium alloys,<br>short chipping                  | 3.2581                        | G-AlSi12                                         | -400                                        | G-IGK-AlSi12                                     |
|           | Kupfer-Legierungen,<br>kurzspanend                                  | Copper alloys,<br>short chipping                     | 2.0402                        | MS58                                             | -500                                        | CuZn40Pb2                                        |
| S         | Titan-Legierungen,<br>mittelfest                                    | Titanium alloys,<br>medium strength                  | 3.7115                        | TiAl5Sn2,5                                       | -950                                        | TiAl5Sn2-5                                       |
|           |                                                                     |                                                      | 3.7164                        | TiAl6V4                                          |                                             | Ti6AlV4                                          |
|           | Titan-Legierungen,<br>hochfest                                      | Titanium alloys,<br>high strength                    | 3.7174                        | TiAl6Sn2                                         | 900-1400                                    | TiAl6V6Sn2                                       |
|           | Nickelbasis-Legierungen,<br>mittelfest                              | Nickel based alloys,<br>medium strength              | 2.4670                        | NiCr12Al6MoNb                                    | -950                                        | NiCr12Al6MoNb                                    |
|           | Nickelbasis-Legierungen,<br>hochwarmfest                            | Heat resistant nickel based<br>alloys, high strength | 2.4668                        | NiCr19Fe19NbMo                                   | 900-1400                                    | Inconel 718<br>NiCr19Fe19Nb5Mo3                  |

Die angegebenen Schnittwerte sind Startwerte und müssen auf die vorhandenen Bedingungen abgestimmt werden.  
The cutting data indicated are starting values and must be adjusted to the prevailing conditions.

Vorschub-Korrektur-Faktoren  $f_1$  siehe Seite 33  
Feed correction factor  $f_1$  see page 33

|                                                                                     | Kühlung<br>Coolant                                                                  | Schnitt-<br>geschwindigkeit<br>Cutting speed<br>$v_c$ (m/min) | Fräserdurchmesser Cutting diameter<br>(mm)        |      |      |      |      |      |       |       |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------|---------------------------------------------------|------|------|------|------|------|-------|-------|
|                                                                                     |                                                                                     |                                                               | Vorschub pro Zahn Feed per tooth<br>$f_z$ (mm/z.) |      |      |      |      |      |       |       |
|                                                                                     |                                                                                     |                                                               | 4                                                 | 5    | 6    | 8    | 10   | 12   | 14-16 | 18-20 |
|    |    | 230                                                           | 0,04                                              | 0,06 | 0,07 | 0,09 | 0,11 | 0,13 | 0,18  | 0,22  |
|                                                                                     |    | 230                                                           | 0,04                                              | 0,06 | 0,07 | 0,09 | 0,11 | 0,13 | 0,18  | 0,22  |
|                                                                                     |    | 200                                                           | 0,04                                              | 0,05 | 0,06 | 0,08 | 0,10 | 0,12 | 0,16  | 0,20  |
|                                                                                     |    | 160                                                           | 0,04                                              | 0,05 | 0,06 | 0,08 | 0,10 | 0,12 | 0,16  | 0,20  |
|                                                                                     |    | 130                                                           | 0,03                                              | 0,04 | 0,05 | 0,07 | 0,09 | 0,10 | 0,14  | 0,17  |
|                                                                                     |    | 160                                                           | 0,04                                              | 0,05 | 0,06 | 0,08 | 0,10 | 0,12 | 0,16  | 0,20  |
|                                                                                     |    | 140                                                           | 0,03                                              | 0,04 | 0,05 | 0,06 | 0,08 | 0,09 | 0,12  | 0,15  |
|                                                                                     |    | 120                                                           | 0,03                                              | 0,04 | 0,05 | 0,06 | 0,08 | 0,09 | 0,12  | 0,15  |
|                                                                                     |    | 110                                                           | 0,03                                              | 0,04 | 0,05 | 0,06 | 0,08 | 0,09 | 0,12  | 0,15  |
|                                                                                     |    | 100                                                           | 0,03                                              | 0,04 | 0,04 | 0,06 | 0,07 | 0,08 | 0,11  | 0,14  |
|  |  | 100                                                           | 0,02                                              | 0,03 | 0,03 | 0,04 | 0,05 | 0,06 | 0,08  | 0,10  |
|                                                                                     |  | 120                                                           | 0,03                                              | 0,03 | 0,04 | 0,05 | 0,07 | 0,08 | 0,10  | 0,13  |
|  |  | 180                                                           | 0,06                                              | 0,07 | 0,08 | 0,11 | 0,14 | 0,17 | 0,22  | 0,28  |
|                                                                                     |  | 160                                                           | 0,05                                              | 0,06 | 0,07 | 0,10 | 0,12 | 0,14 | 0,19  | 0,24  |
|                                                                                     |  | 150                                                           | 0,04                                              | 0,06 | 0,07 | 0,09 | 0,11 | 0,13 | 0,18  | 0,22  |
|                                                                                     |  | 120                                                           | 0,04                                              | 0,06 | 0,07 | 0,09 | 0,11 | 0,13 | 0,18  | 0,22  |
|  |  | 300                                                           | 0,05                                              | 0,06 | 0,08 | 0,10 | 0,13 | 0,15 | 0,20  | 0,25  |
|                                                                                     |  | 250                                                           | 0,04                                              | 0,05 | 0,06 | 0,08 | 0,10 | 0,12 | 0,16  | 0,20  |
|  |  | 80                                                            | 0,03                                              | 0,03 | 0,04 | 0,05 | 0,07 | 0,08 | 0,10  | 0,13  |
|                                                                                     |  | 60                                                            | 0,02                                              | 0,03 | 0,03 | 0,04 | 0,05 | 0,06 | 0,08  | 0,10  |
|                                                                                     |  | 40                                                            | 0,03                                              | 0,03 | 0,04 | 0,05 | 0,07 | 0,08 | 0,10  | 0,13  |
|                                                                                     |  | 30                                                            | 0,02                                              | 0,03 | 0,03 | 0,04 | 0,05 | 0,06 | 0,08  | 0,10  |

 Trockenbearbeitung, Pressluftkühlung ist vorteilhaft  
Dry machining, air-blast cooling is advantageous

 Nassbearbeitung, auf ausreichende Emulsionszuführung achten  
Wet machining, sufficient emulsion volume required

**HPC01 Rougher 35/38 H**  
**High Performance Cutter für gehärtete Stähle ≤ 55 HRC**  
**High Performance Cutter for hard materials ≤ 55 HRC**

| <div> <div>DIN 6527L</div> <div></div> <div></div> <div>LCHP 20M</div> <div></div> </div> |                |                |                |                |                              |   | DIN 6535 HA             |                              | DIN 6535 HB             |                              |
|-------------------------------------------------------------------------------------------|----------------|----------------|----------------|----------------|------------------------------|---|-------------------------|------------------------------|-------------------------|------------------------------|
|                                                                                           |                |                |                |                |                              |   |                         |                              |                         |                              |
| <b>Katalog-Nr. Cat.-No.</b>                                                               |                |                |                |                |                              |   | <b>HPC01-H-A</b>        |                              | <b>HPC01-H-B</b>        |                              |
| <b>P</b>                                                                                  |                |                |                |                |                              |   | ■                       |                              | ■                       |                              |
| <b>M</b>                                                                                  |                |                |                |                |                              |   |                         |                              |                         |                              |
| <b>K</b>                                                                                  |                |                |                |                |                              |   | □                       |                              | □                       |                              |
| <b>N</b>                                                                                  |                |                |                |                |                              |   |                         |                              |                         |                              |
| <b>S</b>                                                                                  |                |                |                |                |                              |   |                         |                              |                         |                              |
| <b>H</b>                                                                                  |                |                |                |                |                              |   | ■                       |                              | ■                       |                              |
| d <sub>1</sub>                                                                            | l <sub>2</sub> | l <sub>1</sub> | l <sub>3</sub> | d <sub>2</sub> | R <sub>theo</sub><br>(+ 0,1) | z | Ident No.               | LMT-Code                     | Ident No.               | LMT-Code                     |
| <b>kurz short</b>                                                                         |                |                |                |                |                              |   |                         |                              |                         |                              |
| 6                                                                                         | 7              | 54             | 16             | 6              | 0,5                          | 4 | <a href="#">7429426</a> | EM-HPC01 H6.0x7/16 4R0.5HA   | <a href="#">7429435</a> | EM-HPC01 H6.0x7/16 4R0.5HB   |
| 8                                                                                         | 9              | 58             | 20             | 8              | 0,5                          | 4 | <a href="#">7429427</a> | EM-HPC01 H8.0x9/20 4R0.5HA   | <a href="#">7429436</a> | EM-HPC01 H8.0x9/20 4R0.5HB   |
| 10                                                                                        | 11             | 66             | 24             | 10             | 0,5                          | 4 | <a href="#">7429428</a> | EM-HPC01 H10.0x11/24 4R0.5HA | <a href="#">7429437</a> | EM-HPC01 H10.0x11/24 4R0.5HB |
| 12                                                                                        | 12             | 73             | 26             | 12             | 0,5                          | 4 | <a href="#">7429429</a> | EM-HPC01 H12.0x12/26 4R0.5HA | <a href="#">7429438</a> | EM-HPC01 H12.0x12/26 4R0.5HB |
| 12                                                                                        | 12             | 73             | 26             | 12             | 1                            | 4 | <a href="#">7429430</a> | EM-HPC01 H12.0x12/26 4R1.0HA | <a href="#">7429439</a> | EM-HPC01 H12.0x12/26 4R1.0HB |
| 16                                                                                        | 16             | 82             | 32             | 16             | 0,5                          | 4 | <a href="#">7429431</a> | EM-HPC01 H16.0x16/32 4R0.5HA | <a href="#">7429440</a> | EM-HPC01 H16.0x16/32 4R0.5HB |
| 16                                                                                        | 16             | 82             | 32             | 16             | 1                            | 4 | <a href="#">7429432</a> | EM-HPC01 H16.0x16/32 4R1.0HA | <a href="#">7429441</a> | EM-HPC01 H16.0x16/32 4R1.0HB |
| 20                                                                                        | 20             | 92             | 40             | 20             | 0,5                          | 4 | <a href="#">7429433</a> | EM-HPC01 H20.0x20/40 4R0.5HA | <a href="#">7429442</a> | EM-HPC01 H20.0x20/40 4R0.5HB |
| 20                                                                                        | 20             | 92             | 40             | 20             | 1                            | 4 | <a href="#">7429434</a> | EM-HPC01 H20.0x20/40 4R1.0HA | <a href="#">7429443</a> | EM-HPC01 H20.0x20/40 4R1.0HB |
| <b>lang long</b>                                                                          |                |                |                |                |                              |   |                         |                              |                         |                              |
| 6                                                                                         | 15             | 57             | 21             | 6              | 0,5                          | 4 | <a href="#">7429444</a> | EM-HPC01 H6.0x15/21 4R0.5HA  | <a href="#">7429453</a> | EM-HPC01 H6.0x15/21 4R0.5HB  |
| 8                                                                                         | 20             | 63             | 27             | 8              | 0,5                          | 4 | <a href="#">7429445</a> | EM-HPC01 H8.0x20/27 4R0.5HA  | <a href="#">7429454</a> | EM-HPC01 H8.0x20/27 4R0.5HB  |
| 10                                                                                        | 25             | 72             | 32             | 10             | 0,5                          | 4 | <a href="#">7429446</a> | EM-HPC01 H10.0x25/32 4R0.5HA | <a href="#">7429455</a> | EM-HPC01 H10.0x25/32 4R0.5HB |
| 12                                                                                        | 30             | 83             | 38             | 12             | 0,5                          | 4 | <a href="#">7429447</a> | EM-HPC01 H12.0x30/38 4R0.5HA | <a href="#">7429456</a> | EM-HPC01 H12.0x30/38 4R0.5HB |
| 12                                                                                        | 30             | 83             | 38             | 12             | 1                            | 4 | <a href="#">7429448</a> | EM-HPC01 H12.0x30/38 4R1.0HA | <a href="#">7429457</a> | EM-HPC01 H12.0x30/38 4R1.0HB |
| 16                                                                                        | 35             | 92             | 44             | 16             | 0,5                          | 4 | <a href="#">7429449</a> | EM-HPC01 H16.0x35/44 4R0.5HA | <a href="#">7429458</a> | EM-HPC01 H16.0x35/44 4R0.5HB |
| 16                                                                                        | 35             | 92             | 44             | 16             | 1                            | 4 | <a href="#">7429450</a> | EM-HPC01 H16.0x35/44 4R1.0HA | <a href="#">7429459</a> | EM-HPC01 H16.0x35/44 4R1.0HB |
| 20                                                                                        | 44             | 104            | 54             | 20             | 0,5                          | 4 | <a href="#">7429451</a> | EM-HPC01 H20.0x44/54 4R0.5HA | <a href="#">7429460</a> | EM-HPC01 H20.0x44/54 4R0.5HB |
| 20                                                                                        | 44             | 104            | 54             | 20             | 1                            | 4 | <a href="#">7429452</a> | EM-HPC01 H20.0x44/54 4R1.0HA | <a href="#">7429461</a> | EM-HPC01 H20.0x44/54 4R1.0HB |

Schnittwertempfehlungen ab Seite 38  
 Cutting data recommendations starting page 38

■ = Hauptanwendung First choice  
 □ = Nebenanwendung Second choice





# **HPC01 Rougher 35/38 H** **Schnittwertempfehlungen** **Cutting data recommendations**

| Werkstoff | Material                        | Werkstoff-Nr.<br>Material No.    | DIN<br>Bezeichnung Alt<br>DIN<br>Description Old | R <sub>m</sub> /UTS<br>(N/mm <sup>2</sup> ) | DIN<br>Bezeichnung Neu<br>DIN<br>Description New |
|-----------|---------------------------------|----------------------------------|--------------------------------------------------|---------------------------------------------|--------------------------------------------------|
| <b>P</b>  | Nitrier- und<br>Vergütungsstahl | Nitriding steel,<br>heat treated | 1.7225                                           | 42CrMo4                                     | 950–1400                                         |
|           |                                 |                                  | 1.2344                                           | X40CrMoV5.1                                 | –900                                             |
|           |                                 |                                  | 1.4104                                           | X12CrMoS17                                  | 500–950                                          |
|           |                                 |                                  | 1.8504                                           | 34CrAl6                                     | 950–1400                                         |
|           | Werkzeugstahl                   | Tool steel                       | 1.2343                                           | X38CrMoV5 1                                 | 950–1400                                         |
|           |                                 |                                  | 1.6580                                           | 30CrNiMo8                                   | 950–1400                                         |
|           |                                 |                                  | 1.2379                                           | X155CrVMo12 1                               | –950                                             |
|           |                                 |                                  | 1.2080                                           | X210Cr12                                    | 950–1400                                         |
|           |                                 |                                  | 1.2311                                           | 40CrMnMo7                                   | –1100                                            |
|           |                                 |                                  | 1.2312                                           | 40CrMnNiMoS8.6                              | –1150                                            |
|           |                                 |                                  | 1.2738                                           | 45CrMnNiMo8.6.4                             | 950–1150                                         |
|           |                                 |                                  | 1.2358                                           | 60CrMoV18-5                                 | 850–1000                                         |
|           |                                 |                                  | 1.2714                                           | 55NiCrMoV7                                  | 1100–1350                                        |
| <b>K</b>  | Grauguss                        | Grey cast iron                   | 0.6025                                           | GG25                                        | 100–400<br>(120–260 HB)                          |
|           | Legierter Grauguss              | Alloyed grey cast iron           | 0.6678                                           | GGL-NiCr35 2                                | 150–250<br>(160–230 HB)                          |
|           | Sphäroguss                      | Nodular cast iron                | 0.7060<br>0.7070                                 | GGG60<br>GGG70L                             | 400–800<br>(120–310 HB)                          |
|           | Temperguss                      | Malleable cast iron              | 0.8155                                           | GTS55                                       | 350–700<br>(150–280 HB)                          |
| <b>H</b>  | Hartguss                        | Chilled cast iron                |                                                  | Ni-hard, Ampco                              | 300–600 HB                                       |
|           | Gehärteter Stahl                | Hardened steel                   |                                                  | Sleipner, Toolox                            | 45–49 HRC                                        |
|           |                                 |                                  |                                                  | Dievar                                      | 50–53 HRC                                        |
|           |                                 |                                  |                                                  | Vandis, Sverker                             | 54–55 HRC                                        |

Die angegebenen Schnittwerte sind Startwerte und müssen auf die vorhandenen Bedingungen abgestimmt werden.  
The cutting data indicated are starting values and must be adjusted to the prevailing conditions.

## **Berechnungsformeln und Vorschubkorrekturfaktoren** **Calculation formula and feed correction factors**

| Drehzahl<br>Speed $n$ (min <sup>-1</sup> ):<br>$n = \frac{v_c \cdot 1000}{\pi \cdot d_1}$<br><br>Vorschubgeschwindigkeit<br>Feed rate $v_f$ (mm/min):<br>$v_f = f_z \cdot z \cdot n \cdot f_1$<br><br>$a_e$ = Schnittbreite Width of cut in mm<br>$a_p$ = Schnitttiefe Depth of cut in mm<br>$d_1$ = Durchmesser Cutter diameter in mm<br>$f_1$ = Korrekturfaktor für Correction factor $v_f$<br>$f_z$ = Vorschub pro Zahn Feed per tooth in mm<br>$n$ = Drehzahl Speed in min <sup>-1</sup><br>$v_f$ = Vorschubgeschwindigkeit Feed rate in mm/min<br>$z$ = Anzahl der Schneiden No. of teeth | Vorschubkorrektur Feed correction $f_1$ |             |                                |                               |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-------------|--------------------------------|-------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | $a_e$                                   | $a_p$       | HPC01-H<br>kurz short<br>$f_1$ | HPC01-H<br>lang long<br>$f_1$ |
| 0,1 · $d_1$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1 x $d_1$                               | 1,5 x $d_1$ | 2                              | 1,8                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         | 2 x $d_1$   | –                              | 1,6                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         | 2 x $d_1$   | –                              | 1,4                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 0,25 · $d_1$                            | 1 x $d_1$   | 1,9                            | 1,4                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         | 1,5 x $d_1$ | –                              | 1,2                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         | 2 x $d_1$   | –                              | 1                             |
| 0,5 · $d_1$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1 x $d_1$                               | 1,5 x $d_1$ | 1,4                            | 1                             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         | 2 x $d_1$   | –                              | 0,8                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         | 2 x $d_1$   | –                              | 0,6                           |
| 0,75 · $d_1$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1 x $d_1$                               | 1,5 x $d_1$ | 0,9                            | 0,6                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         | 2 x $d_1$   | –                              | 0,5                           |
| 1 · $d_1$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0,5 x $d_1$                             | 1 x $d_1$   | 0,7                            | 0,6                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         | 1 x $d_1$   | 0,6                            | 0,5                           |

Trockenbearbeitung, auf ausreichende Pressluftzuführung achten. Nutenbearbeitung mit ausreichend Pressluftzufuhr um Spänestau zu vermeiden.  
Dry machining, mind sufficient air-blast cooling. Slot milling, sufficient air-blast cooling avoids chip congestion

|  | Schnittgeschwindigkeit<br>Cutting speed<br>$v_c$ (m/min) | Fräserdurchmesser Cutting diameter<br>(mm)        |           |           |
|--|----------------------------------------------------------|---------------------------------------------------|-----------|-----------|
|  |                                                          | Vorschub pro Zahn Feed per tooth<br>$f_z$ (mm/z.) |           |           |
|  |                                                          | Ø 6–8                                             | Ø 10–12   | Ø 16–20   |
|  | 120–140                                                  | 0,04–0,06                                         | 0,06–0,08 | 0,15–0,18 |
|  | 120–140                                                  | 0,04–0,06                                         | 0,06–0,08 | 0,15–0,18 |
|  | 120–140                                                  | 0,04–0,06                                         | 0,06–0,08 | 0,15–0,18 |
|  | 120–140                                                  | 0,04–0,06                                         | 0,06–0,08 | 0,15–0,18 |
|  | 100–120                                                  | 0,03–0,05                                         | 0,05–0,08 | 0,12–0,15 |
|  | 120–140                                                  | 0,03–0,05                                         | 0,05–0,08 | 0,12–0,15 |
|  | 100–120                                                  | 0,03–0,05                                         | 0,05–0,08 | 0,12–0,15 |
|  | 100–120                                                  | 0,03–0,05                                         | 0,05–0,08 | 0,12–0,15 |
|  | 120–140                                                  | 0,03–0,05                                         | 0,05–0,08 | 0,12–0,15 |
|  | 140–160                                                  | 0,03–0,05                                         | 0,05–0,08 | 0,12–0,15 |
|  | 120–140                                                  | 0,03–0,05                                         | 0,05–0,08 | 0,12–0,15 |
|  | 100–120                                                  | 0,03–0,05                                         | 0,05–0,08 | 0,12–0,15 |
|  | 100–120                                                  | 0,03–0,05                                         | 0,05–0,08 | 0,12–0,15 |
|  | 180–220                                                  | 0,09–0,12                                         | 0,15–0,18 | 0,22–0,28 |
|  | 160–180                                                  | 0,08–0,11                                         | 0,13–0,16 | 0,20–0,26 |
|  | 150–180                                                  | 0,07–0,10                                         | 0,12–0,14 | 0,19–0,24 |
|  | 120–150                                                  | 0,07–0,10                                         | 0,12–0,14 | 0,19–0,24 |
|  | 80–100                                                   | 0,01–0,02                                         | 0,02–0,03 | 0,04–0,05 |
|  | 100–120                                                  | 0,02–0,03                                         | 0,04–0,05 | 0,08–0,10 |
|  | 80–100                                                   | 0,01–0,02                                         | 0,02–0,03 | 0,06–0,08 |
|  | 80                                                       | 0,01–0,02                                         | 0,02–0,03 | 0,05–0,06 |

Die AMC-Werkzeuge von LMT Onsrud sind herausragend abgestimmt auf die Bearbeitung von Aluminium Legierungen jeder Art. Mit der Zirkonium-Nitrid-Beschichtung erreichen sie außerordentlich hohe Standzeiten bei gleichbeliebender Oberflächenqualität des Bauteils.

The AMC Tools from LMT Onsrud are perfectly fit to the machining of all kinds of aluminium alloys. With our zirconium nitride coating you will reach outstanding high tool life with equal surface quality of the machined part.

**Die Werkzeuge:**

- 2-Schneider im Durchmesserbereich 3–20 mm
- 3-Schneider im Durchmesserbereich 3–20 mm unbeschichtet und ZRN beschichtet
- 2-schneidiger Radiuskopierfräser
- 37° Spiralwinkel
- Schneidentoleranz h6
- Schaft nach DIN 6535 HA

**The Tools:**

- 2-flute cutter diameter range 3–20 mm
- 3-flute cutter diameter range 3–20 mm uncoated and ZRN coated
- 2-flute ball nose end mills
- 37° helix angle
- Cutting edge tolerance h6
- Shank according to DIN 6535 HA

**Die Anwendung:**

- Hauptanwendung ISO-N
- Zum Schruppen und Schlichten
- Seitliches Fräsen, Vollnuten, Taschenfräsen, Schräg eintauchen, Plungen und Konturenfräsen

**The Application:**

- First choice ISO-N
- For roughing and finishing
- Side milling, slot milling, pocket milling, plunge milling (inclined and straight) and contour milling

Einsetzbar im Allgemeinen Maschinenbau, der Luft und Raumfahrt und überall dort, wo Aluminium zerspant wird.

Applicable in the sectors of General machining, Aerospace and everywhere where aluminium has to be machined.



**Ihre Vorteile:**

- Längere Schneide von 2–3 mm im Vergleich zu Standard Werkzeugen dieser Art mit einer Länge nach DIN 6527 L
- Perfekte Oberflächen und damit weniger Nacharbeit beim Freiformfräsen mit dem Radiuskopierfräser
- Lange Standzeiten und weniger Aufbauschneidenbildung durch die ZRN-Beschichtung
- Genaute Toleranzen durch die Schneidenausführung h6
- Bessere Oberflächengüten am Taschenboden dank modifizierter Schneidenausführung

**Your Advantages:**

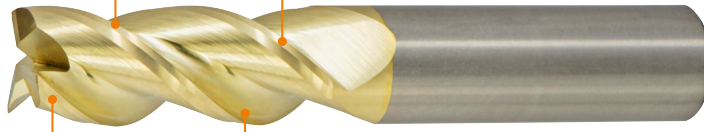
- Longer cutting edge length of 2–3 mm in comparison to standard tools with a length according to DIN 6527 L
- Perfect surfaces and thereby less reworking when milling free-form surfaces with the radius copy-cutter
- Long tool life and less risk of built-up edges through the ZRN coating
- Most exact tolerances through the cutting edge form h6.
- Higher surface quality at the pocket bottom due to latest cutting edge design

ZRN-Beschichtung  
 gegen Aufbauschneide  
 ZRN coating against  
 built-up edges

+ 3 mm mehr Schneidenlänge  
 + 3 mm more cutting length

Bestätigte AMC-Geometrie  
 Proven AMC geometry

Polierte Spankammern für besseren Spänetransport  
 Polished chip spaces for improved chip removal



## Anwendungsbeispiel Application example



**Maschinenbau, Freiformfläche**  
 General machining, free-form surface

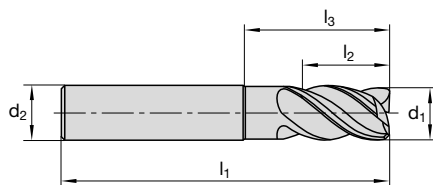
**Werkzeug Tool:**  
 AMC Radiuskopierfräser AMC Radius copy-cutter  
 EM-AMC01 N20.0x30/53 2BHA  
 $d_1 = 20 \text{ mm}$ ,  $z = 2$   
 unbeschichtet uncoated

**Schneidstoff Cutting material:**  
 LWN30W

**Werkstoff Material:**  
 AlCuMg2, 3.1355

**Schnittwerte Cutting data:**  
 $v_c = 1195 \text{ m/min}$        $v_f = 6850 \text{ mm/min}$   
 $n = 19000 \text{ min}^{-1}$        $a_e = 0,4 \text{ mm}$   
 $f_z = 0,18 \text{ mm}$        $a_p = 0,5 \text{ mm}$

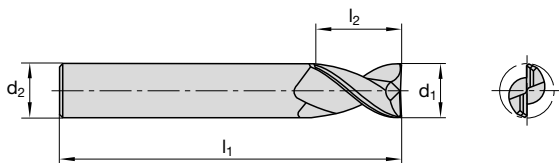
**Ergebnis Result:**  
 Extrem hochwertige und gute Oberfläche ohne Risse und  
 Schlieren.  
 Extremely high surface quality without cracks or flow marks.



Schnittwertempfehlungen ab Seite 46  
Cutting data recommendations starting page 46

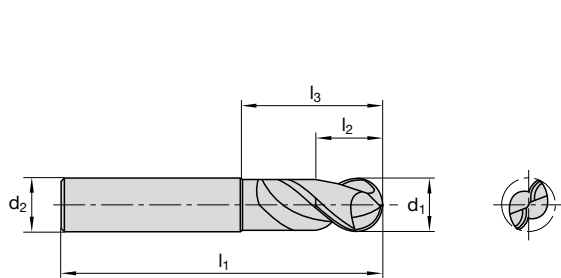
■ = Hauptanwendung First choice  
□ = Nebenanwendung Second choice





Schnittwertempfehlungen ab Seite 46  
Cutting data recommendations starting page 46

■ = Hauptanwendung First choice  
□ = Nebenanwendung Second choice



Schnittwertempfehlungen ab Seite 46  
Cutting data recommendations starting page 46

■ = Hauptanwendung First choice  
□ = Nebenanwendung Second choice



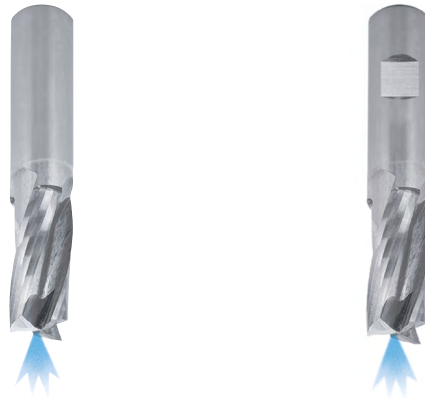
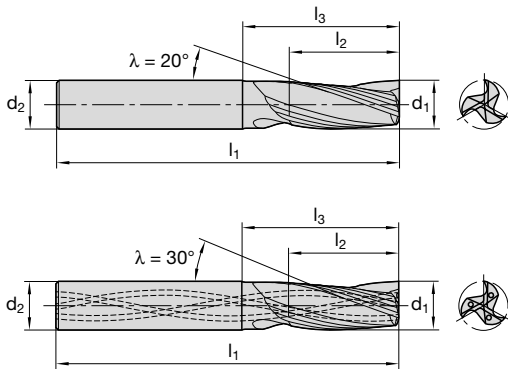
| Werkstoff |                                       | Material                            | Werkstoff-Nr.<br>Material No. | DIN<br>Bezeichnung Alt<br>DIN<br>Description Old | R <sub>m</sub> /UTS<br>(N/mm <sup>2</sup> ) | DIN<br>Bezeichnung Neu<br>DIN<br>Description New |
|-----------|---------------------------------------|-------------------------------------|-------------------------------|--------------------------------------------------|---------------------------------------------|--------------------------------------------------|
| N         | Aluminium-Legierungen,<br>kurzspanend | Aluminium alloys,<br>short chipping | 3.2581                        | G-AlSi12                                         | –400                                        | G-IGK-AlSi12                                     |
|           | Aluminium-Legierungen,<br>langspanend | Aluminium alloys,<br>long chipping  | 3.3535<br>3.4365              | AlMg3<br>AlZnMgCu1,5                             | 100–400                                     | AlMg3<br>AlZnMgCu1,5                             |
|           | Kupfer-Legierungen,<br>kurzspanend    | Copper alloys,<br>short chipping    | 2.0402                        | MS58                                             | –500                                        | CuZn40Pb2                                        |
|           | Kupfer-Legierungen,<br>langspanend    | Copper alloys,<br>long chipping     | 2.0320<br>2.0975              | MS63<br>CuAl10Ni                                 | 150–250                                     | CuZn37<br>CuAl10Fe5Ni5-C                         |
|           | Magnesium-Legierungen                 | Magnesium alloys                    | 3.5912                        | G-MgAl9Zn1                                       | 200–300                                     | G-MgAl9Zn1                                       |



|  | Schnitt-<br>geschwindigkeit<br>Cutting speed<br>$v_c$ (m/min) | Eingriffs-<br>breite<br>Cutting<br>width<br>$a_e$ (mm) | Fräserdurchmesser Cutting diameter<br>(mm)        |            |            |            |           |           |           |           |           |
|--|---------------------------------------------------------------|--------------------------------------------------------|---------------------------------------------------|------------|------------|------------|-----------|-----------|-----------|-----------|-----------|
|  |                                                               |                                                        | Vorschub pro Zahn Feed per tooth<br>$f_z$ (mm/z.) |            |            |            |           |           |           |           |           |
|  |                                                               |                                                        | 3                                                 | 4          | 5          | 6          | 8         | 10        | 12        | 16        | 20        |
|  | 220                                                           | 1 x $d_1$                                              | 0,025–0,04                                        | 0,025–0,05 | 0,03–0,06  | 0,04–0,09  | 0,05–0,12 | 0,06–0,14 | 0,08–0,18 | 0,1–0,25  | 0,13–0,29 |
|  | 300                                                           | 0,33 x $d_1$                                           |                                                   |            |            |            |           |           |           |           |           |
|  | 430                                                           | 0,1 x $d_1$                                            |                                                   |            |            |            |           |           |           |           |           |
|  | 250                                                           | 0,05 x $d_1$                                           |                                                   |            |            |            |           |           |           |           |           |
|  | 250                                                           | 1 x $d_1$                                              | 0,03–0,05                                         | 0,03–0,06  | 0,035–0,08 | 0,05–0,1   | 0,06–0,13 | 0,07–0,15 | 0,09–0,21 | 0,12–0,27 | 0,14–0,3  |
|  | 360                                                           | 0,33 x $d_1$                                           |                                                   |            |            |            |           |           |           |           |           |
|  | 610                                                           | 0,1 x $d_1$                                            |                                                   |            |            |            |           |           |           |           |           |
|  | 300                                                           | 0,05 x $d_1$                                           |                                                   |            |            |            |           |           |           |           |           |
|  | 150                                                           | 1 x $d_1$                                              | 0,03–0,06                                         | 0,03–0,08  | 0,04–0,09  | 0,01–0,011 | 0,06–0,13 | 0,08–0,18 | 0,1–0,23  | 0,13–0,29 | 0,15–0,33 |
|  | 200                                                           | 0,33 x $d_1$                                           |                                                   |            |            |            |           |           |           |           |           |
|  | 280                                                           | 0,1 x $d_1$                                            |                                                   |            |            |            |           |           |           |           |           |
|  | 200                                                           | 0,05 x $d_1$                                           |                                                   |            |            |            |           |           |           |           |           |
|  | 150                                                           | 1 x $d_1$                                              | 0,02–0,04                                         | 0,025–0,05 | 0,03–0,06  | 0,04–0,09  | 0,05–0,11 | 0,06–0,14 | 0,08–0,18 | 0,11–0,25 | 0,13–0,29 |
|  | 200                                                           | 0,33 x $d_1$                                           |                                                   |            |            |            |           |           |           |           |           |
|  | 280                                                           | 0,1 x $d_1$                                            |                                                   |            |            |            |           |           |           |           |           |
|  | 200                                                           | 0,05 x $d_1$                                           |                                                   |            |            |            |           |           |           |           |           |
|  | 150                                                           | 1 x $d_1$                                              | 0,03–0,06                                         | 0,03–0,08  | 0,04–0,09  | 0,05–0,11  | 0,05–0,13 | 0,08–0,18 | 0,1–0,23  | 0,13–0,29 | 0,15–0,34 |
|  | 180                                                           | 0,33 x $d_1$                                           |                                                   |            |            |            |           |           |           |           |           |
|  | 250                                                           | 0,1 x $d_1$                                            |                                                   |            |            |            |           |           |           |           |           |
|  | 180                                                           | 0,05 x $d_1$                                           |                                                   |            |            |            |           |           |           |           |           |







| Katalog-Nr. Cat.-No.                                               |                |                |                |                |   | 1571                    |                       | 1572                    |                       |
|--------------------------------------------------------------------|----------------|----------------|----------------|----------------|---|-------------------------|-----------------------|-------------------------|-----------------------|
| P                                                                  |                |                |                |                |   |                         |                       |                         |                       |
| M                                                                  |                |                |                |                |   |                         |                       |                         |                       |
| K                                                                  |                |                |                |                |   |                         |                       |                         |                       |
| N                                                                  |                |                |                |                |   | ■                       |                       | ■                       |                       |
| S                                                                  |                |                |                |                |   |                         |                       |                         |                       |
| H                                                                  |                |                |                |                |   |                         |                       |                         |                       |
| d <sub>1</sub>                                                     | l <sub>2</sub> | l <sub>1</sub> | l <sub>3</sub> | d <sub>2</sub> | z | Ident No.               | LMT-Code              | Ident No.               | LMT-Code              |
| <b>lang long</b>                                                   |                |                |                |                |   |                         |                       |                         |                       |
| <b>ohne zentrale Innenkühlung without internal coolant λ = 20°</b> |                |                |                |                |   |                         |                       |                         |                       |
| 4                                                                  | 11             | 57             | 21             | 6              | 2 | <a href="#">1121971</a> | EM-ASH 4x11/21 2SA    | <a href="#">1121975</a> | EM-ASH 4x11/21 2SB    |
| 5                                                                  | 13             | 57             | 21             | 6              | 2 | <a href="#">1121972</a> | EM-ASH 5x13/21 2SA    | <a href="#">1121976</a> | EM-ASH 5x13/21 2SB    |
| 6                                                                  | 13             | 57             | 21             | 6              | 2 | <a href="#">1121973</a> | EM-ASH 6x13/21 2SA    | <a href="#">1121977</a> | EM-ASH 6x13/21 2SB    |
| 8                                                                  | 19             | 63             | 27             | 8              | 2 | <a href="#">1121909</a> | EM-ASH 8x19/27 2SA    | <a href="#">1121918</a> | EM-ASH 8x19/27 2SB    |
| 10                                                                 | 22             | 72             | 32             | 10             | 2 | <a href="#">1121910</a> | EM-ASH 10x22/32 2SA   | <a href="#">1121919</a> | EM-ASH 10x22/32 2SB   |
| 12                                                                 | 26             | 83             | 38             | 12             | 3 | <a href="#">1121911</a> | EM-ASH 12x26/38 3SA   | <a href="#">1121920</a> | EM-ASH 12x26/38 3SB   |
| 14                                                                 | 26             | 83             | 38             | 14             | 3 | <a href="#">1121912</a> | EM-ASH 14x26/38 3SA   | <a href="#">1121921</a> | EM-ASH 14x26/38 3SB   |
| 16                                                                 | 32             | 92             | 44             | 16             | 3 | <a href="#">1121913</a> | EM-ASH 16x32/44 3SA   | <a href="#">1121922</a> | EM-ASH 16x32/44 3SB   |
| 18                                                                 | 32             | 92             | 44             | 18             | 3 | <a href="#">1121916</a> | EM-ASH 18x32/44 3SA   | <a href="#">1121924</a> | EM-ASH 18x32/44 3SB   |
| 20                                                                 | 38             | 104            | 54             | 20             | 3 | <a href="#">1121917</a> | EM-ASH 20x38/54 3SA   | <a href="#">1121925</a> | EM-ASH 20x38/54 3SB   |
| 25                                                                 | 45             | 121            | 65             | 25             | 3 | <a href="#">1121974</a> | EM-ASH 25x45/65 3SA   | <a href="#">1121979</a> | EM-ASH 25x45/65 3SB   |
| <b>mit zentraler Innenkühlung with internal coolant λ = 30°</b>    |                |                |                |                |   |                         |                       |                         |                       |
| 12                                                                 | 26             | 83             | 38             | 12             | 3 | 1110002                 | EM-ASH 12x26/38 3SA-I | <a href="#">1110008</a> | EM-ASH 12x26/38 3SB-I |
| 16                                                                 | 32             | 92             | 44             | 16             | 3 | <a href="#">1110003</a> | EM-ASH 16x32/44 3SA-I | <a href="#">1110009</a> | EM-ASH 16x32/44 3SB-I |
| 20                                                                 | 38             | 104            | 54             | 20             | 3 | 1110004                 | EM-ASH 20x38/54 3SA-I | <a href="#">1110010</a> | EM-ASH 20x38/54 3SB-I |

Schnittwertempfehlungen ab Seite 50  
Cutting data recommendations starting page 50

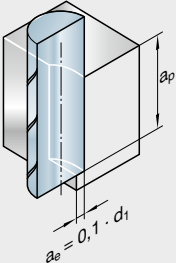
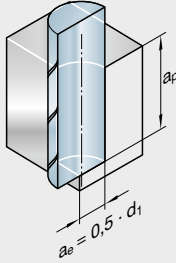
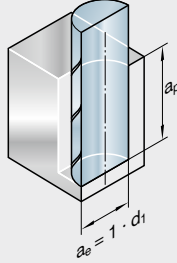
■ = Hauptanwendung First choice  
□ = Nebenanwendung Second choice

**AIRline**  
**Schnittwertempfehlungen und Vorschübe für Schaftfräser**  
**Cutting data recommendations and feeds for end mills**

| Werkstoff                          | Material                         | Werkstoff-Nr.<br>Material No. | DIN<br>Bezeichnung Alt<br>DIN<br>Description Old | R <sub>m</sub> /UTS<br>(N/mm <sup>2</sup> ) | DIN<br>Bezeichnung Neu<br>DIN<br>Description New |
|------------------------------------|----------------------------------|-------------------------------|--------------------------------------------------|---------------------------------------------|--------------------------------------------------|
| <b>N</b> Rein-Metalle, weich       | Pure metals, soft                | 1.1003                        | Reineisen, Blei<br>Pure iron, lead               | 400–800                                     | Reineisen, Blei<br>Pure iron, lead               |
| Aluminium-Legierungen, kurzspanend | Aluminium alloys, short chipping | 3.2581                        | G-AlSi12                                         | –400                                        | G-IGK-AlSi12                                     |
| Aluminium-Legierungen, langspanend | Aluminium alloys, long chipping  | 3.3535<br>3.4365              | AlMg3<br>AlZnMgCu1,5                             | 100–400                                     | AlMg3<br>AlZnMgCu1,5                             |
| Kupfer-Legierungen, kurzspanend    | Copper alloys, short chipping    | 2.0402                        | MS58                                             | –500                                        | CuZn40Pb2                                        |
| Kupfer-Legierungen, langspanend    | Copper alloys, long chipping     | 2.0320<br>2.0975              | MS63<br>CuAl10Ni                                 | 150–250                                     | CuZn37<br>CuAl10Fe5Ni5-C                         |
| Magnesium-Legierungen              | Magnesium alloys                 | 3.5912                        | G-MgAl9Zn1                                       | 200–300                                     | G-MgAl9Zn1                                       |
| Thermoplaste                       | Thermoplastics                   |                               | PVC, Acrylglas<br>PVC, acrylic glass             | 400–700                                     | PVC, Acrylglas<br>PVC, acrylic glass             |
| Duroplaste                         | Duroplastics                     |                               | Bakelit, Melamin                                 | 20–40                                       | Bakelit, Melamin                                 |

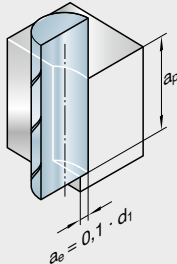
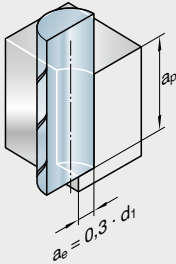
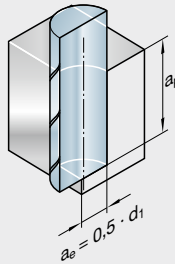
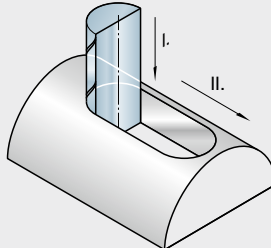
Die angegebenen Schnittwerte sind Startwerte und müssen auf die vorhandenen Bedingungen abgestimmt werden.  
The cutting data indicated are starting values and must be adjusted to the prevailing conditions.

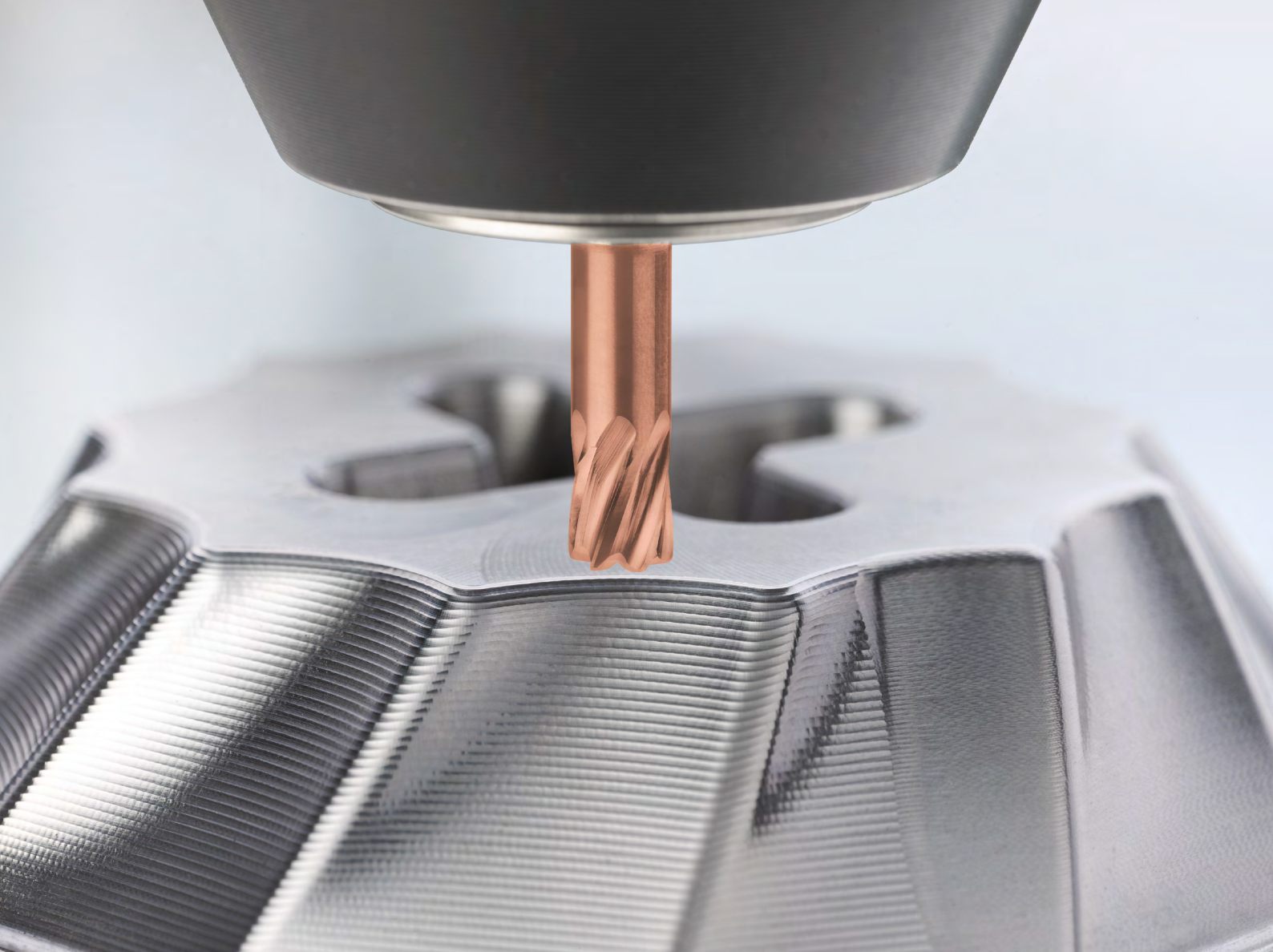
**AIRline**  
**Berechnungsformeln und Vorschubkorrekturfaktoren für Schaftfräser**  
**Calculating formulas and cutting speed correction factor end mills**

|                                                                                                                                                                          |                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                       |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|--|
| <b>Drehzahl</b><br><b>Speed n (min<sup>-1</sup>):</b><br>$n = \frac{v_c \cdot 1000}{\pi \cdot d_1}$                                                                      | <b>Vorschubgeschwindigkeit</b><br><b>Feed rate v<sub>f</sub> (mm/min):</b><br>$v_f = f_z \cdot z \cdot n \cdot f_2$ | a <sub>e</sub> = Schnittbreite Width of cut (mm)<br>a <sub>p</sub> = Schnitttiefe Depth of cut (mm)<br>d <sub>1</sub> = Durchmesser Diameter (mm)<br>f <sub>2</sub> = Korrekturfaktor für v <sub>f</sub> Correction factor v <sub>f</sub><br>f <sub>z</sub> = Vorschub pro Zahn Feed per tooth (mm)<br>n = Drehzahl Speed (min <sup>-1</sup> )<br>v <sub>c</sub> = Schnittgeschwindigkeit Cutting speed (m/min)<br>v <sub>f</sub> = Vorschubgeschwindigkeit Feed rate (mm/min)<br>z = Anzahl der Schneiden Number of teeth |                                                                                       |  |
| <b>Vorschubkorrektur f<sub>2</sub></b><br><b>Cutting speed correction factor f<sub>2</sub></b><br><br>Fräser mit Schrapp-Profil<br>Milling cutters with roughing-profile |                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |
| f <sub>2</sub> =                                                                                                                                                         | 1,0                                                                                                                 | 0,8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0,6                                                                                   |  |

|  | HM-Sorte<br>Carbide grade<br>LWN30M | Schnitt-<br>geschwindigkeit<br>Cutting speed<br>$v_c$ (m/min) | Kühlung<br>Coolant                                                                | Fräserdurchmesser Cutting diameter<br>(mm)                                                     |      |      |                         |      |      |
|--|-------------------------------------|---------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|------|------|-------------------------|------|------|
|  |                                     |                                                               |                                                                                   | Vorschub pro Zahn $f_z$ bei Fräser-Ø<br>Feed per tooth $f_z$ for cutter diameter<br>$d_1$ (mm) |      |      |                         |      |      |
|  |                                     |                                                               |                                                                                   | Schruppen<br>Roughing                                                                          |      |      | Schlichten<br>Finishing |      |      |
|  |                                     |                                                               |                                                                                   | 8                                                                                              | 12   | 16   | 8                       | 12   | 16   |
|  |                                     | 400                                                           |  | 0,10                                                                                           | 0,20 | 0,30 | 0,02                    | 0,07 | 0,10 |
|  |                                     | 280                                                           |  | 0,10                                                                                           | 0,20 | 0,30 | 0,06                    | 0,08 | 0,12 |
|  |                                     | 900                                                           |  | 0,10                                                                                           | 0,20 | 0,30 | 0,06                    | 0,08 | 0,12 |
|  |                                     | 280                                                           |  | 0,10                                                                                           | 0,20 | 0,30 | 0,05                    | 0,07 | 0,10 |
|  |                                     | 280                                                           |  | 0,10                                                                                           | 0,20 | 0,30 | 0,05                    | 0,07 | 0,10 |
|  |                                     | 500                                                           |  | 0,10                                                                                           | 0,20 | 0,30 | 0,06                    | 0,08 | 0,12 |
|  |                                     | 300                                                           |  | 0,10                                                                                           | 0,20 | 0,03 | 0,05                    | 0,10 | 0,14 |
|  |                                     | 300                                                           |  | 0,10                                                                                           | 0,20 | 0,30 | 0,05                    | 0,10 | 0,14 |

 Nassbearbeitung, auf ausreichende Emulsionszuführung achten  
Wet machining, sufficient emulsion volume required

|                                                                                                        |                                                                                     |                                                                                      |                                                                                       |
|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Fräser mit Schlicht-Profil<br>Milling cutters with<br>finishing-profile                                |  |  |  |
| <b>f<sub>2</sub> =</b>                                                                                 | <b>1,0</b>                                                                          | <b>0,6</b>                                                                           | <b>0,5</b>                                                                            |
| Bohren auf volle Tiefe<br>und anschließendes Längsfräsen<br>Plunging to full depth<br>and slot milling |  | I.<br>Bohren                                                                         | II.<br>Fräsen                                                                         |
| <b>f<sub>2</sub> =</b>                                                                                 |                                                                                     | <b>0,3</b>                                                                           | <b>0,5</b>                                                                            |



# HFC – High Feed Cutter

Die neue Generation der  
Hochvorschubfräser-Serie  
The New Generation of the  
High Feed Milling Cutter Series

Ob Sie im Gesenk- und Formenbau, im allgemeinen Maschinenbau, in der Luft- und Raumfahrt oder in anderen Branchen tätig sind – Überall, wo das Hochvorschubfräsen zur Anwendung kommt, sind unsere HFC Werkzeuge die beste Wahl für Sie. Erleben Sie jetzt die Zukunft des Hochvorschubfräsens mit unserer neuen HFC-Familie und steigern Sie Ihre Effizienz sowie Produktivität auf ein neues Level!

Whether you are in die and mold making, general machining, aerospace or other industries – wherever high feed milling is used, our HFC tools are the best choice for you. Experience the future of high feed milling with our new HFC family and increase your efficiency and productivity to a new level!

**Ihre Vorteile:**

- Hohe Schneidenzahl ermöglicht hohe Bahnvorschübe für eine hohe Produktivität
- Längere Standzeiten dank neuester Substrate und Beschichtungen
- Große Auswahl an verschiedenen Geometrien und Längen für unterschiedlichste Anwendungen
- Erhöhte Lebensdauer bei der Bearbeitung von rostfreien Stählen bei der Verwendung von Werkzeugen mit Innenkühlung

**Your advantages:**

- Longer tool life thanks to the latest substrates and coatings
- Increased tool life when machining stainless steels when using tools with internal cooling
- Extensive range of different lengths for use in a wide variety of applications
- High number of cutting edges enables high feed rates for high productivity

**Merkmale:**

**Features:**

Glatte Zylinderschaft  
Cylindrical shank

Halsfreischliff  
Neck relief

Modernste Beschichtung  
Latest generation coating

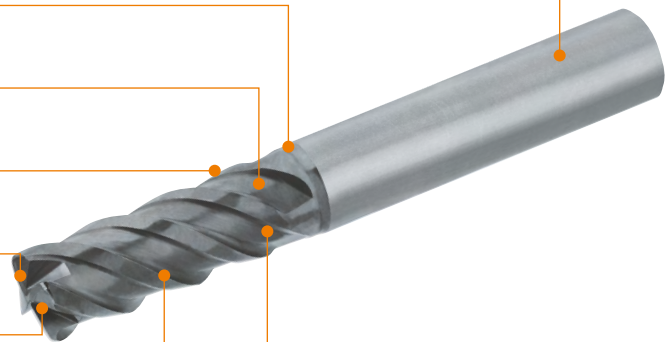
Verlängerte Mantelschneide, nachschleifbar  
Extended sheath cutting edge, regrindable

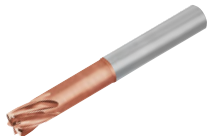
Mikroschneidkantenpräparation  
Micro cutting-edge preparation

S-Schliff ähnliche Ausführung der Schneidkante  
S-shape design

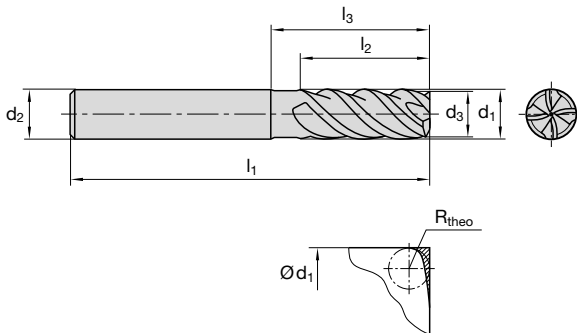
Schneidstoff an die jeweilige Anwendung angepasst  
Grade trimmed to respective focus applications

Speziell auf die Anwendung abgestimmte Geometrie  
Geometry specially adapted to the application



| HFC P                                                                                                                                 | HFC M                                                                                                                      | HFC H                                                                                                                       | HFC U                                                                                                                           |                                                                                                                                    |
|---------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
|                                                      |                                           |                                           |                                              |                                                                                                                                    |
| Für Stahl und Guss<br>For steel and cast iron                                                                                         | Für austenitische Stähle und Superlegierungen<br>For austenitic steels and superalloys                                     | Für gehärtete Stähle bis zu 65 HRC<br>For hardened steels up to 65 HRC                                                      | Universallösung für ISO-Gruppen P, M und K<br>Universal solution for ISO groups P, M and K                                      |                                                                                                                                    |
| <div><div>P</div><div>Nebenanwendung:<br/>Second choice:</div><div>K</div></div>                                                      | <div><div>M</div><div>Nebenanwendung:<br/>Second choice:</div><div>S</div></div>                                           | <div><div>H</div><div>Nebenanwendung:<br/>Second choice:</div><div><div>P</div><div>K</div></div></div>                     | <div><div><div>P</div><div>M</div><div>K</div></div><div>Nebenanwend.:<br/>Second choice:</div><div>H</div></div>               |                                                                                                                                    |
|  <div>Hochvorschubfräsen<br/>High feed milling</div> |  <div>Kopierfräsen<br/>Copy milling</div> |  <div>Nutenfräsen<br/>Groove milling</div> |  <div>Taschenfräsen<br/>Pocket milling</div> |  <div>Zirkularfräsen<br/>Circular milling</div> |





| Katalog-Nr. Cat.-No.   |                |                |                |                |                |   |                   |                    | HFC01-P-A |                               |
|------------------------|----------------|----------------|----------------|----------------|----------------|---|-------------------|--------------------|-----------|-------------------------------|
| P                      |                |                |                |                |                |   |                   |                    | ■         |                               |
| M                      |                |                |                |                |                |   |                   |                    |           |                               |
| K                      |                |                |                |                |                |   |                   |                    | □         |                               |
| N                      |                |                |                |                |                |   |                   |                    |           |                               |
| S                      |                |                |                |                |                |   |                   |                    |           |                               |
| H                      |                |                |                |                |                |   |                   |                    |           |                               |
| d <sub>1</sub>         | d <sub>3</sub> | l <sub>2</sub> | l <sub>1</sub> | l <sub>3</sub> | d <sub>2</sub> | z | R <sub>theo</sub> | a <sub>p max</sub> | Ident No. | LMT-Code                      |
| extra kurz extra short |                |                |                |                |                |   |                   |                    |           |                               |
| 2                      | 1,85           | 3              | 40             | 5              | 4              | 2 | 0,2               | 0,1                | 7430016   | EM-HFC01 P2.0x3/5 2R0.2HA     |
| 3                      | 2,85           | 4              | 50             | 7              | 6              | 2 | 0,3               | 0,15               | 7430017   | EM-HFC01 P3.0x4/7 2R0.3HA     |
| 4                      | 3,8            | 5              | 54             | 9              | 6              | 4 | 0,4               | 0,2                | 7430018   | EM-HFC01 P4.0x5/9 4R0.4HA     |
| 5                      | 4,8            | 6              | 54             | 11             | 6              | 4 | 0,5               | 0,25               | 7430019   | EM-HFC01 P5.0x6/11 4R0.5HA    |
| 6                      | 5,7            | 7              | 54             | 13             | 6              | 4 | 0,6               | 0,3                | 7430020   | EM-HFC01 P6.0x7/13 4R0.6HA    |
| 8                      | 7,7            | 9              | 58             | 17             | 8              | 4 | 0,8               | 0,4                | 7430021   | EM-HFC01 P8.0x9/17 4R0.8HA    |
| 10                     | 9,7            | 11             | 66             | 22             | 10             | 4 | 1                 | 0,5                | 7430022   | EM-HFC01 P10.0x11/22 4R1.0HA  |
| 12                     | 11,7           | 13             | 73             | 26             | 12             | 4 | 1,2               | 0,6                | 7430023   | EM-HFC01 P12.0x13/26 4R1.2HA  |
| kurz short             |                |                |                |                |                |   |                   |                    |           |                               |
| 1                      | 0,95           | 3              | 38             | 6              | 3              | 2 | 0,1               | 0,05               | 7430024   | EM-HFC01 P1.0x3/6 2R0.1HA     |
| 2                      | 1,85           | 6              | 40             | 9              | 4              | 2 | 0,2               | 0,1                | 7430025   | EM-HFC01 P2.0x6/9 2R0.2HA     |
| 3                      | 2,85           | 8              | 54             | 12             | 6              | 2 | 0,3               | 0,15               | 7430026   | EM-HFC01 P3.0x8/12 2R0.3HA    |
| 4                      | 3,8            | 11             | 57             | 21             | 6              | 4 | 0,4               | 0,2                | 7430027   | EM-HFC01 P4.0x11/21 4R0.4HA   |
| 5                      | 4,8            | 14             | 57             | 21             | 6              | 4 | 0,5               | 0,25               | 7430028   | EM-HFC01 P5.0x14/21 4R0.5HA   |
| 6                      | 5,7            | 16             | 57             | 21             | 6              | 4 | 0,6               | 0,3                | 7430029   | EM-HFC01 P6.0x16/21 4R0.6HA   |
| 8                      | 7,7            | 21             | 63             | 27             | 8              | 4 | 0,8               | 0,4                | 7430030   | EM-HFC01 P8.0x21/27 4R0.8HA   |
| 10                     | 9,7            | 26             | 72             | 32             | 10             | 4 | 1                 | 0,5                | 7430031   | EM-HFC01 P10.0x26/32 4R1.0HA  |
| 12                     | 11,7           | 31             | 83             | 38             | 12             | 4 | 1,2               | 0,6                | 7430032   | EM-HFC01 P12.0x31/38 4R1.2HA  |
| 16                     | 15,7           | 40             | 92             | 44             | 16             | 4 | 1,6               | 0,8                | 7430033   | EM-HFC01 P16.0x40/44 4R1.6HA  |
| lang long              |                |                |                |                |                |   |                   |                    |           |                               |
| 4                      | 3,8            | 11             | 70             | 24             | 6              | 4 | 0,4               | 0,2                | 7430034   | EM-HFC01 P4.0x11/24 4R0.4HA   |
| 5                      | 4,8            | 14             | 70             | 30             | 6              | 4 | 0,5               | 0,25               | 7430035   | EM-HFC01 P5.0x14/30 4R0.5HA   |
| 6                      | 5,7            | 16             | 80             | 35             | 6              | 4 | 0,6               | 0,3                | 7430036   | EM-HFC01 P6.0x16/35 4R0.6HA   |
| 8                      | 7,7            | 21             | 80             | 40             | 8              | 4 | 0,8               | 0,4                | 7430037   | EM-HFC01 P8.0x21/40 4R0.8HA   |
| 10                     | 9,7            | 26             | 90             | 45             | 10             | 4 | 1                 | 0,5                | 7430038   | EM-HFC01 P10.0x26/45 4R1.0HA  |
| 12                     | 11,7           | 31             | 100            | 50             | 12             | 4 | 1,2               | 0,6                | 7430039   | EM-HFC01 P12.0x31/50 4R1.2HA  |
| extra lang extra long  |                |                |                |                |                |   |                   |                    |           |                               |
| 4                      | 3,8            | 11             | 80             | 40             | 6              | 4 | 0,4               | 0,2                | 7430040   | EM-HFC01 P4.0x11/40 4R0.4HA   |
| 5                      | 4,8            | 14             | 80             | 42             | 6              | 4 | 0,5               | 0,25               | 7430041   | EM-HFC01 P5.0x14/42 4R0.5HA   |
| 6                      | 5,7            | 16             | 100            | 64             | 6              | 4 | 0,6               | 0,3                | 7430042   | EM-HFC01 P6.0x16/64 4R0.6HA   |
| 8                      | 7,7            | 21             | 120            | 84             | 8              | 4 | 0,8               | 0,4                | 7430043   | EM-HFC01 P8.0x21/84 4R0.8HA   |
| 10                     | 9,7            | 26             | 150            | 110            | 10             | 4 | 1                 | 0,5                | 7430044   | EM-HFC01 P10.0x26/110 4R1.0HA |
| 12                     | 11,7           | 31             | 160            | 110            | 12             | 4 | 1,2               | 0,6                | 7430045   | EM-HFC01 P12.0x31/110 4R1.2HA |
| 16                     | 15,7           | 40             | 160            | 110            | 16             | 4 | 1,6               | 0,8                | 7430046   | EM-HFC01 P16.0x40/110 4R1.6HA |

Schnittwertempfehlungen ab Seite 56  
 Cutting data recommendations starting page 56

■ = Hauptanwendung First choice  
 □ = Nebenanwendung Second choice

**HFC01 Rougher P**  
**Schnittwertempfehlungen**  
**Cutting data recommendations**

| Werkstoff |                                                                   | Material                                   | Werkstoff-Nr.<br>Material No. | DIN<br>Bezeichnung Alt<br>DIN<br>Description Old | R <sub>m</sub> /UTS<br>(N/mm <sup>2</sup> ) | DIN<br>Bezeichnung Neu<br>DIN<br>Description New |
|-----------|-------------------------------------------------------------------|--------------------------------------------|-------------------------------|--------------------------------------------------|---------------------------------------------|--------------------------------------------------|
| <b>P</b>  | Unlegierter Baustahl<br>+ Automatenstahl                          | Plain carbon steel<br>+ free cutting steel | 1.0570                        | St52-3                                           | -700                                        | S355J2G3                                         |
|           |                                                                   |                                            | 1.1730                        | C45                                              | -800                                        | C45U                                             |
|           |                                                                   |                                            | 1.0715                        | 9SMn28                                           | -700                                        | 11SMn30                                          |
|           |                                                                   |                                            | 1.1191                        | Ck45                                             | 500-950                                     | C45E                                             |
|           |                                                                   |                                            | 1.7219                        | 26CrMo4                                          |                                             | 26CrMo4-2                                        |
|           | Vergütungsstahl,<br>mittelfest                                    | Heat-treatment steel,<br>medium strength   | 1.7225                        | 42CrMo4                                          | 500-950                                     | 42CrMo4                                          |
|           |                                                                   |                                            | 1.8159                        | 51CrV4                                           |                                             | 51CrV4                                           |
|           | Stahlguss                                                         | Cast steel                                 | 1.0416                        | GS40                                             | -950                                        | GS40                                             |
|           | Einsatzstahl                                                      | Case hardening steel                       | 1.7131                        | 16MnCr5                                          | -950                                        | 16MnCr5                                          |
|           | Rost- und säurebeständiger<br>Stahl,<br>ferritisch, martensitisch | Stainless steel, ferritic,<br>martensitic  | 1.4006                        | X10Cr13                                          | 500-950                                     | X12Cr13                                          |
|           |                                                                   |                                            | 1.4104                        | X12CrMoS17                                       |                                             | X14CrMoS17                                       |
|           |                                                                   |                                            | 1.4122                        | X35CrMo17                                        |                                             | X39CrMo17-1                                      |
|           | Vergütungsstahl,<br>hochfest                                      | Heat-treatment steel,<br>high strength     | 1.7225                        | 42CrMo4                                          | 950-1400                                    | 42CrMo4                                          |
|           |                                                                   |                                            | 1.6580                        | 30CrNiMo8                                        |                                             | 30CrNiMo8                                        |
|           | Nitrierstahl,<br>vergütet                                         | Nitriding steel,<br>heat treated           | 1.8504                        | 34CrAl6                                          | 950-1400                                    | 34CrAl6                                          |
|           |                                                                   |                                            | 1.2344                        | X40CrMoV5.1                                      | -900                                        | X40CrMoV5-1                                      |
|           | Werkzeugstahl                                                     | Tool steel                                 | 1.2343                        | X38CrMoV5 1                                      | 950-1400                                    | X37CrMoV5-1                                      |
|           |                                                                   |                                            | 1.2316                        | X38CrMo16                                        | -1100                                       | X38CrMo16                                        |
|           |                                                                   |                                            | 1.2379                        | X155CrVMo12 1                                    | -950                                        | X153CrMoV12-1                                    |
|           |                                                                   |                                            | 1.2080                        | X210Cr12                                         | 950-1400                                    | X210Cr12                                         |
|           |                                                                   |                                            | 1.2358                        | 60CrMoV18-5                                      | 850-1000                                    | 60CrMoV18-5                                      |
|           |                                                                   |                                            | 1.2714                        | 55NiCrMoV7                                       | 1100-1350                                   | 55NiCrMoV7                                       |
|           |                                                                   |                                            | 1.2311                        | 40CrMnMo7                                        | -1100                                       | 40CrMnMo7                                        |
|           |                                                                   |                                            | 1.2312                        | 40CrMnNiMoS8.6                                   | -1150                                       | 40CrMnNiMoS8-6                                   |
|           |                                                                   |                                            | 1.2738                        | 45CrMnNiMo8.6.4                                  | 950-1150                                    | 45CrMnNiMo8-6-4                                  |
| <b>K</b>  | Grauguss                                                          | Grey cast iron                             | 0.6025                        | GG25                                             | 100-400<br>(120-260 HB)                     | EN-GJl-250                                       |
|           | Legierter Grauguss                                                | Alloyed grey cast iron                     | 0.6678                        | GGL-NiCr35 2                                     | 150-250<br>(160-230 HB)                     | EN-GJLA-XNiCr35-2                                |
|           | Sphäroguss                                                        | Nodular cast iron                          | 0.7070                        | GGG70L                                           | 400-800<br>(120-310 HB)                     | EN-GJS-700-2U                                    |
|           |                                                                   |                                            | 0.7060                        | GGG60                                            |                                             | EN-GJS-600-3                                     |
|           | Temperguss                                                        | Malleable cast iron                        | 0.8155                        | GTS55                                            | 350-700<br>(150-280 HB)                     | EN-GJMB-550-4                                    |

Die angegebenen Schnittwerte sind Startwerte und müssen auf die vorhandenen Bedingungen abgestimmt werden.  
The cutting data indicated are starting values and must be adjusted to the prevailing conditions.

Bei der langen Ausführung empfehlen wir die f<sub>z</sub>-Werte um 30 % zu reduzieren.  
We recommended to reduce the f<sub>z</sub>-value with the long version by 30 %.

|     | Schnittgeschwindigkeit<br>Cutting speed<br>v <sub>c</sub> (m/min) | Fräserdurchmesser Cutting diameter<br>(mm)                 |       |        |         | Schnitttiefe<br>Cutting depth<br>a <sub>p</sub> (mm) |
|-----|-------------------------------------------------------------------|------------------------------------------------------------|-------|--------|---------|------------------------------------------------------|
|     |                                                                   | Vorschub pro Zahn Feed per tooth<br>f <sub>z</sub> (mm/z.) |       |        |         |                                                      |
|     |                                                                   | Ø 1–3                                                      | Ø 4–6 | Ø 8–10 | Ø 12–16 |                                                      |
|     | 300                                                               | 0,30                                                       | 0,50  | 0,70   | 1,00    | 0,05 x d <sub>1</sub>                                |
|     | 300                                                               | 0,30                                                       | 0,50  | 0,70   | 1,00    |                                                      |
|     | 300                                                               | 0,30                                                       | 0,50  | 0,70   | 1,00    |                                                      |
|     | 240                                                               | 0,25                                                       | 0,40  | 0,60   | 0,80    |                                                      |
|     | 200                                                               | 0,25                                                       | 0,40  | 0,60   | 0,80    |                                                      |
|     | 240                                                               | 0,25                                                       | 0,40  | 0,60   | 0,80    |                                                      |
|     | 200                                                               | 0,25                                                       | 0,40  | 0,60   | 0,80    | 0,045 x d <sub>1</sub>                               |
|     | 200                                                               | 0,25                                                       | 0,40  | 0,60   | 0,80    |                                                      |
|     | 180                                                               | 0,25                                                       | 0,40  | 0,60   | 0,80    |                                                      |
|     | 220                                                               | 0,25                                                       | 0,40  | 0,60   | 0,80    | 0,04 x d <sub>1</sub>                                |
|     | 200                                                               | 0,20                                                       | 0,40  | 0,50   | 0,70    |                                                      |
|     | 200                                                               | 0,25                                                       | 0,40  | 0,60   | 0,80    |                                                      |
|     |                                                                   | 250                                                        | 0,50  | 0,70   | 0,90    | 1,30                                                 |
| 250 |                                                                   | 0,45                                                       | 0,60  | 0,80   | 1,20    |                                                      |
| 180 |                                                                   | 0,20                                                       | 0,30  | 0,50   | 0,70    |                                                      |
| 180 |                                                                   | 0,30                                                       | 0,50  | 0,70   | 1,00    |                                                      |
| 150 |                                                                   | 0,30                                                       | 0,50  | 0,70   | 1,00    |                                                      |

## Anwendungsbeispiel

### Application example



### Kopierfräsen, Z-konstant

#### Copying, Z constant

#### Werkzeug Tool:

HFC P

$d_1 = 8$  mm,  $z = 4$

#### Werkstoff Material:

Werkzeugstahl 1.2312/40CrMnMoS 8-6, P20+S,

$R_m = 1000$  N/mm<sup>2</sup>, 30 HRC

Tool steel 1.2312/40CrMnMoS 8-6, P20+S,

$R_m = 1000$  N/mm<sup>2</sup>, 30 HRC

#### Schnittwerte Cutting data:

$v_c = 240$  m/min

$n = 9550$  min<sup>-1</sup>

$f_z = 0,65$  mm

$v_f = 25000$  mm/min

$a_e = 5$  mm

$a_p = 0,35$  mm

Der neue HFC01 Rougher M wurde speziell für die Bearbeitung von ISO-M-Materialien entwickelt. Der Vierschneider deckt mit seinen Längenausführungen extra kurz, kurz, lang und extra lang sowie dem Durchmesserbereich von 4–16 mm bereits ein breites Anwendungsfeld bei rostfreien Stählen, Superlegierungen und Titanbearbeitungen ab. Alle Werkzeuge sind mit innerer Kühlmittelzufuhr ausgelegt.

The new HFC01 Rougher M was especially developed for the machining of ISO-M materials. The 4-flute end mill already covers a broad range of applications in non-ferrous materials, super alloys and titanium with its standard lengths extra short, short, long and extra long and the diameter range of 4–16 mm. All tools are with internal cooling system.

**Merkmale:**

**Features:**

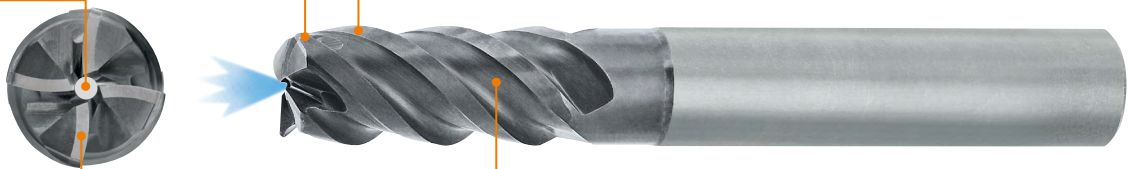
Verlängerte Mantelschneide, nachschleifbar  
Extended lateral cutting edge, regrindable

45°-Spiralwinkel  
45° helix angle

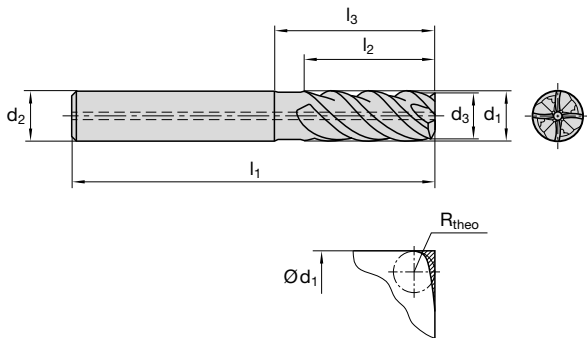
Zentrale  
Innenkühlung  
Central cooling

„S-Schliff“-ähnliche Schneidkante  
Similarity to “S-cutting edge”

Schneidstoff LCMS30M  
Cutting grade LCMS30M



**HFC01 Rougher M**  
**Hochvorschubfräser für austenitische Stähle**  
**High feed end mills for austenitic steels**



Katalog-Nr. Cat.-No.

**HFC01-M-A**

| P                      |                |                |                |                |                |   |                   |                    |           |                                |
|------------------------|----------------|----------------|----------------|----------------|----------------|---|-------------------|--------------------|-----------|--------------------------------|
| M                      |                |                |                |                |                |   |                   |                    | ■         |                                |
| K                      |                |                |                |                |                |   |                   |                    |           |                                |
| N                      |                |                |                |                |                |   |                   |                    |           |                                |
| S                      |                |                |                |                |                |   |                   |                    | □         |                                |
| H                      |                |                |                |                |                |   |                   |                    |           |                                |
| d <sub>1</sub>         | d <sub>3</sub> | l <sub>2</sub> | l <sub>1</sub> | l <sub>3</sub> | d <sub>2</sub> | z | R <sub>theo</sub> | a <sub>p max</sub> | Ident No. | LMT-Code                       |
| extra kurz extra short |                |                |                |                |                |   |                   |                    |           |                                |
| 4                      | 3,8            | 5              | 54             | 9              | 6              | 4 | 0,4               | 0,2                | 7430084   | EM-HFC01 M4.0x5/9 4R0.4HA-I    |
| 5                      | 4,8            | 6              | 54             | 11             | 6              | 4 | 0,5               | 0,25               | 7430085   | EM-HFC01 M5.0x6/11 4R0.5HA-I   |
| 6                      | 5,7            | 7              | 54             | 13             | 6              | 4 | 0,6               | 0,3                | 7430086   | EM-HFC01 M6.0x7/13 4R0.6HA-I   |
| 8                      | 7,7            | 9              | 58             | 17             | 8              | 4 | 0,8               | 0,4                | 7430087   | EM-HFC01 M8.0x9/17 4R0.8HA-I   |
| 10                     | 9,7            | 11             | 66             | 22             | 10             | 4 | 1                 | 0,5                | 7430088   | EM-HFC01 M10.0x11/22 4R1.0HA-I |
| 12                     | 11,7           | 13             | 73             | 26             | 12             | 4 | 1,2               | 0,6                | 7430089   | EM-HFC01 M12.0x13/26 4R1.2HA-I |
| 16                     | 15,7           | 17             | 82             | 34             | 16             | 4 | 1,6               | 0,8                | 7430090   | EM-HFC01 M16.0x17/34 4R1.6HA-I |
| kurz short             |                |                |                |                |                |   |                   |                    |           |                                |
| 4                      | 3,8            | 11             | 57             | 16             | 6              | 4 | 0,4               | 0,2                | 7430091   | EM-HFC01 M4.0x11/16 4R0.4HA-I  |
| 5                      | 4,8            | 14             | 57             | 18             | 6              | 4 | 0,5               | 0,25               | 7430092   | EM-HFC01 M5.0x14/18 4R0.5HA-I  |
| 6                      | 5,7            | 16             | 57             | 21             | 6              | 4 | 0,6               | 0,3                | 7430093   | EM-HFC01 M6.0x16/21 4R0.6HA-I  |
| 8                      | 7,7            | 21             | 63             | 27             | 8              | 4 | 0,8               | 0,4                | 7430094   | EM-HFC01 M8.0x21/27 4R0.8HA-I  |
| 10                     | 9,7            | 26             | 72             | 32             | 10             | 4 | 1                 | 0,5                | 7430095   | EM-HFC01 M10.0x26/32 4R1.0HA-I |
| 12                     | 11,7           | 31             | 83             | 38             | 12             | 4 | 1,2               | 0,6                | 7430096   | EM-HFC01 M12.0x31/38 4R1.2HA-I |
| 16                     | 15,7           | 40             | 92             | 44             | 16             | 4 | 1,6               | 0,8                | 7430097   | EM-HFC01 M16.0x40/44 4R1.6HA-I |
| lang long              |                |                |                |                |                |   |                   |                    |           |                                |
| 4                      | 3,8            | 11             | 69             | 24             | 6              | 4 | 0,4               | 0,2                | 7430098   | EM-HFC01 M4.0x11/24 4R0.4HA-I  |
| 5                      | 4,8            | 14             | 69             | 26             | 6              | 4 | 0,5               | 0,25               | 7430099   | EM-HFC01 M5.0x14/26 4R0.5HA-I  |
| 6                      | 5,7            | 16             | 69             | 33             | 6              | 4 | 0,6               | 0,3                | 7430100   | EM-HFC01 M6.0x16/33 4R0.6HA-I  |
| 8                      | 7,7            | 21             | 75             | 39             | 8              | 4 | 0,8               | 0,4                | 7430101   | EM-HFC01 M8.0x21/39 4R0.8HA-I  |
| 10                     | 9,7            | 26             | 80             | 40             | 10             | 4 | 1                 | 0,5                | 7430102   | EM-HFC01 M10.0x26/40 4R1.0HA-I |
| 12                     | 11,7           | 31             | 93             | 48             | 12             | 4 | 1,2               | 0,6                | 7430103   | EM-HFC01 M12.0x31/48 4R1.2HA-I |
| 16                     | 15,7           | 40             | 108            | 60             | 16             | 4 | 1,6               | 0,8                | 7430104   | EM-HFC01 M16.0x40/60 4R1.6HA-I |
| extra lang extra long  |                |                |                |                |                |   |                   |                    |           |                                |
| 4                      | 3,8            | 11             | 69             | 29             | 6              | 4 | 0,4               | 0,2                | 7430105   | EM-HFC01 M4.0x11/29 4R0.4HA-I  |
| 5                      | 4,8            | 14             | 69             | 30             | 6              | 4 | 0,5               | 0,25               | 7430106   | EM-HFC01 M5.0x14/30 4R0.5HA-I  |
| 6                      | 5,7            | 16             | 75             | 39             | 6              | 4 | 0,6               | 0,3                | 7430107   | EM-HFC01 M6.0x16/39 4R0.6HA-I  |
| 8                      | 7,7            | 21             | 83             | 47             | 8              | 4 | 0,8               | 0,4                | 7430108   | EM-HFC01 M8.0x21/47 4R0.8HA-I  |
| 10                     | 9,7            | 26             | 95             | 55             | 10             | 4 | 1                 | 0,5                | 7430109   | EM-HFC01 M10.0x26/55 4R1.0HA-I |
| 12                     | 11,7           | 31             | 110            | 65             | 12             | 4 | 1,2               | 0,6                | 7430110   | EM-HFC01 M12.0x31/65 4R1.2HA-I |
| 16                     | 15,7           | 40             | 125            | 77             | 16             | 4 | 1,6               | 0,8                | 7430111   | EM-HFC01 M16.0x40/77 4R1.6HA-I |
|                        |                |                |                |                |                |   |                   |                    |           |                                |

Schnittwertempfehlungen ab Seite 60

Cutting data recommendations starting page 60

■ = Hauptanwendung First choice

□ = Nebenanwendung Second choice

**HFC01 Rougher M**  
**Schnittwertempfehlungen**  
**Cutting data recommendations**

| <b>Werkstoff</b> |                                                             | <b>Material</b>                                   | <b>Werkstoff-Nr.<br/>Material No.</b> | <b>DIN<br/>Bezeichnung Alt<br/>DIN<br/>Description Old</b> | <b>R<sub>m</sub>/UTS<br/>(N/mm<sup>2</sup>)</b> | <b>DIN<br/>Bezeichnung Neu<br/>DIN<br/>Description New</b> |  |
|------------------|-------------------------------------------------------------|---------------------------------------------------|---------------------------------------|------------------------------------------------------------|-------------------------------------------------|------------------------------------------------------------|--|
| <b>M</b>         | Rost- und säurebeständiger Stahl, austenitisch              | Stainless steel, austenitic                       | 1.4301                                | X2CrNiMo17-12-2                                            | 500–950                                         | X5CrNiMo18-10                                              |  |
|                  |                                                             |                                                   | 1.4404                                | X6CrNiMoTi17-12-2                                          |                                                 | X2CrNiMo17-12-2                                            |  |
|                  |                                                             |                                                   | 1.4571                                | X10CrNiMoTi18                                              |                                                 | X10CrNiMoTi18                                              |  |
|                  | Rost- und säurebeständiger Stahl, ferritisch, martensitisch | Stainless steel, ferritic, martensitic            | 1.2709                                | X3NiCoMoTi18-9-5                                           | 800–1000                                        | X3NiCoMoTi18-9-5                                           |  |
|                  |                                                             |                                                   | 1.4542                                | X5CrNiCuNb16-4                                             |                                                 | X5CrNiCuNb16-4                                             |  |
|                  |                                                             |                                                   | 1.4568                                | X7CrNiAl17-7                                               |                                                 | X7CrNiAl17-7                                               |  |
| <b>S</b>         | Titan-Legierungen, mittelfest                               | Titanium alloys, medium strength                  | 3.7164                                | TiAl6V4                                                    | –950                                            | Ti6AlV4                                                    |  |
|                  |                                                             |                                                   | 3.7115                                | TiAl5Sn2,5                                                 |                                                 | TiAl5Sn2-5                                                 |  |
|                  | Titan-Legierungen, hochfest                                 | Titanium alloys, high strength                    | 3.7174                                | TiAl6Sn2                                                   | 900–1400                                        | TiAl6V6Sn2                                                 |  |
|                  | Nickelbasis-Legierungen, mittelfest                         | Nickel based alloys, medium strength              | 2.4670                                | NiCr12Al6MoNb                                              | –950                                            | NiCr12Al6MoNb                                              |  |
|                  | Nickelbasis-Legierungen, hochwarmfest                       | Heat resistant nickel based alloys, high strength | 2.4668                                | NiCr19Fe19NbMo                                             | 900–1400                                        | Inconel 718                                                |  |
|                  |                                                             |                                                   |                                       |                                                            |                                                 | NiCr19Fe19Nb5Mo3                                           |  |

Die angegebenen Schnittwerte sind Startwerte und müssen auf die vorhandenen Bedingungen abgestimmt werden.  
The cutting data indicated are starting values and must be adjusted to the prevailing conditions.



|  | Kühlung<br>Coolant                                                                | Schnittgeschwindigkeit<br>Cutting speed<br>v <sub>c</sub> (m/min) | Fräserdurchmesser Cutting diameter<br>(mm)                 |        |         | Schnitttiefe<br>Cutting depth<br>a <sub>p</sub> (mm) |
|--|-----------------------------------------------------------------------------------|-------------------------------------------------------------------|------------------------------------------------------------|--------|---------|------------------------------------------------------|
|  |                                                                                   |                                                                   | Vorschub pro Zahn Feed per tooth<br>f <sub>z</sub> (mm/z.) |        |         |                                                      |
|  |                                                                                   |                                                                   | Ø 4–6                                                      | Ø 8–10 | Ø 12–16 |                                                      |
|  |  | 180                                                               | 0,50                                                       | 0,50   | 0,70    | 0,02 x d <sub>1</sub>                                |
|  |                                                                                   | 180                                                               | 0,40                                                       | 0,50   | 0,70    |                                                      |
|  |                                                                                   | 180                                                               | 0,40                                                       | 0,50   | 0,70    |                                                      |
|  |  | 170                                                               | 0,40                                                       | 0,50   | 0,70    | 0,02 x d <sub>1</sub>                                |
|  |                                                                                   | 170                                                               | 0,40                                                       | 0,50   | 0,70    |                                                      |
|  |                                                                                   | 140                                                               | 0,30                                                       | 0,40   | 0,50    |                                                      |
|  |                                                                                   | 90                                                                | 0,30                                                       | 0,40   | 0,50    |                                                      |
|  |                                                                                   | 70                                                                | 0,30                                                       | 0,40   | 0,50    |                                                      |



Nassbearbeitung, auf ausreichende Emulsionszuführung achten  
Wet machining, sufficient emulsion volume required

Der neue HFC01 Rougher H wurde speziell für die Bearbeitung von ISO-H-Materialien entwickelt. Der Fräser weist eine maximale Zähnezahl (6–8) auf, die durch die Längen extra kurz, kurz und lang zu einem optimalen Programm ergänzt wird. Der Durchmesserbereich liegt hier bei 4–20 mm.

The new HFC01 Rougher H was specially developed for the machining of ISO-H materials. The end mill is equipped with a maximum amount of teeth (6–8) that, combined with the lengths extra short, short and long, form an ideal product range. The diameter range for these tools is 4–20 mm.

**Merkmale:**

**Features:**

Verlängerte Mantelschneide, nachschleifbar  
Extended lateral cutting edge, regrindable

20°-Spiralwinkel  
20° helix angle

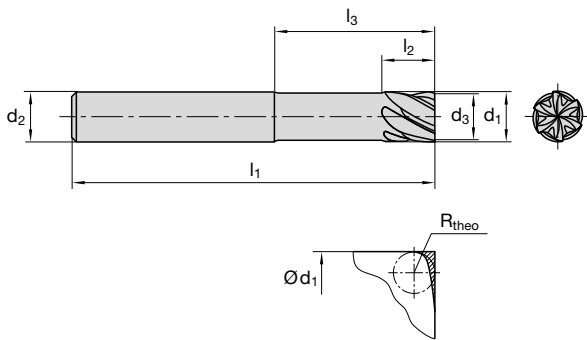
Maximale  
Zähnezahl  
( $z = 6-8$ )  
Maximum  
number of  
teeth ( $z = 6-8$ )

Negative Schneidkanten­geometrie  
Negative cutting edges

Schneidstoff LCHK20M  
Cutting grade LCHK20M



**HFC01 Rougher H**  
**Hochvorschubfräser für gehärtete Stähle bis 65 HRC**  
**High feed end mills for hardened steels up to 65 HRC**



| Katalog-Nr. Cat.-No.   |                |                |                |                |                |   |                   |                    | HFC01-H-A                           |                              |
|------------------------|----------------|----------------|----------------|----------------|----------------|---|-------------------|--------------------|-------------------------------------|------------------------------|
| P                      |                |                |                |                |                |   |                   |                    | <input type="checkbox"/>            |                              |
| M                      |                |                |                |                |                |   |                   |                    |                                     |                              |
| K                      |                |                |                |                |                |   |                   |                    | <input type="checkbox"/>            |                              |
| N                      |                |                |                |                |                |   |                   |                    |                                     |                              |
| S                      |                |                |                |                |                |   |                   |                    |                                     |                              |
| H                      |                |                |                |                |                |   |                   |                    | <input checked="" type="checkbox"/> |                              |
| d <sub>1</sub>         | d <sub>3</sub> | l <sub>2</sub> | l <sub>1</sub> | l <sub>3</sub> | d <sub>2</sub> | z | R <sub>theo</sub> | a <sub>p max</sub> | Ident No.                           | LMT-Code                     |
| extra kurz extra short |                |                |                |                |                |   |                   |                    |                                     |                              |
| 4                      | 3,8            | 4              | 57             | 9              | 6              | 6 | 0,4               | 0,2                | <a href="#">7429966</a>             | EM-HFC01 H4.0x4/9 6R0.4HA    |
| 5                      | 4,8            | 5              | 57             | 11             | 6              | 6 | 0,5               | 0,25               | <a href="#">7429967</a>             | EM-HFC01 H5.0x5/11 6R0.5HA   |
| 6                      | 5,7            | 6              | 57             | 13             | 6              | 6 | 0,6               | 0,3                | <a href="#">7429968</a>             | EM-HFC01 H6.0x6/13 6R0.6HA   |
| 8                      | 7,6            | 8              | 63             | 17             | 8              | 6 | 0,8               | 0,4                | <a href="#">7429969</a>             | EM-HFC01 H8.0x8/17 6R0.8HA   |
| 10                     | 9,5            | 10             | 72             | 22             | 10             | 6 | 1                 | 0,5                | <a href="#">7429970</a>             | EM-HFC01 H10.0x10/22 6R1.0HA |
| 12                     | 11,5           | 12             | 83             | 26             | 12             | 6 | 1,2               | 0,6                | <a href="#">7429971</a>             | EM-HFC01 H12.0x12/26 6R1.2HA |
| 16                     | 15,5           | 16             | 92             | 34             | 16             | 8 | 1,6               | 0,8                | <a href="#">7429972</a>             | EM-HFC01 H16.0x16/34 8R1.6HA |
| 20                     | 19,5           | 20             | 104            | 42             | 20             | 8 | 2                 | 1                  | <a href="#">7429973</a>             | EM-HFC01 H20.0x20/42 8R2.0HA |
| kurz short             |                |                |                |                |                |   |                   |                    |                                     |                              |
| 4                      | 3,8            | 4              | 57             | 15             | 6              | 6 | 0,4               | 0,2                | <a href="#">7429974</a>             | EM-HFC01 H4.0x4/15 6R0.4HA   |
| 5                      | 4,8            | 5              | 57             | 16             | 6              | 6 | 0,5               | 0,25               | <a href="#">7429975</a>             | EM-HFC01 H5.0x5/16 6R0.5HA   |
| 6                      | 5,7            | 6              | 57             | 19             | 6              | 6 | 0,6               | 0,3                | <a href="#">7429976</a>             | EM-HFC01 H6.0x6/19 6R0.6HA   |
| 8                      | 7,6            | 8              | 63             | 25             | 8              | 6 | 0,8               | 0,4                | <a href="#">7429977</a>             | EM-HFC01 H8.0x8/25 6R0.8HA   |
| 10                     | 9,5            | 10             | 72             | 32             | 10             | 6 | 1                 | 0,5                | <a href="#">7429978</a>             | EM-HFC01 H10.0x10/32 6R1.0HA |
| 12                     | 11,5           | 12             | 83             | 38             | 12             | 6 | 1,2               | 0,6                | <a href="#">7429979</a>             | EM-HFC01 H12.0x12/38 6R1.2HA |
| 16                     | 15,5           | 16             | 100            | 50             | 16             | 8 | 1,6               | 0,8                | <a href="#">7429980</a>             | EM-HFC01 H16.0x16/50 8R1.6HA |
| 20                     | 19,5           | 20             | 114            | 62             | 20             | 8 | 2                 | 1                  | <a href="#">7429981</a>             | EM-HFC01 H20.0x20/62 8R2.0HA |
| lang long              |                |                |                |                |                |   |                   |                    |                                     |                              |
| 4                      | 3,8            | 4              | 70             | 24             | 6              | 6 | 0,4               | 0,2                | <a href="#">7429982</a>             | EM-HFC01 H4.0x4/24 6R0.4HA   |
| 5                      | 4,8            | 5              | 70             | 30             | 6              | 6 | 0,5               | 0,25               | <a href="#">7429983</a>             | EM-HFC01 H5.0x6/30 6R0.5HA   |
| 6                      | 5,7            | 6              | 80             | 35             | 6              | 6 | 0,6               | 0,3                | <a href="#">7429984</a>             | EM-HFC01 H6.0x6/35 6R0.6HA   |
| 8                      | 7,6            | 8              | 80             | 40             | 8              | 6 | 0,8               | 0,4                | <a href="#">7429985</a>             | EM-HFC01 H8.0x8/40 6R0.8HA   |
| 10                     | 9,5            | 10             | 90             | 45             | 10             | 6 | 1                 | 0,5                | <a href="#">7429986</a>             | EM-HFC01 H10.0x10/45 6R1.0HA |
| 12                     | 11,5           | 12             | 100            | 50             | 12             | 6 | 1,2               | 0,6                | <a href="#">7429987</a>             | EM-HFC01 H12.0x12/50 6R1.2HA |
| 16                     | 15,5           | 16             | 120            | 66             | 16             | 8 | 1,6               | 0,8                | <a href="#">7429988</a>             | EM-HFC01 H16.0x16/66 8R1.6HA |
| 20                     | 19,5           | 20             | 135            | 82             | 20             | 8 | 2                 | 1                  | <a href="#">7429989</a>             | EM-HFC01 H20.0x20/82 8R2.0HA |

Schnittwertempfehlungen ab Seite 64  
 Cutting data recommendations starting page 64

■ = Hauptanwendung First choice  
☐ = Nebenanwendung Second choice

# HFC01 Rougher H

## Schnittwertempfehlungen

### Cutting data recommendations

| Werkstoff |                                 | Material                      | Werkstoff-Nr.<br>Material No. | DIN<br>Bezeichnung Alt<br>DIN<br>Description Old | R <sub>m</sub> /UTS<br>(N/mm <sup>2</sup> ) | DIN<br>Bezeichnung Neu<br>DIN<br>Description New |  |
|-----------|---------------------------------|-------------------------------|-------------------------------|--------------------------------------------------|---------------------------------------------|--------------------------------------------------|--|
| P         | Vergütbare<br>Formenstähle      | Heat-treatable<br>die steels  | 1.2311                        | 40CrMnMo7                                        | -1100                                       | 40CrMnMo7                                        |  |
|           |                                 |                               | 1.2312                        | 40CrMnMoS8.6                                     |                                             | 40CrMnMoS8-6                                     |  |
|           |                                 |                               | 1.2738                        | 40CrMnNiMoS8.6.4                                 |                                             | 40CrMnNiMoS8-6-4                                 |  |
|           |                                 |                               | 1.2711                        | 54NiCrMoV6                                       |                                             | 54NiCrMoV6                                       |  |
|           | Durchhärtende<br>Werkzeugstähle | Full hardening<br>tool steels | 1.2343                        | X38CrMoV5 1                                      | 350-1400                                    | X37CrMoV5 1                                      |  |
|           |                                 |                               | 1.2080                        | X210Cr12                                         |                                             | X210Cr12                                         |  |
|           |                                 |                               | 1.2379                        | X155CrVMo12 1                                    |                                             | X153CrVMo12 1                                    |  |
|           |                                 |                               | 1.2767                        | X45NiCrMo4                                       |                                             | X45NiCrMo4                                       |  |
|           | Nitrierstähle                   | Nitriding steels              | 1.8550                        | 34CrAlNi7                                        | 950-1400                                    | 34CrAlNi7                                        |  |
|           |                                 |                               | 1.8519                        | 31CrMoV9                                         |                                             | 31CrMoV9                                         |  |
|           |                                 |                               | 1.7735                        | 14CrMoV6.9                                       |                                             | 14CrMoV6.9                                       |  |
|           |                                 |                               | 1.2344                        | X40CrMoV5.1                                      |                                             | X40CrMoV5-1                                      |  |
| K         | Grauguss                        | Grey cast iron                | 0.6025                        | GG25                                             | 100-400<br>(120-260 HB)                     | EN-GJL-250                                       |  |
|           | Legierter Grauguss              | Alloyed grey cast iron        | 0.6678                        | GGL-NiCr35 2                                     | 150-250<br>(160-230 HB)                     | EN-GJLA-XNiCr35-2                                |  |
|           | Sphäroguss                      | Nodular cast iron             | 0.7060<br>0.7070              | GGG60<br>GGG70L                                  | 400-800<br>(120-310 HB)                     | EN-GJS-600-3<br>EN-GJS-700-2U                    |  |
|           | Temperguss                      | Malleable cast iron           | 0.8155                        | GTS55                                            | 350-700<br>(150-280 HB)                     | EN-GJMB-550-4                                    |  |
| H         | Gehärteter Stahl                | Hardened steel                |                               |                                                  | 45-52 HRC                                   |                                                  |  |
|           |                                 |                               |                               |                                                  | 53-56 HRC                                   |                                                  |  |
|           |                                 |                               |                               |                                                  | 57-62 HRC                                   |                                                  |  |
|           |                                 |                               |                               |                                                  | 63-65 HRC                                   |                                                  |  |

Die angegebenen Schnittwerte sind Startwerte und müssen auf die vorhandenen Bedingungen abgestimmt werden.

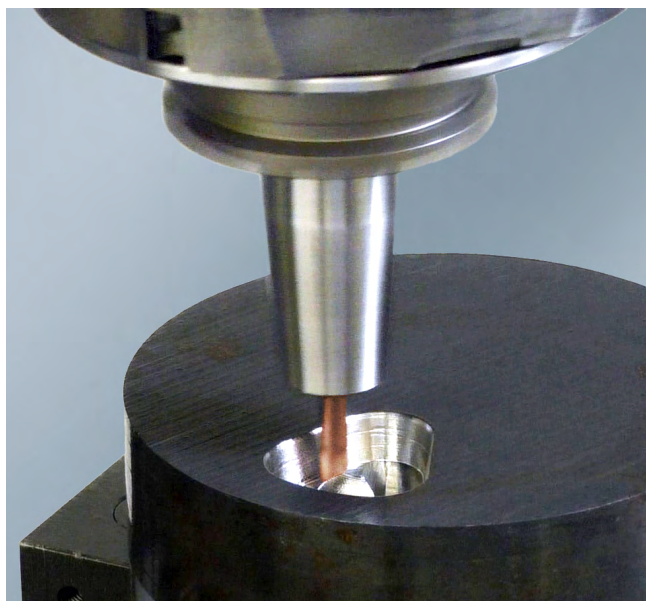
The cutting data indicated are starting values and must be adjusted to the prevailing conditions.

Bei der langen Ausführung empfehlen wir die  $f_z$ -Werte um 30 % zu reduzieren.

We recommended to reduce the  $f_z$ -value with the long version by 30 %.

## Anwendungsbeispiel

### Application example



#### Kopierfräsen, Z-konstant

#### Copying, Z constant

#### Werkzeug Tool:

HFC H

$d_1 = 6 \text{ mm}$ ,  $z = 6$

#### Werkstoff Material:

Werkzeugstahl gehärtet,

Boehler W300 (1.2343 – X38CrMoV 5-1), H11, 54 HRC

Tool steel hardened,

Boehler W300 (1.2343 – X38CrMoV 5-1), H11, 54 HRC

#### Schnittwerte Cutting data:

$v_c = 100 \text{ m/min}$

$n = 5300 \text{ min}^{-1}$

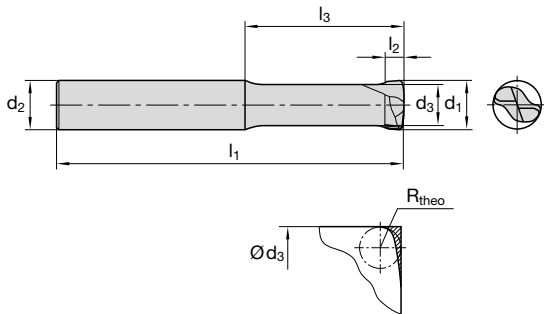
$f_z = 0,175 \text{ mm}$

$v_f = 5600 \text{ mm/min}$

$a_e = 3,5 \text{ mm}$

$a_p = 0,2 \text{ mm}$

|     | Schnittgeschwindigkeit<br>Cutting speed<br>v <sub>c</sub> (m/min) | Fräserdurchmesser Cutting diameter<br>(mm)                 |      |      |      |      |         | Schnitttiefe<br>Cutting depth<br>a <sub>p</sub> (mm) |
|-----|-------------------------------------------------------------------|------------------------------------------------------------|------|------|------|------|---------|------------------------------------------------------|
|     |                                                                   | Vorschub pro Zahn Feed per tooth<br>f <sub>z</sub> (mm/z.) |      |      |      |      |         |                                                      |
|     |                                                                   | Ø 4                                                        | Ø 5  | Ø 6  | Ø 8  | Ø 10 | Ø 12-20 |                                                      |
|     | 240                                                               | 0,30                                                       | 0,38 | 0,45 | 0,60 | 0,75 | 0,90    | 0,05 x d <sub>1</sub><br>(= a <sub>p max</sub> )     |
|     | 220                                                               | 0,30                                                       | 0,38 | 0,45 | 0,60 | 0,75 | 0,90    |                                                      |
|     | 200                                                               | 0,24                                                       | 0,30 | 0,36 | 0,48 | 0,60 | 0,70    |                                                      |
|     | 200                                                               | 0,28                                                       | 0,35 | 0,42 | 0,56 | 0,70 | 0,85    | 0,04 x d <sub>1</sub>                                |
|     | 180                                                               | 0,26                                                       | 0,33 | 0,39 | 0,52 | 0,65 | 0,80    |                                                      |
|     | 160                                                               | 0,24                                                       | 0,30 | 0,36 | 0,48 | 0,60 | 0,70    |                                                      |
|     | 200                                                               | 0,28                                                       | 0,35 | 0,42 | 0,56 | 0,70 | 0,85    | 0,04 x d <sub>1</sub>                                |
|     | 180                                                               | 0,26                                                       | 0,33 | 0,39 | 0,52 | 0,65 | 0,80    |                                                      |
|     | 160                                                               | 0,24                                                       | 0,30 | 0,36 | 0,48 | 0,60 | 0,70    |                                                      |
|     | 200                                                               | 0,35                                                       | 0,40 | 0,55 | 0,65 | 0,80 | 0,95    | 0,05 x d <sub>1</sub>                                |
|     | 180                                                               | 0,30                                                       | 0,35 | 0,50 | 0,60 | 0,75 | 0,90    |                                                      |
|     | 180                                                               | 0,30                                                       | 0,35 | 0,50 | 0,60 | 0,75 | 0,90    |                                                      |
| 160 | 0,30                                                              | 0,35                                                       | 0,50 | 0,60 | 0,75 | 0,90 |         |                                                      |
|     | 160-180                                                           | 0,16                                                       | 0,20 | 0,24 | 0,32 | 0,40 | 0,48    | 0,04 x d <sub>1</sub>                                |
|     | 120-160                                                           | 0,12                                                       | 0,15 | 0,18 | 0,24 | 0,30 | 0,36    | 0,03 x d <sub>1</sub>                                |
|     | 100-120                                                           | 0,08                                                       | 0,10 | 0,12 | 0,16 | 0,20 | 0,24    | 0,02 x d <sub>1</sub>                                |
|     | 80-100                                                            | 0,06                                                       | 0,08 | 0,09 | 0,12 | 0,15 | 0,18    | 0,01 x d <sub>1</sub>                                |

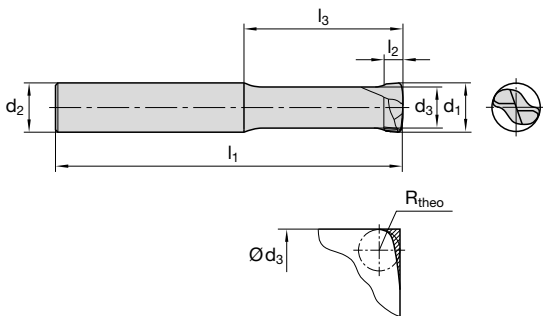


| Katalog-Nr. Cat.-No.   |                |                |                |                |                |   |                   |                    | HFC01-U-A |                                 |  |
|------------------------|----------------|----------------|----------------|----------------|----------------|---|-------------------|--------------------|-----------|---------------------------------|--|
| P                      |                |                |                |                |                |   |                   |                    | ■         |                                 |  |
| M                      |                |                |                |                |                |   |                   |                    | ■         |                                 |  |
| K                      |                |                |                |                |                |   |                   |                    | ■         |                                 |  |
| N                      |                |                |                |                |                |   |                   |                    |           |                                 |  |
| S                      |                |                |                |                |                |   |                   |                    |           |                                 |  |
| H                      |                |                |                |                |                |   |                   |                    | □         |                                 |  |
| d <sub>1</sub>         | d <sub>3</sub> | l <sub>2</sub> | l <sub>1</sub> | l <sub>3</sub> | d <sub>2</sub> | z | R <sub>theo</sub> | a <sub>p max</sub> | Ident No. | LMT-Code                        |  |
| extra kurz extra short |                |                |                |                |                |   |                   |                    |           |                                 |  |
| 1                      | 0,8            | 0,35           | 40             | 2              | 3              | 2 | 0,1               | 0,05               | 7422488   | EM-HFC01 U1.0x0.35/2 2R0.1HA    |  |
| 2                      | 1,6            | 0,7            | 40             | 4              | 4              | 2 | 0,2               | 0,1                | 7422489   | EM-HFC01 U2.0x0.7/4 2R0.2HA     |  |
| 3                      | 2,5            | 1              | 50             | 6              | 6              | 2 | 0,3               | 0,15               | 7422490   | EM-HFC01 U3.0x1/6 2R0.3HA       |  |
| 4                      | 3,4            | 1,5            | 57             | 8              | 6              | 2 | 0,4               | 0,2                | 7422494   | EM-HFC01 U4.0x1.5/8 2R0.4HA     |  |
| 5                      | 4,2            | 2              | 57             | 10             | 6              | 2 | 0,5               | 0,25               | 7422495   | EM-HFC01 U5.0x2/10 2R0.5HA      |  |
| 6                      | 5              | 2,5            | 57             | 12             | 6              | 2 | 0,6               | 0,3                | 7422496   | EM-HFC01 U6.0x2.5/12 2R0.6HA    |  |
| 8                      | 6,7            | 3              | 63             | 16             | 8              | 2 | 0,8               | 0,4                | 7422497   | EM-HFC01 U8.0x3/16 2R0.8HA      |  |
| 10                     | 8,5            | 3,5            | 72             | 20             | 10             | 2 | 1                 | 0,5                | 7422498   | EM-HFC01 U10.0x3.5/20 2R1.0HA   |  |
| 12                     | 10             | 4              | 83             | 24             | 12             | 2 | 1,2               | 0,6                | 7422499   | EM-HFC01 U12.0x4/24 2R1.2HA     |  |
| 14                     | 11,8           | 4              | 83             | 28             | 14             | 2 | 1,4               | 0,7                | 7422500   | EM-HFC01 U14.0x4/28 2R1.4HA     |  |
| kurz short             |                |                |                |                |                |   |                   |                    |           |                                 |  |
| 1                      | 0,8            | 0,35           | 40             | 4              | 3              | 2 | 0,1               | 0,05               | 7422491   | EM-HFC01 U1.0x0.35/4 2R0.1HA    |  |
| 2                      | 1,6            | 0,7            | 40             | 8              | 4              | 2 | 0,2               | 0,1                | 7422492   | EM-HFC01 U2.0x0.7/8 2R0.2HA     |  |
| 3                      | 2,5            | 1              | 57             | 12             | 6              | 2 | 0,3               | 0,15               | 7422493   | EM-HFC01 U3.0x1/12 2R0.3HA      |  |
| 4                      | 3,4            | 1,5            | 57             | 15             | 6              | 2 | 0,4               | 0,2                | 7422466   | EM-HFC01 U4.0x1.5/15 2R0.4HA    |  |
| 5                      | 4,2            | 2              | 57             | 17,5           | 6              | 2 | 0,5               | 0,25               | 7422467   | EM-HFC01 U5.0x2/17.5 2R0.5HA    |  |
| 6                      | 5              | 2,5            | 57             | 19             | 6              | 2 | 0,6               | 0,3                | 7422468   | EM-HFC01 U6.0x2.5/19 2R0.6HA    |  |
| 8                      | 6,7            | 3              | 63             | 24             | 8              | 2 | 0,8               | 0,4                | 7422469   | EM-HFC01 U8.0x3/24 2R0.8HA      |  |
| 10                     | 8,5            | 3,5            | 72             | 28,5           | 10             | 2 | 1                 | 0,5                | 7422470   | EM-HFC01 U10.0x3.5/28.5 2R1.0HA |  |
| 12                     | 10             | 4              | 83             | 34             | 12             | 2 | 1,2               | 0,6                | 7422471   | EM-HFC01 U12.0x4/34 2R1.2HA     |  |
| 16                     | 13,5           | 5,5            | 92             | 39             | 16             | 2 | 1,6               | 0,8                | 7422472   | EM-HFC01 U16.0x5.5/39 2R1.6HA   |  |
| 20                     | 17             | 7              | 104            | 48             | 20             | 2 | 2                 | 1                  | 7422473   | EM-HFC01 U20.0x7/48 2R2.0HA     |  |
| lang long              |                |                |                |                |                |   |                   |                    |           |                                 |  |
| 4                      | 3,4            | 1,5            | 70             | 24             | 6              | 2 | 0,4               | 0,2                | 7422482   | EM-HFC01 U4.0x1.5/24 2R0.4HA    |  |
| 5                      | 4,2            | 2              | 70             | 30             | 6              | 2 | 0,5               | 0,25               | 7422483   | EM-HFC01 U5.0x2/30 2R0.5HA      |  |
| 6                      | 5              | 2,5            | 80             | 35             | 6              | 2 | 0,6               | 0,3                | 7422484   | EM-HFC01 U6.0x2.5/35 2R0.6HA    |  |
| 8                      | 6,7            | 3              | 80             | 40             | 8              | 2 | 0,8               | 0,4                | 7422485   | EM-HFC01 U8.0x3/40 2R0.8HA      |  |
| 10                     | 8,5            | 3,5            | 90             | 45             | 10             | 2 | 1                 | 0,5                | 7422486   | EM-HFC01 U10.0x3.5/45 2R1.0HA   |  |
| 12                     | 10             | 4              | 100            | 50             | 12             | 2 | 1,2               | 0,6                | 7422487   | EM-HFC01 U12.0x4/50 2R1.2HA     |  |
|                        |                |                |                |                |                |   |                   |                    |           |                                 |  |

Schnittwertempfehlungen ab Seite 68  
 Cutting data recommendations starting page 68

■ = Hauptanwendung First choice  
 □ = Nebenanwendung Second choice





| Katalog-Nr. Cat.-No.  |                |                |                |                |                |   |                   |                    | HFC01-U-A |                                 |  |
|-----------------------|----------------|----------------|----------------|----------------|----------------|---|-------------------|--------------------|-----------|---------------------------------|--|
| P                     |                |                |                |                |                |   |                   |                    | ■         |                                 |  |
| M                     |                |                |                |                |                |   |                   |                    | ■         |                                 |  |
| K                     |                |                |                |                |                |   |                   |                    | ■         |                                 |  |
| N                     |                |                |                |                |                |   |                   |                    |           |                                 |  |
| S                     |                |                |                |                |                |   |                   |                    |           |                                 |  |
| H                     |                |                |                |                |                |   |                   |                    | □         |                                 |  |
| d <sub>1</sub>        | d <sub>3</sub> | l <sub>2</sub> | l <sub>1</sub> | l <sub>3</sub> | d <sub>2</sub> | z | R <sub>theo</sub> | a <sub>p max</sub> | Ident No. | LMT-Code                        |  |
| extra lang extra long |                |                |                |                |                |   |                   |                    |           |                                 |  |
| 4                     | 3,4            | 1,5            | 80             | 34             | 6              | 2 | 0,4               | 0,2                | 7422474   | EM-HFC01 U4.0x1.5/34 2R0.4HA    |  |
| 5                     | 4,2            | 2              | 80             | 37             | 6              | 2 | 0,5               | 0,25               | 7422475   | EM-HFC01 U5.0x2/37 2R0.5HA      |  |
| 6                     | 5              | 2,5            | 80             | 42             | 6              | 2 | 0,6               | 0,3                | 7422476   | EM-HFC01 U6.0x2.5/42 2R0.6HA    |  |
| 8                     | 6,7            | 3              | 90             | 51             | 8              | 2 | 0,8               | 0,4                | 7422477   | EM-HFC01 U8.0x3/51 2R0.8HA      |  |
| 10                    | 8,5            | 3,5            | 100            | 56,5           | 10             | 2 | 1                 | 0,5                | 7422478   | EM-HFC01 U10.0x3.5/56.5 2R1.0HA |  |
| 12                    | 10             | 4              | 110            | 61             | 12             | 2 | 1,2               | 0,6                | 7422479   | EM-HFC01 U12.0x4/61 2R1.2HA     |  |
| 16                    | 13,5           | 5,5            | 130            | 77             | 16             | 2 | 1,6               | 0,8                | 7422480   | EM-HFC01 U16.0x5.5/77 2R1.6HA   |  |
| 20                    | 17             | 7              | 150            | 94             | 20             | 2 | 2                 | 1                  | 7422481   | EM-HFC01 U20.0x7/94 2R2.0HA     |  |
|                       |                |                |                |                |                |   |                   |                    |           |                                 |  |

**HFC01 Rougher UNI**  
**Schnittwertempfehlungen**  
**Cutting data recommendations**

| Werkstoff |                                                                     | Material                                   | Werkstoff-Nr.<br>Material No. | DIN<br>Bezeichnung Alt<br>DIN<br>Description Old | R <sub>m</sub> /UTS<br>(N/mm <sup>2</sup> ) | DIN<br>Bezeichnung Neu<br>DIN<br>Description New |
|-----------|---------------------------------------------------------------------|--------------------------------------------|-------------------------------|--------------------------------------------------|---------------------------------------------|--------------------------------------------------|
| <b>P</b>  | Unlegierter Baustahl<br>+ Automatenstahl                            | Plain carbon steel<br>+ free cutting steel | 1.0570                        | St52-3                                           | -700                                        | S355J2G3                                         |
|           |                                                                     |                                            | 1.1730                        | C45                                              | -800                                        | C45U                                             |
|           |                                                                     |                                            | 1.0715                        | 9SMn28                                           | -700                                        | 11SMn30                                          |
|           |                                                                     |                                            | 1.1191                        | Ck45                                             | 500-950                                     | C45E                                             |
|           |                                                                     |                                            | 1.7219                        | 26CrMo4                                          |                                             | 26CrMo4-2                                        |
|           | Vergütungsstahl,<br>mittelfest                                      | Heat-treatment steel,<br>medium strength   | 1.7225                        | 42CrMo4                                          | 500-950                                     | 42CrMo4                                          |
|           | Stahlguss                                                           | Cast steel                                 | 1.8159                        | 51CrV4                                           |                                             | 51CrV4                                           |
|           | Einsatzstahl                                                        | Case hardening steel                       | 1.0416                        | GS40                                             | -950                                        | GS40                                             |
|           |                                                                     |                                            | 1.7131                        | 16MnCr5                                          | -950                                        | 16MnCr5                                          |
|           | Rost- und säurebeständiger<br>Stahl, ferritisch, martensi-<br>tisch | Stainless steel, ferritic,<br>martensitic  | 1.4006                        | X10Cr13                                          | 500-950                                     | X12Cr13                                          |
|           |                                                                     |                                            | 1.4104                        | X12CrMoS17                                       |                                             | X14CrMoS17                                       |
|           |                                                                     |                                            | 1.4122                        | X35CrMo17                                        |                                             | X39CrMo17-1                                      |
|           | Vergütungsstahl,<br>hochfest                                        | Heat-treatment steel,<br>high strength     | 1.7225                        | 42CrMo4                                          | 950-1400                                    | 42CrMo4                                          |
|           |                                                                     |                                            | 1.6580                        | 30CrNiMo8                                        |                                             | 30CrNiMo8                                        |
|           | Nitrierstahl,<br>vergütet                                           | Nitriding steel,<br>heat treated           | 1.8504                        | 34CrAl6                                          | 950-1400                                    | 34CrAl6                                          |
|           |                                                                     |                                            | 1.2344                        | X40CrMoV5.1                                      | -900                                        | X40CrMoV5-1                                      |
|           | Werkzeugstahl                                                       | Tool steel                                 | 1.2343                        | X38CrMoV5 1                                      | 950-1400                                    | X37CrMoV5-1                                      |
|           |                                                                     |                                            | 1.2316                        | X38CrMo16                                        | -1100                                       | X38CrMo16                                        |
|           |                                                                     |                                            | 1.2379                        | X155CrVMo12 1                                    | -950                                        | X153CrMoV12-1                                    |
|           |                                                                     |                                            | 1.2080                        | X210Cr12                                         | 950-1400                                    | X210Cr12                                         |
|           |                                                                     |                                            | 1.2358                        | 60CrMoV18-5                                      | 850-1000                                    | 60CrMoV18-5                                      |
|           |                                                                     |                                            | 1.2714                        | 55NiCrMoV7                                       | 1100-1350                                   | 55NiCrMoV7                                       |
|           |                                                                     |                                            | 1.2311                        | 40CrMnMo7                                        | -1100                                       | 40CrMnMo7                                        |
|           |                                                                     |                                            | 1.2312                        | 40CrMnNiMoS8.6                                   | -1150                                       | 40CrMnNiMoS8-6                                   |
|           |                                                                     |                                            | 1.2738                        | 45CrMnNiMo8.6.4                                  | 950-1150                                    | 45CrMnNiMo8-6-4                                  |
| <b>M</b>  | Rost- und säurebeständiger<br>Stahl, austenitisch                   | Stainless steel,<br>austenitic             | 1.4301                        | X2CrNiMo17-12-2                                  | 500-950                                     | X5CrNiMo18-10                                    |
|           |                                                                     |                                            | 1.4404                        | X6CrNiMoTi17-12-2                                |                                             | X2CrNiMo17-12-2                                  |
|           |                                                                     |                                            | 1.4571                        | X10CrNiMoTi18                                    |                                             | X10CrNiMoTi18                                    |
|           | Rost- und säurebestän-<br>diger Stahl, martensitisch<br>aushärtbar  | Stainless steel,<br>martensitic steel      | 1.2709                        | X3NiCoMoTi18-9-5                                 | 800-1000                                    | X3NiCoMoTi18-9-5                                 |
|           |                                                                     |                                            | 1.4542                        | X5CrNiCuNb16-4                                   |                                             | X5CrNiCuNb16-4                                   |
| <b>K</b>  |                                                                     |                                            | 1.4568                        | X7CrNiAl17-7                                     |                                             | X7CrNiAl17-7                                     |
|           | Grauguss                                                            | Grey cast iron                             | 0.6025                        | GG25                                             | 100-400<br>(120-260 HB)                     | EN-GJL-250                                       |
|           | Legierter Grauguss                                                  | Alloyed grey cast iron                     | 0.6678                        | GGL-NiCr35 2                                     | 150-250<br>(160-230 HB)                     | EN-GJLA-XNiCr35-2                                |
|           | Sphäroguss                                                          | Nodular cast iron                          | 0.7070                        | GGG70L                                           | 400-800                                     | EN-GJS-700-2U                                    |
|           |                                                                     |                                            | 0.7060                        | GGG60                                            | (120-310 HB)                                | EN-GJS-600-3                                     |
| <b>H</b>  | Temperguss                                                          | Malleable cast iron                        | 0.8155                        | GTS55                                            | 350-700<br>(150-280 HB)                     | EN-GJMB-550-4                                    |
|           | Hartguss                                                            | Chilled cast iron                          |                               | Ni-hard, Ampco                                   | 300-600 HB                                  | Ni-hard, Ampco                                   |
|           | Gehärteter Stahl                                                    | Hardened steel                             |                               |                                                  | 45-52 HRC                                   |                                                  |

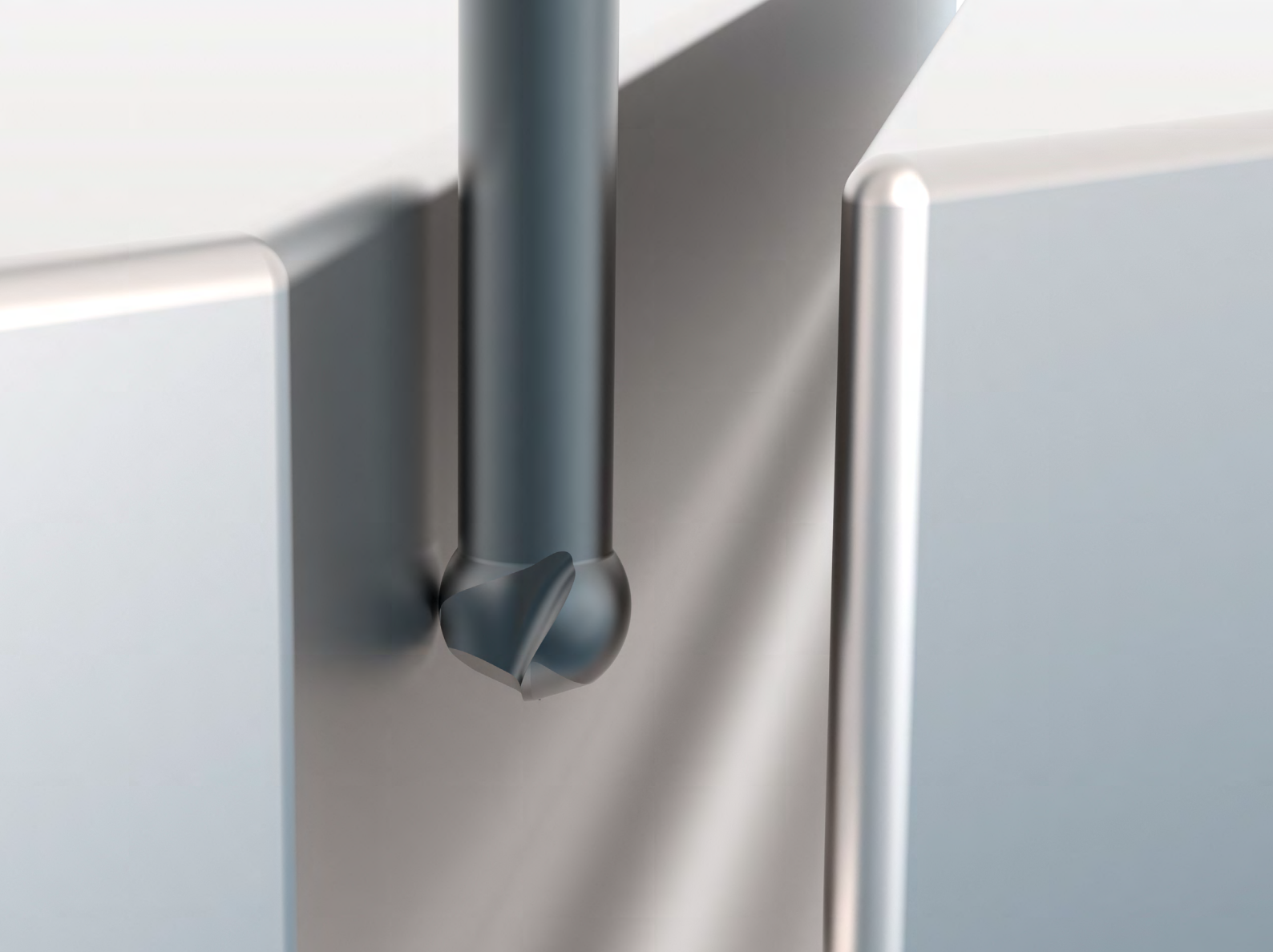
Die angegebenen Schnittwerte sind Startwerte bezogen auf Ø 10 mm und müssen auf die vorhandenen Bedingungen abgestimmt werden.

The cutting data indicated are starting values based on Ø 10 mm and must be adjusted to the prevailing conditions.

Bei der langen Ausführung empfehlen wir die f<sub>z</sub>-Werte um 30% zu reduzieren.

We recommended to reduce the f<sub>z</sub>-value with the long version by 30 %.

|     | Schnittgeschwindigkeit<br>Cutting speed<br>v <sub>c</sub> (m/min) | Fräserdurchmesser Cutting diameter<br>(mm)                 |        |         | Schnitttiefe<br>Cutting depth<br>a <sub>p</sub> (mm) |
|-----|-------------------------------------------------------------------|------------------------------------------------------------|--------|---------|------------------------------------------------------|
|     |                                                                   | Vorschub pro Zahn Feed per tooth<br>f <sub>z</sub> (mm/z.) |        |         |                                                      |
|     |                                                                   | Ø 1–4                                                      | Ø 5–10 | Ø 12–20 |                                                      |
|     | 300                                                               | 0,30                                                       | 0,70   | 1,00    | 0,05 x d <sub>1</sub>                                |
|     | 300                                                               | 0,30                                                       | 0,70   | 1,00    |                                                      |
|     | 300                                                               | 0,30                                                       | 0,70   | 1,00    |                                                      |
|     | 240                                                               | 0,25                                                       | 0,60   | 0,80    |                                                      |
|     | 200                                                               | 0,25                                                       | 0,60   | 0,80    |                                                      |
|     | 240                                                               | 0,25                                                       | 0,60   | 0,80    |                                                      |
|     | 200                                                               | 0,25                                                       | 0,60   | 0,80    | 0,045 x d <sub>1</sub>                               |
|     | 200                                                               | 0,25                                                       | 0,60   | 0,80    |                                                      |
|     | 200                                                               | 0,25                                                       | 0,60   | 0,80    |                                                      |
|     | 180                                                               | 0,25                                                       | 0,60   | 0,80    | 0,04 x d <sub>1</sub>                                |
|     | 220                                                               | 0,25                                                       | 0,60   | 0,80    | 0,04 x d <sub>1</sub>                                |
|     | 200                                                               | 0,20                                                       | 0,50   | 0,70    |                                                      |
| 200 | 0,25                                                              | 0,60                                                       | 0,80   |         |                                                      |
|     | 230                                                               | 0,20                                                       | 0,50   | 0,70    | 0,02 x d <sub>1</sub>                                |
|     | 230                                                               | 0,20                                                       | 0,50   | 0,70    |                                                      |
|     | 250                                                               | 0,50                                                       | 0,90   | 1,30    | 0,04 x d <sub>1</sub>                                |
|     | 250                                                               | 0,45                                                       | 0,80   | 1,20    |                                                      |
|     | 180                                                               | 0,20                                                       | 0,50   | 0,70    |                                                      |
|     | 180                                                               | 0,30                                                       | 0,70   | 1,00    |                                                      |
|     | 150                                                               | 0,30                                                       | 0,70   | 1,00    |                                                      |
|     | 100                                                               | 0,20                                                       | 0,50   | 0,70    | 0,03 x d <sub>1</sub>                                |
|     | 160–180                                                           | 0,15                                                       | 0,30   | 0,50    |                                                      |



# HSC – High Speed Cutter

Unsere Komplettlösung  
für Ihre anspruchsvollsten  
Fräsprozesse

Our Complete Solution  
for Your Most Demanding  
Milling Processes

Mit unserem HSC-Programm sind wir stolz darauf, Ihnen eine breite Palette von Spezialisten für Ihre anspruchsvollsten fünfachsigen Bearbeitungsaufgaben anzubieten. Dank unserer Expertise im Schlichten und der Bereitstellung von erstklassigen Oberflächengüten, setzen unsere Werkzeuge neue Maßstäbe. Egal ob konvex oder konkav – unsere Auswahl an runden und torischen Geometrien ermöglicht eine perfekte Bearbeitung der jeweiligen Oberflächen.

Des Weiteren haben Sie in unserem Programm eine Vielzahl an Optionen. So maximieren unter anderem verlängerte Hälse und optimierte Schneidstoffe Ihre Produktivität und die Ergebnisse Ihrer Bauteile in verschiedenen Werkstückmaterialien. Ob es sich um harte oder langspanende Materialien handelt, wir haben die perfekte Lösung für Sie. Dank unserer langjährigen Erfahrung im Gesenk- und Formenbau wissen wir genau, worauf es ankommt. Wir von LMT Tools sind der verlässliche Partner an Ihrer Seite und wissen mit unseren Werkzeugen, Ihre Erwartungen zu übertreffen. Entdecken Sie die grenzenlosen Möglichkeiten mit unserem HSC-Programm!

With our HSC program, we are proud to offer you a wide range of specialists for your most demanding five-axis machining tasks. Thanks to our expertise in finishing and providing first-class surface finishes, our tools set new standards. Whether convex or concave, our selection of geometries enables perfect machining of the respective surfaces. You have a wide range of options in our program.

Among other things, extended necks and optimized cutting materials maximize your productivity and the results of your components in various workpiece materials. Whether your material is hard or long-chipping, we have the perfect solution for you. Thanks to our many years of experience in die and mold making, we know exactly what matters. We at LMT Tools are the reliable partner at your side and know how to exceed your expectations with our tools. Discover unlimited possibilities with our HSC program!

## **Unsere Komplettlösung für das beste Ergebnis in Ihrer Fertigung** **Our Complete Solution for the Best Result in Your Production**

Das besondere Highlight an unserem HSC-Programm? Unser ergänzendes Kopierfräsprogramm im Wendeplattenbereich bietet Ihnen eine vollständige Werkzeug-Palette aus einer Hand. So müssen Sie nicht länger verschiedene Lieferanten koordinieren oder Kompromisse bei der Qualität eingehen. Wir bieten Ihnen alles, was Sie benötigen, um Ihre Fertigungsprozesse zu optimieren und effizienter zu gestalten.

Warten Sie nicht länger und treten Sie ein in die Welt unseres HSC-Programms. Erleben Sie Perfektion durch unsere langjährige Erfahrung und unseren unermüdlichen Einsatz für Qualität. Kontaktieren Sie uns noch heute und lassen Sie uns gemeinsam Ihre Bearbeitungsaufgaben auf ein neues Niveau heben!

### **Ihre Vorteile:**

- Sehr gute Oberflächenqualität der bearbeiteten Werkstücke
- Optimierte Geometrie mit sehr engen Fertigungstoleranzen für höchste Präzision im Einsatz
- Hochwertige Substrate für hohe Schnittgeschwindigkeiten und kürzere Bearbeitungszeiten
- Ausgereifte Beschichtung mit hoher Verschleißbeständigkeit für stabile Fertigungsprozesse

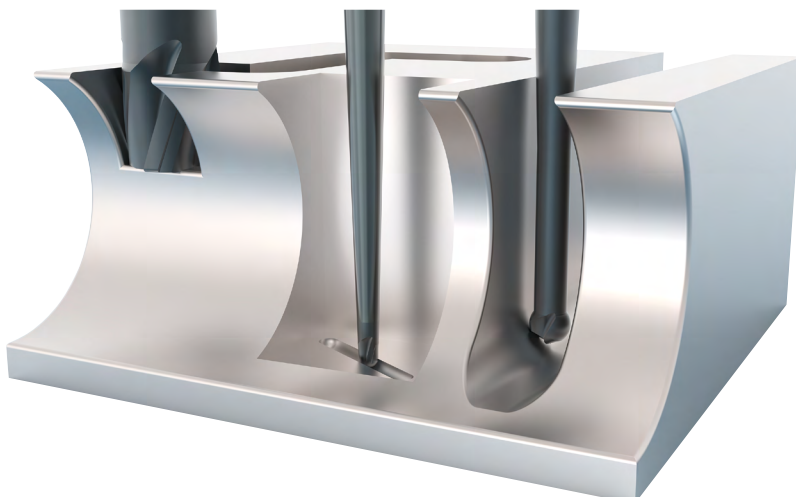
The special highlight of our HSC program?

Our copy milling program in the insert area offers you a complete range of tools from a single source. This means you no longer have to coordinate different suppliers or compromise on quality. We offer you everything you need to optimize your machining processes and make them more efficient.

Don't wait any longer and enter the world of our HSC program. Experience perfection through our years of experience and unwavering commitment to quality. Contact us today and let's work together to take your machining tasks to the next level!

### **Your benefits:**

- Very good surface quality of the machined workpieces
- Optimized geometry with very tight manufacturing tolerances for maximum precision in use
- High-quality substrate for high cutting speeds and shorter machining times
- Advanced coating with high wear resistance for stable manufacturing processes



Schneidenlänge  $2 \times d_1$  und  $3 \times d_1$   
Cutting length  $2 \times d_1$  and  $3 \times d_1$



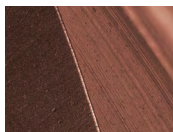
Schaft nach  
DIN 6535 HA  
Shank according  
DIN 6535 HA

2 und 4 Schneiden mit Eckenradius  
2 and 4 flutes with corner radius

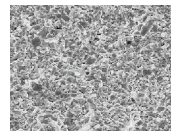


Halsgestaltung für Formauszugsschrägen  
Neck design for form draft angles

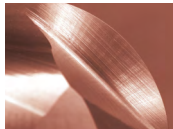
Halslänge bis  $10 \times d_1$   
Neck length up to  $10 \times d_1$



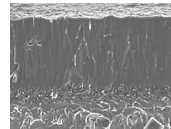
Definiert behandelte Schneidkante  
Defined preparation of the cutting edge



Innovativer Schneidstoff (LCHK20M)  
Innovative cutting material (LCHK20M)



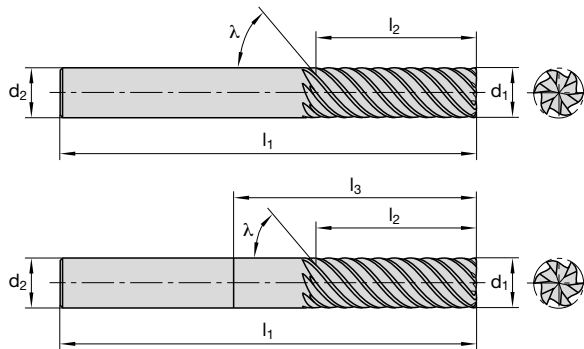
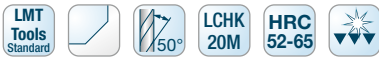
Sehr eng tolerierter Radius  $\pm 0,005 \text{ mm}$   
Very closely tolerated radius  $\pm 0.005 \text{ mm}$



Leistungsstarke Mehrlagenbeschichtung  
High-performance multi-layer coating



**HSC01 Finisher 50 H**  
**Schaftfräser, hochgedrallt mit Kantenschutzfase**  
 End mills, high helix angle with edge protection chamfer



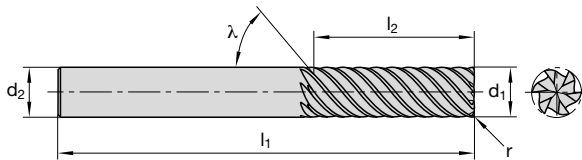
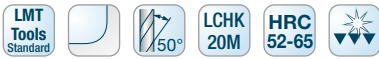
| Katalog-Nr. Cat.-No.                    |                      |                      |                      |                      |          | HSC01-H-A                           |                               |
|-----------------------------------------|----------------------|----------------------|----------------------|----------------------|----------|-------------------------------------|-------------------------------|
| <b>P</b>                                |                      |                      |                      |                      |          | <input type="checkbox"/>            |                               |
| <b>M</b>                                |                      |                      |                      |                      |          |                                     |                               |
| <b>K</b>                                |                      |                      |                      |                      |          | <input type="checkbox"/>            |                               |
| <b>N</b>                                |                      |                      |                      |                      |          |                                     |                               |
| <b>S</b>                                |                      |                      |                      |                      |          |                                     |                               |
| <b>H</b>                                |                      |                      |                      |                      |          | <input checked="" type="checkbox"/> |                               |
| <b>d<sub>1</sub></b>                    |                      |                      |                      |                      |          | <b>Ident No.</b>                    | <b>LMT-Code</b>               |
| 0<br>Ø 4-6 -0,038<br>0<br>Ø 8-20 -0,047 | <b>l<sub>2</sub></b> | <b>l<sub>1</sub></b> | <b>l<sub>3</sub></b> | <b>d<sub>2</sub></b> | <b>z</b> |                                     |                               |
| <b>lang long</b>                        |                      |                      |                      |                      |          |                                     |                               |
| 4                                       | 14                   | 57                   | –                    | 6                    | 4        | 7440204                             | EM-HSC01 H4.0x14/14 4C0.05HA  |
| 5                                       | 17                   | 65                   | –                    | 6                    | 4        | 7440205                             | EM-HSC01 H5.0x17/17 4C0.05HA  |
| 6                                       | 20                   | 65                   | –                    | 6                    | 6        | 7440206                             | EM-HSC01 H6.0x20/20 6C0.05HA  |
| 8                                       | 26                   | 75                   | –                    | 8                    | 6        | 7440207                             | EM-HSC01 H8.0x26/26 6C0.05HA  |
| 10                                      | 32                   | 90                   | –                    | 10                   | 6        | 7440208                             | EM-HSC01 H10.0x32/32 6C0.05HA |
| 12                                      | 38                   | 100                  | –                    | 12                   | 8        | 7440209                             | EM-HSC01 H12.0x38/38 8C0.1HA  |
| 16                                      | 50                   | 120                  | –                    | 16                   | 8        | 7440210                             | EM-HSC01 H16.0x50/50 8C0.1HA  |
| 20                                      | 62                   | 135                  | –                    | 20                   | 8        | 7440211                             | EM-HSC01 H20.0x62/62 8C0.1HA  |
| <b>extra lang extra long</b>            |                      |                      |                      |                      |          |                                     |                               |
| 6                                       | 12                   | 80                   | 44                   | 6                    | 6        | 7440212                             | EM-HSC01 H6.0x12/44 6C0.05HA  |
| 8                                       | 16                   | 100                  | 64                   | 8                    | 6        | 7440213                             | EM-HSC01 H8.0x16/64 6C0.05HA  |
| 10                                      | 20                   | 100                  | 60                   | 10                   | 6        | 7440214                             | EM-HSC01 H10.0x20/60 6C0.05HA |
| 12                                      | 24                   | 120                  | 75                   | 12                   | 8        | 7440215                             | EM-HSC01 H12.0x24/75 8C0.1HA  |
| 16                                      | 32                   | 150                  | 102                  | 16                   | 8        | 7440216                             | EM-HSC01 H16.0x32/102 8C0.1HA |

■ = Hauptanwendung First choice  
 □ = Nebenanwendung Second choice

Schnittwertempfehlungen ab Seite 76  
 Cutting data recommendations starting page 76

| Kantenschutzfase<br>Edge protection chamfer | d <sub>1</sub> | b    |
|---------------------------------------------|----------------|------|
|                                             | 4 – 10         | 0,05 |
|                                             | 12 – 20        | 0,1  |

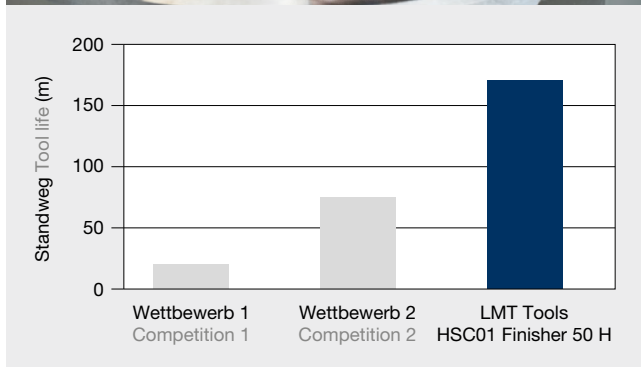
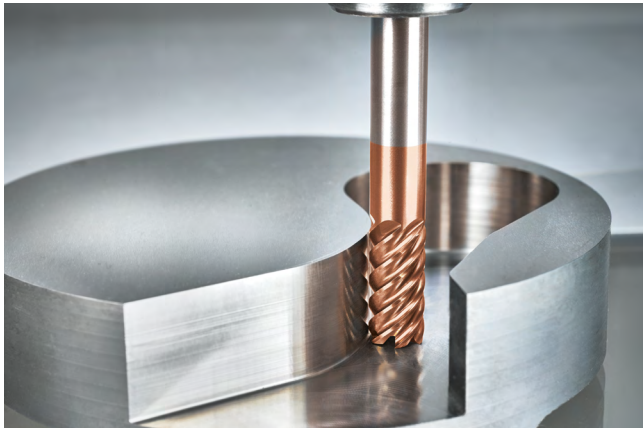
**HSC01 Finisher 50 H**  
**Schaftfräser, hochgedrallt mit Eckenradius**  
**End mills, high helix angle with corner radius**



| Katalog-Nr. Cat.-No.                                            |    |     |    |   |                    | HSC-H-A                             |                              |
|-----------------------------------------------------------------|----|-----|----|---|--------------------|-------------------------------------|------------------------------|
| <b>P</b>                                                        |    |     |    |   |                    | <input type="checkbox"/>            |                              |
| <b>M</b>                                                        |    |     |    |   |                    |                                     |                              |
| <b>K</b>                                                        |    |     |    |   |                    | <input type="checkbox"/>            |                              |
| <b>N</b>                                                        |    |     |    |   |                    |                                     |                              |
| <b>S</b>                                                        |    |     |    |   |                    |                                     |                              |
| <b>H</b>                                                        |    |     |    |   |                    | <input checked="" type="checkbox"/> |                              |
| <b>d<sub>1</sub></b><br>0<br>Ø 4-6 -0,038<br>0<br>Ø 8-20 -0,047 |    |     |    |   | <b>r</b><br>±0,015 | <b>Ident No.</b>                    | <b>LMT-Code</b>              |
| <b>lang long</b>                                                |    |     |    |   |                    |                                     |                              |
| 4                                                               | 14 | 57  | 6  | 4 | 0,5                | <a href="#">7440217</a>             | EM-HSC01 H4.0x14/14 4R0.5HA  |
| 4                                                               | 14 | 57  | 6  | 4 | 1                  | <a href="#">7440218</a>             | EM-HSC01 H4.0x14/14 4R1.0HA  |
| 5                                                               | 17 | 65  | 6  | 4 | 0,5                | <a href="#">7440219</a>             | EM-HSC01 H5.0x17/17 4R0.5HA  |
| 5                                                               | 17 | 65  | 6  | 4 | 1                  | <a href="#">7440220</a>             | EM-HSC01 H5.0x17/17 4R1.0HA  |
| 6                                                               | 20 | 65  | 6  | 6 | 0,5                | <a href="#">7440221</a>             | EM-HSC01 H6.0x20/20 6R0.5HA  |
| 6                                                               | 20 | 65  | 6  | 6 | 1                  | <a href="#">7440222</a>             | EM-HSC01 H6.0x20/20 6R1.0HA  |
| 8                                                               | 26 | 75  | 8  | 6 | 0,5                | <a href="#">7440223</a>             | EM-HSC01 H8.0x26/26 6R0.5HA  |
| 8                                                               | 26 | 75  | 8  | 6 | 1                  | <a href="#">7440224</a>             | EM-HSC01 H8.0x26/26 6R1.0HA  |
| 8                                                               | 26 | 75  | 8  | 6 | 2                  | <a href="#">7440225</a>             | EM-HSC01 H8.0x26/26 6R2.0HA  |
| 10                                                              | 32 | 90  | 10 | 6 | 0,5                | <a href="#">7440226</a>             | EM-HSC01 H10.0x32/32 6R0.5HA |
| 10                                                              | 32 | 90  | 10 | 6 | 1                  | <a href="#">7440227</a>             | EM-HSC01 H10.0x32/32 6R1.0HA |
| 10                                                              | 32 | 90  | 10 | 6 | 2                  | <a href="#">7440228</a>             | EM-HSC01 H10.0x32/32 6R2.0HA |
| 12                                                              | 38 | 100 | 12 | 8 | 0,5                | <a href="#">7440229</a>             | EM-HSC01 H12.0x38/38 8R0.5HA |
| 12                                                              | 38 | 100 | 12 | 8 | 1                  | <a href="#">7440230</a>             | EM-HSC01 H12.0x38/38 8R1.0HA |
| 12                                                              | 38 | 100 | 12 | 8 | 2                  | <a href="#">7440231</a>             | EM-HSC01 H12.0x38/38 8R2.0HA |
| 16                                                              | 50 | 120 | 16 | 8 | 0,5                | <a href="#">7440232</a>             | EM-HSC01 H16.0x50/50 8R0.5HA |
| 16                                                              | 50 | 120 | 16 | 8 | 1                  | <a href="#">7440233</a>             | EM-HSC01 H16.0x50/50 8R1.0HA |
| 16                                                              | 50 | 120 | 16 | 8 | 2                  | <a href="#">7440234</a>             | EM-HSC01 H16.0x50/50 8R2.0HA |
| 20                                                              | 62 | 135 | 20 | 8 | 0,5                | <a href="#">7440235</a>             | EM-HSC01 H20.0x62/62 8R0.5HA |
| 20                                                              | 62 | 135 | 20 | 8 | 1                  | <a href="#">7440236</a>             | EM-HSC01 H20.0x62/62 8R1.0HA |
| 20                                                              | 62 | 135 | 20 | 8 | 2                  | <a href="#">7440237</a>             | EM-HSC01 H20.0x62/62 8R2.0HA |

Schnittwertempfehlungen ab Seite 76  
 Cutting data recommendations starting page 76

■ = Hauptanwendung First choice  
☐ = Nebenanwendung Second choice



**Labortest: Besäumen / Zeilenfräsen**

Laboratory test, contour milling / traverse milling

**Werkzeug Tool:**

HSC01 Finisher 50 H

EM-HSC01 H12.0x38/38 8C0.1HA (Ident No. [7440209](#))

$d_1 = 12 \text{ mm}$ ,  $z = 8$

**Schneidstoff Cutting material:**

LCHK20M

**Werkstoff Material:**

X155CrMoV12-1, 1.2379 (61 HRC)

**Schnittwerte Cutting data:**

$v_c = 120 \text{ m/min}$

$n = 3200 \text{ min}^{-1}$

$f_z = 0,05 \text{ mm}$

$v_f = 1280 \text{ mm/min}$

$a_e = 0,12 \text{ mm}$

$a_p = 24 \text{ mm}$

**Ergebnis Result:**

Der Standweg konnte bei unserem Werkzeug im Vergleich zum besten Wettbewerber mehr als verdoppelt werden.

The tool life was doubled with our tool comparing to the best competitor at this point.

## HSC01 Finisher 50 H

### Schnittwertempfehlungen für hochgedrallte Schaftfräser mit Eckenradius und Kantenschutzfase

Cutting data recommendations for high helix end mills with corner radius and edge protection chamfer

| Werkstoff |                                 | Material                       | Werkstoff-Nr.<br>Material No. | DIN<br>Bezeichnung Alt<br>DIN<br>Description Old | Härte<br>Hardness       | DIN<br>Bezeichnung Neu<br>DIN<br>Description New |
|-----------|---------------------------------|--------------------------------|-------------------------------|--------------------------------------------------|-------------------------|--------------------------------------------------|
| P         | Vergütbare<br>Formenstähle      | Heat-treatable<br>die steels   | 1.2311                        | 40CrMnMo7                                        | 280–325 HB              | 40CrMnMo7                                        |
|           |                                 |                                | 1.2312                        | 40CrMnMoS8.6                                     | 280–325 HB              | 40CrMnMoS8-6                                     |
|           |                                 |                                | 1.2738                        | 40CrMnNiMoS8.6.4                                 | 280–325 HB              | 40CrMnNiMoS8-6-4                                 |
|           |                                 |                                | 1.2711                        | 54NiCrMoV6                                       | 280–415 HB              | 54NiCrMoV6                                       |
|           | Durchhärtende<br>Werkzeugstähle | Full hardening<br>tools steels | 1.2343                        | X38CrMoV5 1                                      | 230 HB                  | X37CrMoV5 1                                      |
|           |                                 |                                | 1.2080                        | X210Cr12                                         | 250 HB                  | X210Cr12                                         |
|           |                                 |                                | 1.2379                        | X155CrVMo12 1                                    | 250 HB                  | X153CrVMo12 1                                    |
|           |                                 |                                | 1.2767                        | X45NiCrMo4                                       | 260 HB                  | X45NiCrMo4                                       |
|           | Nitrierstähle                   | Nitriding steels               | 1.8550                        | 34CrAlNi7                                        | 240–300 HB              | 34CrAlNi7                                        |
|           |                                 |                                | 1.8519                        | 31CrMoV9                                         | 265–310 HB              | 31CrMoV9                                         |
|           |                                 |                                | 1.7735                        | 14CrMoV6.9                                       | 265–310 HB              | 14CrMoV6.9                                       |
|           |                                 |                                | 1.2344                        | X40CrMoV5.1                                      | 280–325 HB              | X40CrMoV5-1                                      |
| K         | Grauguss                        | Grey cast iron                 | 0.6025                        | GG25                                             | 100–400<br>(120–260 HB) | EN-GJl-250                                       |
|           | Legierter Grauguss              | Alloyed grey cast iron         | 0.6678                        | GGL-NiCr35 2                                     | 150–250<br>(160–230 HB) | EN-GJLA-XNiCr35-2                                |
|           | Sphäroguss                      | Nodular cast iron              | 0.7060<br>0.7070              | GGG60<br>GGG70L                                  | 400–800<br>(120–310 HB) | EN-GJS-600-3<br>EN-GJS-700-2U                    |
|           | Temperguss                      | Malleable cast iron            | 0.8155                        | GTS55                                            | 350–700<br>(150–280 HB) | EN-GJMB-550-4                                    |
| H         | Gehärteter Stahl                | Hardened steel                 |                               |                                                  | 45–52 HRC               |                                                  |
|           |                                 |                                |                               |                                                  | 53–56 HRC               |                                                  |
|           |                                 |                                |                               |                                                  | 57–62 HRC               |                                                  |
|           |                                 |                                |                               |                                                  | 63–65 HRC               |                                                  |

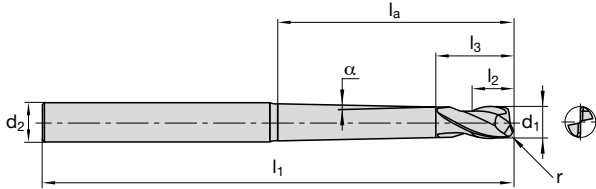
Die angegebenen Schnittwerte sind Startwerte und müssen auf die vorhandenen Bedingungen abgestimmt werden.

The cutting data specified represents base values and must be adapted to the existing conditions.

Bei der langen Ausführung empfehlen wir die  $f_z$ -Werte um 30 % zu reduzieren.

For high values of total feed we recommend reducing the specified unit values of feed ( $f_z$ ) by 30 %.

|  | Schnitt-<br>geschwindigkeit<br>Cutting speed<br>v <sub>c</sub> (m/min) | Fräserdurchmesser Cutting diameter<br>(mm)                 |      |      |      |      |      |      |      | Schnitttiefe<br>Cutting depth<br>a <sub>e</sub> (mm) |
|--|------------------------------------------------------------------------|------------------------------------------------------------|------|------|------|------|------|------|------|------------------------------------------------------|
|  |                                                                        | Vorschub pro Zahn Feed per tooth<br>f <sub>z</sub> (mm/z.) |      |      |      |      |      |      |      |                                                      |
|  |                                                                        | 4                                                          | 5    | 6    | 8    | 10   | 12   | 16   | 20   |                                                      |
|  | 200                                                                    | 0,02                                                       | 0,03 | 0,03 | 0,04 | 0,05 | 0,06 | 0,08 | 0,09 | 0,08 x d <sub>1</sub>                                |
|  | 220                                                                    | 0,02                                                       | 0,03 | 0,03 | 0,04 | 0,05 | 0,06 | 0,08 | 0,09 |                                                      |
|  | 180                                                                    | 0,01                                                       | 0,02 | 0,02 | 0,02 | 0,03 | 0,04 | 0,05 | 0,05 |                                                      |
|  | 200                                                                    | 0,02                                                       | 0,02 | 0,02 | 0,03 | 0,04 | 0,05 | 0,06 | 0,07 | 0,06 x d <sub>1</sub>                                |
|  | 200                                                                    | 0,02                                                       | 0,03 | 0,03 | 0,04 | 0,05 | 0,06 | 0,07 | 0,09 |                                                      |
|  | 160                                                                    | 0,01                                                       | 0,02 | 0,02 | 0,02 | 0,03 | 0,04 | 0,04 | 0,05 |                                                      |
|  | 160                                                                    | 0,01                                                       | 0,02 | 0,02 | 0,02 | 0,03 | 0,04 | 0,04 | 0,05 |                                                      |
|  | 200                                                                    | 0,02                                                       | 0,02 | 0,02 | 0,03 | 0,04 | 0,05 | 0,06 | 0,07 | 0,08 x d <sub>1</sub>                                |
|  | 180                                                                    | 0,01                                                       | 0,02 | 0,02 | 0,02 | 0,03 | 0,04 | 0,05 | 0,05 |                                                      |
|  | 200                                                                    | 0,01                                                       | 0,02 | 0,02 | 0,02 | 0,03 | 0,04 | 0,05 | 0,05 |                                                      |
|  | 200                                                                    | 0,02                                                       | 0,02 | 0,02 | 0,03 | 0,04 | 0,05 | 0,06 | 0,07 |                                                      |
|  | 200                                                                    | 0,02                                                       | 0,03 | 0,03 | 0,04 | 0,05 | 0,06 | 0,07 | 0,09 |                                                      |
|  | 240                                                                    | 0,03                                                       | 0,04 | 0,05 | 0,06 | 0,07 | 0,09 | 0,10 | 0,11 | 0,06 x d <sub>1</sub>                                |
|  | 220                                                                    | 0,02                                                       | 0,03 | 0,04 | 0,05 | 0,06 | 0,07 | 0,08 | 0,09 |                                                      |
|  | 220                                                                    | 0,02                                                       | 0,03 | 0,04 | 0,05 | 0,06 | 0,07 | 0,08 | 0,09 |                                                      |
|  | 200                                                                    | 0,02                                                       | 0,03 | 0,04 | 0,05 | 0,06 | 0,07 | 0,07 | 0,08 |                                                      |
|  | 180                                                                    | 0,01                                                       | 0,02 | 0,02 | 0,02 | 0,03 | 0,04 | 0,05 | 0,05 | 0,04 x d <sub>1</sub>                                |
|  | 150                                                                    | 0,01                                                       | 0,01 | 0,02 | 0,02 | 0,03 | 0,03 | 0,05 | 0,05 | 0,03 x d <sub>1</sub>                                |
|  | 120                                                                    | 0,01                                                       | 0,01 | 0,02 | 0,02 | 0,03 | 0,03 | 0,04 | 0,05 | 0,02 x d <sub>1</sub>                                |
|  | 100                                                                    | 0,01                                                       | 0,01 | 0,01 | 0,02 | 0,02 | 0,03 | 0,04 | 0,04 | 0,01 x d <sub>1</sub>                                |

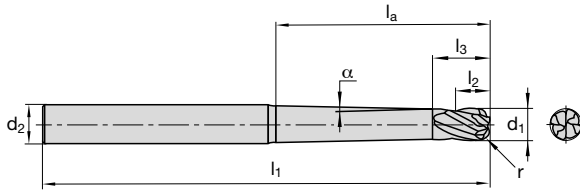


| Katalog-Nr. Cat.-No.          |                |                |                |                |                 |                |   |            | HSC01-H-A                           |                                   |
|-------------------------------|----------------|----------------|----------------|----------------|-----------------|----------------|---|------------|-------------------------------------|-----------------------------------|
| P                             |                |                |                |                |                 |                |   |            | <input type="checkbox"/>            |                                   |
| M                             |                |                |                |                |                 |                |   |            |                                     |                                   |
| K                             |                |                |                |                |                 |                |   |            | <input type="checkbox"/>            |                                   |
| N                             |                |                |                |                |                 |                |   |            |                                     |                                   |
| S                             |                |                |                |                |                 |                |   |            |                                     |                                   |
| H                             |                |                |                |                |                 |                |   |            | <input checked="" type="checkbox"/> |                                   |
| d <sub>1</sub><br>0<br>-0,015 | l <sub>2</sub> | l <sub>1</sub> | l <sub>3</sub> | l <sub>a</sub> | α<br>0<br>-0,2° | d <sub>2</sub> | z | r<br>±0,01 | Ident No.                           | LMT-Code                          |
| <b>lang long</b>              |                |                |                |                |                 |                |   |            |                                     |                                   |
| 1                             | 1              | 60             | 3              | 10             | 0,9             | 4              | 2 | 0,1        | <a href="#">7439642</a>             | EM-HSC01 H1.0x1/3/10 2R0.1HA      |
| 1,5                           | 1,5            | 60             | 4,5            | 16             | 1,5             | 4              | 2 | 0,25       | <a href="#">7439643</a>             | EM-HSC01 H1.5x1.5/4.5/16 2R0.25HA |
| 2                             | 2              | 60             | 6              | 20             | 0,9             | 4              | 2 | 0,5        | <a href="#">7439644</a>             | EM-HSC01 H2.0x2/6/20 2R0.5HA      |
| 3                             | 3              | 80             | 8              | 40             | 0,9             | 6              | 2 | 0,1        | <a href="#">7439645</a>             | EM-HSC01 H3.0x3/8/40 2R0.1HA      |
| 3                             | 3              | 80             | 8              | 40             | 0,9             | 6              | 2 | 0,5        | <a href="#">7439646</a>             | EM-HSC01 H3.0x3/8/40 2R0.5HA      |
| 3                             | 3              | 80             | 8              | 40             | 0,9             | 6              | 2 | 1          | <a href="#">7439647</a>             | EM-HSC01 H3.0x3/8/40 2R1.0HA      |
| 4                             | 4              | 80             | 10             | 40             | 0,9             | 6              | 2 | 0,5        | <a href="#">7439648</a>             | EM-HSC01 H4.0x4/10/40 2R0.5HA     |
| 4                             | 4              | 80             | 10             | 40             | 0,9             | 6              | 2 | 1          | <a href="#">7439649</a>             | EM-HSC01 H4.0x4/10/40 2R1.0HA     |
| 6                             | 6              | 80             | 15             | 40             | 0,9             | 8              | 2 | 0,5        | <a href="#">7439650</a>             | EM-HSC01 H6.0x6/15/40 2R0.5HA     |
| 6                             | 6              | 80             | 15             | 40             | 0,9             | 8              | 2 | 1          | <a href="#">7439651</a>             | EM-HSC01 H6.0x6/15/40 2R1.0HA     |
| 6                             | 6              | 80             | 15             | 40             | 0,9             | 8              | 2 | 1,5        | <a href="#">7439652</a>             | EM-HSC01 H6.0x6/15/40 2R1.5HA     |
| 6                             | 6              | 80             | 15             | 40             | 0,9             | 8              | 2 | 2          | <a href="#">7439653</a>             | EM-HSC01 H6.0x6/15/40 2R2.0HA     |
| 8                             | 8              | 100            | 20             | 50             | 0,9             | 10             | 2 | 0,5        | <a href="#">7439654</a>             | EM-HSC01 H8.0x8/20/50 2R0.5HA     |
| 8                             | 8              | 100            | 20             | 50             | 0,9             | 10             | 2 | 1          | <a href="#">7439655</a>             | EM-HSC01 H8.0x8/20/50 2R1.0HA     |
| 8                             | 8              | 100            | 20             | 50             | 0,9             | 10             | 2 | 2          | <a href="#">7439656</a>             | EM-HSC01 H8.0x8/20/50 2R2.0HA     |
| 10                            | 10             | 120            | 30             | 70             | 0,9             | 12             | 2 | 0,5        | <a href="#">7439657</a>             | EM-HSC01 H10.0x10/30/70 2R0.5HA   |
| 10                            | 10             | 120            | 30             | 70             | 0,9             | 12             | 2 | 1          | <a href="#">7439658</a>             | EM-HSC01 H10.0x10/30/70 2R1.0HA   |
| 10                            | 10             | 120            | 30             | 70             | 0,9             | 12             | 2 | 2          | <a href="#">7439659</a>             | EM-HSC01 H10.0x10/30/70 2R2.0HA   |
| <b>extra lang extra long</b>  |                |                |                |                |                 |                |   |            |                                     |                                   |
| 1                             | 1              | 60             | 3              | 15             | 0,4             | 4              | 2 | 0,1        | <a href="#">7439660</a>             | EM-HSC01 H1.0x1/3/15 2R0.1HA      |
| 2                             | 2              | 100            | 6              | 60             | 0,9             | 4              | 2 | 0,5        | <a href="#">7439661</a>             | EM-HSC01 H2.0x2/6/60 2R0.5HA      |
| 3                             | 3              | 100            | 8              | 60             | 1,3             | 6              | 2 | 0,1        | <a href="#">7439662</a>             | EM-HSC01 H3.0x3/8/60 2R0.1HA      |
| 3                             | 3              | 100            | 8              | 60             | 1,3             | 6              | 2 | 0,5        | <a href="#">7439663</a>             | EM-HSC01 H3.0x3/8/60 2R0.5HA      |
| 3                             | 3              | 100            | 8              | 60             | 1,3             | 6              | 2 | 1          | <a href="#">7439664</a>             | EM-HSC01 H3.0x3/8/60 2R1.0HA      |
| 6                             | 6              | 100            | 15             | 50             | 1,2             | 8              | 2 | 0,5        | <a href="#">7439665</a>             | EM-HSC01 H6.0x6/15/50 2R0.5HA     |
| 6                             | 6              | 100            | 15             | 50             | 1,2             | 8              | 2 | 1          | <a href="#">7439666</a>             | EM-HSC01 H6.0x6/15/50 2R1.0HA     |
| 6                             | 6              | 100            | 15             | 50             | 1,2             | 8              | 2 | 1,5        | <a href="#">7439667</a>             | EM-HSC01 H6.0x6/15/50 2R1.5HA     |
| 6                             | 6              | 100            | 15             | 50             | 1,2             | 8              | 2 | 2          | <a href="#">7439668</a>             | EM-HSC01 H6.0x6/15/50 2R2.0HA     |
| 8                             | 8              | 120            | 20             | 60             | 1,2             | 10             | 2 | 0,5        | <a href="#">7439669</a>             | EM-HSC01 H8.0x8/20/60 2R0.5HA     |
| 8                             | 8              | 120            | 20             | 60             | 1,2             | 10             | 2 | 1          | <a href="#">7439670</a>             | EM-HSC01 H8.0x8/20/60 2R1.0HA     |
| 8                             | 8              | 120            | 20             | 60             | 1,2             | 10             | 2 | 2          | <a href="#">7439671</a>             | EM-HSC01 H8.0x8/20/60 2R2.0HA     |
| 10                            | 10             | 150            | 30             | 100            | 0,9             | 12             | 2 | 0,5        | <a href="#">7439672</a>             | EM-HSC01 H10.0x10/30/100 2R0.5HA  |
| 10                            | 10             | 150            | 30             | 100            | 0,9             | 12             | 2 | 1          | <a href="#">7439673</a>             | EM-HSC01 H10.0x10/30/100 2R1.0HA  |
| 10                            | 10             | 150            | 30             | 100            | 0,9             | 12             | 2 | 2          | <a href="#">7439674</a>             | EM-HSC01 H10.0x10/30/100 2R2.0HA  |

Schnittwertempfehlungen ab Seite 80  
 Cutting data recommendations starting page 80

■ = Hauptanwendung First choice  
☐ = Nebenanwendung Second choice





| Katalog-Nr. Cat.-No.          |                |                |                |                |                 |                |   |            | HSC01-H-A                           |                                  |
|-------------------------------|----------------|----------------|----------------|----------------|-----------------|----------------|---|------------|-------------------------------------|----------------------------------|
| P                             |                |                |                |                |                 |                |   |            | <input type="checkbox"/>            |                                  |
| M                             |                |                |                |                |                 |                |   |            |                                     |                                  |
| K                             |                |                |                |                |                 |                |   |            | <input type="checkbox"/>            |                                  |
| N                             |                |                |                |                |                 |                |   |            |                                     |                                  |
| S                             |                |                |                |                |                 |                |   |            |                                     |                                  |
| H                             |                |                |                |                |                 |                |   |            | <input checked="" type="checkbox"/> |                                  |
| d <sub>1</sub><br>0<br>-0,015 | l <sub>2</sub> | l <sub>1</sub> | l <sub>3</sub> | l <sub>a</sub> | α<br>0<br>-0,2° | d <sub>2</sub> | z | r<br>±0,01 | Ident No.                           | LMT-Code                         |
| <b>lang long</b>              |                |                |                |                |                 |                |   |            |                                     |                                  |
| 6                             | 6              | 80             | 15             | 40             | 0,9             | 8              | 4 | 0,5        | <a href="#">7439599</a>             | EM-HSC01 H6.0x6/15/40 4R0.5HA    |
| 6                             | 6              | 80             | 15             | 40             | 0,9             | 8              | 4 | 1          | <a href="#">7439600</a>             | EM-HSC01 H6.0x6/15/40 4R1.0HA    |
| 6                             | 6              | 80             | 15             | 40             | 0,9             | 8              | 4 | 1,5        | <a href="#">7439601</a>             | EM-HSC01 H6.0x6/15/40 4R1.5HA    |
| 6                             | 6              | 80             | 15             | 40             | 0,9             | 8              | 4 | 2          | <a href="#">7439602</a>             | EM-HSC01 H6.0x6/15/40 4R2.0HA    |
| 8                             | 8              | 100            | 20             | 50             | 0,9             | 10             | 4 | 0,5        | <a href="#">7439603</a>             | EM-HSC01 H8.0x8/20/50 4R0.5HA    |
| 8                             | 8              | 100            | 20             | 50             | 0,9             | 10             | 4 | 1          | <a href="#">7439604</a>             | EM-HSC01 H8.0x8/20/50 4R1.0HA    |
| 8                             | 8              | 100            | 20             | 50             | 0,9             | 10             | 4 | 2          | <a href="#">7439605</a>             | EM-HSC01 H8.0x8/20/50 4R2.0HA    |
| 10                            | 10             | 120            | 30             | 70             | 0,9             | 12             | 4 | 0,5        | <a href="#">7439606</a>             | EM-HSC01 H10.0x10/30/70 4R0.5HA  |
| 10                            | 10             | 120            | 30             | 70             | 0,9             | 12             | 4 | 1          | <a href="#">7439607</a>             | EM-HSC01 H10.0x10/30/70 4R1.0HA  |
| 10                            | 10             | 120            | 30             | 70             | 0,9             | 12             | 4 | 2          | <a href="#">7439608</a>             | EM-HSC01 H10.0x10/30/70 4R2.0HA  |
| <b>extra lang extra long</b>  |                |                |                |                |                 |                |   |            |                                     |                                  |
| 6                             | 6              | 100            | 15             | 50             | 1,2             | 8              | 4 | 0,5        | <a href="#">7439609</a>             | EM-HSC01 H6.0x6/15/50 4R0.5HA    |
| 6                             | 6              | 100            | 15             | 50             | 1,2             | 8              | 4 | 1          | <a href="#">7439610</a>             | EM-HSC01 H6.0x6/15/50 4R1.0HA    |
| 6                             | 6              | 100            | 15             | 50             | 1,2             | 8              | 4 | 1,5        | <a href="#">7439611</a>             | EM-HSC01 H6.0x6/15/50 4R1.5HA    |
| 6                             | 6              | 100            | 15             | 50             | 1,2             | 8              | 4 | 2          | <a href="#">7439612</a>             | EM-HSC01 H6.0x6/15/50 4R2.0HA    |
| 8                             | 8              | 120            | 20             | 60             | 1,2             | 10             | 4 | 0,5        | <a href="#">7439613</a>             | EM-HSC01 H8.0x8/20/60 4R0.5HA    |
| 8                             | 8              | 120            | 20             | 60             | 1,2             | 10             | 4 | 1          | <a href="#">7439614</a>             | EM-HSC01 H8.0x8/20/60 4R1.0HA    |
| 8                             | 8              | 120            | 20             | 60             | 1,2             | 10             | 4 | 2          | <a href="#">7439615</a>             | EM-HSC01 H8.0x8/20/60 4R2.0HA    |
| 10                            | 10             | 150            | 30             | 100            | 0,9             | 12             | 4 | 0,5        | <a href="#">7439616</a>             | EM-HSC01 H10.0x10/30/100 4R0.5HA |
| 10                            | 10             | 150            | 30             | 100            | 0,9             | 12             | 4 | 1          | <a href="#">7439617</a>             | EM-HSC01 H10.0x10/30/100 4R1.0HA |
| 10                            | 10             | 150            | 30             | 100            | 0,9             | 12             | 4 | 2          | <a href="#">7439618</a>             | EM-HSC01 H10.0x10/30/100 4R2.0HA |

Schnittwertempfehlungen ab Seite 80  
 Cutting data recommendations starting page 80

■ = Hauptanwendung First choice  
☐ = Nebenanwendung Second choice

## HSC Toric-Finisher 30 H

### Schnittwertempfehlungen für lange und extra lange, torische Schaftfräser mit Eckenradius

#### Cutting data recommendations for long and extra long, toric end mills with corner radius

| Werkstoff | Material                        | Werkstoff-Nr.<br>Material No.  | R <sub>m</sub> /UTS<br>(N/mm <sup>2</sup> ) | DIN<br>Bezeichnung Alt<br>DIN<br>Description Old | Schnitt-<br>geschwindigkeit<br>Cutting speed<br>v <sub>c</sub> (m/min) |         |
|-----------|---------------------------------|--------------------------------|---------------------------------------------|--------------------------------------------------|------------------------------------------------------------------------|---------|
| P         | Vergütbare<br>Formenstähle      | Heat-treatable<br>die steels   | 1.2311                                      | 950-1150                                         | 40CrMnMo7                                                              | 230-280 |
|           |                                 |                                | 1.2312                                      | 950-1150                                         | 40CrMnNiMoS8-6                                                         | 260-300 |
|           |                                 |                                | 1.2738                                      | 950-1150                                         | 45CrMnNiMo8-6-4                                                        | 230-300 |
|           |                                 |                                | 1.2711                                      | 950-1400                                         | 54NiCrMoV6                                                             | 220-280 |
|           |                                 |                                | 1.2358                                      | 850-1000                                         | 60CrMoV18-5                                                            | 230-280 |
|           | Durchhärtende<br>Werkzeugstähle | Full hardening tools<br>steels | 1.2343                                      | -950                                             | X37CrMoV5 1                                                            | 250-300 |
|           |                                 |                                | 1.2080                                      | -850                                             | X210Cr12                                                               | 220-280 |
|           |                                 |                                | 1.2379                                      | -850                                             | X153CrVMo12 1                                                          | 230-280 |
|           |                                 |                                | 1.2767                                      | -900                                             | X45NiCrMo4                                                             | 250-300 |
|           | Nitrierstähle                   | Nitriding steels               | 1.8550                                      | 800-1000                                         | 34CrAlNi7                                                              | 220-280 |
|           |                                 |                                | 1.8519                                      | 850-1050                                         | 31CrMoV9                                                               | 240-320 |
|           |                                 |                                | 1.7735                                      | 850-1050                                         | 14CrMoV6.9                                                             | 260-350 |
|           |                                 |                                | 1.2344                                      | 950-1100                                         | X40CrMoV5-1                                                            | 260-350 |
| K         | Grauguss                        | Grey cast iron                 | 0.6025                                      | 400-900                                          | EN-GJI-250                                                             | 200-280 |
|           | Legierter Grauguss              | Alloyed grey cast iron         | 0.6678                                      | 500-800                                          | EN-GJLA-XNiCr35-2                                                      | 220-280 |
|           | Sphäroguss                      | Nodular cast iron              | 0.7060                                      | 400-1000                                         | EN-GJS-600-3                                                           | 220-260 |
|           |                                 |                                | 0.7070                                      |                                                  | EN-GJS-700-2U                                                          |         |
|           | Temperguss                      | Malleable cast iron            | 0.8155                                      | 500-1000                                         | EN-GJMB-550-4                                                          | 140-240 |
| H         | Gehärteter Stahl                | Hardened steel                 |                                             | 45-52 HRC                                        |                                                                        | 230-280 |
|           |                                 |                                |                                             | 53-56 HRC                                        |                                                                        | 200-250 |
|           |                                 |                                |                                             | 57-62 HRC                                        |                                                                        | 150-200 |
|           |                                 |                                |                                             | 63-65 HRC                                        |                                                                        | 100-150 |

Bei der extra langen Ausführung empfehlen wir die Vorschübe (f<sub>z</sub>) um 30 % zu reduzieren.

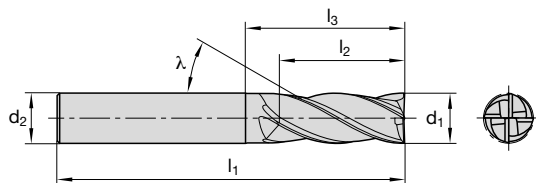
When using the extra long version we recommend reducing the feed (f<sub>z</sub>) by 30 %.

Die angegebenen Schnittwerte sind Startwerte und müssen auf die individuellen Einsatzbedingungen abgestimmt werden.

The cutting data specified are just for the first try. They need to be adjusted to the individual conditions within the production.

|  | Fräserdurchmesser Cutting diameter<br>(mm)                 |       |       |      |      |      |           | Schlichten<br>Finishing<br>a <sub>e</sub> (mm) |
|--|------------------------------------------------------------|-------|-------|------|------|------|-----------|------------------------------------------------|
|  | Vorschub pro Zahn Feed per tooth<br>f <sub>z</sub> (mm/z.) |       |       |      |      |      |           |                                                |
|  | Ø 1                                                        | Ø 2   | Ø 3   | Ø 4  | Ø 6  | Ø 8  | Ø 10      |                                                |
|  | 0,01                                                       | 0,02  | 0,03  | 0,05 | 0,07 | 0,1  | 0,12–0,15 | d x 0,018–0,02                                 |
|  | 0,012                                                      | 0,024 | 0,036 | 0,06 | 0,09 | 0,12 | 0,12–0,15 |                                                |
|  | 0,008                                                      | 0,016 | 0,024 | 0,04 | 0,06 | 0,08 | 0,12–0,15 |                                                |
|  | 0,012                                                      | 0,024 | 0,036 | 0,06 | 0,08 | 0,12 | 0,12–0,15 |                                                |
|  | 0,012                                                      | 0,024 | 0,036 | 0,05 | 0,08 | 0,1  | 0,12–0,15 |                                                |
|  | 0,008                                                      | 0,016 | 0,024 | 0,06 | 0,09 | 0,12 | 0,14      |                                                |
|  | 0,007                                                      | 0,014 | 0,020 | 0,04 | 0,06 | 0,08 | 0,1       |                                                |
|  | 0,01                                                       | 0,02  | 0,03  | 0,03 | 0,05 | 0,07 | 0,08      |                                                |
|  | 0,008                                                      | 0,016 | 0,024 | 0,05 | 0,07 | 0,1  | 0,12      |                                                |
|  | 0,008                                                      | 0,016 | 0,024 | 0,06 | 0,09 | 0,12 | 0,12–0,15 |                                                |
|  | 0,008                                                      | 0,016 | 0,024 | 0,06 | 0,09 | 0,12 | 0,12–0,15 |                                                |
|  | 0,012                                                      | 0,024 | 0,036 | 0,06 | 0,09 | 0,12 | 0,12–0,15 |                                                |
|  | 0,012                                                      | 0,024 | 0,036 | 0,06 | 0,09 | 0,12 | 0,12–0,15 |                                                |
|  | 0,01                                                       | 0,02  | 0,03  | 0,05 | 0,07 | 0,1  | 0,12–0,15 | d x 0,018–0,02                                 |
|  | 0,01                                                       | 0,02  | 0,03  | 0,06 | 0,08 | 0,12 | 0,12–0,15 |                                                |
|  | 0,01                                                       | 0,02  | 0,03  | 0,06 | 0,08 | 0,12 | 0,12–0,15 |                                                |
|  | 0,01                                                       | 0,02  | 0,03  | 0,06 | 0,08 | 0,12 | 0,12–0,15 |                                                |
|  | 0,008                                                      | 0,016 | 0,024 | 0,05 | 0,07 | 0,1  | 0,12–0,15 | d x 0,018–0,02                                 |
|  | 0,006                                                      | 0,012 | 0,018 | 0,03 | 0,04 | 0,06 | 0,07      | d x 0,01–0,018                                 |
|  | 0,005                                                      | 0,01  | 0,014 | 0,02 | 0,04 | 0,05 | 0,06      |                                                |
|  | 0,004                                                      | 0,007 | 0,011 | 0,02 | 0,03 | 0,04 | 0,05      |                                                |

**HSC01 Finisher 30 H**  
**Schaftfräser mit Kantenschutzfase**  
**End mills with edge protection chamfer**



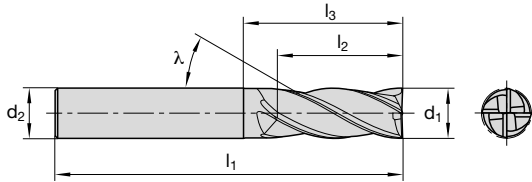
| Katalog-Nr. Cat.-No.      |                      |                      |                      |                      |          | HSC01-H-A                           |                                |
|---------------------------|----------------------|----------------------|----------------------|----------------------|----------|-------------------------------------|--------------------------------|
| <b>P</b>                  |                      |                      |                      |                      |          | <input type="checkbox"/>            |                                |
| <b>M</b>                  |                      |                      |                      |                      |          |                                     |                                |
| <b>K</b>                  |                      |                      |                      |                      |          | <input type="checkbox"/>            |                                |
| <b>N</b>                  |                      |                      |                      |                      |          |                                     |                                |
| <b>S</b>                  |                      |                      |                      |                      |          |                                     |                                |
| <b>H</b>                  |                      |                      |                      |                      |          | <input checked="" type="checkbox"/> |                                |
| <b>d<sub>1</sub></b>      |                      |                      |                      |                      |          | <b>Ident No.</b>                    | <b>LMT-Code</b>                |
| Ø 3-6<br>0<br>-0,038<br>0 |                      |                      |                      |                      |          |                                     |                                |
| Ø 8-20<br>0<br>-0,047     | <b>l<sub>2</sub></b> | <b>l<sub>1</sub></b> | <b>l<sub>3</sub></b> | <b>d<sub>2</sub></b> | <b>z</b> |                                     |                                |
| <b>lang long</b>          |                      |                      |                      |                      |          |                                     |                                |
| 3                         | 7,5                  | 54                   | 12                   | 6                    | 4        | <a href="#">7440247</a>             | EM-HSC01 H3.0x7.5/12 4C0.05HA  |
| 4                         | 10                   | 54                   | 12                   | 6                    | 4        | <a href="#">7440248</a>             | EM-HSC01 H4.0x10/12 4C0.05HA   |
| 5                         | 12,5                 | 57                   | 15                   | 6                    | 4        | <a href="#">7440249</a>             | EM-HSC01 H5.0x12.5/15 4C0.05HA |
| 6                         | 15                   | 57                   | 21                   | 6                    | 4        | <a href="#">7440250</a>             | EM-HSC01 H6.0x15/21 4C0.05HA   |
| 8                         | 20                   | 63                   | 27                   | 8                    | 4        | <a href="#">7440251</a>             | EM-HSC01 H8.0x20/27 4C0.05HA   |
| 10                        | 25                   | 72                   | 32                   | 10                   | 4        | <a href="#">7440252</a>             | EM-HSC01 H10.0x25/32 4C0.05HA  |
| 12                        | 30                   | 83                   | 38                   | 12                   | 4        | <a href="#">7440253</a>             | EM-HSC01 H12.0x30/38 4C0.1HA   |
| 16                        | 40                   | 100                  | 52                   | 16                   | 4        | <a href="#">7440254</a>             | EM-HSC01 H16.0x40/52 4C0.1HA   |
| 20                        | 50                   | 114                  | 64                   | 20                   | 4        | <a href="#">7440255</a>             | EM-HSC01 H20.0x50/64 4C0.1HA   |

■ = Hauptanwendung First choice  
 □ = Nebenanwendung Second choice

Schnittwertempfehlungen ab Seite 84  
 Cutting data recommendations starting page 84

| Kantenschutzfase<br>Edge protection chamfer | d <sub>1</sub> | b    |
|---------------------------------------------|----------------|------|
|                                             | 4 – 10         | 0,05 |
|                                             | 12 – 20        | 0,1  |

**HSC01 Finisher 30 H**  
**Schaftfräser mit Kantenschutzfase**  
**End mills with edge protection chamfer**



| Katalog-Nr. Cat.-No.         |                      |                      |                      |                      |          | HSC01-H-A                           |                               |
|------------------------------|----------------------|----------------------|----------------------|----------------------|----------|-------------------------------------|-------------------------------|
| <b>P</b>                     |                      |                      |                      |                      |          | <input type="checkbox"/>            |                               |
| <b>M</b>                     |                      |                      |                      |                      |          |                                     |                               |
| <b>K</b>                     |                      |                      |                      |                      |          | <input type="checkbox"/>            |                               |
| <b>N</b>                     |                      |                      |                      |                      |          |                                     |                               |
| <b>S</b>                     |                      |                      |                      |                      |          |                                     |                               |
| <b>H</b>                     |                      |                      |                      |                      |          | <input checked="" type="checkbox"/> |                               |
| <b>d<sub>1</sub></b>         |                      |                      |                      |                      |          | <b>Ident No.</b>                    | <b>LMT-Code</b>               |
| Ø 3-6<br>0<br>-0,038<br>0    |                      |                      |                      |                      |          |                                     |                               |
| Ø 8-20<br>0<br>-0,047        |                      |                      |                      |                      |          |                                     |                               |
|                              | <b>l<sub>2</sub></b> | <b>l<sub>1</sub></b> | <b>l<sub>3</sub></b> | <b>d<sub>2</sub></b> | <b>z</b> |                                     |                               |
| <b>extra lang extra long</b> |                      |                      |                      |                      |          |                                     |                               |
| 6                            | 12                   | 80                   | 36                   | 6                    | 4        | <a href="#">7440256</a>             | EM-HSC01 H6.0x12/36 4C0.05HA  |
| 8                            | 16                   | 90                   | 48                   | 8                    | 4        | <a href="#">7440257</a>             | EM-HSC01 H8.0x16/48 4C0.05HA  |
| 10                           | 20                   | 100                  | 60                   | 10                   | 4        | <a href="#">7440258</a>             | EM-HSC01 H10.0x20/60 4C0.05HA |
| 12                           | 24                   | 120                  | 72                   | 12                   | 4        | <a href="#">7440259</a>             | EM-HSC01 H12.0x24/72 4C0.1HA  |
| 16                           | 32                   | 150                  | 96                   | 16                   | 4        | <a href="#">7440260</a>             | EM-HSC01 H16.0x32/96 4C0.1HA  |
| 20                           | 40                   | 175                  | 120                  | 20                   | 4        | <a href="#">7440261</a>             | EM-HSC01 H20.0x40/120 4C0.1HA |

■ = Hauptanwendung First choice  
 □ = Nebenanwendung Second choice

Schnittwertempfehlungen ab Seite 84  
 Cutting data recommendations starting page 84

| Kantenschutzfase<br>Edge protection chamfer | d <sub>1</sub> | b    |
|---------------------------------------------|----------------|------|
|                                             | 4-10           | 0,05 |
|                                             | 12-20          | 0,1  |

## HSC01 Finisher 30 H

### Schnittwertempfehlungen für Schaftfräser mit Kantenschutzfase

Cutting data recommendations for end mills edge protection chamfer

| Werkstoff |                                 | Material                       | Werkstoff-Nr.<br>Material No. | DIN<br>Bezeichnung Alt<br>DIN<br>Description Old | Härte<br>Hardness       | DIN<br>Bezeichnung Neu<br>DIN<br>Description New |  |
|-----------|---------------------------------|--------------------------------|-------------------------------|--------------------------------------------------|-------------------------|--------------------------------------------------|--|
| P         | Vergütbare<br>Formenstähle      | Heat-treatable<br>die steels   | 1.2311                        | 40CrMnMo7                                        | 280–325 HB              | 40CrMnMo7                                        |  |
|           |                                 |                                | 1.2312                        | 40CrMnMoS8.6                                     | 280–325 HB              | 40CrMnMoS8-6                                     |  |
|           |                                 |                                | 1.2738                        | 40CrMnNiMoS8.6.4                                 | 280–325 HB              | 40CrMnNiMoS8-6-4                                 |  |
|           |                                 |                                | 1.2711                        | 54NiCrMoV6                                       | 280–415 HB              | 54NiCrMoV6                                       |  |
|           | Durchhärtende<br>Werkzeugstähle | Full hardening<br>tools steels | 1.2343                        | X38CrMoV5 1                                      | 230 HB                  | X37CrMoV5 1                                      |  |
|           |                                 |                                | 1.2080                        | X210Cr12                                         | 250 HB                  | X210Cr12                                         |  |
|           |                                 |                                | 1.2379                        | X155CrVMo12 1                                    | 250 HB                  | X153CrVMo12 1                                    |  |
|           |                                 |                                | 1.2767                        | X45NiCrMo4                                       | 260 HB                  | X45NiCrMo4                                       |  |
|           | Nitrierstähle                   | Nitriding steels               | 1.8550                        | 34CrAlNi7                                        | 240–300 HB              | 34CrAlNi7                                        |  |
|           |                                 |                                | 1.8519                        | 31CrMoV9                                         | 265–310 HB              | 31CrMoV9                                         |  |
|           |                                 |                                | 1.7735                        | 14CrMoV6.9                                       | 265–310 HB              | 14CrMoV6.9                                       |  |
|           |                                 |                                | 1.2344                        | X40CrMoV5.1                                      | 280–325 HB              | X40CrMoV5-1                                      |  |
| K         | Grauguss                        | Grey cast iron                 | 0.6025                        | GG25                                             | 100–400<br>(120–260 HB) | EN-GJL-250                                       |  |
|           | Legierter Grauguss              | Alloyed grey cast iron         | 0.6678                        | GGL-NiCr35 2                                     | 150–250<br>(160–230 HB) | EN-GJLA-XNiCr35-2                                |  |
|           | Sphäroguss                      | Nodular cast iron              | 0.7060<br>0.7070              | GGG60<br>GGG70L                                  | 400–800<br>(120–310 HB) | EN-GJS-600-3<br>EN-GJS-700-2U                    |  |
|           | Temperguss                      | Malleable cast iron            | 0.8155                        | GTS55                                            | 350–700<br>(150–280 HB) | EN-GJMB-550-4                                    |  |
| H         | Gehärteter Stahl                | Hardened steel                 |                               |                                                  | 45–52 HRC               |                                                  |  |
|           |                                 |                                |                               |                                                  | 53–56 HRC               |                                                  |  |
|           |                                 |                                |                               |                                                  | 57–62 HRC               |                                                  |  |
|           |                                 |                                |                               |                                                  | 63–65 HRC               |                                                  |  |

Bei der extra langen Ausführung empfehlen wir die Vorschübe ( $f_z$ ) um 30 % zu reduzieren.

When using the extra long version we recommend reducing the feed ( $f_z$ ) by 30 %.

Die angegebenen Schnittwerte sind Startwerte und müssen auf die individuellen Einsatzbedingungen abgestimmt werden.

The cutting data specified are just for the first try. They need to be adjusted to the individual conditions within the production.

|  | Schnitt-<br>geschwindigkeit<br>Cutting speed<br>$v_c$ (m/min) | Fräserdurchmesser Cutting diameter<br>(mm)        |      |      |      |      |      |      |      |      |
|--|---------------------------------------------------------------|---------------------------------------------------|------|------|------|------|------|------|------|------|
|  |                                                               | Vorschub pro Zahn Feed per tooth<br>$f_z$ (mm/z.) |      |      |      |      |      |      |      |      |
|  |                                                               | 3                                                 | 4    | 5    | 6    | 8    | 10   | 12   | 16   | 20   |
|  | 200–260                                                       | 0,01                                              | 0,02 | 0,03 | 0,04 | 0,05 | 0,06 | 0,08 | 0,10 | 0,12 |
|  | 220–280                                                       | 0,012                                             | 0,02 | 0,04 | 0,05 | 0,06 | 0,07 | 0,10 | 0,12 | 0,14 |
|  | 180–240                                                       | 0,008                                             | 0,02 | 0,02 | 0,03 | 0,04 | 0,05 | 0,06 | 0,08 | 0,10 |
|  | 200–260                                                       | 0,012                                             | 0,02 | 0,04 | 0,05 | 0,06 | 0,07 | 0,10 | 0,12 | 0,14 |
|  | 190–250                                                       | 0,012                                             | 0,02 | 0,04 | 0,05 | 0,06 | 0,07 | 0,10 | 0,12 | 0,14 |
|  | 160–220                                                       | 0,008                                             | 0,02 | 0,02 | 0,03 | 0,04 | 0,05 | 0,06 | 0,08 | 0,10 |
|  | 160–200                                                       | 0,007                                             | 0,01 | 0,02 | 0,03 | 0,04 | 0,04 | 0,06 | 0,07 | 0,08 |
|  | 200–260                                                       | 0,01                                              | 0,02 | 0,03 | 0,04 | 0,05 | 0,06 | 0,08 | 0,10 | 0,12 |
|  | 160–220                                                       | 0,008                                             | 0,02 | 0,02 | 0,03 | 0,04 | 0,05 | 0,06 | 0,08 | 0,10 |
|  | 180–240                                                       | 0,008                                             | 0,02 | 0,02 | 0,03 | 0,04 | 0,05 | 0,06 | 0,08 | 0,10 |
|  | 200–260                                                       | 0,008                                             | 0,02 | 0,02 | 0,03 | 0,04 | 0,05 | 0,06 | 0,08 | 0,10 |
|  | 200–260                                                       | 0,012                                             | 0,02 | 0,04 | 0,05 | 0,06 | 0,07 | 0,10 | 0,12 | 0,14 |
|  | 200–300                                                       | 0,012                                             | 0,02 | 0,03 | 0,05 | 0,06 | 0,07 | 0,10 | 0,13 | 0,15 |
|  | 180–280                                                       | 0,01                                              | 0,02 | 0,03 | 0,04 | 0,06 | 0,07 | 0,09 | 0,12 | 0,13 |
|  | 160–260                                                       | 0,01                                              | 0,02 | 0,03 | 0,04 | 0,06 | 0,07 | 0,09 | 0,12 | 0,13 |
|  | 140–240                                                       | 0,01                                              | 0,02 | 0,03 | 0,04 | 0,06 | 0,07 | 0,09 | 0,12 | 0,13 |
|  | 160–200                                                       | 0,008                                             | 0,02 | 0,02 | 0,03 | 0,04 | 0,05 | 0,06 | 0,08 | 0,10 |
|  | 120–150                                                       | 0,006                                             | 0,01 | 0,02 | 0,02 | 0,03 | 0,04 | 0,05 | 0,06 | 0,07 |
|  | 80–120                                                        | 0,008                                             | 0,01 | 0,01 | 0,02 | 0,02 | 0,03 | 0,04 | 0,05 | 0,05 |
|  | 60–100                                                        | 0,006                                             | 0,01 | 0,01 | 0,01 | 0,02 | 0,02 | 0,03 | 0,04 | 0,04 |



## HSC01 Ball-Nose-Finisher 30 H

### Kopierfräser für allerhöchste Ansprüche

Copy milling cutter to fit highest requirements

Für die Entwicklung des VHM-Schaftfräasers mit 2 oder 4 Schneiden und runder Stirn wurde sowohl das Know-how der Werkzeugexperten von LMT Tools aufgegriffen. Das bereits bestehende Werkzeugprogramm wurde hierzu einer detaillierten Prüfung unterzogen. Bei der neuen Entwicklung wurden zahlreiche Verbesserungen umgesetzt.

Der HSC01 Ball-Nose-Finisher 30 H setzt Maßstäbe in Präzision sowie Prozesssicherheit und Standzeit. Darüber hinaus garantieren die angegebenen Schnittwerte ein Höchstmaß an Produktivität.

Der Erfolg lässt sich durch die bekannten Parameter Geometrie, Substrat und Beschichtung leicht beschreiben:

- Optimierte Geometrie mit sehr engen Fertigungstoleranzen für höchste Präzision im Einsatz
- Hochwertiges Substrat für hohe Schnittgeschwindigkeiten (Werkstoffe bis 65 HRC) und kürzere Bearbeitungszeiten
- Ausgereifte Beschichtung mit hoher Verschleißbeständigkeit für stabile Fertigungsprozesse

The know-how of the tool experts at LMT Tools was called upon to develop the solid carbide end mill with 2 or 4 cutting edges and a round face. In conjunction with this, the new existing tool range underwent a close check. Numerous improvements were implemented in the newly developed tool.

The HSC01 Ball-Nose-Finisher 30 H sets new standards with regard to precision, process reliability and service life. In addition, the specified cutting values ensure maximum productivity.

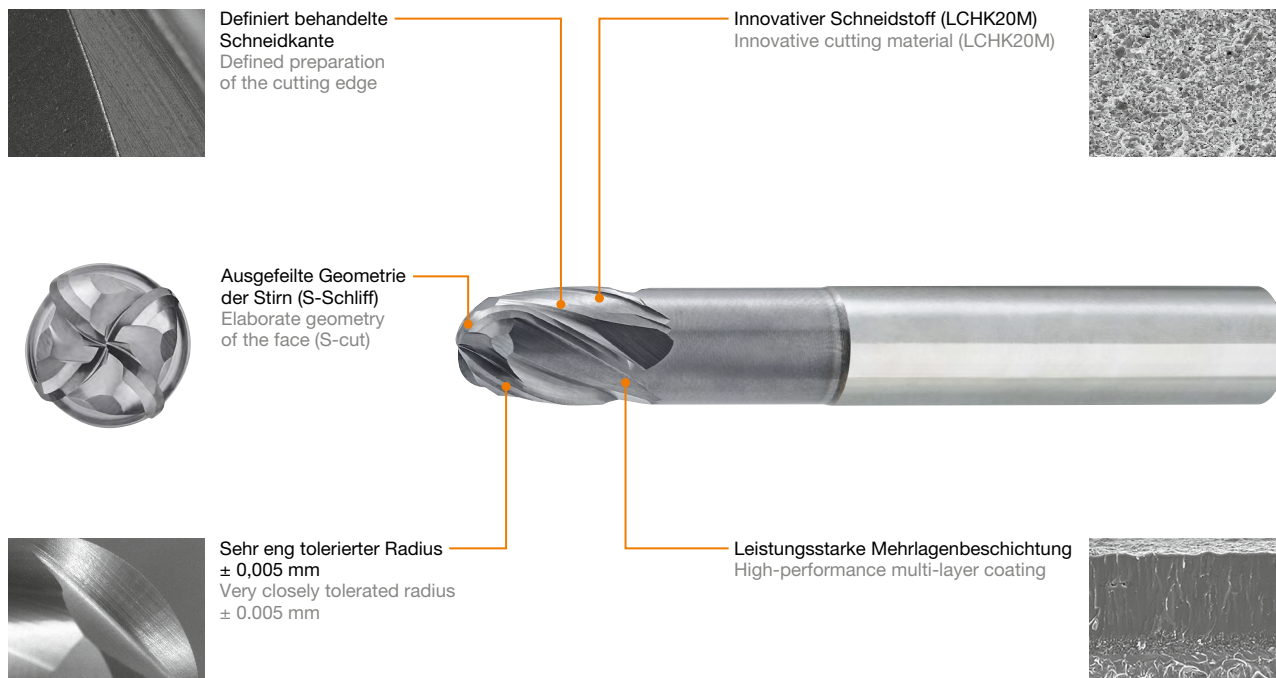
The success is easy to describe by means of the well-known parameters geometry, substrate and coating:

- Optimized geometry with very narrow manufacturing tolerances for maximum precision during use
- High quality substrate for high cutting speeds (materials up to 65 HRC) and shorter processing times
- Highly developed coating with high wear resistance for stable manufacturing processes

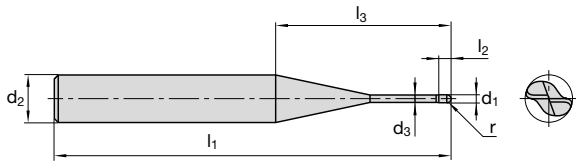
## HSC01 Ball-Nose-Finisher 30 H

### Eigenschaften auf einen Blick

Features at a glance



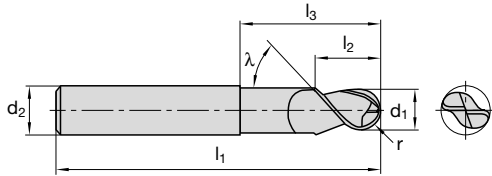
**HSC01 Ball-Nose-Finisher 30 H**  
**Kugel-Kopierfräser**  
**Ball nose end mill**



| Katalog-Nr. Cat.-No.         |                |                |                |                |                |   |             | HSC01-H-A                           |                           |
|------------------------------|----------------|----------------|----------------|----------------|----------------|---|-------------|-------------------------------------|---------------------------|
| P                            |                |                |                |                |                |   |             | <input type="checkbox"/>            |                           |
| M                            |                |                |                |                |                |   |             |                                     |                           |
| K                            |                |                |                |                |                |   |             | <input type="checkbox"/>            |                           |
| N                            |                |                |                |                |                |   |             |                                     |                           |
| S                            |                |                |                |                |                |   |             |                                     |                           |
| H                            |                |                |                |                |                |   |             | <input checked="" type="checkbox"/> |                           |
| d <sub>1</sub><br>0<br>-0,01 | l <sub>2</sub> | l <sub>1</sub> | l <sub>3</sub> | d <sub>2</sub> | d <sub>3</sub> | z | r<br>±0,005 | Ident No.                           | LMT-Code                  |
| <b>kurz short</b>            |                |                |                |                |                |   |             |                                     |                           |
| 1                            | 1,5            | 50             | 3              | 4              | 0,94           | 2 | 0,5         | <a href="#">7438541</a>             | EM-HSC01 H1.0x1.5/3 2BHA  |
| 1                            | 1,5            | 50             | 3              | 6              | 0,94           | 2 | 0,5         | <a href="#">7438542</a>             | EM-HSC01 H1.0x1.5/3 2BHA  |
| 1,5                          | 2              | 50             | 4              | 4              | 1,4            | 2 | 0,75        | <a href="#">7438543</a>             | EM-HSC01 H1.5x2/4 2BHA    |
| 1,5                          | 2              | 50             | 4              | 6              | 1,4            | 2 | 0,75        | <a href="#">7438544</a>             | EM-HSC01 H1.5x2/4 2BHA    |
| 2                            | 3              | 50             | 6              | 4              | 1,85           | 2 | 1           | <a href="#">7438545</a>             | EM-HSC01 H2.0x3/6 2BHA    |
| 2                            | 3              | 50             | 6              | 6              | 1,85           | 2 | 1           | <a href="#">7438546</a>             | EM-HSC01 H2.0x3/6 2BHA    |
| 2,5                          | 3,5            | 60             | 8              | 6              | 2,35           | 2 | 1,25        | <a href="#">7438547</a>             | EM-HSC01 H2.5x3.5/8 2BHA  |
| 3                            | 4              | 60             | 9              | 6              | 2,85           | 2 | 1,5         | <a href="#">7438548</a>             | EM-HSC01 H3.0x4/9 2BHA    |
| <b>lang long</b>             |                |                |                |                |                |   |             |                                     |                           |
| 1                            | 1,5            | 50             | 10             | 4              | 0,94           | 2 | 0,5         | <a href="#">7438549</a>             | EM-HSC01 H1.0x1.5/10 2BHA |
| 1                            | 1,5            | 50             | 10             | 6              | 0,94           | 2 | 0,5         | <a href="#">7438550</a>             | EM-HSC01 H1.0x1.5/10 2BHA |
| 1,5                          | 2              | 50             | 14             | 4              | 1,4            | 2 | 0,75        | <a href="#">7438551</a>             | EM-HSC01 H1.5x2/14 2BHA   |
| 1,5                          | 2              | 50             | 14             | 6              | 1,4            | 2 | 0,75        | <a href="#">7438552</a>             | EM-HSC01 H1.5x2/14 2BHA   |
| 2                            | 3              | 60             | 16             | 4              | 1,85           | 2 | 1           | <a href="#">7438553</a>             | EM-HSC01 H2.0x3/16 2BHA   |
| 2                            | 3              | 60             | 16             | 6              | 1,85           | 2 | 1           | <a href="#">7438554</a>             | EM-HSC01 H2.0x3/16 2BHA   |
| 2,5                          | 3,5            | 70             | 20             | 6              | 2,35           | 2 | 1,25        | <a href="#">7438555</a>             | EM-HSC01 H2.5x3.5/20 2BHA |
| 3                            | 4              | 70             | 30             | 6              | 2,85           | 2 | 1,5         | <a href="#">7438556</a>             | EM-HSC01 H3.0x4/30 2BHA   |
| <b>extra lang extra long</b> |                |                |                |                |                |   |             |                                     |                           |
| 1                            | 1,5            | 60             | 16             | 4              | 0,94           | 2 | 0,5         | <a href="#">7438557</a>             | EM-HSC01 H1.0x1.5/16 2BHA |
| 1                            | 1,5            | 70             | 16             | 6              | 0,94           | 2 | 0,5         | <a href="#">7438558</a>             | EM-HSC01 H1.0x1.5/16 2BHA |
| 1,5                          | 2              | 60             | 20             | 4              | 1,4            | 2 | 0,75        | <a href="#">7438559</a>             | EM-HSC01 H1.5x2/20 2BHA   |
| 1,5                          | 2              | 70             | 20             | 6              | 1,4            | 2 | 0,75        | <a href="#">7438560</a>             | EM-HSC01 H1.5x2/20 2BHA   |
| 2                            | 3              | 70             | 30             | 4              | 1,85           | 2 | 1           | <a href="#">7438561</a>             | EM-HSC01 H2.0x3/30 2BHA   |
| 2                            | 3              | 80             | 30             | 6              | 1,85           | 2 | 1           | <a href="#">7438562</a>             | EM-HSC01 H2.0x3/30 2BHA   |
| 2,5                          | 3,5            | 80             | 30             | 6              | 2,35           | 2 | 1,25        | <a href="#">7438563</a>             | EM-HSC01 H2.5x3.5/30 2BHA |
| 3                            | 4              | 80             | 35             | 6              | 2,85           | 2 | 1,5         | <a href="#">7438564</a>             | EM-HSC01 H3.0x4/35 2BHA   |

Schnittwertempfehlungen ab Seite 90  
 Cutting data recommendations starting page 90

■ = Hauptanwendung First choice  
☐ = Nebenanwendung Second choice



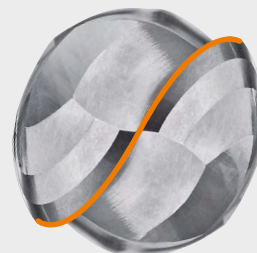
| Katalog-Nr. Cat.-No. |      |     |      |    |   |             | HSC01-H-A                           |                             |
|----------------------|------|-----|------|----|---|-------------|-------------------------------------|-----------------------------|
| P                    |      |     |      |    |   |             | <input type="checkbox"/>            |                             |
| M                    |      |     |      |    |   |             |                                     |                             |
| K                    |      |     |      |    |   |             | <input type="checkbox"/>            |                             |
| N                    |      |     |      |    |   |             |                                     |                             |
| S                    |      |     |      |    |   |             |                                     |                             |
| H                    |      |     |      |    |   |             | <input checked="" type="checkbox"/> |                             |
| d1<br>0<br>-0,01     | l2   | l1  | l3   | d2 | z | r<br>±0,005 | Ident No.                           | LMT-Code                    |
| kurz short           |      |     |      |    |   |             |                                     |                             |
| 4                    | 5    | 57  | 14,5 | 6  | 2 | 2           | <a href="#">7438565</a>             | EM-HSC01 H4.0x5/14.5 2BHA   |
| 6                    | 7,5  | 57  | 21   | 6  | 2 | 3           | <a href="#">7438566</a>             | EM-HSC01 H6.0x7.5/21 2BHA   |
| 8                    | 10   | 63  | 27   | 8  | 2 | 4           | <a href="#">7438567</a>             | EM-HSC01 H8.0x10/27 2BHA    |
| 10                   | 12,5 | 72  | 32   | 10 | 2 | 5           | <a href="#">7438568</a>             | EM-HSC01 H10.0x12.5/32 2BHA |
| 12                   | 15   | 83  | 38   | 12 | 2 | 6           | <a href="#">7438569</a>             | EM-HSC01 H12.0x15/38 2BHA   |
| lang long            |      |     |      |    |   |             |                                     |                             |
| 4                    | 5    | 80  | 19   | 6  | 2 | 2           | <a href="#">7438570</a>             | EM-HSC01 H4.0x5/19 2BHA     |
| 6                    | 7,5  | 90  | 54   | 6  | 2 | 3           | <a href="#">7438571</a>             | EM-HSC01 H6.0x7.5/54 2BHA   |
| 8                    | 10   | 100 | 64   | 8  | 2 | 4           | <a href="#">7438572</a>             | EM-HSC01 H8.0x10/64 2BHA    |
| 10                   | 12,5 | 100 | 60   | 10 | 2 | 5           | <a href="#">7438573</a>             | EM-HSC01 H10.0x12.5/60 2BHA |
| 12                   | 15   | 110 | 65   | 12 | 2 | 6           | <a href="#">7438574</a>             | EM-HSC01 H12.0x15/65 2BHA   |

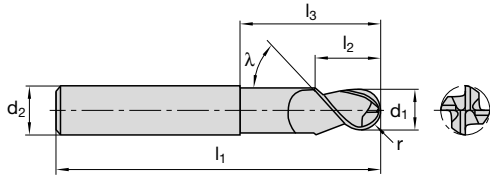
Schnittwertempfehlungen ab Seite 90  
 Cutting data recommendations starting page 90

■ = Hauptanwendung First choice  
 □ = Nebenanwendung Second choice

**Der S-Schliff im Zentrum der  
 Stirnschneide ermöglicht optimale  
 Schnittwerte und garantiert beste  
 Oberflächengüten.**

The S-cut in the center of the front  
 cutting edge enables optimized  
 cutting data to ensure high class  
 surface qualities.





| Katalog-Nr. Cat.-No.         |                |                |                |                |   |             | HSC01-H-A                           |                             |
|------------------------------|----------------|----------------|----------------|----------------|---|-------------|-------------------------------------|-----------------------------|
| P                            |                |                |                |                |   |             | <input type="checkbox"/>            |                             |
| M                            |                |                |                |                |   |             |                                     |                             |
| K                            |                |                |                |                |   |             | <input type="checkbox"/>            |                             |
| N                            |                |                |                |                |   |             |                                     |                             |
| S                            |                |                |                |                |   |             |                                     |                             |
| H                            |                |                |                |                |   |             | <input checked="" type="checkbox"/> |                             |
| d <sub>1</sub><br>0<br>-0,01 | l <sub>2</sub> | l <sub>1</sub> | l <sub>3</sub> | d <sub>2</sub> | z | r<br>±0,005 | Ident No.                           | LMT-Code                    |
| <b>kurz short</b>            |                |                |                |                |   |             |                                     |                             |
| 4                            | 5              | 57             | 14,5           | 6              | 4 | 2           | <a href="#">7438855</a>             | EM-HSC01 H4.0x5/14.5 4BHA   |
| 6                            | 7,5            | 57             | 21             | 6              | 4 | 3           | <a href="#">7438856</a>             | EM-HSC01 H6.0x7.5/21 4BHA   |
| 8                            | 10             | 63             | 27             | 8              | 4 | 4           | <a href="#">7438857</a>             | EM-HSC01 H8.0x10/27 4BHA    |
| 10                           | 12,5           | 72             | 32             | 10             | 4 | 5           | <a href="#">7438858</a>             | EM-HSC01 H10.0x12.5/32 4BHA |
| 12                           | 15             | 83             | 38             | 12             | 4 | 6           | <a href="#">7438859</a>             | EM-HSC01 H12.0x15/38 4BHA   |
| <b>lang long</b>             |                |                |                |                |   |             |                                     |                             |
| 4                            | 5              | 80             | 19             | 6              | 4 | 2           | <a href="#">7438860</a>             | EM-HSC01 H4.0x5/19 4BHA     |
| 6                            | 7,5            | 90             | 54             | 6              | 4 | 3           | <a href="#">7438861</a>             | EM-HSC01 H6.0x7.5/54 4BHA   |
| 8                            | 10             | 100            | 64             | 8              | 4 | 4           | <a href="#">7438862</a>             | EM-HSC01 H8.0x10/64 4BHA    |
| 10                           | 12,5           | 100            | 60             | 10             | 4 | 5           | <a href="#">7438863</a>             | EM-HSC01 H10.0x12.5/60 4BHA |
| 12                           | 15             | 110            | 65             | 12             | 4 | 6           | <a href="#">7438864</a>             | EM-HSC01 H12.0x15/65 4BHA   |

Schnittwertempfehlungen ab Seite 90  
 Cutting data recommendations starting page 90

■ = Hauptanwendung First choice  
 □ = Nebenanwendung Second choice

**Der S-Schliff im Zentrum der  
 Stirnschneide ermöglicht optimale  
 Schnittwerte und garantiert beste  
 Oberflächengüten.**

The S-cut in the center of the front  
 cutting edge enables optimized  
 cutting data to ensure high class  
 surface qualities.



# HSC01 Ball-Nose-Finisher 30 H

## Schnittwertempfehlungen für Radiuskopierfräser

### Cutting data recommendations for ball nose copy milling cutter

| Werkstoff | Material                        | Werkstoff-Nr.<br>Material No.                                                                                                                                                                                          | R <sub>m</sub> /UTS<br>(N/mm²) | DIN<br>Bezeichnung Alt<br>DIN<br>Description Old | Schnitt-<br>geschwindigkeit<br>Cutting speed<br>v <sub>c</sub> (m/min) |         |  |
|-----------|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|--------------------------------------------------|------------------------------------------------------------------------|---------|--|
| P         | Vergütbare<br>Formenstähle      | Heat-treatable<br>die steels                                                                                                                                                                                           | 1.2311                         | 950–1150                                         | 40CrMnMo7                                                              | 230–280 |  |
|           |                                 |                                                                                                                                                                                                                        | 1.2312                         | 950–1150                                         | 40CrMnNiMoS8-6                                                         | 260–300 |  |
|           |                                 |                                                                                                                                                                                                                        | 1.2738                         | 950–1150                                         | 45CrMnNiMo8-6-4                                                        | 230–300 |  |
|           |                                 |                                                                                                                                                                                                                        | 1.2711                         | 950–1400                                         | 54NiCrMoV6                                                             | 220–280 |  |
|           |                                 |                                                                                                                                                                                                                        | 1.2358                         | 850–1000                                         | 60CrMoV18-5                                                            | 230–280 |  |
|           | Durchhärtende<br>Werkzeugstähle | Full hardening tools<br>steels                                                                                                                                                                                         | 1.2343                         | –950                                             | X37CrMoV5 1                                                            | 250–300 |  |
|           |                                 |                                                                                                                                                                                                                        | 1.2080                         | –850                                             | X210Cr12                                                               | 220–280 |  |
|           |                                 |                                                                                                                                                                                                                        | 1.2379                         | –850                                             | X153CrVMo12 1                                                          | 230–280 |  |
|           |                                 |                                                                                                                                                                                                                        | 1.2767                         | –900                                             | X45NiCrMo4                                                             | 250–300 |  |
|           | Nitrierstähle                   | Nitriding steels                                                                                                                                                                                                       | 1.8550                         | 800–1000                                         | 34CrAlNi7                                                              | 220–280 |  |
|           |                                 |                                                                                                                                                                                                                        | 1.8519                         | 850–1050                                         | 31CrMoV9                                                               | 240–320 |  |
|           |                                 |                                                                                                                                                                                                                        | 1.7735                         | 850–1050                                         | 14CrMoV6.9                                                             | 260–350 |  |
|           |                                 |                                                                                                                                                                                                                        | 1.2344                         | 950–1100                                         | X40CrMoV5-1                                                            | 260–350 |  |
| K         | Grauguss                        | Grey cast iron                                                                                                                                                                                                         | 0.6025                         | 400–900                                          | EN-GJL-250                                                             | 200–280 |  |
|           | Legierter Grauguss              | Alloyed grey cast iron                                                                                                                                                                                                 | 0.6678                         | 500–800                                          | EN-GJLA-XNiCr35-2                                                      | 220–280 |  |
|           | Sphäroguss                      | Nodular cast iron                                                                                                                                                                                                      | 0.7060<br>0.7070               | 400–1000                                         | EN-GJS-600-3<br>EN-GJS-700-2U                                          | 220–260 |  |
|           | Temperguss                      | Malleable cast iron                                                                                                                                                                                                    | 0.8155                         | 500–1000                                         | EN-GJMB-550-4                                                          | 140–240 |  |
| H         | Gehärteter Stahl                | Hardened steel<br><br>Werkzeugstähle und<br>Sphärogusslegierungen,<br>Kaltarbeitsstähle und<br>PM-Stähle<br><br>Tool steel and nodular<br>cast iron alloys,<br>cold working steel and<br>powder metallurgical<br>steel | 45–52 HRC                      |                                                  |                                                                        | 230–280 |  |
|           |                                 |                                                                                                                                                                                                                        | 53–56 HRC                      |                                                  |                                                                        | 200–250 |  |
|           |                                 |                                                                                                                                                                                                                        | 57–62 HRC                      |                                                  |                                                                        | 150–200 |  |
|           |                                 |                                                                                                                                                                                                                        | 63–65 HRC                      |                                                  |                                                                        | 100–150 |  |

Bei der langen Ausführung empfehlen wir die Vorschübe (f<sub>z</sub>) um 30 % zu reduzieren.

When using the long version we recommend reducing the feed (f<sub>z</sub>) by 30 %.

Die angegebenen Schnittwerte sind Startwerte und müssen auf die individuellen Einsatzbedingungen abgestimmt werden.

The cutting data specified are just for the first try. They need to be adjusted to the individual conditions within the production.

|  | Fräserdurchmesser Cutting diameter<br>(mm)                 |       |       |      |           |                                                      |           |           | Schlichten<br>Finishing<br>a <sub>e</sub> (mm) |
|--|------------------------------------------------------------|-------|-------|------|-----------|------------------------------------------------------|-----------|-----------|------------------------------------------------|
|  | Schlichten Finishing<br>a <sub>p</sub> (mm) 0,02–0,12      |       |       |      |           | Schlichten Finishing<br>a <sub>p</sub> (mm) 0,08–0,2 |           |           |                                                |
|  | Vorschub pro Zahn Feed per tooth<br>f <sub>z</sub> (mm/z.) |       |       |      |           |                                                      |           |           |                                                |
|  | Ø 1                                                        | Ø 2   | Ø 3   | Ø 4  | Ø 6       | Ø 8                                                  | Ø 10      | Ø 12      |                                                |
|  | 0,01                                                       | 0,02  | 0,03  | 0,05 | 0,07–0,1  | 0,1                                                  | 0,12–0,15 | 0,12–0,18 | d x 0,018–0,02                                 |
|  | 0,012                                                      | 0,024 | 0,036 | 0,06 | 0,09–0,12 | 0,12                                                 | 0,12–0,15 | 0,12–0,18 |                                                |
|  | 0,008                                                      | 0,016 | 0,024 | 0,04 | 0,06–0,08 | 0,08                                                 | 0,12–0,15 | 0,12–0,18 |                                                |
|  | 0,012                                                      | 0,024 | 0,036 | 0,06 | 0,08–0,1  | 0,12                                                 | 0,12–0,15 | 0,12–0,18 |                                                |
|  | 0,012                                                      | 0,024 | 0,036 | 0,05 | 0,08–0,1  | 0,1                                                  | 0,12–0,15 | 0,12–0,18 |                                                |
|  | 0,008                                                      | 0,016 | 0,024 | 0,06 | 0,09      | 0,12                                                 | 0,14      | 0,17      |                                                |
|  | 0,007                                                      | 0,014 | 0,020 | 0,04 | 0,06      | 0,08                                                 | 0,1       | 0,12      |                                                |
|  | 0,01                                                       | 0,02  | 0,03  | 0,03 | 0,05      | 0,07                                                 | 0,08      | 0,1       |                                                |
|  | 0,008                                                      | 0,016 | 0,024 | 0,05 | 0,07      | 0,1                                                  | 0,12      | 0,14      |                                                |
|  | 0,008                                                      | 0,016 | 0,024 | 0,06 | 0,09–0,12 | 0,12                                                 | 0,12–0,15 | 0,12–0,18 |                                                |
|  | 0,008                                                      | 0,016 | 0,024 | 0,06 | 0,09–0,12 | 0,12                                                 | 0,12–0,15 | 0,12–0,18 |                                                |
|  | 0,012                                                      | 0,024 | 0,036 | 0,06 | 0,09–0,12 | 0,12                                                 | 0,12–0,15 | 0,12–0,18 |                                                |
|  | 0,012                                                      | 0,024 | 0,036 | 0,06 | 0,09–0,12 | 0,12                                                 | 0,12–0,15 | 0,12–0,18 |                                                |
|  | 0,01                                                       | 0,02  | 0,03  | 0,05 | 0,07–0,1  | 0,1                                                  | 0,12–0,15 | 0,12–0,18 | d x 0,018–0,02                                 |
|  | 0,01                                                       | 0,02  | 0,03  | 0,06 | 0,08–0,1  | 0,12                                                 | 0,12–0,15 | 0,12–0,18 |                                                |
|  | 0,01                                                       | 0,02  | 0,03  | 0,06 | 0,08–0,1  | 0,12                                                 | 0,12–0,15 | 0,12–0,18 |                                                |
|  | 0,01                                                       | 0,02  | 0,03  | 0,06 | 0,08–0,1  | 0,12                                                 | 0,12–0,15 | 0,12–0,18 |                                                |
|  | 0,008                                                      | 0,016 | 0,024 | 0,05 | 0,07–0,1  | 0,1                                                  | 0,12–0,15 | 0,12–0,18 | d x 0,018–0,02                                 |
|  | 0,006                                                      | 0,012 | 0,018 | 0,03 | 0,04      | 0,06                                                 | 0,07      | 0,09      | d x 0,01–0,018                                 |
|  | 0,005                                                      | 0,01  | 0,014 | 0,02 | 0,04      | 0,05                                                 | 0,06      | 0,07      |                                                |
|  | 0,004                                                      | 0,007 | 0,011 | 0,02 | 0,03      | 0,04                                                 | 0,05      | 0,06      |                                                |

## Anwendungsbeispiel

### Application example



**Gesenk- und Formenbau: Schlichten Umformtechnik**  
**Mold & Die: Finishing punching**

#### Werkzeug Tool:

HSC01 Ball-Nose-Finisher 30 H  
EM-HSC01 H12.0x15/65 2BHA (Ident No. [7438574](#))  
 $d_1 = 12$  mm,  $z = 2$

#### Schneidstoff Cutting material:

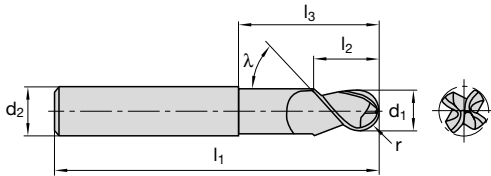
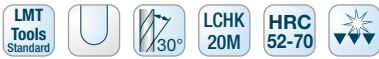
LCHK20M

#### Werkstoff Material:

1.2343, ca. 50–52 HRC

#### Schnittwerte Cutting data:

$v_c = 250$  m/min  
 $n = 6635$  min<sup>-1</sup>  
 $f_z = 0,09$  mm  
 $v_f = 1195$  mm/min  
 $a_e = 0,1$  mm  
 $a_p = 0,05$  mm



| Katalog-Nr. Cat.-No. |                |                |                |                |   |                                                       | HSC01-H-A                           |                           |
|----------------------|----------------|----------------|----------------|----------------|---|-------------------------------------------------------|-------------------------------------|---------------------------|
| P                    |                |                |                |                |   |                                                       | <input type="checkbox"/>            |                           |
| M                    |                |                |                |                |   |                                                       |                                     |                           |
| K                    |                |                |                |                |   |                                                       | <input type="checkbox"/>            |                           |
| N                    |                |                |                |                |   |                                                       |                                     |                           |
| S                    |                |                |                |                |   |                                                       |                                     |                           |
| H                    |                |                |                |                |   |                                                       | <input checked="" type="checkbox"/> |                           |
| d <sub>1</sub>       | l <sub>2</sub> | l <sub>1</sub> | l <sub>3</sub> | d <sub>2</sub> | z | r<br>Ø < 2,5 ±0,005<br>Ø 2,5-6 ±0,010<br>Ø > 6 ±0,015 | Ident No.                           | LMT-Code                  |
| kurz short           |                |                |                |                |   |                                                       |                                     |                           |
| 1                    | 1              | 38             | 2,2            | 3              | 2 | 0,5                                                   | <a href="#">7441573</a>             | EM-HSC01 H1.0x1/2.2 2BHA  |
| 2                    | 2              | 50             | 3,6            | 6              | 2 | 1                                                     | <a href="#">7441574</a>             | EM-HSC01 H2.0x2/3.6 2BHA  |
| 3                    | 3              | 50             | 5,5            | 6              | 2 | 1,5                                                   | <a href="#">7441575</a>             | EM-HSC01 H3.0x3/5.5 2BHA  |
| 4                    | 4              | 57             | 14,5           | 6              | 2 | 2                                                     | <a href="#">7441576</a>             | EM-HSC01 H4.0x4/14.5 2BHA |
| 5                    | 5              | 57             | 21             | 6              | 2 | 2,5                                                   | <a href="#">7441577</a>             | EM-HSC01 H5.0x5/21 2BHA   |
| 6                    | 6              | 57             | 21             | 6              | 2 | 3                                                     | <a href="#">7441578</a>             | EM-HSC01 H6.0x6/21 2BHA   |
| 8                    | 8              | 63             | 27             | 8              | 2 | 4                                                     | <a href="#">7441579</a>             | EM-HSC01 H8.0x8/27 2BHA   |
| 10                   | 10             | 72             | 32             | 10             | 2 | 5                                                     | <a href="#">7441580</a>             | EM-HSC01 H10.0x10/32 2BHA |
| 12                   | 12             | 83             | 38             | 12             | 2 | 6                                                     | <a href="#">7441581</a>             | EM-HSC01 H12.0x12/38 2BHA |
| 4                    | 4              | 57             | 14,5           | 6              | 4 | 2                                                     | <a href="#">7441582</a>             | EM-HSC01 H4.0x4/14.5 4BHA |
| 5                    | 5              | 57             | 21             | 6              | 4 | 2,5                                                   | <a href="#">7441583</a>             | EM-HSC01 H5.0x5/21 4BHA   |
| 6                    | 6              | 57             | 21             | 6              | 4 | 3                                                     | <a href="#">7441584</a>             | EM-HSC01 H6.0x6/21 4BHA   |
| 8                    | 8              | 63             | 27             | 8              | 4 | 4                                                     | <a href="#">7441585</a>             | EM-HSC01 H8.0x8/27 4BHA   |
| 10                   | 10             | 72             | 32             | 10             | 4 | 5                                                     | <a href="#">7441586</a>             | EM-HSC01 H10.0x10/32 4BHA |
| lang long            |                |                |                |                |   |                                                       |                                     |                           |
| 4                    | 4              | 80             | 19             | 6              | 2 | 2                                                     | <a href="#">7441587</a>             | EM-HSC01 H4.0x4/19 2BHA   |
| 5                    | 5              | 80             | 44             | 6              | 2 | 2,5                                                   | <a href="#">7441588</a>             | EM-HSC01 H5.0x5/44 2BHA   |
| 6                    | 6              | 80             | 44             | 6              | 2 | 3                                                     | <a href="#">7441589</a>             | EM-HSC01 H6.0x6/44 2BHA   |
| 8                    | 8              | 90             | 54             | 8              | 2 | 4                                                     | <a href="#">7441590</a>             | EM-HSC01 H8.0x8/54 2BHA   |
| 10                   | 10             | 100            | 60             | 10             | 2 | 5                                                     | <a href="#">7441591</a>             | EM-HSC01 H10.0x10/60 2BHA |
| 12                   | 12             | 110            | 65             | 12             | 2 | 6                                                     | <a href="#">7441592</a>             | EM-HSC01 H12.0x12/65 2BHA |
| 4                    | 4              | 80             | 19             | 6              | 4 | 2                                                     | <a href="#">7441593</a>             | EM-HSC01 H4.0x4/19 4BHA   |
| 5                    | 5              | 80             | 44             | 6              | 4 | 2,5                                                   | <a href="#">7441594</a>             | EM-HSC01 H5.0x5/44 4BHA   |
| 6                    | 6              | 80             | 44             | 6              | 4 | 3                                                     | <a href="#">7441595</a>             | EM-HSC01 H6.0x6/44 4BHA   |
| 8                    | 8              | 90             | 54             | 8              | 4 | 4                                                     | <a href="#">7441596</a>             | EM-HSC01 H8.0x8/54 4BHA   |
| 10                   | 10             | 100            | 60             | 10             | 4 | 5                                                     | <a href="#">7441597</a>             | EM-HSC01 H10.0x10/60 4BHA |

Schnittwertempfehlungen ab Seite 94  
 Cutting data recommendations starting page 94

■ = Hauptanwendung First choice  
☐ = Nebenanwendung Second choice





## HSC01 Ball-Nose-Finisher 30 H

### Schnittwertempfehlungen für Schaftfräser Typ H, gerade und runde Stirn

## HSC01 Ball-Nose-Finisher 30 H

### Cutting data recommendations for end mills type H, straight corner or ball nose

|           |                                 |                                | DIN<br>Bezeichnung Alt<br>DIN |                   | DIN<br>Bezeichnung Neu<br>DIN |                               |  |
|-----------|---------------------------------|--------------------------------|-------------------------------|-------------------|-------------------------------|-------------------------------|--|
| Werkstoff | Material                        | Werkstoff-Nr.<br>Material No.  | Description Old               | Härte<br>Hardness | Description New               |                               |  |
| P         | Vergütbare<br>Formenstähle      | Heat-treatable<br>die steels   | 1.2311                        | 40CrMnMo7         | 280–325 HB                    | 40CrMnMo7                     |  |
|           |                                 |                                | 1.2312                        | 40CrMnMoS8.6      | 280–325 HB                    | 40CrMnMoS8-6                  |  |
|           |                                 |                                | 1.2738                        | 40CrMnNiMoS8.6.4  | 280–325 HB                    | 40CrMnNiMoS8-6-4              |  |
|           |                                 |                                | 1.2711                        | 54NiCrMoV6        | 280–415 HB                    | 54NiCrMoV6                    |  |
|           | Durchhärtende<br>Werkzeugstähle | Full hardening<br>tools steels | 1.2343                        | X38CrMoV5 1       | 230 HB                        | X37CrMoV5 1                   |  |
|           |                                 |                                | 1.2080                        | X210Cr12          | 250 HB                        | X210Cr12                      |  |
|           |                                 |                                | 1.2379                        | X155CrVMo12 1     | 250 HB                        | X153CrVMo12 1                 |  |
|           |                                 |                                | 1.2767                        | X45NiCrMo4        | 260 HB                        | X45NiCrMo4                    |  |
|           | Nitrierstähle                   | Nitriding steels               | 1.8550                        | 34CrAlNi7         | 240–300 HB                    | 34CrAlNi7                     |  |
|           |                                 |                                | 1.8519                        | 31CrMoV9          | 265–310 HB                    | 31CrMoV9                      |  |
|           |                                 |                                | 1.7735                        | 14CrMoV6.9        | 265–310 HB                    | 14CrMoV6.9                    |  |
|           |                                 |                                | 1.2344                        | X40CrMoV5.1       | 280–325 HB                    | X40CrMoV5-1                   |  |
| K         | Grauguss                        | Grey cast iron                 | 0.6025                        | GG25              | 100–400<br>(120–260 HB)       | EN-GJ1-250                    |  |
|           | Legierter Grauguss              | Alloyed grey cast iron         | 0.6678                        | GGL-NiCr35 2      | 150–250<br>(160–230 HB)       | EN-GJLA-XNiCr35-2             |  |
|           | Sphäroguss                      | Nodular cast iron              | 0.7060<br>0.7070              | GGG60<br>GGG70L   | 400–800<br>(120–310 HB)       | EN-GJS-600-3<br>EN-GJS-700-2U |  |
|           | Temperguss                      | Malleable cast iron            | 0.8155                        | GTS55             | 350–700<br>(150–280 HB)       | EN-GJMB-550-4                 |  |
| H         | Gehärteter Stahl                | Hardened steel                 |                               |                   | 45–52 HRC                     |                               |  |
|           |                                 |                                |                               |                   | 53–56 HRC                     |                               |  |
|           |                                 |                                |                               |                   | 57–62 HRC                     |                               |  |
|           |                                 |                                |                               |                   | 63–70 HRC                     |                               |  |

Die angegebenen Schnittwerte sind Startwerte und müssen auf die vorhandenen Bedingungen abgestimmt werden.

The cutting data specified represents base values and must be adapted to the existing conditions.

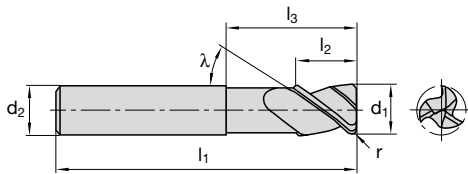
Bei der langen Ausführung empfehlen wir die  $f_z$ -Werte um 30% zu reduzieren.

For high values of total feed we recommend reducing the specified unit values of feed ( $f_z$ ) by 30%.

Hinweise zur Ermittlung des effektiven Schneidendurchmessers bei Kugelfräsern auf Seite 146.

Hints for calculation of the effective cutting diameter of ball nose end mills see page 146.

|  | Schnitt-<br>geschwindigkeit<br>Cutting speed<br>$v_c$ (m/min) | Fräserdurchmesser Cutting diameter<br>(mm)        |       |       |      |      |      |      |      |      |
|--|---------------------------------------------------------------|---------------------------------------------------|-------|-------|------|------|------|------|------|------|
|  |                                                               | Vorschub pro Zahn Feed per tooth<br>$f_z$ (mm/z.) |       |       |      |      |      |      |      |      |
|  |                                                               | 1                                                 | 2     | 3     | 4    | 5    | 6    | 8    | 10   | 12   |
|  | 280–400                                                       | 0,012                                             | 0,024 | 0,036 | 0,05 | 0,06 | 0,07 | 0,10 | 0,12 | 0,14 |
|  | 280–400                                                       | 0,014                                             | 0,03  | 0,043 | 0,06 | 0,07 | 0,09 | 0,12 | 0,14 | 0,17 |
|  | 260–350                                                       | 0,01                                              | 0,02  | 0,03  | 0,04 | 0,05 | 0,06 | 0,08 | 0,10 | 0,12 |
|  | 260–350                                                       | 0,014                                             | 0,03  | 0,043 | 0,06 | 0,07 | 0,09 | 0,12 | 0,14 | 0,17 |
|  | 250–300                                                       | 0,014                                             | 0,03  | 0,043 | 0,06 | 0,07 | 0,09 | 0,12 | 0,14 | 0,17 |
|  | 220–280                                                       | 0,01                                              | 0,02  | 0,03  | 0,04 | 0,05 | 0,06 | 0,08 | 0,10 | 0,12 |
|  | 200–250                                                       | 0,008                                             | 0,017 | 0,025 | 0,03 | 0,04 | 0,05 | 0,07 | 0,08 | 0,10 |
|  | 250–300                                                       | 0,01                                              | 0,024 | 0,036 | 0,05 | 0,06 | 0,07 | 0,10 | 0,12 | 0,14 |
|  | 220–280                                                       | 0,01                                              | 0,02  | 0,03  | 0,04 | 0,05 | 0,06 | 0,08 | 0,10 | 0,12 |
|  | 240–320                                                       | 0,01                                              | 0,02  | 0,03  | 0,04 | 0,05 | 0,06 | 0,08 | 0,10 | 0,12 |
|  | 260–350                                                       | 0,01                                              | 0,02  | 0,03  | 0,04 | 0,05 | 0,06 | 0,08 | 0,10 | 0,12 |
|  | 260–350                                                       | 0,014                                             | 0,03  | 0,043 | 0,06 | 0,07 | 0,09 | 0,12 | 0,14 | 0,17 |
|  | 200–300                                                       | 0,012                                             | 0,02  | 0,03  | 0,05 | 0,06 | 0,07 | 0,10 | 0,13 | 0,15 |
|  | 180–280                                                       | 0,01                                              | 0,018 | 0,025 | 0,04 | 0,06 | 0,07 | 0,09 | 0,12 | 0,13 |
|  | 160–260                                                       | 0,01                                              | 0,018 | 0,025 | 0,04 | 0,06 | 0,07 | 0,09 | 0,12 | 0,13 |
|  | 140–240                                                       | 0,01                                              | 0,018 | 0,025 | 0,04 | 0,06 | 0,07 | 0,09 | 0,12 | 0,13 |
|  | 200–250                                                       | 0,01                                              | 0,02  | 0,03  | 0,04 | 0,05 | 0,06 | 0,08 | 0,10 | 0,12 |
|  | 180–220                                                       | 0,007                                             | 0,014 | 0,02  | 0,03 | 0,04 | 0,04 | 0,06 | 0,07 | 0,09 |
|  | 150–200                                                       | 0,006                                             | 0,012 | 0,02  | 0,02 | 0,03 | 0,04 | 0,05 | 0,06 | 0,07 |
|  | 100–150                                                       | 0,005                                             | 0,01  | 0,01  | 0,02 | 0,02 | 0,03 | 0,04 | 0,05 | 0,06 |

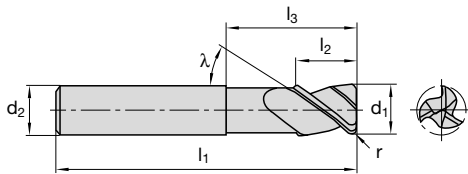


| Katalog-Nr. Cat.-No. |                |                |                |                |   |      | HSC01-P-A                           |                               |
|----------------------|----------------|----------------|----------------|----------------|---|------|-------------------------------------|-------------------------------|
| P                    |                |                |                |                |   |      | <input checked="" type="checkbox"/> |                               |
| M                    |                |                |                |                |   |      | <input type="checkbox"/>            |                               |
| K                    |                |                |                |                |   |      | <input checked="" type="checkbox"/> |                               |
| N                    |                |                |                |                |   |      | <input type="checkbox"/>            |                               |
| S                    |                |                |                |                |   |      | <input type="checkbox"/>            |                               |
| H                    |                |                |                |                |   |      | <input type="checkbox"/>            |                               |
| d <sub>1</sub>       | l <sub>2</sub> | l <sub>1</sub> | l <sub>3</sub> | d <sub>2</sub> | z | r    | Ident No.                           | LMT-Code                      |
| kurz short           |                |                |                |                |   |      |                                     |                               |
| 1                    | 1,5            | 38             | 2,7            | 3              | 2 | 0,2  | <a href="#">7438980</a>             | EM-HSC01 P1.0x1.5/2.7 2R0.2HA |
| 2                    | 2              | 50             | 3,6            | 6              | 2 | 0,3  | <a href="#">7438981</a>             | EM-HSC01 P2.0x2/3.6 2R0.3HA   |
| 3                    | 3              | 50             | 5,5            | 6              | 2 | 0,4  | <a href="#">7438982</a>             | EM-HSC01 P3.0x3/5.5 2R0.4HA   |
| 4                    | 4              | 57             | 9,5            | 6              | 2 | 0,5  | <a href="#">7438983</a>             | EM-HSC01 P4.0x4/14.5 2R0.5HA  |
| 4                    | 4              | 57             | 9,5            | 6              | 2 | 1    | <a href="#">7438984</a>             | EM-HSC01 P4.0x4/14.5 2R1.0HA  |
| 5                    | 5              | 57             | 21             | 6              | 2 | 0,6  | <a href="#">7438986</a>             | EM-HSC01 P5.0x5/21 2R0.6HA    |
| 6                    | 6              | 57             | 21             | 6              | 2 | 0,3  | <a href="#">7438988</a>             | EM-HSC01 P6.0x6/21 2R0.3HA    |
| 6                    | 6              | 57             | 21             | 6              | 2 | 0,5  | <a href="#">7438989</a>             | EM-HSC01 P6.0x6/21 2R0.5HA    |
| 6                    | 6              | 57             | 21             | 6              | 2 | 0,8  | <a href="#">7438990</a>             | EM-HSC01 P6.0x6/21 2R0.8HA    |
| 6                    | 6              | 57             | 21             | 6              | 2 | 1    | <a href="#">7438991</a>             | EM-HSC01 P6.0x6/21 2R1.0HA    |
| 8                    | 8              | 63             | 27             | 8              | 3 | 0,3  | <a href="#">7438992</a>             | EM-HSC01 P8.0x8/27 3R0.3HA    |
| 8                    | 8              | 63             | 27             | 8              | 3 | 1    | <a href="#">7438993</a>             | EM-HSC01 P8.0x8/27 3R1.0HA    |
| 8                    | 8              | 63             | 27             | 8              | 3 | 2    | <a href="#">7438995</a>             | EM-HSC01 P8.0x8/27 3R2.0HA    |
| 10                   | 10             | 72             | 32             | 10             | 3 | 0,5  | <a href="#">7438996</a>             | EM-HSC01 P10.0x10/32 3R0.5HA  |
| 10                   | 10             | 72             | 32             | 10             | 3 | 1    | <a href="#">7438997</a>             | EM-HSC01 P10.0x10/32 3R1.0HA  |
| 10                   | 10             | 72             | 32             | 10             | 3 | 1,25 | <a href="#">7438998</a>             | EM-HSC01 P10.0x10/32 3R1.25HA |
| 10                   | 10             | 72             | 32             | 10             | 3 | 2    | <a href="#">7439000</a>             | EM-HSC01 P10.0x10/32 3R2.0HA  |
| 12                   | 12             | 83             | 38             | 12             | 3 | 1    | <a href="#">7439002</a>             | EM-HSC01 P12.0x12/38 3R1.0HA  |
| 12                   | 12             | 83             | 38             | 12             | 3 | 1,6  | <a href="#">7439004</a>             | EM-HSC01 P12.0x12/38 3R1.6HA  |
| 12                   | 12             | 83             | 38             | 12             | 3 | 2    | <a href="#">7439005</a>             | EM-HSC01 P12.0x12/38 3R2.0HA  |

Schnittwertempfehlungen ab Seite 100  
 Cutting data recommendations starting page 100

☒ = Hauptanwendung First choice  
☐ = Nebenanwendung Second choice



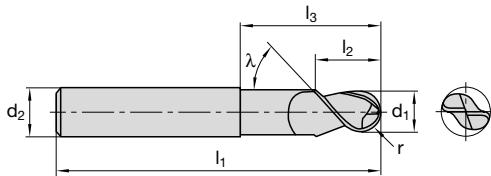


| Katalog-Nr. Cat.-No. |                |                |                |                |   |      | HSC01-P-A                           |                               |
|----------------------|----------------|----------------|----------------|----------------|---|------|-------------------------------------|-------------------------------|
| P                    |                |                |                |                |   |      | <input checked="" type="checkbox"/> |                               |
| M                    |                |                |                |                |   |      | <input type="checkbox"/>            |                               |
| K                    |                |                |                |                |   |      | <input checked="" type="checkbox"/> |                               |
| N                    |                |                |                |                |   |      | <input type="checkbox"/>            |                               |
| S                    |                |                |                |                |   |      | <input type="checkbox"/>            |                               |
| H                    |                |                |                |                |   |      | <input type="checkbox"/>            |                               |
| d <sub>1</sub>       | l <sub>2</sub> | l <sub>1</sub> | l <sub>3</sub> | d <sub>2</sub> | z | r    | Ident No.                           | LMT-Code                      |
| lang long            |                |                |                |                |   |      |                                     |                               |
| 2                    | 2              | 70             | 17             | 6              | 2 | 0,3  | <a href="#">7439009</a>             | EM-HSC01 P2.0x2/17 2R0.3HA    |
| 3                    | 3              | 70             | 18             | 6              | 2 | 0,4  | <a href="#">7439010</a>             | EM-HSC01 P3.0x3/18 2R0.4HA    |
| 5                    | 5              | 80             | 44             | 6              | 2 | 0,6  | <a href="#">7439014</a>             | EM-HSC01 P5.0x5/44 2R0.6HA    |
| 5                    | 5              | 80             | 44             | 6              | 2 | 1    | <a href="#">7439015</a>             | EM-HSC01 P5.0x5/44 2R1.0HA    |
| 6                    | 6              | 80             | 44             | 6              | 2 | 0,3  | <a href="#">7439016</a>             | EM-HSC01 P6.0x6/44 2R0.3HA    |
| 6                    | 6              | 80             | 44             | 6              | 2 | 0,5  | <a href="#">7439017</a>             | EM-HSC01 P6.0x6/44 2R0.5HA    |
| 6                    | 6              | 80             | 44             | 6              | 2 | 0,8  | <a href="#">7439018</a>             | EM-HSC01 P6.0x6/44 2R0.8HA    |
| 6                    | 6              | 80             | 44             | 6              | 2 | 1    | <a href="#">7439019</a>             | EM-HSC01 P6.0x6/44 2R1.0HA    |
| 8                    | 8              | 90             | 54             | 8              | 3 | 0,3  | <a href="#">7439020</a>             | EM-HSC01 P8.0x8/54 3R0.3HA    |
| 8                    | 8              | 90             | 54             | 8              | 3 | 1    | <a href="#">7439021</a>             | EM-HSC01 P8.0x8/54 3R1.0HA    |
| 8                    | 8              | 90             | 54             | 8              | 3 | 1,5  | <a href="#">7439022</a>             | EM-HSC01 P8.0x8/54 3R1.5HA    |
| 10                   | 10             | 100            | 60             | 10             | 3 | 1    | <a href="#">7439025</a>             | EM-HSC01 P10.0x10/60 3R1.0HA  |
| 10                   | 10             | 100            | 60             | 10             | 3 | 1,25 | <a href="#">7439026</a>             | EM-HSC01 P10.0x10/60 3R1.25HA |
| 10                   | 10             | 100            | 60             | 10             | 3 | 2    | <a href="#">7439028</a>             | EM-HSC01 P10.0x10/60 3R2.0HA  |
| 12                   | 12             | 110            | 65             | 12             | 3 | 1    | <a href="#">7439030</a>             | EM-HSC01 P12.0x12/65 3R1.0HA  |
| 16                   | 16             | 130            | 82             | 16             | 4 | 2    | <a href="#">7439034</a>             | EM-HSC01 P16.0x16/82 4R2.0HA  |

Schnittwertempfehlungen ab Seite 100  
 Cutting data recommendations starting page 100

☒ = Hauptanwendung First choice  
☐ = Nebenanwendung Second choice

**HSC01 Ball-Nose-Finisher 20 P**  
**Kugel-Kopierfräser**  
**Ball nose end mill**

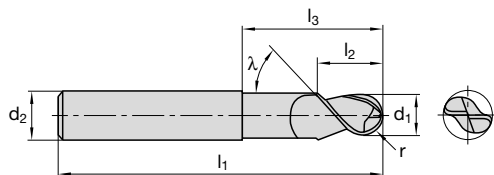


| Katalog-Nr. Cat.-No. |                |                |                |                |   |     | HSC01-P-A                           |                            |
|----------------------|----------------|----------------|----------------|----------------|---|-----|-------------------------------------|----------------------------|
| P                    |                |                |                |                |   |     | <input checked="" type="checkbox"/> |                            |
| M                    |                |                |                |                |   |     | <input type="checkbox"/>            |                            |
| K                    |                |                |                |                |   |     | <input checked="" type="checkbox"/> |                            |
| N                    |                |                |                |                |   |     | <input type="checkbox"/>            |                            |
| S                    |                |                |                |                |   |     | <input type="checkbox"/>            |                            |
| H                    |                |                |                |                |   |     | <input type="checkbox"/>            |                            |
| d <sub>1</sub>       | l <sub>2</sub> | l <sub>1</sub> | l <sub>3</sub> | d <sub>2</sub> | z | r   | Ident No.                           | LMT-Code                   |
| kurz short           |                |                |                |                |   |     |                                     |                            |
| 1                    | 1,5            | 38             | 2,7            | 3              | 2 | 0,5 | <a href="#">7438895</a>             | EM-HSC01 P1.0x1.5/2.7 2BHA |
| 2                    | 2              | 50             | 3,6            | 6              | 2 | 1   | <a href="#">7438896</a>             | EM-HSC01 P2.0x2/3.6 2BHA   |
| 3                    | 3              | 50             | 5,5            | 6              | 2 | 1,5 | <a href="#">7438897</a>             | EM-HSC01 P3.0x3/5.5 2BHA   |
| 4                    | 4              | 57             | 9,5            | 6              | 2 | 2   | <a href="#">7438898</a>             | EM-HSC01 P4.0x4/14.5 2BHA  |
| 5                    | 5              | 57             | 21             | 6              | 2 | 2,5 | <a href="#">7438899</a>             | EM-HSC01 P5.0x5/21 2BHA    |
| 6                    | 6              | 57             | 21             | 6              | 2 | 3   | <a href="#">7438900</a>             | EM-HSC01 P6.0x6/21 2BHA    |
| 8                    | 8              | 63             | 27             | 8              | 2 | 4   | <a href="#">7438901</a>             | EM-HSC01 P8.0x8/27 2BHA    |
| 10                   | 10             | 72             | 32             | 10             | 2 | 5   | <a href="#">7438902</a>             | EM-HSC01 P10.0x10/32 2BHA  |
| 12                   | 12             | 83             | 38             | 12             | 2 | 6   | <a href="#">7438903</a>             | EM-HSC01 P12.0x12/38 2BHA  |
| 16                   | 16             | 92             | 44             | 16             | 4 | 8   | <a href="#">7438904</a>             | EM-HSC01 P16.0x16/44 4BHA  |
| 20                   | 20             | 104            | 54             | 20             | 4 | 10  | <a href="#">7438905</a>             | EM-HSC01 P20.0x20/54 4BHA  |
| lang long            |                |                |                |                |   |     |                                     |                            |
| 2                    | 2              | 70             | 17             | 6              | 2 | 1   | <a href="#">7438906</a>             | EM-HSC01 P2.0x2/17 2BHA    |
| 3                    | 3              | 70             | 18             | 6              | 2 | 1,5 | <a href="#">7438907</a>             | EM-HSC01 P3.0x3/18 2BHA    |
| 4                    | 4              | 80             | 19             | 6              | 2 | 2   | <a href="#">7438908</a>             | EM-HSC01 P4.0x4/19 2BHA    |
| 5                    | 5              | 80             | 44             | 6              | 2 | 2,5 | <a href="#">7438909</a>             | EM-HSC01 P5.0x5/44 2BHA    |
| 6                    | 6              | 80             | 44             | 6              | 2 | 3   | <a href="#">7438910</a>             | EM-HSC01 P6.0x6/44 2BHA    |
| 8                    | 8              | 90             | 54             | 8              | 2 | 4   | <a href="#">7438911</a>             | EM-HSC01 P8.0x8/54 2BHA    |
| 10                   | 10             | 100            | 60             | 10             | 2 | 5   | <a href="#">7438912</a>             | EM-HSC01 P10.0x10/60 2BHA  |
| 12                   | 12             | 110            | 65             | 12             | 2 | 6   | <a href="#">7438913</a>             | EM-HSC01 P12.0x12/65 2BHA  |
| 16                   | 16             | 130            | 82             | 16             | 4 | 8   | <a href="#">7438914</a>             | EM-HSC01 P16.0x16/82 4BHA  |

Schnittwertempfehlungen ab Seite 100  
 Cutting data recommendations starting page 100

■ = Hauptanwendung First choice  
 □ = Nebenanwendung Second choice





Schnittwertempfehlungen ab Seite 100  
Cutting data recommendations starting page 100

■ = Hauptanwendung First choice  
□ = Nebenanwendung Second choice



**HSC01 Finisher 20 P & HSC01 Ball-Nose-Finisher 20 P**  
**Schnittwertempfehlungen für Schafffräser mit Eckenradius und runder Stirn**  
**Cutting data recommendations for end mills corner radius or ball nose**

| Werkstoff |                                                                     | Material                                             | Werkstoff-Nr.<br>Material No. | DIN<br>Bezeichnung Alt<br>DIN<br>Description Old | R <sub>m</sub> /UTS<br>(N/mm <sup>2</sup> ) | DIN<br>Bezeichnung Neu<br>DIN<br>Description New |
|-----------|---------------------------------------------------------------------|------------------------------------------------------|-------------------------------|--------------------------------------------------|---------------------------------------------|--------------------------------------------------|
| <b>P</b>  | Unlegierter Baustahl<br>+ Automatenstahl                            | Plain carbon steel<br>+ free cutting steel           | 1.0570                        | St52-3                                           | -700                                        | S355J2G3                                         |
|           |                                                                     |                                                      | 1.1730                        | C45                                              | -800                                        | C45U                                             |
|           |                                                                     |                                                      | 1.0715                        | 9SMn28                                           | -700                                        | 11SMn30                                          |
|           |                                                                     |                                                      | 1.1191                        | Ck45                                             | 500-950                                     | C45E                                             |
|           |                                                                     |                                                      | 1.7219                        | 26CrMo4                                          | 500-950                                     | 26CrMo4-2                                        |
|           | Vergütungsstahl,<br>mittelfest                                      | Heat-treatment steel,<br>medium strength             | 1.7225                        | 42CrMo4                                          | 500-950                                     | 42CrMo4                                          |
|           | Stahlguss                                                           | Cast steel                                           | 1.8159                        | 51CrV4                                           |                                             | 51CrV4                                           |
|           | Einsatzstahl                                                        | Case hardening steel                                 | 1.0416                        | GS40                                             | -950                                        | GS40                                             |
|           |                                                                     |                                                      | 1.7131                        | 16MnCr5                                          | -950                                        | 16MnCr5                                          |
|           | Rost- und säurebe-<br>ständiger Stahl,<br>ferritisch, martensitisch | Stainless steel,<br>ferritic, martensitic            | 1.4006                        | X10Cr13                                          | 500-950                                     | X12Cr13                                          |
|           |                                                                     |                                                      | 1.4104                        | X12CrMoS17                                       |                                             | X14CrMoS17                                       |
|           |                                                                     |                                                      | 1.4122                        | X35CrMo17                                        |                                             | X39CrMo17-1                                      |
|           | Vergütungsstahl,<br>hochfest                                        | Heat-treatment steel,<br>high strength               | 1.7225                        | 42CrMo4                                          | 950-1400                                    | 42CrMo4                                          |
|           | Nitrierstahl,<br>vergütet                                           | Nitriding steel,<br>heat treated                     | 1.6580                        | 30CrNiMo8                                        |                                             | 30CrNiMo8                                        |
|           |                                                                     |                                                      | 1.8504                        | 34CrAl6                                          | 950-1400                                    | 34CrAl6                                          |
|           | Werkzeugstahl                                                       | Tool steel                                           | 1.2344                        | X40CrMoV5.1                                      | -900                                        | X40CrMoV5-1                                      |
|           |                                                                     |                                                      | 1.2343                        | X38CrMoV5 1                                      | 950-1400                                    | X37CrMoV5-1                                      |
|           |                                                                     |                                                      | 1.2316                        | X38CrMo16                                        | -1100                                       | X38CrMo16                                        |
|           |                                                                     |                                                      | 1.2379                        | X153CrVMo12 1                                    | -950                                        | X153CrMoV12-1                                    |
|           |                                                                     |                                                      | 1.2080                        | X210Cr12                                         | 950-1400                                    | X210Cr12                                         |
|           |                                                                     |                                                      | 1.2358                        | 60CrMoV18-5                                      | 850-1000                                    | 60CrMoV18-5                                      |
|           |                                                                     |                                                      | 1.2714                        | 55NiCrMoV7                                       | 1100-1350                                   | 55NiCrMoV7                                       |
|           |                                                                     |                                                      | 1.2311                        | 40CrMnMo7                                        | -1100                                       | 40CrMnMo7                                        |
|           |                                                                     |                                                      | 1.2312                        | 40CrMnNiMoS8.6                                   | -1150                                       | 40CrMnNiMoS8-6                                   |
|           |                                                                     |                                                      | 1.2738                        | 45CrMnNiMo8.6.4                                  | 950-1150                                    | 45CrMnNiMo8-6-4                                  |
| <b>M</b>  | Rost- und säurebe-<br>ständiger Stahl,<br>austenitisch              | Stainless steel,<br>austenitic                       | 1.4301                        | X2CrNiMo17-12-2                                  | 500-950                                     | X5CrNiMo18-10                                    |
|           |                                                                     |                                                      | 1.4404                        | X6CrNiMoTi17-12-2                                |                                             | X2CrNiMo17-12-2                                  |
|           |                                                                     |                                                      | 1.4571                        | X10CrNiMoTi18                                    | 500-950                                     | X10CrNiMoTi18                                    |
|           | Rost- und säurebe-<br>ständiger Stahl,<br>martensitisch aushärtbar  | Stainless steel,<br>martensitic steel                | 1.2709                        | X3NiCoMoTi18-9-5                                 | 800-1000                                    | X3NiCoMoTi18-9-5                                 |
|           |                                                                     |                                                      | 1.4542                        | X5CrNiCuNb16-4                                   |                                             | X5CrNiCuNb16-4                                   |
| <b>K</b>  | Grauguss                                                            | Grey cast iron                                       | 0.6025                        | GG25                                             | 100-400<br>(120-260 HB)                     | EN-GJL-250                                       |
|           |                                                                     |                                                      | 0.6678                        | GGL-NiCr35 2                                     | 150-250<br>(160-230 HB)                     | EN-GJLA-XNiCr35-2                                |
|           | Sphäroguss                                                          | Nodular cast iron                                    | 0.7070                        | GGG70L                                           | 400-800<br>(120-310 HB)                     | EN-GJS-700-2U                                    |
|           |                                                                     |                                                      | 0.7060                        | GGG60                                            |                                             | EN-GJS-600-3                                     |
|           | Temperguss                                                          | Malleable cast iron                                  | 0.8155                        | GTS55                                            | 350-700<br>(150-280 HB)                     | EN-GJMB-550-4                                    |
| <b>N</b>  | Aluminium-Legierungen,<br>kurzspanend                               | Aluminium alloys,<br>short chipping                  | 3.2581                        | G-AlSi12                                         | -400                                        | G-IGK-AlSi12                                     |
|           | Aluminium-Legierungen,<br>langspanend                               | Aluminium alloys,<br>long chipping                   | 3.3535                        | AlMg3                                            | -550                                        | AlMg3                                            |
|           |                                                                     |                                                      | 3.4365                        | AlZnMgCu1,5                                      |                                             | AlZnMgCu1,5                                      |
|           | Kupfer-Legierungen,<br>kurzspanend                                  | Copper alloys,<br>short chipping                     | 2.0402                        | MS58                                             | -500                                        | CuZn40Pb2                                        |
|           | Kupfer-Legierungen,<br>langspanend                                  | Copper alloys,<br>long chipping                      | 2.0320                        | MS63                                             | 300-500                                     | CuZn37                                           |
|           |                                                                     |                                                      | 2.0975                        | CuAl10Ni                                         |                                             | CuAl10Fe5Ni5-C                                   |
|           | Thermoplaste                                                        | Thermoplastics                                       |                               | PVC                                              | 40-70                                       | PVC                                              |
| <b>S</b>  | Duroplaste                                                          | Duroplastics                                         |                               | Bakelit, Melamin                                 | 20-40                                       | Bakelit, Melamin                                 |
|           | Graphit                                                             | Graphite                                             |                               |                                                  |                                             |                                                  |
|           | Titan-Legierungen,<br>mittelfest                                    | Titanium alloys,<br>medium strength                  | 3.7115                        | TiAl5Sn2,5                                       | -950                                        | TiAl5Sn2-5                                       |
|           |                                                                     |                                                      | 3.7164                        | TiAl6V4                                          |                                             | Ti6AlV4                                          |
|           | Titan-Legierungen,<br>hochfest                                      | Titanium alloys,<br>high strength                    | 3.7174                        | TiAl6Sn2                                         | 900-1400                                    | TiAl6V6Sn2                                       |
|           | Nickelbasis-Legierungen,<br>mittelfest                              | Nickel based alloys,<br>medium strength              | 2.4670                        | NiCr12Al6MoNb                                    | -950                                        | NiCr12Al6MoNb                                    |
|           | Nickelbasis-Legierungen,<br>hochwarmfest                            | Heat resistant nickel based<br>alloys, high strength | 2.4668                        | NiCr19Fe19NbMo                                   | 900-1400                                    | Inconel 718<br>NiCr19Fe19Nb5Mo3                  |
| <b>H</b>  | Hartguss                                                            | Chilled cast iron                                    |                               | Ni-hard, Ampco                                   | 300-600 HB                                  | Ni-hard, Ampco                                   |
|           | Gehärteter Stahl                                                    | Hardened steel                                       |                               |                                                  | 45-52 HRC                                   |                                                  |

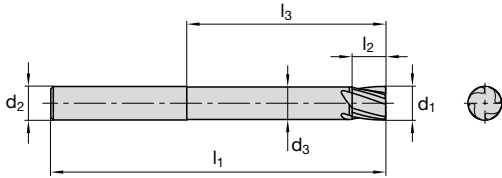
Die angegebenen Schnittwerte sind Startwerte und müssen auf die vorhandenen Bedingungen abgestimmt werden.  
The cutting data indicated are starting values based and must be adjusted to the prevailing conditions.

Bei der langen Ausführung empfehlen wir die  $f_z$ -Werte um 20 % und bei der extra langen Ausführung um 40 % zu reduzieren.  
We recommend reducing the  $f_z$  values by 20 % for the long version and by 40 % for the extra-long version.

|  | Schnittgeschwindigkeit<br>Cutting speed<br>v <sub>c</sub> (m/min) | Fräserdurchmesser Cutting diameter<br>(mm)                 |       |         |         |
|--|-------------------------------------------------------------------|------------------------------------------------------------|-------|---------|---------|
|  |                                                                   | Vorschub pro Zahn Feed per tooth<br>f <sub>z</sub> (mm/z.) |       |         |         |
|  | Schlichten Finishing                                              |                                                            |       |         |         |
|  | HSC01 20 P                                                        | Ø 1–4                                                      | Ø 5–8 | Ø 10–12 | Ø 14–20 |
|  | 600                                                               | 0,05                                                       | 0,10  | 0,12    | 0,15    |
|  | 600                                                               | 0,05                                                       | 0,10  | 0,12    | 0,15    |
|  | 600                                                               | 0,05                                                       | 0,10  | 0,12    | 0,15    |
|  | 450                                                               | 0,04                                                       | 0,07  | 0,10    | 0,13    |
|  | 450                                                               | 0,03                                                       | 0,07  | 0,10    | 0,13    |
|  | 400                                                               | 0,015                                                      | 0,04  | 0,08    | 0,12    |
|  | 300                                                               | 0,015                                                      | 0,04  | 0,08    | 0,12    |
|  | 350                                                               | 0,03                                                       | 0,06  | 0,09    | 0,13    |
|  | 300                                                               | 0,02                                                       | 0,05  | 0,07    | 0,01    |
|  | 250                                                               | 0,03                                                       | 0,06  | 0,90    | 0,12    |
|  | 220                                                               |                                                            |       |         |         |
|  | 230                                                               | 0,03                                                       | 0,06  | 0,90    | 0,12    |
|  | 250                                                               | 0,04                                                       | 0,07  | 0,10    | 0,13    |
|  | 230                                                               | 0,03                                                       | 0,07  | 0,09    | 0,11    |
|  | 180                                                               | 0,04                                                       | 0,07  | 0,10    | 0,13    |
|  | 600                                                               | 0,04                                                       | 0,07  | 0,10    | 0,13    |
|  | 500                                                               | 0,04                                                       | 0,07  | 0,10    | 0,14    |
|  | 500                                                               | 0,02                                                       | 0,06  | 0,07    | 0,09    |
|  | 350                                                               | 0,02                                                       | 0,06  | 0,07    | 0,09    |
|  | 300                                                               | 0,02                                                       | 0,06  | 0,07    | 0,09    |
|  | 800                                                               | 0,04                                                       | 0,08  | 0,10    | 0,12    |
|  | 1000                                                              | 0,04                                                       | 0,08  | 0,10    | 0,12    |
|  | 700                                                               | 0,04                                                       | 0,08  | 0,10    | 0,12    |
|  | 1000                                                              | 0,04                                                       | 0,08  | 0,10    | 0,12    |
|  | 600                                                               | 0,05                                                       | 0,10  | 0,12    | 0,15    |
|  | 700                                                               | 0,04                                                       | 0,08  | 0,10    | 0,12    |
|  | 1000                                                              | 0,04                                                       | 0,07  | 0,10    | 0,14    |
|  | 120                                                               | 0,02                                                       | 0,06  | 0,07    | 0,09    |
|  | 80                                                                | 0,015                                                      | 0,05  | 0,06    | 0,08    |
|  | 100                                                               | 0,02                                                       | 0,06  | 0,07    | 0,09    |
|  | 60                                                                | 0,015                                                      | 0,05  | 0,06    | 0,08    |
|  | 50–70                                                             | 0,025                                                      | 0,05  | 0,06    | 0,08    |
|  | 160–200                                                           | 0,025                                                      | 0,05  | 0,06    | 0,08    |

Hinweise zur Ermittlung des effektiven Schneidendurchmessers bei Kugelfräsern auf Seite 146.  
Hints for calculation of the effective cutting diameter of ball nose end mills on page 146.

**HSC 01 Toric-Finisher 20 H**  
**Torischer Fräser 4-schneidig mit Halsfreistellung**  
**Toric end mill 4 flute with neck relief**



| Katalog-Nr. Cat.-No. |                |                |                |                |                |   |     | HSC01-H-A               |                              |
|----------------------|----------------|----------------|----------------|----------------|----------------|---|-----|-------------------------|------------------------------|
| P                    |                |                |                |                |                |   |     | ■                       |                              |
| M                    |                |                |                |                |                |   |     |                         |                              |
| K                    |                |                |                |                |                |   |     |                         |                              |
| N                    |                |                |                |                |                |   |     |                         |                              |
| S                    |                |                |                |                |                |   |     |                         |                              |
| H                    |                |                |                |                |                |   |     | ■                       |                              |
| d <sub>1</sub>       | l <sub>2</sub> | l <sub>1</sub> | l <sub>3</sub> | d <sub>2</sub> | d <sub>3</sub> | z | r   | Ident No.               | LMT-Code                     |
| kurz short           |                |                |                |                |                |   |     |                         |                              |
| 4                    | 4              | 45             | 11             | 6              | 3,8            | 4 | 0,5 | <a href="#">7434494</a> | EM-HSC01 H4.0x4/11 4R0.5HA   |
| 4                    | 4              | 45             | 11             | 6              | 3,8            | 4 | 1   | <a href="#">7434495</a> | EM-HSC01 H4.0x4/11 4R1HA     |
| 5                    | 5              | 50             | 12             | 6              | 4,8            | 4 | 0,5 | <a href="#">7434496</a> | EM-HSC01 H5.0x5/12 4R0.5HA   |
| 5                    | 5              | 50             | 12             | 6              | 4,8            | 4 | 1   | <a href="#">7434497</a> | EM-HSC01 H5.0x5/12 4R1HA     |
| 6                    | 3              | 50             | 12             | 6              | 5,8            | 4 | 0,5 | <a href="#">7434500</a> | EM-HSC01 H6.0x3/12 4R0.5HA   |
| 8                    | 4              | 60             | 21             | 8              | 7,8            | 4 | 1   | <a href="#">7434504</a> | EM-HSC01 H8.0x4/21 4R1HA     |
| 8                    | 4              | 60             | 21             | 8              | 7,8            | 4 | 2   | <a href="#">7434505</a> | EM-HSC01 H8.0x4/21 4R2HA     |
| 10                   | 5              | 70             | 27             | 10             | 9,8            | 4 | 0,5 | <a href="#">7434510</a> | EM-HSC01 H10.0x5/27 4R0.5HA  |
| 10                   | 5              | 70             | 27             | 10             | 9,8            | 4 | 2,5 | <a href="#">7434511</a> | EM-HSC01 H10.0x5/27 4R2.5HA  |
| 12                   | 6              | 75             | 27             | 12             | 11,7           | 4 | 3   | <a href="#">7434512</a> | EM-HSC01 H12.0x6/27 4R3HA    |
| lang long            |                |                |                |                |                |   |     |                         |                              |
| 6                    | 6              | 80             | 43             | 6              | 5,8            | 4 | 0,5 | <a href="#">7434498</a> | EM-HSC01 H6.0x6/43 4R0.5HA   |
| 6                    | 6              | 80             | 43             | 6              | 5,8            | 4 | 1   | <a href="#">7434499</a> | EM-HSC01 H6.0x6/43 4R1HA     |
| 8                    | 8              | 90             | 53             | 8              | 7,8            | 4 | 0,5 | <a href="#">7434501</a> | EM-HSC01 H8.0x8/53 4R0.5HA   |
| 8                    | 8              | 90             | 53             | 8              | 7,8            | 4 | 1   | <a href="#">7434502</a> | EM-HSC01 H8.0x8/53 4R1HA     |
| 8                    | 8              | 90             | 53             | 8              | 7,8            | 4 | 2   | <a href="#">7434503</a> | EM-HSC01 H8.0x8/53 4R2HA     |
| 10                   | 10             | 100            | 59             | 10             | 9,8            | 4 | 0,5 | <a href="#">7434506</a> | EM-HSC01 H10.0x10/59 4R0.5HA |
| 10                   | 10             | 100            | 59             | 10             | 9,8            | 4 | 1   | <a href="#">7434507</a> | EM-HSC01 H10.0x10/59 4R1HA   |
| 10                   | 10             | 100            | 59             | 10             | 9,8            | 4 | 2   | <a href="#">7434508</a> | EM-HSC01 H10.0x10/59 4R2HA   |
| 10                   | 10             | 100            | 59             | 10             | 9,8            | 4 | 2,5 | <a href="#">7434509</a> | EM-HSC01 H10.0x10/59 4R2.5HA |
| 12                   | 12             | 110            | 64             | 12             | 11,7           | 4 | 1   | <a href="#">7434513</a> | EM-HSC01 H12.0x12/64 4R1HA   |
| 12                   | 12             | 110            | 64             | 12             | 11,7           | 4 | 3   | <a href="#">7434514</a> | EM-HSC01 H12.0x12/64 4R3HA   |

Schnittwertempfehlungen ab Seite 103  
 Cutting data recommendations starting page 103

■ = Hauptanwendung First choice  
 □ = Nebenanwendung Second choice

| Werkstoff<br>Material                                                                     | Werk-<br>stoff-Nr.<br>Material<br>No. | R <sub>m</sub> /UTS<br>(N/mm <sup>2</sup> ) | DIN<br>Bezeichnung<br>DIN<br>Description | Kühlung<br>Coolant                                                                | Schnitt-<br>geschwin-<br>digkeit<br>Cutting<br>speed<br>v <sub>c</sub> (m/min) | Fräserdurchmesser<br>Cutting diameter (mm)                                   |      |      |      |      |      | Kanten-<br>fräsen<br>Side<br>milling |                | Nuten-<br>fräsen<br>Slot<br>milling |
|-------------------------------------------------------------------------------------------|---------------------------------------|---------------------------------------------|------------------------------------------|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------|------------------------------------------------------------------------------|------|------|------|------|------|--------------------------------------|----------------|-------------------------------------|
|                                                                                           |                                       |                                             |                                          |                                                                                   |                                                                                | Vorschub pro Zahn f <sub>z</sub><br>Feed per tooth f <sub>z</sub><br>(mm/z.) |      |      |      |      |      | a <sub>p</sub>                       | a <sub>e</sub> | a <sub>p</sub>                      |
|                                                                                           |                                       |                                             |                                          |                                                                                   |                                                                                | Ø 4                                                                          | Ø 5  | Ø 6  | Ø 8  | Ø 10 | Ø 12 |                                      |                |                                     |
| <b>P2</b> Stahl<br>Steel                                                                  | 1.7225<br>1.1191                      | 500–<br>1000                                | 42CrMo4-NT<br>Ck45                       |  | 120–160                                                                        | 0,03                                                                         | 0,03 | 0,04 | 0,06 | 0,07 | 0,08 | 0,5<br>x D                           | 0,4<br>x D     | 0,3<br>x D                          |
| <b>P3</b> Stahl<br>Steel                                                                  | 1.2343                                | > 1000                                      | X38CrMoV5 1<br>Toolox33                  |                                                                                   | 90–150                                                                         | 0,02                                                                         | 0,03 | 0,04 | 0,05 | 0,06 | 0,07 | 0,5<br>x D                           | 0,4<br>x D     | 0,3<br>x D                          |
| <b>H1</b> Hartguss u.<br>gehärteter<br>Stahl<br>Chilled<br>steel and<br>Hardened<br>steel |                                       | 45–55<br>HRC                                | Ni-hard,<br>Ampco                        |  | 60–80                                                                          | 0,02                                                                         | 0,02 | 0,03 | 0,04 | 0,04 | 0,02 | 0,5<br>x D                           | 0,3<br>x D     | 0,2<br>x D                          |
| <b>H2</b> Gehärtete<br>Stähle<br>Hardened<br>steel                                        |                                       | 56–60<br>HRC                                |                                          |                                                                                   | 50–70                                                                          | 0,01                                                                         | 0,02 | 0,02 | 0,03 | 0,04 | 0,04 | 0,5<br>x D                           | 0,15<br>x D    | 0,15<br>x D                         |
| <b>H3</b> Gehärtete<br>Stähle<br>Hardened<br>steel                                        |                                       | > 60<br>HRC                                 |                                          |                                                                                   | 40–60                                                                          | 0,01                                                                         | 0,01 | 0,01 | 0,02 | 0,02 | 0,03 | 0,5<br>x D                           | 0,1<br>x D     | 0,1<br>x D                          |

Die f<sub>z</sub>-Angaben gelten für das seitliche Fräsen. Beim Nutenfräsen ist f<sub>z</sub> um 20 % zu reduzieren. Ein niedrigerer Wert der Schnittgeschwindigkeit ermöglicht die Anwendung mit hohem Zerspanungsvolumen oder den Einsatz in Materialien mit höherer Festigkeit.

Ein höherer Wert der Schnittgeschwindigkeit ermöglicht den Einsatz bei der Schlichtbearbeitung, oder den Einsatz in Materialien mit geringerer Festigkeit. Die oben genannten Parameter basieren auf idealen Bedingungen.

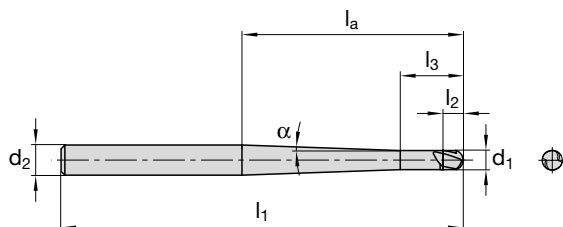
f<sub>z</sub> information is for side milling. For slot milling reduce f<sub>z</sub> by 20 %. Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.

Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.

Above parameters are based on ideal conditions.

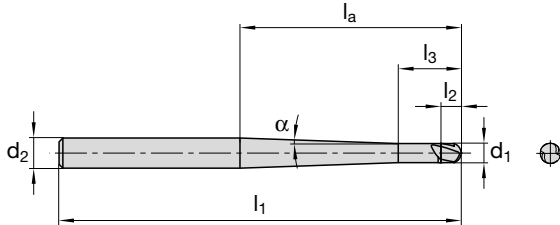


Trockenbearbeitung, Pressluftkühlung ist vorteilhaft  
 Dry machining, Compressed air cooling is advantageous



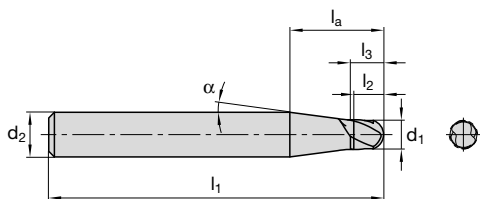
Schnittwertempfehlungen ab Seite 110  
Cutting data recommendations starting page 110

■ = Hauptanwendung First choice  
□ = Nebenanwendung Second choice



Schnittwertempfehlungen ab Seite 110  
Cutting data recommendations starting page 110

■ = Hauptanwendung First choice  
□ = Nebenanwendung Second choice



Schnittwertempfehlungen ab Seite 110  
Cutting data recommendations starting page 110

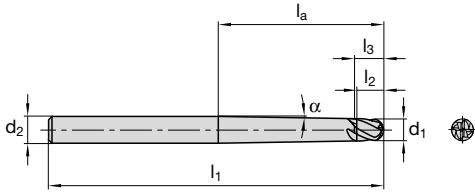
■ = Hauptanwendung First choice  
□ = Nebenanwendung Second choice



# HSC 01 Ball-Nose-Finisher 30 H

Kugel-Kopierfräser 4-schneidig mit konischem Hals und verstärktem Schaft

Ball nose end mill 4 flute with conical neck and reinforced shank



| Katalog-Nr. Cat.-No.  |                |                |                |                |      |                |   |     | HSC01-H-A               |                              |
|-----------------------|----------------|----------------|----------------|----------------|------|----------------|---|-----|-------------------------|------------------------------|
| P                     |                |                |                |                |      |                |   |     | ■                       |                              |
| M                     |                |                |                |                |      |                |   |     |                         |                              |
| K                     |                |                |                |                |      |                |   |     |                         |                              |
| N                     |                |                |                |                |      |                |   |     |                         |                              |
| S                     |                |                |                |                |      |                |   |     |                         |                              |
| H                     |                |                |                |                |      |                |   |     | ■                       |                              |
| d <sub>1</sub>        | l <sub>2</sub> | l <sub>1</sub> | l <sub>3</sub> | l <sub>a</sub> | α    | d <sub>2</sub> | z | r   | Ident No.               | LMT-Code                     |
| lang long             |                |                |                |                |      |                |   |     |                         |                              |
| 3                     | 4              | 75             | 4,5            | 37             | 2,64 | 6              | 4 | 1,5 | <a href="#">7434475</a> | EM-HSC01 H3.0x4/4.5 4B1.5HA  |
| 4                     | 5              | 75             | 5,5            | 37             | 1,82 | 6              | 4 | 2   | <a href="#">7434476</a> | EM-HSC01 H4.0x5/5.5 4B2HA    |
| 5                     | 6              | 75             | 6,5            | 37             | 0,94 | 6              | 4 | 2,5 | <a href="#">7434477</a> | EM-HSC01 H5.0x6/6.5 4B2.5HA  |
| 6                     | 8              | 75             | 8,5            | 37             | 2    | 8              | 4 | 3   | <a href="#">7434478</a> | EM-HSC01 H6.0x8/8.5 4B3HA    |
| extra lang extra long |                |                |                |                |      |                |   |     |                         |                              |
| 8                     | 12             | 150            | 12,5           | 103            | 1,27 | 12             | 4 | 4   | <a href="#">7434479</a> | EM-HSC01 H8.0x12/12.5 4B4HA  |
| 10                    | 15             | 150            | 15,5           | 103            | 0,65 | 12             | 4 | 5   | <a href="#">7434480</a> | EM-HSC01 H10.0x15/15.5 4B5HA |

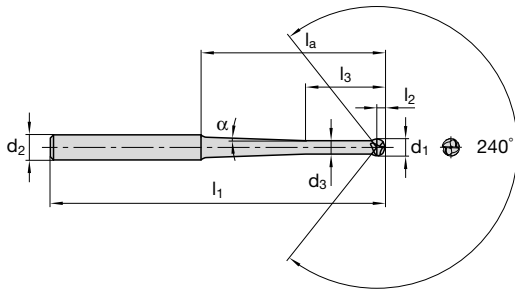
Schnittwertempfehlungen ab Seite 110

Cutting data recommendations starting page 110

■ = Hauptanwendung First choice

□ = Nebenanwendung Second choice

**HSC 01 Ball-Nose-Finisher 30 H**  
**Kugel-Kopierfräser mit 240° Schneide**  
**Ball nose end mill with 240° cutting edge**



| Katalog-Nr. Cat.-No. |                |                |                |                |   |                |                |   |     | HSC01-H-A               |                              |
|----------------------|----------------|----------------|----------------|----------------|---|----------------|----------------|---|-----|-------------------------|------------------------------|
| P                    |                |                |                |                |   |                |                |   |     | ■                       |                              |
| M                    |                |                |                |                |   |                |                |   |     |                         |                              |
| K                    |                |                |                |                |   |                |                |   |     |                         |                              |
| N                    |                |                |                |                |   |                |                |   |     |                         |                              |
| S                    |                |                |                |                |   |                |                |   |     |                         |                              |
| H                    |                |                |                |                |   |                |                |   |     | ■                       |                              |
| d <sub>1</sub>       | l <sub>2</sub> | l <sub>1</sub> | l <sub>3</sub> | l <sub>a</sub> | α | d <sub>2</sub> | d <sub>3</sub> | z | r   | Ident No.               | LMT-Code                     |
| lang long            |                |                |                |                |   |                |                |   |     |                         |                              |
| 2                    | 1              | 70             | 17             | 34             | 6 | 6              | 1,6            | 2 | 1   | <a href="#">7434481</a> | EM-HSC01 H2.0x1/17 2B1HA     |
| 3                    | 1,5            | 70             | 18             | 34             | 5 | 6              | 2,4            | 2 | 1,5 | <a href="#">7434482</a> | EM-HSC01 H3.0x1.5/18 2B1.5HA |
| 4                    | 2              | 80             | 19             | 44             | 2 | 6              | 3,2            | 2 | 2   | <a href="#">7434484</a> | EM-HSC01 H4.0x2/19 2B2HA     |
| 5                    | 2,5            | 80             | 42             | 44             | – | 6              | 4,1            | 2 | 2,5 | <a href="#">7434486</a> | EM-HSC01 H5.0x2.5/42 2B2.5HA |
| 6                    | 3              | 80             | 42             | 44             | – | 6              | 4,9            | 2 | 3   | <a href="#">7434488</a> | EM-HSC01 H6.0x3/42 2B3HA     |
| 8                    | 4              | 90             | 52             | 54             | – | 8              | 6,5            | 2 | 4   | <a href="#">7434490</a> | EM-HSC01 H8.0x4/52 2B4HA     |
| 10                   | 5              | 100            | 58             | 60             | – | 10             | 8,2            | 2 | 5   | <a href="#">7434492</a> | EM-HSC01 H10.0x5/58 2B5HA    |
| 12                   | 6              | 110            | 63             | 65             | – | 12             | 9,9            | 2 | 6   | <a href="#">7434493</a> | EM-HSC01 H12.0x6/63 2B6HA    |
|                      |                |                |                |                |   |                |                |   |     |                         |                              |

Schnittwertempfehlungen ab Seite 110  
 Cutting data recommendations starting page 110

■ = Hauptanwendung First choice  
 □ = Nebenanwendung Second choice



# HSC 01 Ball-Nose-Finisher 15 H, 20 H & 30 H

## Schnittwertempfehlungen

### Cutting data recommendations

| Werkstoff<br>Material                                                       | Werkstoff-Nr.<br>Material No. | R <sub>m</sub> /UTS<br>(N/mm <sup>2</sup> ) | DIN Bezeichnung<br>DIN Description | Kühlung<br>Coolant                                                                  | Schnittgeschwindigkeit<br>Cutting speed<br>v <sub>c</sub> (m/min) |  |
|-----------------------------------------------------------------------------|-------------------------------|---------------------------------------------|------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------|--|
| <b>P2</b> Stahl<br>Steel                                                    | 1.7225<br>1.1191              | 500–1000                                    | 42CrMo4-NT<br>Ck45                 |  | 210–230                                                           |  |
|                                                                             |                               |                                             |                                    |                                                                                     | 270–310                                                           |  |
|                                                                             |                               |                                             |                                    |                                                                                     | 420–470                                                           |  |
| <b>P3</b> Stahl<br>Steel                                                    | 1.2343                        | > 1000                                      | X38CrMoV5 1<br>Toolox33            |                                                                                     | 180–210                                                           |  |
|                                                                             |                               |                                             |                                    |                                                                                     | 240–270                                                           |  |
|                                                                             |                               |                                             |                                    |                                                                                     | 370–420                                                           |  |
| <b>H1</b> Hartguss und gehärteter Stahl<br>Chilled steel and Hardened steel |                               | 45–55 HRC                                   | Ni-hard, Ampco                     |  | 120–200                                                           |  |
|                                                                             |                               |                                             |                                    |                                                                                     | 160–280                                                           |  |
|                                                                             |                               |                                             |                                    |                                                                                     | 200–350                                                           |  |
| <b>H2</b> Gehärtete Stähle<br>Hardened steel                                |                               | 56–60 HRC                                   |                                    |                                                                                     | 140–210                                                           |  |
|                                                                             |                               |                                             |                                    |                                                                                     | 180–260                                                           |  |
|                                                                             |                               |                                             |                                    |                                                                                     | 220–320                                                           |  |
| <b>H3</b> Gehärtete Stähle<br>Hardened steel                                |                               | > 60 HRC                                    |                                    |                                                                                     | 120–160                                                           |  |
|                                                                             |                               |                                             |                                    |                                                                                     | 150–200                                                           |  |
|                                                                             |                               |                                             |                                    |                                                                                     | 180–250                                                           |  |

Die angegebenen Schnittwerte sind Startwerte und müssen auf die vorhandenen Bedingungen abgestimmt werden.  
The specified cutting data are start values and must be adjusted to the existing conditions.



Trockenbearbeitung, Pressluftkühlung ist vorteilhaft  
Dry machining, Compressed air cooling is advantageous

|  | Fräserdurchmesser Cutting diameter (mm)                                   |       |      |      |      |      |      |      | Schruppen<br>Roughing |                | Vorschlichten<br>Semi finishing |                | Schlichten<br>Finishing |                |
|--|---------------------------------------------------------------------------|-------|------|------|------|------|------|------|-----------------------|----------------|---------------------------------|----------------|-------------------------|----------------|
|  | Vorschub pro Zahn f <sub>z</sub> Feed per tooth f <sub>z</sub><br>(mm/z.) |       |      |      |      |      |      |      |                       |                |                                 |                |                         |                |
|  | Ø 2                                                                       | Ø 3   | Ø 4  | Ø 5  | Ø 6  | Ø 8  | Ø 10 | Ø 12 | a <sub>p</sub>        | a <sub>e</sub> | a <sub>p</sub>                  | a <sub>e</sub> | a <sub>p</sub>          | a <sub>e</sub> |
|  | 0,015                                                                     | 0,023 | 0,03 | 0,04 | 0,05 | 0,07 | 0,08 | 0,09 | 0,2 x D               | 0,1 x D        |                                 |                |                         |                |
|  | 0,034                                                                     | 0,052 | 0,07 | 0,09 | 0,11 | 0,15 | 0,18 | 0,21 |                       |                | 0,1 x D                         | 0,05 x D       |                         |                |
|  | 0,052                                                                     | 0,080 | 0,11 | 0,14 | 0,17 | 0,23 | 0,28 | 0,32 |                       |                |                                 |                | 0,04 x D                | 0,04 x D       |
|  | 0,014                                                                     | 0,021 | 0,03 | 0,04 | 0,04 | 0,06 | 0,07 | 0,08 | 0,2 x D               | 0,1 x D        |                                 |                |                         |                |
|  | 0,031                                                                     | 0,048 | 0,06 | 0,08 | 0,10 | 0,13 | 0,16 | 0,19 |                       |                | 0,1 x D                         | 0,05 x D       |                         |                |
|  | 0,048                                                                     | 0,073 | 0,10 | 0,13 | 0,15 | 0,21 | 0,25 | 0,29 |                       |                |                                 |                | 0,04 x D                | 0,04 x D       |
|  | 0,024                                                                     | 0,036 | 0,05 | 0,06 | 0,07 | 0,10 | 0,12 | 0,14 | 0,1 x D               | 0,075 x D      |                                 |                |                         |                |
|  | 0,034                                                                     | 0,052 | 0,07 | 0,88 | 0,11 | 0,15 | 0,17 | 0,20 |                       |                | 0,05 x D                        | 0,04 x D       |                         |                |
|  | 0,039                                                                     | 0,059 | 0,08 | 0,10 | 0,12 | 0,17 | 0,20 | 0,23 |                       |                |                                 |                | 0,03 x D                | 0,03 x D       |
|  | 0,027                                                                     | 0,041 | 0,06 | 0,07 | 0,08 | 0,11 | 0,14 | 0,16 | 0,05 x D              | 0,05 x D       |                                 |                |                         |                |
|  | 0,031                                                                     | 0,047 | 0,06 | 0,08 | 0,10 | 0,13 | 0,16 | 0,18 |                       |                | 0,03 x D                        | 0,03 x D       |                         |                |
|  | 0,033                                                                     | 0,050 | 0,07 | 0,08 | 0,10 | 0,14 | 0,17 | 0,20 |                       |                |                                 |                | 0,02 x D                | 0,02 x D       |
|  | 0,018                                                                     | 0,027 | 0,04 | 0,05 | 0,06 | 0,08 | 0,09 | 0,11 | 0,05 x D              | 0,05 x D       |                                 |                |                         |                |
|  | 0,021                                                                     | 0,031 | 0,04 | 0,05 | 0,06 | 0,09 | 0,11 | 0,12 |                       |                | 0,03 x D                        | 0,03 x D       |                         |                |
|  | 0,022                                                                     | 0,033 | 0,05 | 0,06 | 0,07 | 0,09 | 0,11 | 0,13 |                       |                |                                 |                | 0,02 x D                | 0,02 x D       |

## Qualität, Produktivität, Zuverlässigkeit

### Herkömmliches Kopierfräsen

Kugel-Kopierfräser, die im allgemeinen zum Kopierfräsen eingesetzt werden, benutzen ungefähr die Hälfte der Werkzeugschneide während der Bearbeitung. Um eine glatte Oberfläche mit entsprechender Qualität zu erzeugen, sind daher mehrere Werkzeugbahnen mit kleinen Sprüngen erforderlich, was zu einer längeren Bearbeitungszeit führt.

Kugel-Kopierfräser sind während der Bearbeitung in ständigem Kontakt mit dem Werkstück und dem Material, was zu erhöhten Axialkräften und potentiell zu erhöhter Vibration führt. Stärkere Vibrationen verringern die Werkzeugstandzeit und gleichzeitig die Oberflächenqualität.

Aufgrund dieser Aspekte hat LMT Onsrud die Kreissegment- oder Radialfräser entwickelt.

### Kreissegment- oder Radialfräsen

Radialfräser wurden für den Einsatz in einer 5-Achsen-Bearbeitungsumgebung entwickelt und ermöglichen einen optimierten Werkzeugeingriff bei dem zu bearbeitenden Werkstück. Diese Optimierung ermöglicht eine höhere Produktivität durch höhere Materialabtragsraten pro Durchlauf bei gleichzeitiger Reduzierung der Bearbeitungszeit.

Zusätzlich zu der geringeren Zahl an Werkzeugbahnen werden Materialschwingungen oder „Rattern“ verringert, wodurch eine sehr gute Werkstückoberfläche erzeugt wird. Außerdem werden weniger Kräfte auf das Werkzeug selbst ausgeübt, was zu einer höheren Werkzeugstandzeit führt.

## Quality, Productivity, Reliability

### Conventional Ball nose Milling

Generally utilized for contour milling, ball nose tools use approximately half of the tool's cutting edge during machining. This, therefore, requires multiple machining passes to create a smooth sidewall or surface finish leading to longer production timeframes.

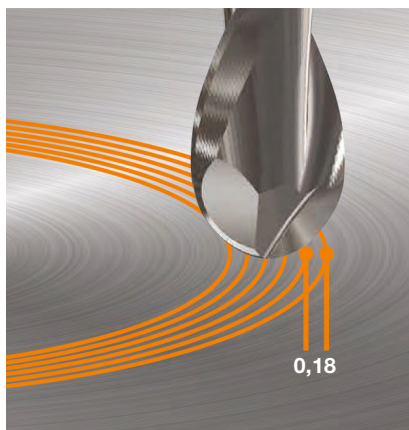
During machining, ball nose end mills remain in constant contact with the material being cut leading to increased axial forces on the tool and, potentially, increased vibration within the machined part itself. Higher vibration tends to reduce tool life, while diminishing the part finish within a 3-axis work pattern.

It is because of these aspects of machining that LMT Onsrud has developed a line of Radial Milling Cutters.

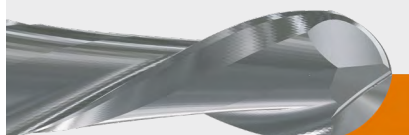
### Radial Milling

Created to be used within a 5-axis machining environment, Radial Milling Cutters have been designed to allow for increased tool engagement with the material being cut. This increase allows for greater productivity through higher material removal rates per pass, while reducing machining time.

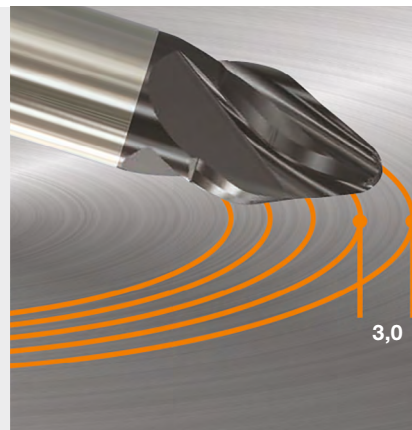
In addition to fewer machining passes required, material vibration or "chatter" is also lessened creating a superior work piece finish. Less stress is also being placed onto the tool itself resulting in greater tool life.



Kugel-Kopierfräser haben einen kleineren Eingriffsbereich und dadurch einen geringeren Zeilensprung  
Ball nose tools have a narrow engagement area resulting in a smaller step over length



Anteil der Werkzeugschneide im Eingriff zum Material  
Portion of tool engaged with material

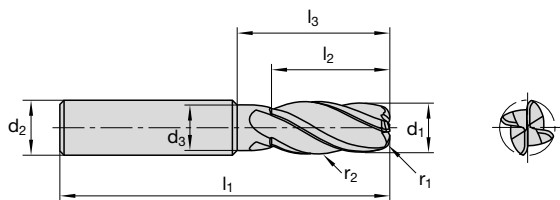


Kreissegmentfräser erlauben einen höheren Werkzeugeingriff und somit größere Zeilensprünge  
Radial milling cutter allow for greater tool engagement an increased step over lengths



Anteil der Werkzeugschneide im Eingriff zum Material  
Portion of tool engaged with material

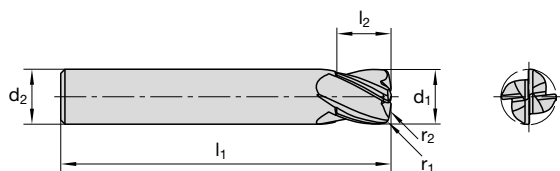
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BEIJN  
FETTE  
KIENINGER  
ONSRUD



Schnittwertempfehlungen ab Seite 118  
Cutting data recommendations starting page 118

■ = Hauptanwendung First choice  
□ = Nebenanwendung Second choice

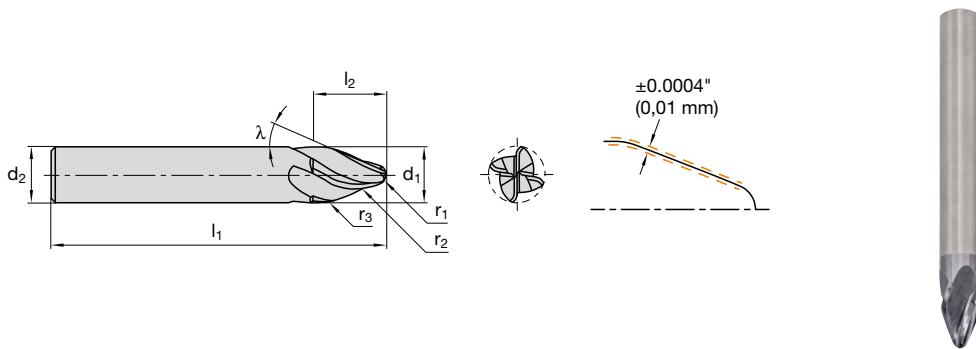




Schnittwertempfehlungen ab Seite 118  
Cutting data recommendations starting page 118

■ = Hauptanwendung First choice  
□ = Nebenanwendung Second choice

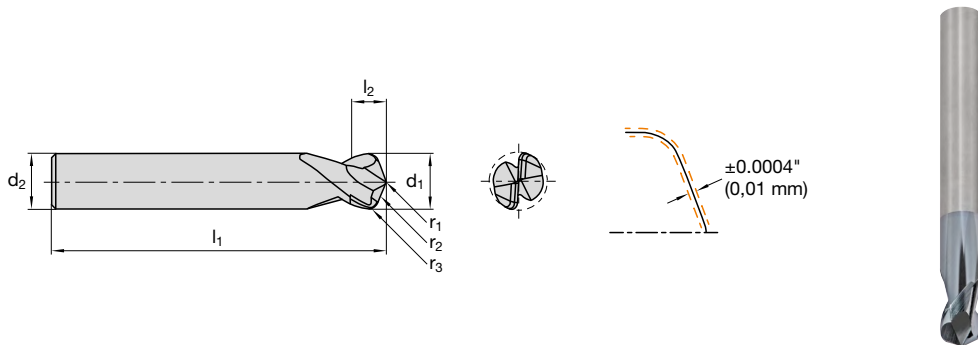
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Schnittwertempfehlungen ab Seite 118  
Cutting data recommendations starting page 118

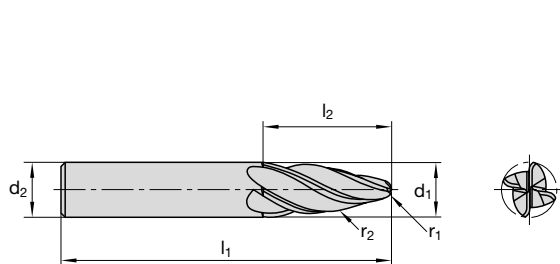
■ = Hauptanwendung First choice  
□ = Nebenanwendung Second choice

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Schnittwertempfehlungen ab Seite 118  
Cutting data recommendations starting page 118

■ = Hauptanwendung First choice  
□ = Nebenanwendung Second choice

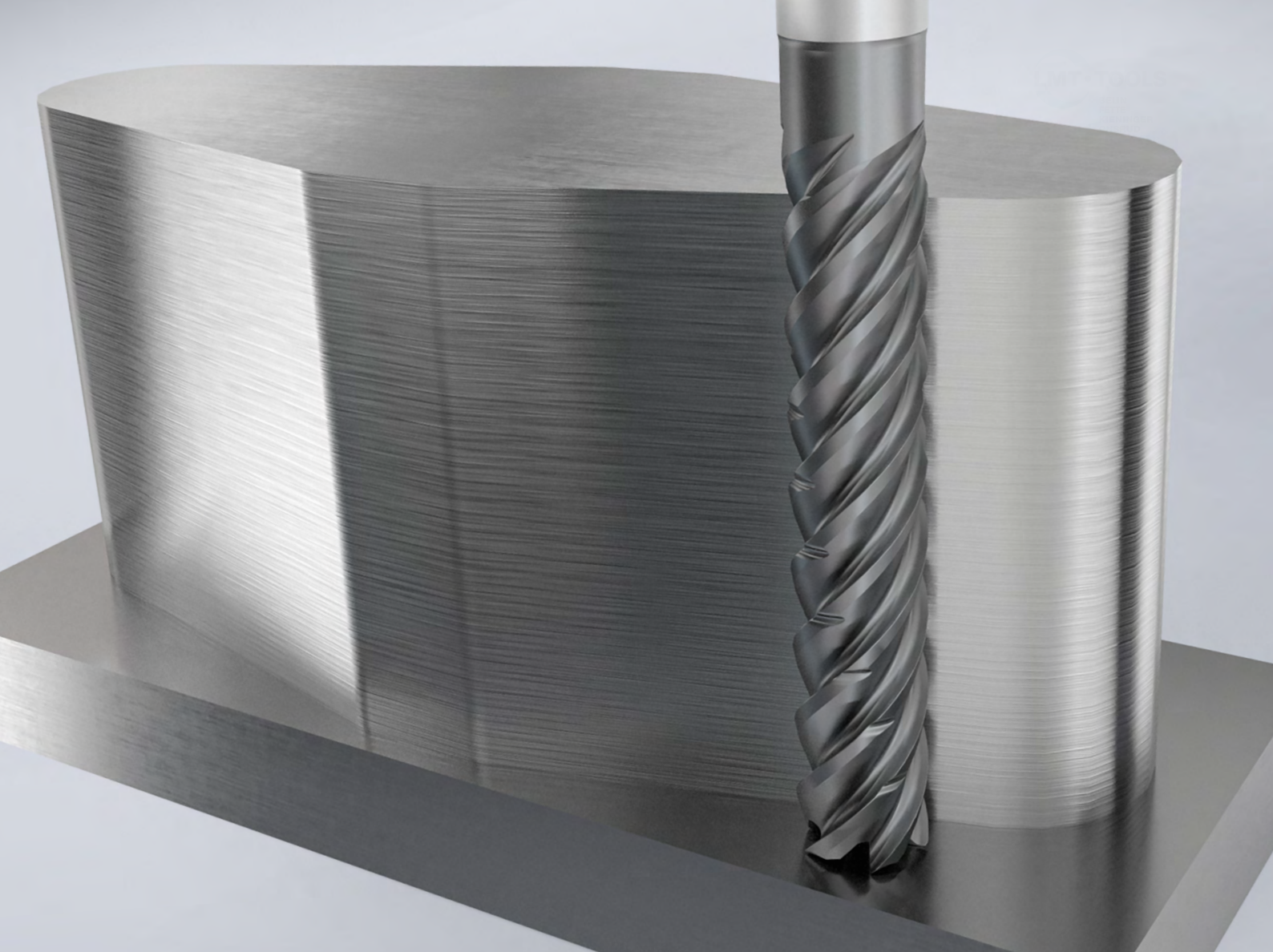


Schnittwertempfehlungen ab Seite 118  
Cutting data recommendations starting page 118

■ = Hauptanwendung First choice  
□ = Nebenanwendung Second choice

| Werkstoff |                                                                     | Material                                             | Werkstoff-Nr.<br>Material No. | DIN<br>Bezeichnung Alt<br>DIN<br>Description Old | R <sub>m</sub> /UTS<br>(N/mm <sup>2</sup> ) | DIN<br>Bezeichnung Neu<br>DIN<br>Description New |
|-----------|---------------------------------------------------------------------|------------------------------------------------------|-------------------------------|--------------------------------------------------|---------------------------------------------|--------------------------------------------------|
| P         | Unlegierter Baustahl<br>+ Automatenstahl                            | Plain carbon steel<br>+ free cutting steel           | 1.0570                        | St52-3                                           | -700                                        | S355J2G3                                         |
|           |                                                                     |                                                      | 1.1730                        | C45                                              | -800                                        | C45U                                             |
|           |                                                                     |                                                      | 1.0715                        | 9SMn28                                           | -700                                        | 11SMn30                                          |
|           |                                                                     |                                                      | 1.1191                        | Ck45                                             | 500-950                                     | C45E                                             |
|           |                                                                     |                                                      | 1.7219                        | 26CrMo4                                          |                                             | 26CrMo4-2                                        |
|           | Vergütungsstahl,<br>mittelfest                                      | Heat-treatment steel,<br>medium strength             | 1.7225                        | 42CrMo4                                          | 500-950                                     | 42CrMo4                                          |
|           |                                                                     |                                                      | 1.8159                        | 51CrV4                                           |                                             | 51CrV4                                           |
|           | Stahlguss                                                           | Cast steel                                           | 1.0416                        | GS40                                             | -950                                        | GS40                                             |
|           | Einsatzstahl                                                        | Case hardening steel                                 | 1.7131                        | 16MnCr5                                          | -950                                        | 16MnCr5                                          |
|           | Rost- und säure-<br>beständiger Stahl,<br>ferritisch, martensitisch | Stainless steel,<br>ferritic, martensitic            | 1.4006                        | X10Cr13                                          | 500-950                                     | X12Cr13                                          |
|           |                                                                     |                                                      | 1.4104                        | X12CrMoS17                                       |                                             | X14CrMoS17                                       |
|           |                                                                     |                                                      | 1.4122                        | X35CrMo17                                        |                                             | X39CrMo17-1                                      |
|           | Vergütungsstahl,<br>hochfest                                        | Heat-treatment steel,<br>high strength               | 1.7225                        | 42CrMo4                                          | 950-1400                                    | 42CrMo4                                          |
|           |                                                                     |                                                      | 1.6580                        | 30CrNiMo8                                        |                                             | 30CrNiMo8                                        |
|           | Nitrierstahl,<br>vergütet                                           | Nitriding steel,<br>heat treated                     | 1.8504                        | 34CrAl6                                          | 950-1400<br>-900                            | 34CrAl6                                          |
|           |                                                                     |                                                      | 1.2344                        | X40CrMoV5.1                                      |                                             | X40CrMoV5-1                                      |
|           | Werkzeugstahl                                                       | Tool steel                                           | 1.2343                        | X38CrMoV5 1                                      | 950-1400<br>-1100                           | X37CrMoV5-1                                      |
|           |                                                                     |                                                      | 1.2316                        | X38CrMo16                                        |                                             | X38CrMo16                                        |
|           |                                                                     |                                                      | 1.2379                        | X155CrVMo12 1                                    | -950                                        | X153CrMoV12-1                                    |
|           |                                                                     |                                                      | 1.2080                        | X210Cr12                                         | 950-1400                                    | X210Cr12                                         |
|           |                                                                     |                                                      | 1.2358                        | 60CrMoV18-5                                      |                                             | 60CrMoV18-5                                      |
|           |                                                                     |                                                      | 1.2714                        | 55NiCrMoV7                                       | 1100-1350<br>-1100                          | 55NiCrMoV7                                       |
|           |                                                                     |                                                      | 1.2311                        | 40CrMnMo7                                        |                                             | 40CrMnMo7                                        |
|           |                                                                     |                                                      | 1.2312                        | 40CrMnNiMoS8.6                                   | -1150                                       | 40CrMnNiMoS8-6                                   |
|           |                                                                     |                                                      | 1.2738                        | 45CrMnNiMo8.6.4                                  | 950-1150                                    | 45CrMnNiMo8-6-4                                  |
| M         | Rost- und säurebe-<br>ständiger Stahl,<br>austenitisch              | Stainless steel,<br>austenitic                       | 1.4301                        | X2CrNiMo17-12-2                                  | 500-950                                     | X5CrNiMo18-10                                    |
|           |                                                                     |                                                      | 1.4404                        | X6CrNiMoTi17-12-2                                |                                             | X2CrNiMo17-12-2                                  |
|           |                                                                     |                                                      | 1.4571                        | X10CrNiMoTi18                                    | 500-950                                     | X10CrNiMoTi18                                    |
|           | Rost- und säure-<br>beständiger Stahl,<br>martensitisch aushärtbar  | Stainless steel,<br>martensitic steel                | 1.2709                        | X3NiCoMoTi18-9-5                                 | 800-1000                                    | X3NiCoMoTi18-9-5                                 |
|           |                                                                     |                                                      | 1.4542                        | X5CrNiCuNb16-4                                   |                                             | X5CrNiCuNb16-4                                   |
| K         | Grauguss                                                            | Grey cast iron                                       | 0.6025                        | GG25                                             | 100-400<br>(120-260 HB)                     | EN-GJL-250                                       |
|           | Legierter Grauguss                                                  | Alloyed grey cast iron                               | 0.6678                        | GGL-NiCr35 2                                     | 150-250<br>(160-230 HB)                     | EN-GJLA-XNiCr35-2                                |
|           | Sphäroguss                                                          | Nodular cast iron                                    | 0.7070                        | GGG70L                                           | 400-800<br>(120-310 HB)                     | EN-GJS-700-2U                                    |
|           |                                                                     |                                                      | 0.7060                        | GGG60                                            |                                             | EN-GJS-600-3                                     |
|           | Temperguss                                                          | Malleable cast iron                                  | 0.8155                        | GTS55                                            | 350-700<br>(150-280 HB)                     | EN-GJMB-550-4                                    |
| N         | Aluminium-Legierungen,<br>kurzspanend                               | Aluminium alloys,<br>short chipping                  | 3.2581                        | G-AlSi12                                         | -400                                        | G-IGK-AlSi12                                     |
|           | Aluminium-Legierungen,<br>langspanend                               | Aluminium alloys,<br>long chipping                   | 3.3535                        | AlMg3                                            | -550                                        | AlMg3                                            |
|           |                                                                     |                                                      | 3.4365                        | AlZnMgCu1,5                                      |                                             | AlZnMgCu1,5                                      |
|           | Kupfer-Legierungen,<br>kurzspanend                                  | Copper alloys,<br>short chipping                     | 2.0402                        | MS58                                             | -500                                        | CuZn40Pb2                                        |
|           | Kupfer-Legierungen,<br>langspanend                                  | Copper alloys,<br>long chipping                      | 2.0320                        | MS63                                             | 300-500                                     | CuZn37                                           |
| S         |                                                                     |                                                      | 2.0975                        | CuAl10Ni                                         |                                             | CuAl10Fe5Ni5-C                                   |
|           | Titan-Legierungen,<br>mittelfest                                    | Titanium alloys,<br>medium strength                  | 3.7115                        | TiAl5Sn2,5                                       | -950                                        | TiAl5Sn2-5                                       |
|           |                                                                     |                                                      | 3.7164                        | TiAl6V4                                          |                                             | Ti6AlV4                                          |
|           | Titan-Legierungen,<br>hochfest                                      | Titanium alloys,<br>high strength                    | 3.7174                        | TiAl6Sn2                                         | 900-1400                                    | TiAl6V6Sn2                                       |
|           | Nickelbasis-Legierungen,<br>mittelfest                              | Nickel based alloys,<br>medium strength              | 2.4670                        | NiCr12Al6MoNb                                    | -950                                        | NiCr12Al6MoNb                                    |
| H         | Nickelbasis-Legierungen,<br>hochwarmfest                            | Heat resistant nickel based<br>alloys, high strength | 2.4668                        | NiCr19Fe19NbMo                                   | 900-1400                                    | Inconel 718<br>NiCr19Fe19Nb5Mo3                  |
|           | Hartguss                                                            | Chilled cast iron                                    |                               | Ni-hard, Ampco                                   | 300-600 HB                                  | Ni-hard, Ampco                                   |
|           | Gehärteter Stahl                                                    | Hardened steel                                       |                               |                                                  | 45-52 HRC<br>53-59 HRC                      |                                                  |

|  | Linsenprofil<br>Lens shape                         |                                                      |      |      |      | Tonnenprofil<br>Barrel shape                       |                                                      |      |      |      | Konisches Profil Form A und B<br>Conical taper shape A and B |                                                      |      |      |      | Ovales Profil<br>Oval shape                        |                                                      |      |      |      |
|--|----------------------------------------------------|------------------------------------------------------|------|------|------|----------------------------------------------------|------------------------------------------------------|------|------|------|--------------------------------------------------------------|------------------------------------------------------|------|------|------|----------------------------------------------------|------------------------------------------------------|------|------|------|
|  | Schnitt-<br>geschw.<br>Cut. speed<br>$v_c$ (m/min) | Vorschub pro Zahn<br>Feed per tooth<br>$f_z$ (mm/z.) |      |      |      | Schnitt-<br>geschw.<br>Cut. speed<br>$v_c$ (m/min) | Vorschub pro Zahn<br>Feed per tooth<br>$f_z$ (mm/z.) |      |      |      | Schnitt-<br>geschw.<br>Cut. speed<br>$v_c$ (m/min)           | Vorschub pro Zahn<br>Feed per tooth<br>$f_z$ (mm/z.) |      |      |      | Schnitt-<br>geschw.<br>Cut. speed<br>$v_c$ (m/min) | Vorschub pro Zahn<br>Feed per tooth<br>$f_z$ (mm/z.) |      |      |      |
|  |                                                    | 6                                                    | 10   | 12   | 16   |                                                    | 6                                                    | 10   | 12   | 16   |                                                              | 6                                                    | 10   | 12   | 16   |                                                    | 6                                                    | 10   | 12   | 16   |
|  | 275                                                | 0,03                                                 | 0,04 | 0,05 | 0,06 | 275                                                | 0,03                                                 | 0,05 | 0,06 | 0,08 | 275                                                          | 0,02                                                 | 0,03 | 0,04 | 0,05 | 275                                                | 0,03                                                 | 0,05 | 0,06 | 0,08 |
|  | 245                                                | 0,03                                                 | 0,04 | 0,05 | 0,06 | 250                                                | 0,03                                                 | 0,04 | 0,05 | 0,06 | 250                                                          | 0,02                                                 | 0,03 | 0,04 | 0,05 | 250                                                | 0,03                                                 | 0,04 | 0,05 | 0,06 |
|  | 150                                                | 0,01                                                 | 0,02 | 0,03 | 0,03 | 100                                                | 0,01                                                 | 0,02 | 0,03 | 0,03 | 100                                                          | 0,01                                                 | 0,02 | 0,03 | 0,03 | 100                                                | 0,01                                                 | 0,02 | 0,03 | 0,03 |
|  | 220                                                | 0,03                                                 | 0,04 | 0,05 | 0,06 | 220                                                | 0,03                                                 | 0,04 | 0,05 | 0,06 | 220                                                          | 0,02                                                 | 0,03 | 0,04 | 0,05 | 220                                                | 0,03                                                 | 0,04 | 0,05 | 0,06 |
|  | 200                                                | 0,03                                                 | 0,04 | 0,05 | 0,06 | 250                                                | 0,03                                                 | 0,04 | 0,05 | 0,06 | 250                                                          | 0,02                                                 | 0,03 | 0,04 | 0,05 | 250                                                | 0,03                                                 | 0,04 | 0,05 | 0,06 |
|  | 150                                                | 0,01                                                 | 0,02 | 0,03 | 0,03 | 160                                                | 0,01                                                 | 0,02 | 0,03 | 0,03 | 160                                                          | 0,01                                                 | 0,02 | 0,03 | 0,03 | 160                                                | 0,01                                                 | 0,02 | 0,03 | 0,03 |
|  | 180                                                | 0,01                                                 | 0,02 | 0,03 | 0,03 | 200                                                | 0,01                                                 | 0,02 | 0,03 | 0,03 | 200                                                          | 0,01                                                 | 0,02 | 0,03 | 0,03 | 200                                                | 0,01                                                 | 0,02 | 0,03 | 0,03 |
|  | 120                                                | 0,01                                                 | 0,02 | 0,03 | 0,03 | 80                                                 | 0,01                                                 | 0,02 | 0,03 | 0,03 | 80                                                           | 0,01                                                 | 0,02 | 0,03 | 0,03 | 80                                                 | 0,01                                                 | 0,02 | 0,03 | 0,03 |
|  | 90                                                 | 0,01                                                 | 0,01 | 0,01 | 0,02 | 60                                                 | 0,01                                                 | 0,01 | 0,01 | 0,02 | 60                                                           | 0,01                                                 | 0,01 | 0,01 | 0,02 | 60                                                 | 0,01                                                 | 0,01 | 0,01 | 0,02 |
|  | 300                                                | 0,03                                                 | 0,05 | 0,06 | 0,08 | 280                                                | 0,03                                                 | 0,05 | 0,06 | 0,08 | 280                                                          | 0,03                                                 | 0,04 | 0,05 | 0,06 | 280                                                | 0,03                                                 | 0,05 | 0,06 | 0,08 |
|  | 275                                                | 0,03                                                 | 0,04 | 0,05 | 0,06 | 250                                                | 0,03                                                 | 0,04 | 0,05 | 0,06 | 250                                                          | 0,03                                                 | 0,04 | 0,05 | 0,06 | 250                                                | 0,03                                                 | 0,04 | 0,05 | 0,06 |
|  | 250                                                | 0,03                                                 | 0,04 | 0,05 | 0,06 | 230                                                | 0,03                                                 | 0,04 | 0,05 | 0,06 | 230                                                          | 0,03                                                 | 0,04 | 0,05 | 0,06 | 230                                                | 0,03                                                 | 0,04 | 0,05 | 0,06 |
|  | 230                                                | 0,03                                                 | 0,04 | 0,05 | 0,06 | 220                                                | 0,03                                                 | 0,04 | 0,05 | 0,06 | 220                                                          | 0,03                                                 | 0,04 | 0,05 | 0,06 | 220                                                | 0,03                                                 | 0,04 | 0,05 | 0,06 |
|  | 700                                                | 0,03                                                 | 0,05 | 0,06 | 0,08 | 600                                                | 0,03                                                 | 0,05 | 0,06 | 0,08 | 600                                                          | 0,03                                                 | 0,04 | 0,05 | 0,06 | 600                                                | 0,03                                                 | 0,05 | 0,06 | 0,08 |
|  | 275                                                | 0,03                                                 | 0,04 | 0,05 | 0,06 | 180                                                | 0,03                                                 | 0,04 | 0,05 | 0,06 | 180                                                          | 0,03                                                 | 0,04 | 0,05 | 0,06 | 180                                                | 0,03                                                 | 0,04 | 0,05 | 0,06 |
|  | 150                                                | 0,02                                                 | 0,03 | 0,04 | 0,05 | 100                                                | 0,01                                                 | 0,01 | 0,01 | 0,02 | 100                                                          | 0,02                                                 | 0,03 | 0,04 | 0,05 | 100                                                | 0,02                                                 | 0,03 | 0,04 | 0,05 |
|  | 120                                                | 0,01                                                 | 0,02 | 0,03 | 0,03 | 75                                                 | 0,01                                                 | 0,02 | 0,03 | 0,03 | 75                                                           | 0,01                                                 | 0,02 | 0,03 | 0,03 | 75                                                 | 0,01                                                 | 0,02 | 0,03 | 0,03 |
|  | 75                                                 | 0,01                                                 | 0,01 | 0,01 | 0,02 | 100                                                | 0,01                                                 | 0,01 | 0,01 | 0,02 | 100                                                          | 0,01                                                 | 0,01 | 0,01 | 0,02 | 100                                                | 0,01                                                 | 0,01 | 0,01 | 0,02 |
|  | 200                                                | 0,02                                                 | 0,03 | 0,04 | 0,05 | 200                                                | 0,02                                                 | 0,03 | 0,04 | 0,05 | 200                                                          | 0,01                                                 | 0,02 | 0,03 | 0,03 | 200                                                | 0,02                                                 | 0,03 | 0,04 | 0,05 |



# TPC – Trochoidal Performance Cutter

Die perfekte Lösung  
für trochoidales Fräsen  
The Perfect Solution  
for Trochoidal Milling



Mit unserem TPC-Programm (Trochoidal Performance Cutter) bieten wir Ihnen eine bahnbrechende Lösung, die für exzellentes Trochoidalfräsen in einer Vielzahl von Materialien entwickelt wurde. Egal, ob Sie mit Stahl (ISO-P), rostfreiem Stahl (ISO-M), Guss (ISO-K), oder hochwarmfesten Stählen/Superlegierungen (ISO-S) arbeiten. Mit ihrem maximalen axialen Eingriff ( $3 \times \varnothing$  und  $5 \times \varnothing$ ) und sorgfältig abgestimmten Geometrien liefern alle Fräser der TPC-Familie makellose Leistungen in verschiedenen Bearbeitungsanwendungen.

Kontaktieren Sie uns jetzt und profitieren Sie von den Vorteilen der TPC-Werkzeuge. Wir unterstützen Sie gerne auf dem Weg, Ihre Produktivität mit herausragender Frästechnik zu revolutionieren!

With our TPC (Trochoidal Performance Cutter) program, we offer you a cutting-edge solution designed for excellent trochoidal milling in a wide range of materials. Whether you are working with steel (ISO-P), stainless steel (ISO-M), cast iron (ISO-K) or high temperature steel or superalloys (ISO-S) – With their maximum axial depth of engagement ( $3 \times \varnothing$  and  $5 \times \varnothing$ ) and carefully matched geometries, all cutters in the TPC family deliver impeccable performance in various machining applications.

Contact us now and benefit from the advantages of TPC tools. We will be happy to support you on your way to revolutionize your productivity with outstanding milling technology!

## **Präzision, Effizienz und Zuverlässigkeit – Neu definiert** **Precision, Efficiency and Reliability – Redefined**

Das Trochoidalfräsen hält besonders einzigartige Herausforderungen im Rahmen des Bearbeitungsprozesses bereit. Insbesondere das enorme Spanvolumen gilt als Hürde in Bezug auf den Späneabtransport.

Mit unserem TPC können Sie sich von spanbedingten Störungen verabschieden. Die Werkzeug-Anwendung kommt mit deutlich weniger Spanvolumen aus, ohne Abstriche bei der Produktivität zu machen. Zudem wird der Verschleiß auf ein Minimum reduziert, was die Lebensdauer des Werkzeugs erhöht und den Bedarf an häufigen Austauschen verringert.

Die hohe Anzahl der Spanbrecher vermindert Vibrationen erheblich und verbessert die Stabilität und Präzision während des Bearbeitungsprozesses. Nicht zuletzt garantiert die versetzte Anordnung der Spanbrecher saubere und glatte Oberflächen, wodurch die Werkzeuge ideal für nachfolgende Finish-Bearbeitungen sind.

### **Ihre Vorteile:**

- Minimierter Verschleißentwicklung
- Dämpfung von Vibrationen
- Saubere und glatte Oberflächen

Trochoidal milling faces particularly unique challenges in the machining process. Especially the enormous chip volume is considered a hurdle in terms of chip removal.

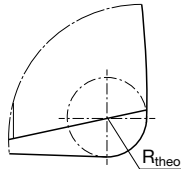
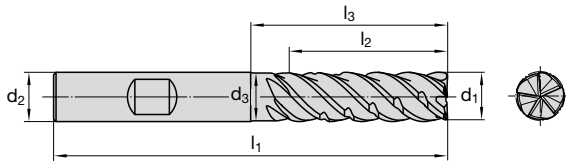
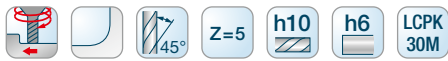
With our TPC, you can say goodbye to chip-related disturbances. The tool application gets by with significantly less chip volume without sacrificing productivity. In addition, wear is reduced to a minimum, which increases tool life and reduces the need for frequent replacements.

The high number of chipbreakers significantly reduces vibrations and improves stability and precision during the machining process. Last but not least, the staggered arrangement of chipbreakers guarantees clean and smooth surfaces, making the tools ideal for subsequent finishing operations.

### **Your benefits:**

- Minimized abrasion
- Damping of vibrations
- Clean and smooth surfaces

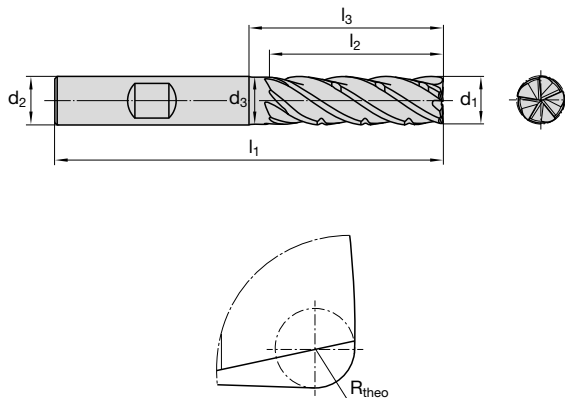
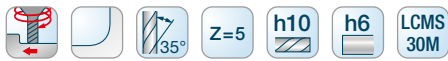




| Katalog-Nr. Cat.-No. |                |                |                |                |                |   |                              | TPC01-P-B               |                                |
|----------------------|----------------|----------------|----------------|----------------|----------------|---|------------------------------|-------------------------|--------------------------------|
| P                    |                |                |                |                |                |   |                              | ■                       |                                |
| M                    |                |                |                |                |                |   |                              |                         |                                |
| K                    |                |                |                |                |                |   |                              | ■                       |                                |
| N                    |                |                |                |                |                |   |                              |                         |                                |
| S                    |                |                |                |                |                |   |                              |                         |                                |
| H                    |                |                |                |                |                |   |                              |                         |                                |
| d <sub>1</sub>       | d <sub>3</sub> | l <sub>2</sub> | l <sub>1</sub> | l <sub>3</sub> | d <sub>2</sub> | z | R <sub>theo</sub><br>(+0,05) | Ident No.               | LMT-Code                       |
| <b>3 x Ø</b>         |                |                |                |                |                |   |                              |                         |                                |
| 6                    | 5,8            | 20             | 65             | 27             | 6              | 5 | 0,5                          | <a href="#">7437616</a> | EM-TPC01 P6.0x20/27 5R0.5HB    |
| 8                    | 7,8            | 26             | 70             | 33             | 8              | 5 | 0,5                          | <a href="#">7437617</a> | EM-TPC01 P8.0x26/33 5R0.5HB    |
| 10                   | 9,7            | 32             | 80             | 39             | 10             | 5 | 0,5                          | <a href="#">7437618</a> | EM-TPC01 P10.0x32/39 5R0.5HB   |
| 12                   | 11,7           | 38             | 93             | 47             | 12             | 5 | 0,5                          | <a href="#">7437619</a> | EM-TPC01 P12.0x38/47 5R0.5HB   |
| 16                   | 15,7           | 50             | 108            | 59             | 16             | 5 | 0,5                          | <a href="#">7437620</a> | EM-TPC01 P16.0x50/59 5R0.5HB   |
| 20                   | 19,7           | 62             | 126            | 75             | 20             | 5 | 0,5                          | <a href="#">7437621</a> | EM-TPC01 P20.0x62/75 5R0.5HB   |
| <b>5 x Ø</b>         |                |                |                |                |                |   |                              |                         |                                |
| 6                    | 5,8            | 32             | 80             | 43             | 6              | 5 | 0,5                          | <a href="#">7437622</a> | EM-TPC01 P6.0x32/43 5R0.5HB    |
| 8                    | 7,8            | 42             | 90             | 53             | 8              | 5 | 0,5                          | <a href="#">7437623</a> | EM-TPC01 P8.0x42/53 5R0.5HB    |
| 10                   | 9,7            | 52             | 100            | 59             | 10             | 5 | 0,5                          | <a href="#">7437624</a> | EM-TPC01 P10.0x52/59 5R0.5HB   |
| 12                   | 11,7           | 62             | 120            | 74             | 12             | 5 | 0,5                          | <a href="#">7437625</a> | EM-TPC01 P12.0x62/74 5R0.5HB   |
| 16                   | 15,7           | 82             | 140            | 91             | 16             | 5 | 0,5                          | <a href="#">7437626</a> | EM-TPC01 P16.0x82/91 5R0.5HB   |
| 20                   | 19,7           | 102            | 165            | 114            | 20             | 5 | 0,5                          | <a href="#">7437627</a> | EM-TPC01 P20.0x102/114 5R0.5HB |

Schnittwertempfehlungen ab Seite 124  
Cutting data recommendations starting page 124

■ = Hauptanwendung First choice  
□ = Nebenanwendung Second choice



| Katalog-Nr. Cat.-No. |                |                |                |                |                |   |                              | TPC01-M-B               |                                |
|----------------------|----------------|----------------|----------------|----------------|----------------|---|------------------------------|-------------------------|--------------------------------|
| P                    |                |                |                |                |                |   |                              |                         |                                |
| M                    |                |                |                |                |                |   |                              | ■                       |                                |
| K                    |                |                |                |                |                |   |                              |                         |                                |
| N                    |                |                |                |                |                |   |                              |                         |                                |
| S                    |                |                |                |                |                |   |                              | ■                       |                                |
| H                    |                |                |                |                |                |   |                              |                         |                                |
| d <sub>1</sub>       | d <sub>3</sub> | l <sub>2</sub> | l <sub>1</sub> | l <sub>3</sub> | d <sub>2</sub> | z | R <sub>theo</sub><br>(+0,05) | Ident No.               | LMT-Code                       |
| <b>3 x Ø</b>         |                |                |                |                |                |   |                              |                         |                                |
| 6                    | 5,8            | 20             | 65             | 27             | 6              | 5 | 0,5                          | <a href="#">7437628</a> | EM-TPC01 M6.0x20/27 5R0.5HB    |
| 8                    | 7,8            | 26             | 70             | 33             | 8              | 5 | 0,5                          | <a href="#">7437629</a> | EM-TPC01 M8.0x26/33 5R0.5HB    |
| 10                   | 9,7            | 32             | 80             | 39             | 10             | 5 | 0,5                          | <a href="#">7437630</a> | EM-TPC01 M10.0x32/39 5R0.5HB   |
| 12                   | 11,7           | 38             | 93             | 47             | 12             | 5 | 0,5                          | <a href="#">7437631</a> | EM-TPC01 M12.0x38/47 5R0.5HB   |
| 16                   | 15,7           | 50             | 108            | 59             | 16             | 5 | 0,5                          | <a href="#">7437632</a> | EM-TPC01 M16.0x50/59 5R0.5HB   |
| 20                   | 19,7           | 62             | 126            | 75             | 20             | 5 | 0,5                          | <a href="#">7437633</a> | EM-TPC01 M20.0x62/75 5R0.5HB   |
| <b>5 x Ø</b>         |                |                |                |                |                |   |                              |                         |                                |
| 6                    | 5,8            | 32             | 80             | 43             | 6              | 5 | 0,5                          | <a href="#">7437634</a> | EM-TPC01 M6.0x32/43 5R0.5HB    |
| 8                    | 7,8            | 42             | 90             | 53             | 8              | 5 | 0,5                          | <a href="#">7437635</a> | EM-TPC01 M8.0x42/53 5R0.5HB    |
| 10                   | 9,7            | 52             | 100            | 59             | 10             | 5 | 0,5                          | <a href="#">7437636</a> | EM-TPC01 M10.0x52/59 5R0.5HB   |
| 12                   | 11,7           | 62             | 120            | 74             | 12             | 5 | 0,5                          | <a href="#">7437637</a> | EM-TPC01 M12.0x62/74 5R0.5HB   |
| 16                   | 15,7           | 82             | 140            | 91             | 16             | 5 | 0,5                          | <a href="#">7437638</a> | EM-TPC01 M16.0x82/91 5R0.5HB   |
| 20                   | 19,7           | 102            | 165            | 114            | 20             | 5 | 0,5                          | <a href="#">7437639</a> | EM-TPC01 M20.0x102/114 5R0.5HB |

Schnittwertempfehlungen ab Seite 124  
 Cutting data recommendations starting page 124

■ = Hauptanwendung First choice  
 □ = Nebenanwendung Second choice

**TPC 01 Rougher**  
**Schnittwertempfehlungen**  
**Cutting data recommendations**

| Werkstoff<br>Material                                                                                        | Werkstoff-Nr.<br>Material No. | DIN<br>Bezeichnung Alt<br>DIN<br>Description Old | R <sub>m</sub> /UTS<br>(N/mm <sup>2</sup> ) | DIN<br>Bezeichnung Neu<br>DIN<br>Description New |
|--------------------------------------------------------------------------------------------------------------|-------------------------------|--------------------------------------------------|---------------------------------------------|--------------------------------------------------|
| <b>P</b><br>Nitrier- und Vergütungsstahl<br>Nitriding steel and heat-treatment steel                         | 1.7225                        | 42CrMo4                                          | 950–1400                                    | 42CrMo4                                          |
|                                                                                                              | 1.2344                        | X40CrMoV5.1                                      | –900                                        | X40CrMoV5-1                                      |
|                                                                                                              | 1.4104                        | X12CrMoS17                                       | 500–950                                     | X14CrMoS17                                       |
|                                                                                                              | 1.8504                        | 34CrAl6                                          | 950–1400                                    | 34CrAl6                                          |
|                                                                                                              | 1.2343                        | X38CrMoV5 1                                      | 950–1400                                    | X37CrMoV5-1                                      |
|                                                                                                              | 1.6580                        | 30CrNiMo8                                        | 950–1400                                    | 30CrNiMo8                                        |
|                                                                                                              | 1.2379                        | X155CrVMo12 1                                    | –950                                        | X153CrMoV12-1                                    |
|                                                                                                              | 1.2080                        | X210Cr12                                         | 950–1400                                    | X210Cr12                                         |
|                                                                                                              | 1.2311                        | 40CrMnMo7                                        | –1100                                       | 40CrMnMo7                                        |
|                                                                                                              | 1.2312                        | 40CrMnNiMoS8.6                                   | –1150                                       | 40CrMnNiMoS8-6                                   |
|                                                                                                              | 1.2738                        | 45CrMnNiMo8.6.4                                  | 950–1150                                    | 45CrMnNiMo8-6-4                                  |
|                                                                                                              | 1.2358                        | 60CrMoV18-5                                      | 850–1000                                    | 60CrMoV18-5                                      |
|                                                                                                              | 1.2714                        | 55NiCrMoV7                                       | 1100–1350                                   | 55NiCrMoV7                                       |
| <b>K</b><br>Grauguss<br>Grey cast iron                                                                       | 0.6025                        | GG25                                             | 100–400<br>(120–260 HB)                     | EN-GJL-250                                       |
|                                                                                                              | 0.6678                        | GGL-NiCr35 2                                     | 150–250<br>(160–230 HB)                     | EN-GJLA-XNiCr35-2                                |
|                                                                                                              | 0.7060                        | GGG60                                            | 400–800                                     | EN-GJS-600-3                                     |
|                                                                                                              | 0.7070                        | GGG70L                                           | (120–310 HB)                                | EN-GJS-700-2U                                    |
| <b>M</b><br>Sphäroguss<br>Nodular cast iron                                                                  | 0.8155                        | GTS55                                            | 350–700<br>(150–280 HB)                     | EN-GJMB-550-4                                    |
|                                                                                                              |                               |                                                  |                                             |                                                  |
|                                                                                                              |                               |                                                  |                                             |                                                  |
|                                                                                                              |                               |                                                  |                                             |                                                  |
| <b>M</b><br>Rost- und säurebeständiger Stahl,<br>austenitisch<br>Stainless steel, austenitic                 | 1.4301                        | X2CrNiMo17-12-2                                  | 500–950                                     | X5CrNiMo18-10                                    |
|                                                                                                              | 1.4404                        | X6CrNiMoTi17-12-2                                |                                             | X2CrNiMo17-12-2                                  |
|                                                                                                              | 1.4571                        | X10CrNiMoTi18                                    |                                             | X10CrNiMoTi18                                    |
|                                                                                                              | 1.4024                        | X15Cr13                                          | 500–950                                     | X15Cr13                                          |
|                                                                                                              | 1.4057                        | X17CrNi16-2                                      |                                             | X17CrNi16-2                                      |
|                                                                                                              | 1.4122                        | X35CrMo17                                        |                                             | X35CrMo17                                        |
|                                                                                                              | 1.2709                        | X3NiCoMoTi18-9-5                                 | 800–1000                                    | X3NiCoMoTi18-9-5                                 |
|                                                                                                              | 1.4542                        | X5CrNiCuNb16-4                                   |                                             | X5CrNiCuNb16-4                                   |
|                                                                                                              | 1.4568                        | X7CrNiAl17-7                                     |                                             | X7CrNiAl17-7                                     |
|                                                                                                              |                               |                                                  |                                             |                                                  |
| <b>S</b><br>Titan-Legierungen, mittelfest<br>Titanium alloys, medium strength                                | 3.7164                        | TiAl6V4                                          | –950                                        | Ti6AlV4                                          |
|                                                                                                              | 3.7115                        | TiAl5Sn2,5                                       |                                             | TiAl5Sn2-5                                       |
|                                                                                                              | 3.7174                        | TiAl6Sn2                                         | 900–1400                                    | TiAl6V6Sn2                                       |
|                                                                                                              |                               |                                                  |                                             |                                                  |
|                                                                                                              |                               |                                                  |                                             |                                                  |
|                                                                                                              |                               |                                                  |                                             |                                                  |
| <b>S</b><br>Titan-Legierungen, hochfest<br>Titanium alloys, high strength                                    | 2.4670                        | NiCr12Al6MoNb                                    | –950                                        | NiCr12Al6MoNb                                    |
|                                                                                                              |                               |                                                  |                                             |                                                  |
| <b>S</b><br>Nickelbasis-Legierungen, mittelfest<br>Nickel based alloys, medium strength                      | 2.4668                        | NiCr19Fe19NbMo                                   | 900–1400                                    | Inconel 718<br>NiCr19Fe19Nb5Mo3                  |
|                                                                                                              |                               |                                                  |                                             |                                                  |
| <b>S</b><br>Nickelbasis-Legierungen,<br>hochwarmfest<br>Heat resistant nickel based alloys,<br>high strength |                               |                                                  |                                             |                                                  |
|                                                                                                              |                               |                                                  |                                             |                                                  |

Die angegebenen Schnittwerte sind Startwerte und müssen auf die vorhandenen Bedingungen abgestimmt werden.  
The specified cutting data are start values and must be adjusted to the existing conditions.

- <sup>1)</sup> Bei Ausführung 5 x Ø sind die kleinsten f<sub>z</sub>-Werte als Startwert zu verwenden.  
<sup>1)</sup> For the 5 x Ø version, the smallest f<sub>z</sub> values are to be used as starting values.

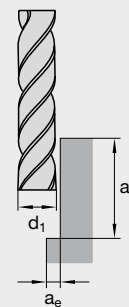


**3 x Ø**

a<sub>e</sub> Stahl Steel = 0,1 x d<sub>1</sub>  
a<sub>e</sub> Rostfreier Stahl Stainless Steel = 0,05 x d<sub>1</sub>  
a<sub>p max</sub> = 3 x d<sub>1</sub>

**5 x Ø**

a<sub>e</sub> Stahl Steel = 0,05 x d<sub>1</sub>  
a<sub>e</sub> Rostfreier Stahl Stainless Steel = 0,03 x d<sub>1</sub>  
a<sub>p max</sub> = 5 x d<sub>1</sub>



a<sub>e</sub> = Schnittbreite in mm  
a<sub>p</sub> = Schnitttiefe in mm  
d<sub>1</sub> = Durchmesser in mm  
a<sub>e</sub> = Width of cut in mm  
a<sub>p</sub> = Depth of cut in mm  
d<sub>1</sub> = Cutter diameter in mm

|        | Eingriffswinkel<br>Pressure angle<br>$\beta$ |                       | Radiale Zustellung<br>Radial depth of cut<br>$a_e$ |                                                                                     | Schnittgeschwindigkeit<br>Cutting speed<br>$v_c$ (m/min) |         | Fräserdurchmesser Cutting diameter (mm)<br>Vorschub pro Zahn Feed per tooth<br>$f_z$ (mm/z.) <sup>1)</sup> |           |           |
|--------|----------------------------------------------|-----------------------|----------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------|---------|------------------------------------------------------------------------------------------------------------|-----------|-----------|
|        | 3 x Ø                                        | 5 x Ø                 | 3 x Ø                                              | 5 x Ø                                                                               | 3 x Ø                                                    | 5 x Ø   | Ø 6–8                                                                                                      | Ø 10–12   | Ø 16–20   |
| 35–45° | 25°                                          | 0,1 x d <sub>1</sub>  | 0,05 x d <sub>1</sub>                              |    | 280–320                                                  | 200–250 | 0,06–0,1                                                                                                   | 0,1–0,15  | 0,15–0,25 |
|        |                                              |                       |                                                    |                                                                                     | 280–320                                                  | 200–250 | 0,06–0,1                                                                                                   | 0,1–0,15  | 0,15–0,25 |
|        |                                              |                       |                                                    |                                                                                     | 280–320                                                  | 200–250 | 0,06–0,1                                                                                                   | 0,1–0,15  | 0,15–0,25 |
|        |                                              |                       |                                                    |                                                                                     | 280–320                                                  | 200–250 | 0,06–0,1                                                                                                   | 0,1–0,15  | 0,15–0,25 |
|        |                                              |                       |                                                    |                                                                                     | 250–300                                                  | 180–230 | 0,05–0,1                                                                                                   | 0,1–0,15  | 0,15–0,25 |
|        |                                              |                       |                                                    |                                                                                     | 250–300                                                  | 180–230 | 0,05–0,1                                                                                                   | 0,1–0,15  | 0,15–0,25 |
|        |                                              |                       |                                                    |                                                                                     | 250–300                                                  | 180–230 | 0,05–0,1                                                                                                   | 0,1–0,15  | 0,15–0,25 |
|        |                                              |                       |                                                    |                                                                                     | 250–300                                                  | 180–230 | 0,05–0,1                                                                                                   | 0,1–0,15  | 0,15–0,25 |
|        |                                              |                       |                                                    |                                                                                     | 250–300                                                  | 180–230 | 0,05–0,1                                                                                                   | 0,1–0,15  | 0,15–0,25 |
|        |                                              |                       |                                                    |                                                                                     | 250–300                                                  | 180–230 | 0,05–0,1                                                                                                   | 0,1–0,15  | 0,15–0,25 |
|        |                                              |                       |                                                    |                                                                                     | 230–280                                                  | 160–200 | 0,05–0,1                                                                                                   | 0,08–0,15 | 0,12–0,2  |
|        |                                              |                       |                                                    |                                                                                     | 230–280                                                  | 160–200 | 0,05–0,1                                                                                                   | 0,08–0,15 | 0,12–0,2  |
| 35–45° | 25°                                          | 0,1 x d <sub>1</sub>  | 0,05 x d <sub>1</sub>                              |    | 400–450                                                  | 320–370 | 0,2–0,25                                                                                                   | 0,25–0,3  | 0,3–0,4   |
|        |                                              |                       |                                                    |                                                                                     | 350–400                                                  | 280–230 | 0,15–0,2                                                                                                   | 0,2–0,25  | 0,25–0,35 |
|        |                                              |                       |                                                    |                                                                                     | 300–350                                                  | 240–290 | 0,15–0,2                                                                                                   | 0,2–0,25  | 0,25–0,35 |
|        |                                              |                       |                                                    |                                                                                     | 280–320                                                  | 220–260 | 0,10–0,15                                                                                                  | 0,15–0,2  | 0,2–0,3   |
| 25°    | 20°                                          | 0,05 x d <sub>1</sub> | 0,03 x d <sub>1</sub>                              |   | 120–140                                                  | 100–120 | 0,05–0,12                                                                                                  | 0,08–0,15 | 0,12–0,2  |
|        |                                              |                       |                                                    |                                                                                     | 100–140                                                  | 80–120  | 0,05–0,1                                                                                                   | 0,08–0,12 | 0,1–0,2   |
|        |                                              |                       |                                                    |                                                                                     | 80–120                                                   | 70–100  | 0,05–0,1                                                                                                   | 0,08–0,12 | 0,1–0,2   |
| 25°    | 20°                                          | 0,05 x d <sub>1</sub> | 0,03 x d <sub>1</sub>                              |  | 100–120                                                  | 90–110  | 0,03–0,07                                                                                                  | 0,06–0,1  | 0,12–0,16 |
|        |                                              |                       |                                                    |                                                                                     | 80–100                                                   | 70–90   | 0,03–0,07                                                                                                  | 0,06–0,1  | 0,12–0,16 |
|        |                                              |                       |                                                    |                                                                                     | 35–55                                                    | 25–35   | 0,03–0,07                                                                                                  | 0,06–0,1  | 0,12–0,16 |
|        |                                              |                       |                                                    |                                                                                     | 25–35                                                    | 20–30   | 0,03–0,07                                                                                                  | 0,06–0,1  | 0,12–0,16 |

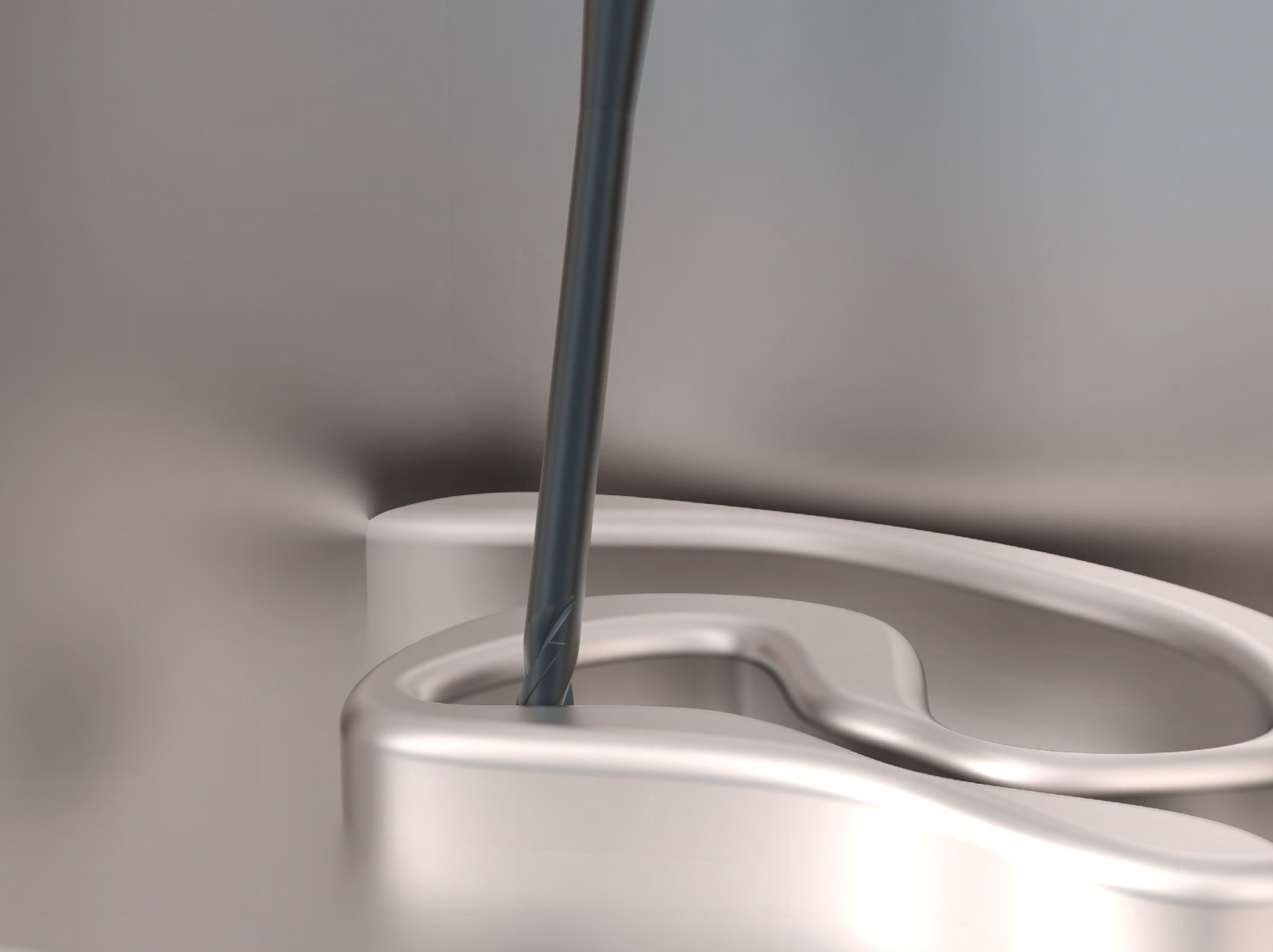
 Trockenbearbeitung, Pressluftkühlung ist vorteilhaft  
Dry machining, Compressed air cooling is advantageous

 Nassbearbeitung, auf ausreichende Emulsionszuführung achten  
Wet machining, Ensure sufficient emulsion supply

**CAM-Systeme rechnen mit einer konstanten mittleren Spandicke, um den Prozess stabil und vibrationsarm zu halten.**  
CAM systems calculate with a constant average chip thickness to keep the process stable and low-vibration.

| CAM                                                                      |                                        |
|--------------------------------------------------------------------------|----------------------------------------|
| Konstante $h_m$<br>variabler Vorschub<br>Constant $h_m$<br>variable feed | $h_m = f_z \cdot \sqrt{\frac{a_e}{D}}$ |

| CNC                                                                                                 |                               |
|-----------------------------------------------------------------------------------------------------|-------------------------------|
| Konstante $f_z$<br>variable mittlere Spandicke<br>Constant $f_z$<br>variable average chip thickness | $f_z = \frac{v_f}{z \cdot n}$ |



# MIC – Micro Cutter

Erleben Sie Präzision  
in Perfektion  
Experience Precision  
in Perfection



Unser revolutionäres Mikrofräser-Programm eröffnet Ihnen eine völlig neue Dimension in der Welt der Bearbeitung mit Präzisionswerkzeugen. Die MIC-Produkte gelten als Inbegriff von Vielseitigkeit und Zuverlässigkeit. Ganz gleich, ob Sie mit hochzähem oder gehärtetem Stahl arbeiten möchten, sogar schwer zu bearbeitende Materialien sind für unsere MIC-Werkzeuge eine Leichtigkeit. Dabei wurden sie speziell für herausragende Leistungen in Form- und Matrizenanwendungen entwickelt. So setzen scharfe und widerstandsfähige Zähne neue Maßstäbe in der Präzisionsbearbeitung. Keine Herausforderung ist zu groß, wenn es darum geht, Ihren Ansprüchen gerecht zu werden.

Erleben Sie faszinierende Ergebnisse was Ihre Oberflächen betrifft und erzielen Sie stets eine Veredelung, die Ihre Werkstücke zum Strahlen bringt

Our revolutionary micro milling cutter program opens up a whole new dimension in the world of machining with precision tools. MIC products are considered the epitome of versatility and reliability. Whether you want to work with high toughness or hardened steel, even difficult-to-machine materials are a simple matter for our MIC tools. At the same time, they are specifically designed for outstanding performance in mold and die applications. As a result, sharp and durable teeth set new standards in precision machining. No challenge is too great when it comes to meeting your needs.

Experience fascinating results regarding your surfaces and always achieve a finish that makes your workpieces shine.

### **Exzellente Leistung: Langlebig und vielseitig mit engsten Toleranzen** **Excellent Performance: Durable and Versatile with Tight Tolerances**

Die MIC-Werkzeuge bestechen durch eine beeindruckende Standzeit und eignen sich für die Bearbeitung von hochzähem Stahllegierungen bis hin zu hartem Stahl > 55 HRC. Dank des extra langen Halses haben Sie die Freiheit, in verschiedenen Tiefen zu arbeiten. Von Formen bis hin zu Matrizen – mit unserem MIC-Programm erreichen Sie mühelos beispiellose Ergebnisse.

Präzision ist unsere Leidenschaft – und das zeigt sich in den engen Toleranzen unserer MIC-Werkzeuge ( $\pm 0,007$  mm). Verlassen Sie sich darauf, dass Ihre Bearbeitungsergebnisse die höchsten Qualitätsstandards erfüllen und Ihre Erwartungen übertreffen.

Sind Sie bereit, die Grenzen zu sprengen? Tauchen Sie in die MIC-Welt ein und erleben Sie die Faszination der Präzision und Vielseitigkeit. Gemeinsam haben wir Ihre Bearbeitungsergebnisse auf ein völlig neues Niveau!

#### **Ihre Vorteile:**

- Hohe Standzeiten
- Begeisternde Oberflächengüte
- Scharfe und widerstandsfähige Zähne für präziseste Ergebnisse in jeder Tiefe
- Engste Toleranzen zur Erfüllung höchster Qualitätsstandards

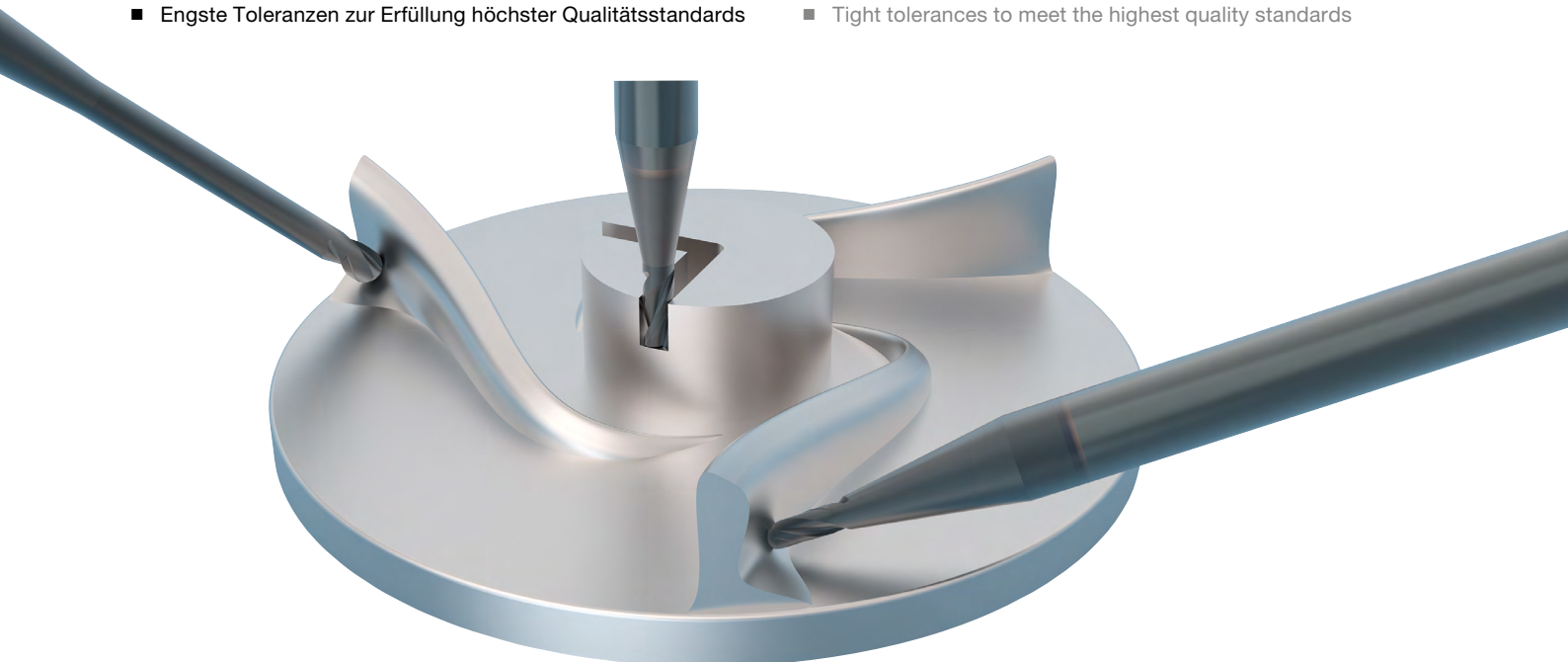
The MIC tools excel with an impressive tool life and are suitable for machining high-toughness steel alloys up to hard steel > 55 HRC. Thanks to the extra-long neck, you have the freedom to work at different depths. From molds to dies – with our MIC range you can effortlessly achieve unprecedented results.

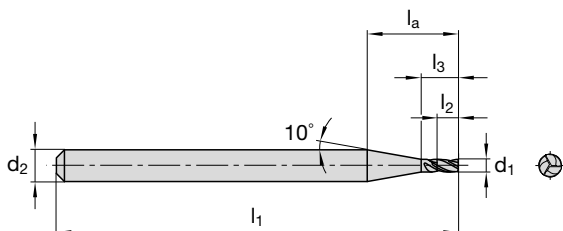
Precision is our passion – and it shows in the tight tolerances of our MIC tools ( $\pm 0.007$  mm). Count on your machining results to meet the highest quality standards and exceed your expectations.

Are you ready to push the boundaries? Immerse yourself in the MIC world and experience the fascination of precision and versatility. Together, we'll take your machining results to a whole new level!

#### **Your benefits:**

- Long tool life
- Inspiring surface quality
- Sharp and resistant flute for the most precise results at any depth
- Tight tolerances to meet the highest quality standards





Schnittwertempfehlungen ab Seite 130  
Cutting data recommendations starting page 130

■ = Hauptanwendung First choice  
□ = Nebenanwendung Second choice





Bildquelle Sources: Firma Work NC-Dental®

**MIC 01 Finisher 30 U**  
**Schnittwertempfehlungen**  
**Cutting data recommendations**

| Werkstoff<br>Material                                                                                                                                                          | Werkstoff-Nr.<br>Material No. | R <sub>m</sub> /UTS<br>(N/mm <sup>2</sup> ) | DIN Bezeichnung<br>DIN Description                  | Kühlung<br>Coolant                                                                  | Schnittge-<br>schwindigkeit<br>Cutting speed<br>v <sub>c</sub> (m/min) |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------|-----------------------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------|--|
| <b>P1</b> Unlegierter Baustahl + Automatenstahl<br>Plain carbon steel + free cutting steel                                                                                     | 1.0037<br>1.1121              | < 500                                       | St37-2<br>Ck10                                      |  | 150–200                                                                |  |
| <b>P2</b> Vergütungsstahl, mittelfest<br>Heat-treatment steel, medium strength                                                                                                 | 1.7225<br>1.1191              | 500–1000                                    | 42CrMo4-NT<br>Ck45                                  |                                                                                     | 120–160                                                                |  |
| <b>P3</b> Werkzeugstahl<br>Tool steel                                                                                                                                          | 1.2343                        | > 1000                                      | X38CrMoV5 1<br>Toolox33                             |                                                                                     | 90–150                                                                 |  |
| <b>M1</b> Rost- und säurebeständiger Stahl,<br>austenitisch<br>Stainless steel, austenitic                                                                                     | 1.4301<br>1.4404<br>1.4571    | 500–950                                     | X5CrNi18-10<br>X2CrNiMo17-12-2<br>X6CrNiMoTi17-12-2 |  | 60–80                                                                  |  |
| <b>K1</b> Grauguss<br>Grey cast iron                                                                                                                                           | 0.6025                        | 100–400<br>(120–260 HB)                     | GG25                                                |  | 120–150                                                                |  |
| <b>K2</b> Sphäroguss<br>Nodular cast iron                                                                                                                                      | 0.7060<br>0.7070              | 400–800<br>(120–310 HB)                     | GGG60<br>GGG70L                                     |                                                                                     | 110–140                                                                |  |
| <b>N1</b> Aluminiumlegierungen, langspanend<br>< 5 % Si<br>Aluminium alloys, long shipping<br>< 5 % Si<br>Kupferlegierungen<br>Copper alloys<br>Thermoplaste<br>Thermoplastics | 3.3535<br>3.4365              | < 500                                       | AlMg3 AlZnMgCu1,5                                   |  | 500–2000                                                               |  |
| <b>N2</b> Aluminiumlegierungen, langspanend<br>< 5–10% Si<br>Aluminium alloys, long shipping<br>< 5–10 % Si<br>Kupferlegierungen<br>Copper alloys                              | 3.2134                        | 500–1000                                    | G-AlSi5Cu1Mg                                        |                                                                                     | 500–1500                                                               |  |

Die f<sub>z</sub>-Angaben gelten für das seitliche Fräsen. Beim Nutenfräsen ist f<sub>z</sub> um 20 % zu reduzieren.

Ein niedrigerer Wert der Schnittgeschwindigkeit ermöglicht die Anwendung mit hohem Zerspanungsvolumen oder den Einsatz in Materialien mit höherer Festigkeit.

Ein höherer Wert der Schnittgeschwindigkeit ermöglicht den Einsatz bei der Schlichtbearbeitung, oder den Einsatz in Materialien mit geringerer Festigkeit.

Für Werkzeuge mit einer max. Nutzlänge > 3 x D, f<sub>z</sub> um 20 % reduzieren

Für Werkzeuge mit einer max. Nutzlänge > 5 x D, f<sub>z</sub> um 30 % reduzieren

Für Werkzeuge mit einer max. Nutzlänge > 10 x D, v<sub>c</sub> und f<sub>z</sub> um 20–30 % reduzieren

Die f<sub>z</sub>-Angaben gelten für das seitliche Fräsen. Beim Nutenfräsen ist f<sub>z</sub> um 20 % zu reduzieren.

f<sub>z</sub> information is for side milling. For slot milling reduce f<sub>z</sub> by 20 %.

Lower value of cutting speed is used for high stock removal applications or for higher hardness (machinability) within group.

Higher value of cutting speed is used for finishing applications or for lower hardness (machinability) within group.

For tools with reach > 3 x D, reduce f<sub>z</sub> by 20 %

For tools with reach > 5 x D, reduce f<sub>z</sub> by 30 %

For tools with reach > 10 x D, reduce v<sub>c</sub> and f<sub>z</sub> by 20–30 %



Trockenbearbeitung, Pressluftkühlung ist vorteilhaft  
 Dry machining, Compressed air cooling is advantageous



Nassbearbeitung, auf ausreichende Emulsionszuführung achten  
 Wet machining, Ensure sufficient emulsion supply



|  | Fräserdurchmesser Cutting diameter (mm)                               |       |       |       |       |       |       |       |       | Kantenfräsen<br>Side milling |         | Nuten-<br>fräsen<br>Slot milling |
|--|-----------------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|------------------------------|---------|----------------------------------|
|  | Vorschub pro Zahn $f_z$ Feed per tooth $f_z$<br>(mm/z.) <sup>1)</sup> |       |       |       |       |       |       |       |       |                              |         |                                  |
|  | Ø 0,5                                                                 | Ø 0,6 | Ø 0,8 | Ø 1,0 | Ø 1,2 | Ø 1,5 | Ø 2,0 | Ø 2,5 | Ø 3,0 | $a_p$                        | $a_e$   | $a_p$                            |
|  | 0,004                                                                 | 0,004 | 0,006 | 0,007 | 0,009 | 0,011 | 0,015 | 0,019 | 0,023 | 1 x D                        | 0,1 x D | 0,25 x D                         |
|  | 0,003                                                                 | 0,004 | 0,005 | 0,006 | 0,007 | 0,009 | 0,012 | 0,016 | 0,019 | 1 x D                        | 0,1 x D | 0,25 x D                         |
|  | 0,003                                                                 | 0,003 | 0,005 | 0,006 | 0,007 | 0,009 | 0,012 | 0,014 | 0,017 | 1 x D                        | 0,1 x D | 0,25 x D                         |
|  | 0,003                                                                 | 0,003 | 0,004 | 0,005 | 0,006 | 0,008 | 0,010 | 0,013 | 0,016 | 1 x D                        | 0,1 x D | 0,25 x D                         |
|  | 0,004                                                                 | 0,004 | 0,006 | 0,007 | 0,009 | 0,011 | 0,015 | 0,019 | 0,023 | 1 x D                        | 0,1 x D | 0,25 x D                         |
|  | 0,003                                                                 | 0,004 | 0,005 | 0,006 | 0,007 | 0,009 | 0,012 | 0,016 | 0,019 | 1 x D                        | 0,1 x D | 0,25 x D                         |
|  | 0,006                                                                 | 0,007 | 0,009 | 0,011 | 0,013 | 0,017 | 0,022 | 0,028 | 0,033 | 1 x D                        | 0,1 x D | 0,25 x D                         |
|  | 0,005                                                                 | 0,006 | 0,008 | 0,010 | 0,012 | 0,015 | 0,020 | 0,025 | 0,030 | 1 x D                        | 0,1 x D | 0,25 x D                         |

## Berechnungsformeln und Vorschubkorrekturfaktoren Calculation formula and feed correction factors

### Drehzahl

Speed  $n$  (min<sup>-1</sup>):

$$n = \frac{v_c \cdot 1000}{\pi \cdot d_1}$$

### Vorschubgeschwindigkeit

Feed rate  $v_f$  (mm/min):

$$v_f = f_z \cdot Z \cdot n \cdot f_1$$

$a_e$  = Schnittbreite Width of cut in mm  
 $a_p$  = Schnitttiefe Depth of cut in mm  
 $d_1$  = Durchmesser Cutter diameter in mm  
 $f_1$  = Korrekturfaktor für Correction factor  $v_f$   
 $f_z$  = Vorschub pro Zahn Feed per tooth in mm  
 $n$  = Drehzahl Speed in min<sup>-1</sup>  
 $v_f$  = Vorschubgeschwindigkeit Feed rate in mm/min  
 $Z$  = Anzahl der Schneiden No. of teeth

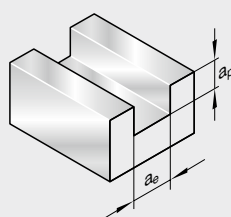
### Vorschubkorrektur Feed correction $f_1$

|                           | $f_1$ |
|---------------------------|-------|
| XS extra kurz extra short | 1,35  |
| S kurz short              | 1     |
| L lang long               | 0,8   |
| XL extra lang extra long  | 0,6   |

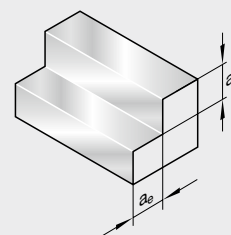
### Einteilung Ausführungslängen Classification design length

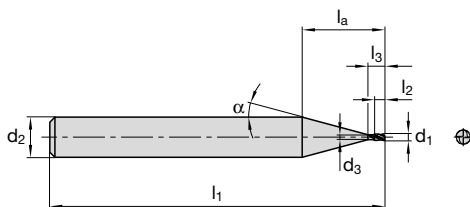
|                           | Verhältnis Relation<br>$l_3/d_1$ |
|---------------------------|----------------------------------|
| XS extra kurz extra short | < 3,0                            |
| S kurz short              | 3,1–5,0                          |
| L lang long               | 5,1–8,0                          |
| XL extra lang extra long  | 8,1–20,0                         |

### Nutenfräsen Slot milling



### Kantenfräsen Side milling





| Katalog-Nr. Cat.-No. |                |                |                |                |                |                |   |    | MIC01-H-A               |                           |
|----------------------|----------------|----------------|----------------|----------------|----------------|----------------|---|----|-------------------------|---------------------------|
| P                    |                |                |                |                |                |                |   |    | ■                       |                           |
| M                    |                |                |                |                |                |                |   |    |                         |                           |
| K                    |                |                |                |                |                |                |   |    |                         |                           |
| N                    |                |                |                |                |                |                |   |    |                         |                           |
| S                    |                |                |                |                |                |                |   |    |                         |                           |
| H                    |                |                |                |                |                |                |   |    | ■                       |                           |
| d <sub>1</sub>       | l <sub>2</sub> | l <sub>1</sub> | l <sub>3</sub> | l <sub>a</sub> | d <sub>2</sub> | d <sub>3</sub> | z |    | Ident No.               | LMT-Code                  |
| <b>kurz short</b>    |                |                |                |                |                |                |   |    |                         |                           |
| 0,3                  | 0,4            | 50             | 0,4            | 16,6           | 6              | –              | 2 | XS | <a href="#">7434427</a> | EM-MIC01 H003x004/0004 2S |
| 0,4                  | 0,6            | 50             | 0,6            | 16,5           | 6              | –              | 2 | XS | <a href="#">7434428</a> | EM-MIC01 H004x006/0006 2S |
| 0,5                  | 0,7            | 50             | 1,5            | 11,9           | 6              | 0,44           | 2 | XS | <a href="#">7434430</a> | EM-MIC01 H005x007/0015 2S |
| 0,6                  | 0,9            | 50             | 1,8            | 12             | 6              | 0,54           | 2 | XS | <a href="#">7434431</a> | EM-MIC01 H006x009/0018 2S |
| 0,8                  | 1,2            | 50             | 2,4            | 12,2           | 6              | 0,74           | 2 | XS | <a href="#">7434433</a> | EM-MIC01 H008x012/0024 2S |
| 1                    | 1,5            | 50             | 2,5            | 12,3           | 6              | 0,74           | 2 | XS | <a href="#">7434435</a> | EM-MIC01 H010x015/0025 2S |
| 1,2                  | 1,8            | 50             | 3              | 12             | 6              | 1,14           | 2 | XS | <a href="#">7434437</a> | EM-MIC01 H012x018/0030 2S |
| 1,4                  | 2,1            | 50             | 3,5            | 12,2           | 6              | 1,34           | 2 | XS | <a href="#">7434439</a> | EM-MIC01 H014x021/0035 2S |
| 1,5                  | 2,3            | 50             | 3,5            | 12,2           | 6              | 1,34           | 2 | XS | <a href="#">7434441</a> | EM-MIC01 H015x023/0035 2S |
| 1,6                  | 2,4            | 50             | 4              | 12,3           | 6              | 1,55           | 2 | XS | <a href="#">7434443</a> | EM-MIC01 H016x024/0040 2S |
| 1,8                  | 2,7            | 50             | 4,5            | 12,4           | 6              | 1,75           | 2 | XS | <a href="#">7434445</a> | EM-MIC01 H018x027/0045 2S |
| 2                    | 3              | 50             | 5              | 12,6           | 6              | 1,94           | 2 | XS | <a href="#">7434447</a> | EM-MIC01 H020x030/0050 2S |
| 2,5                  | 3,7            | 50             | 5              | 11,7           | 6              | 2,4            | 2 | XS | <a href="#">7434449</a> | EM-MIC01 H025x037/0050 2S |
| <b>lang long</b>     |                |                |                |                |                |                |   |    |                         |                           |
| 0,5                  | 0,7            | 60             | 2,5            | 12,9           | 6              | 0,44           | 2 | S  | <a href="#">7434429</a> | EM-MIC01 H005x007/0025 2S |
| 0,8                  | 1,2            | 60             | 4              | 13,8           | 6              | 0,74           | 2 | S  | <a href="#">7434432</a> | EM-MIC01 H008x012/0040 2S |
| 1                    | 1,5            | 60             | 5              | 14,4           | 6              | 0,94           | 2 | S  | <a href="#">7434434</a> | EM-MIC01 H010x015/0050 2S |
| 1,2                  | 1,8            | 60             | 6              | 15,1           | 6              | 1,14           | 2 | S  | <a href="#">7434436</a> | EM-MIC01 H012x018/0060 2S |
| 1,4                  | 2,1            | 60             | 7              | 15,7           | 6              | 1,34           | 2 | S  | <a href="#">7434438</a> | EM-MIC01 H014x021/0070 2S |
| 1,5                  | 2,3            | 60             | 7,5            | 16             | 6              | 1,44           | 2 | S  | <a href="#">7434440</a> | EM-MIC01 H015x023/0075 2S |
| 1,6                  | 2,4            | 60             | 8              | 16,3           | 6              | 1,54           | 2 | S  | <a href="#">7434442</a> | EM-MIC01 H016x024/0080 2S |
| 1,8                  | 2,7            | 60             | 9              | 16,9           | 6              | 1,74           | 2 | S  | <a href="#">7434444</a> | EM-MIC01 H018x027/0090 2S |
| 2                    | 3              | 60             | 10             | 17,6           | 6              | 1,94           | 2 | S  | <a href="#">7434446</a> | EM-MIC01 H020x030/0100 2S |
| 2,5                  | 3,7            | 60             | 12,5           | 19,1           | 6              | 2,44           | 2 | S  | <a href="#">7434448</a> | EM-MIC01 H025x037/0125 2S |

Schnittwertempfehlungen ab Seite 134  
 Cutting data recommendations starting page 134

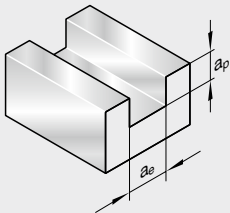
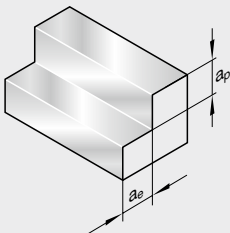
■ = Hauptanwendung First choice  
 □ = Nebenanwendung Second choice



| Werkstoff<br>Material |                                                                   | Werkstoff-Nr.<br>Material No. | R <sub>m</sub> /UTS<br>(N/mm <sup>2</sup> )  | DIN Bezeichnung<br>DIN Description | Kühlung<br>Coolant                                                                  | Schnittge-<br>schwindigkeit<br>Cutting speed<br>v <sub>c</sub> (m/min) |  |
|-----------------------|-------------------------------------------------------------------|-------------------------------|----------------------------------------------|------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------------------------------------|--|
| P2                    | Stahl<br>Steel                                                    | 1.7225                        | 500–1000                                     | 42CrMo4-NT                         |  | 120–160                                                                |  |
|                       |                                                                   | 1.1191                        |                                              | Ck45                               |                                                                                     |                                                                        |  |
| P3                    | Stahl<br>Steel                                                    | 1.2343                        | > 1000                                       | X38CrMoV5 1<br>Toolox33            |                                                                                     |                                                                        |  |
| K1                    | Grey cast iron<br>Grauguss                                        | 0.6025<br>0.6678              | 100–400 (120–260 HB)<br>150–300 (160–230 HB) | GG25<br>GGL-NiCr35 2               |  | 120–150                                                                |  |
| K2                    | Nodular cast iron<br>Sphäroguss                                   | 0.7060                        | 400–800 (120–310 HB)                         | GGG60                              |                                                                                     | 110–140                                                                |  |
| H1                    | Hartguss und gehärtete Stähle<br>Chilled steel and Hardened steel |                               | 45–55 HRC                                    | Ni-hard, Ampco                     |  | 70–120                                                                 |  |
| H2                    | Gehärtete Stähle<br>Hardened steel                                |                               | 56–60 HRC                                    |                                    |                                                                                     | 60–90                                                                  |  |

For tools with reach  $> 10 \times D$ , reduce  $v_c$  and  $f_z$  by 20–30 %

### Calculation formula and feed correction factors

| <b>Drehzahl</b><br><b>Speed n (min<sup>-1</sup>):</b><br>$n = \frac{v_c \cdot 1000}{\pi \cdot d_1}$                                                                                                                                                                                                                                                                                                                                                 |                        | <b>Vorschubkorrektur Feed correction f<sub>1</sub></b><br><table> <tr> <th></th><th></th><th></th><th>f<sub>1</sub></th></tr> <tr> <td>XS</td><td>extra kurz extra short</td><td></td><td>1,35</td></tr> <tr> <td>S</td><td>kurz short</td><td></td><td>1</td></tr> <tr> <td>L</td><td>lang long</td><td></td><td>0,8</td></tr> <tr> <td>XL</td><td>extra lang extra long</td><td></td><td>0,6</td></tr> </table>                                                                              |                                                       |  |  |  | f <sub>1</sub>                                        | XS | extra kurz extra short |  | 1,35  | S | kurz short |  | 1       | L | lang long |  | 0,8     | XL | extra lang extra long |  | 0,6      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|--|--|--|-------------------------------------------------------|----|------------------------|--|-------|---|------------|--|---------|---|-----------|--|---------|----|-----------------------|--|----------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | f <sub>1</sub>                                        |  |  |  |                                                       |    |                        |  |       |   |            |  |         |   |           |  |         |    |                       |  |          |
| XS                                                                                                                                                                                                                                                                                                                                                                                                                                                  | extra kurz extra short |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1,35                                                  |  |  |  |                                                       |    |                        |  |       |   |            |  |         |   |           |  |         |    |                       |  |          |
| S                                                                                                                                                                                                                                                                                                                                                                                                                                                   | kurz short             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1                                                     |  |  |  |                                                       |    |                        |  |       |   |            |  |         |   |           |  |         |    |                       |  |          |
| L                                                                                                                                                                                                                                                                                                                                                                                                                                                   | lang long              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 0,8                                                   |  |  |  |                                                       |    |                        |  |       |   |            |  |         |   |           |  |         |    |                       |  |          |
| XL                                                                                                                                                                                                                                                                                                                                                                                                                                                  | extra lang extra long  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 0,6                                                   |  |  |  |                                                       |    |                        |  |       |   |            |  |         |   |           |  |         |    |                       |  |          |
| <b>Vorschubgeschwindigkeit</b><br><b>Feed rate v<sub>f</sub> (mm/min):</b><br>$v_f = f_z \cdot z \cdot n \cdot f_1$                                                                                                                                                                                                                                                                                                                                 |                        | <b>Einteilung Ausführungslängen</b><br><b>Classification design length</b><br><table> <tr> <th></th><th></th><th></th><th>Verhältnis Relation<br/>l<sub>3</sub>/d<sub>1</sub></th></tr> <tr> <td>XS</td><td>extra kurz extra short</td><td></td><td>&lt; 3,0</td></tr> <tr> <td>S</td><td>kurz short</td><td></td><td>3,1–5,0</td></tr> <tr> <td>L</td><td>lang long</td><td></td><td>5,1–8,0</td></tr> <tr> <td>XL</td><td>extra lang extra long</td><td></td><td>8,1–20,0</td></tr> </table> |                                                       |  |  |  | Verhältnis Relation<br>l <sub>3</sub> /d <sub>1</sub> | XS | extra kurz extra short |  | < 3,0 | S | kurz short |  | 3,1–5,0 | L | lang long |  | 5,1–8,0 | XL | extra lang extra long |  | 8,1–20,0 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Verhältnis Relation<br>l <sub>3</sub> /d <sub>1</sub> |  |  |  |                                                       |    |                        |  |       |   |            |  |         |   |           |  |         |    |                       |  |          |
| XS                                                                                                                                                                                                                                                                                                                                                                                                                                                  | extra kurz extra short |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | < 3,0                                                 |  |  |  |                                                       |    |                        |  |       |   |            |  |         |   |           |  |         |    |                       |  |          |
| S                                                                                                                                                                                                                                                                                                                                                                                                                                                   | kurz short             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 3,1–5,0                                               |  |  |  |                                                       |    |                        |  |       |   |            |  |         |   |           |  |         |    |                       |  |          |
| L                                                                                                                                                                                                                                                                                                                                                                                                                                                   | lang long              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 5,1–8,0                                               |  |  |  |                                                       |    |                        |  |       |   |            |  |         |   |           |  |         |    |                       |  |          |
| XL                                                                                                                                                                                                                                                                                                                                                                                                                                                  | extra lang extra long  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 8,1–20,0                                              |  |  |  |                                                       |    |                        |  |       |   |            |  |         |   |           |  |         |    |                       |  |          |
| <b>Nutenfräsen</b><br><b>Slot milling</b><br>                                                                                                                                                                                                                                                                                                                    |                        | <b>Kantenfräsen</b><br><b>Side milling</b><br>                                                                                                                                                                                                                                                                                                                                                            |                                                       |  |  |  |                                                       |    |                        |  |       |   |            |  |         |   |           |  |         |    |                       |  |          |
| a <sub>e</sub> = Schnittbreite Width of cut in mm<br>a <sub>p</sub> = Schnitttiefe Depth of cut in mm<br>d <sub>1</sub> = Durchmesser Cutter diameter in mm<br>f <sub>1</sub> = Korrekturfaktor für Correction factor v <sub>f</sub><br>f <sub>z</sub> = Vorschub pro Zahn Feed per tooth in mm<br>n = Drehzahl Speed in min <sup>-1</sup><br>v <sub>f</sub> = Vorschubgeschwindigkeit Feed rate in mm/min<br>z = Anzahl der Schneiden No. of teeth |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                       |  |  |  |                                                       |    |                        |  |       |   |            |  |         |   |           |  |         |    |                       |  |          |

|  | Fräserdurchmesser Cutting diameter (mm)                               |       |       |       |       |       |       |       | Kantenfräsen<br>Side milling |          | Nutenfräsen<br>Slot milling |
|--|-----------------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|------------------------------|----------|-----------------------------|
|  | Vorschub pro Zahn $f_z$ Feed per tooth $f_z$<br>(mm/z.) <sup>1)</sup> |       |       |       |       |       |       |       |                              |          |                             |
|  | Ø 0,4                                                                 | Ø 0,5 | Ø 0,6 | Ø 0,8 | Ø 1,0 | Ø 1,5 | Ø 2,0 | Ø 2,5 | $a_p$                        | $a_e$    | $a_p$                       |
|  | 0,002                                                                 | 0,003 | 0,003 | 0,004 | 0,006 | 0,008 | 0,011 | 0,014 | 1,25 x D                     | 0,25 x D | 0,75 x D                    |
|  | 0,002                                                                 | 0,002 | 0,003 | 0,004 | 0,005 | 0,007 | 0,009 | 0,012 | 1,25 x D                     | 0,25 x D | 0,5 x D                     |
|  | 0,003                                                                 | 0,003 | 0,004 | 0,005 | 0,007 | 0,010 | 0,014 | 0,017 | 1,25 x D                     | 0,25 x D | 0,75 x D                    |
|  | 0,002                                                                 | 0,003 | 0,003 | 0,004 | 0,006 | 0,008 | 0,011 | 0,014 | 1,25 x D                     | 0,25 x D | 0,5 x D                     |
|  | 0,002                                                                 | 0,002 | 0,002 | 0,003 | 0,004 | 0,006 | 0,008 | 0,010 | 1,25 x D                     | 0,25 x D | 0,3 x D                     |
|  | 0,001                                                                 | 0,002 | 0,002 | 0,002 | 0,003 | 0,005 | 0,006 | 0,008 | 1,25 x D                     | 0,25 x D | 0,25 x D                    |

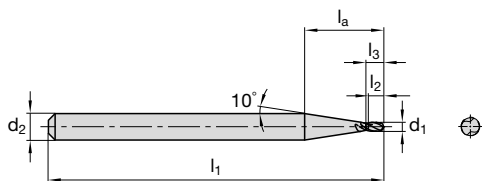


Trockenbearbeitung, Pressluftkühlung ist vorteilhaft  
Dry machining, Compressed air cooling is advantageous



Nassbearbeitung, auf ausreichende Emulsionszuführung achten  
Wet machining, Ensure sufficient emulsion supply

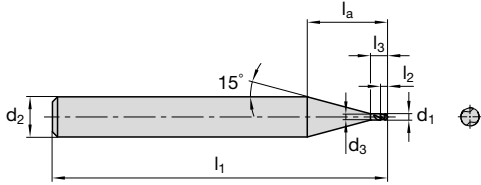




Schnittwertempfehlungen ab Seite 140  
Cutting data recommendations starting page 140

■ = Hauptanwendung First choice  
□ = Nebenanwendung Second choice

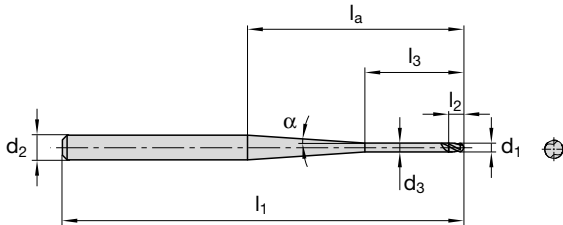
**MIC 01 Ball-Nose-Finisher 30 PH**  
**Mikrofräser Kugelkopf mit Halsfreistellung**  
**Ball nose micro cutter with neck relief**



| Katalog-Nr. Cat.-No. |                |                |                |                |                |                |   |      |    | MIC01-H-A               |                               |
|----------------------|----------------|----------------|----------------|----------------|----------------|----------------|---|------|----|-------------------------|-------------------------------|
| P                    |                |                |                |                |                |                |   |      |    | ■                       |                               |
| M                    |                |                |                |                |                |                |   |      |    |                         |                               |
| K                    |                |                |                |                |                |                |   |      |    |                         |                               |
| N                    |                |                |                |                |                |                |   |      |    |                         |                               |
| S                    |                |                |                |                |                |                |   |      |    |                         |                               |
| H                    |                |                |                |                |                |                |   |      |    | ■                       |                               |
| d <sub>1</sub>       | l <sub>2</sub> | l <sub>1</sub> | l <sub>3</sub> | l <sub>a</sub> | d <sub>2</sub> | d <sub>3</sub> | z | r    |    | Ident No.               | LMT-Code                      |
| lang long            |                |                |                |                |                |                |   |      |    |                         |                               |
| 0,3                  | 0,3            | 50             | 0,3            | 16,5           | 6              | –              | 2 | 0,15 | XS | <a href="#">7434405</a> | EM-MIC01 H003x003/0003 2B0015 |
| 0,4                  | 0,4            | 50             | 0,4            | 16,3           | 6              | –              | 2 | 0,2  | XS | <a href="#">7434406</a> | EM-MIC01 H004x004/0004 2B0020 |
| 0,5                  | 0,5            | 50             | 1,9            | 12,3           | 6              | 0,44           | 2 | 0,25 | S  | <a href="#">7434407</a> | EM-MIC01 H005x005/0019 2B0025 |
| 0,6                  | 0,6            | 50             | 2,2            | 12,4           | 6              | 0,54           | 2 | 0,3  | S  | <a href="#">7434408</a> | EM-MIC01 H006x006/0022 2B0030 |
| 0,8                  | 0,8            | 50             | 2,9            | 12,8           | 6              | 0,74           | 2 | 0,4  | S  | <a href="#">7434409</a> | EM-MIC01 H008x008/0029 2B0040 |
| 1                    | 1              | 50             | 2,5            | 12             | 6              | 0,94           | 2 | 0,5  | XS | <a href="#">7434410</a> | EM-MIC01 H010x010/0025 2B0050 |
| 1,2                  | 1,2            | 50             | 3              | 12,1           | 6              | 1,14           | 2 | 0,6  | XS | <a href="#">7434411</a> | EM-MIC01 H012x012/0030 2B0060 |
| 1,5                  | 1,5            | 50             | 3,8            | 12,3           | 6              | 1,44           | 2 | 0,75 | XS | <a href="#">7434412</a> | EM-MIC01 H015x015/0038 2B0075 |
| 1,6                  | 1,6            | 50             | 4              | 12,3           | 6              | 1,54           | 2 | 0,8  | XS | <a href="#">7434413</a> | EM-MIC01 H016x016/0040 2B0080 |
| 1,8                  | 1,8            | 50             | 4,5            | 12,5           | 6              | 1,74           | 2 | 0,9  | XS | <a href="#">7434414</a> | EM-MIC01 H018x018/0045 2B0090 |
| 2                    | 2              | 50             | 5              | 12,6           | 6              | 1,94           | 2 | 1    | XS | <a href="#">7434415</a> | EM-MIC01 H020x020/0050 2B0100 |
| 2,5                  | 2,5            | 50             | 5              | 11,7           | 6              | 2,44           | 2 | 1,25 | XS | <a href="#">7434416</a> | EM-MIC01 H025x025/0050 2B0125 |
| 3                    | 3              | 50             | 6              | 11,8           | 6              | 2,9            | 2 | 1,5  | XS | <a href="#">7434417</a> | EM-MIC01 H030x030/0060 2B0150 |

Schnittwertempfehlungen ab Seite 140  
 Cutting data recommendations starting page 140

■ = Hauptanwendung First choice  
 □ = Nebenanwendung Second choice



Schnittwertempfehlungen ab Seite 140  
Cutting data recommendations starting page 140

■ = Hauptanwendung First choice  
□ = Nebenanwendung Second choice



# MIC 01 Ball-Nose-Finisher 30 PH

## Schnittwertempfehlungen

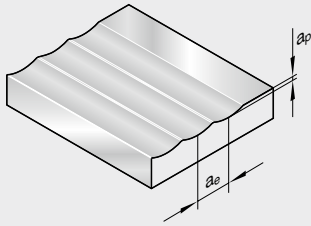
### Cutting data recommendations

| Werkstoff<br>Material                                                   | Werkstoff-Nr.<br>Material No. | R <sub>m</sub> /UTS<br>(N/mm²) | DIN Bezeichnung<br>DIN Description | Kühlung<br>Coolant                                                                  | Schnittgeschwindigkeit<br>Cutting speed<br>v <sub>c</sub> (m/min) |
|-------------------------------------------------------------------------|-------------------------------|--------------------------------|------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| P2<br>Stahl<br>Steel                                                    | 1.7225<br>1.1191              | 500–1000                       | 42CrMo4-NT<br>Ck45                 |  | 210–230                                                           |
|                                                                         |                               |                                |                                    |                                                                                     | 270–310                                                           |
|                                                                         |                               |                                |                                    |                                                                                     | 420–470                                                           |
| P3<br>Stahl<br>Steel                                                    | 1.2343                        | > 1000                         | X38CrMoV5 1<br>Toolox33            |  | 180–210                                                           |
|                                                                         |                               |                                |                                    |                                                                                     | 240–270                                                           |
|                                                                         |                               |                                |                                    |                                                                                     | 370–420                                                           |
| H1<br>Hartguss und gehärtete Stähle<br>Chilled steel and Hardened steel |                               | 45–55 HRC                      | Ni-hard, Ampco                     |  | 120–200                                                           |
| H2<br>Gehärtete Stähle<br>Hardened steel                                |                               | 56–60 HRC                      |                                    |  | 160–280                                                           |
|                                                                         |                               |                                |                                    |                                                                                     | 200–350                                                           |
|                                                                         |                               |                                |                                    |                                                                                     | 140–210                                                           |
| H3<br>Gehärtete Stähle<br>Hardened steel                                |                               | > 60 HRC                       |                                    |  | 180–260                                                           |
|                                                                         |                               |                                |                                    |                                                                                     | 220–320                                                           |
|                                                                         |                               |                                |                                    |                                                                                     | 120–160                                                           |
|                                                                         |                               |                                |                                    |                                                                                     | 150–200                                                           |
|                                                                         |                               |                                |                                    |                                                                                     | 180–250                                                           |

Die angegebenen Schnittwerte sind Startwerte und müssen auf die vorhandenen Bedingungen abgestimmt werden.  
The specified cutting data are start values and must be adjusted to the existing conditions.

## Berechnungsformeln und Vorschubkorrekturfaktoren

### Calculation formula and feed correction factors

|                                                                                                                     |                                                                                      |                                                                  |
|---------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|------------------------------------------------------------------|
| <b>Drehzahl</b><br><b>Speed n (min<sup>-1</sup>):</b><br>$n = \frac{v_c \cdot 1000}{\pi \cdot d_1}$                 | <b>Vorschubkorrektur Feed correction f<sub>1</sub></b>                               |                                                                  |
|                                                                                                                     |   | <b>f<sub>1</sub></b>                                             |
| <b>Vorschubgeschwindigkeit</b><br><b>Feed rate v<sub>f</sub> (mm/min):</b><br>$v_f = f_z \cdot z \cdot n \cdot f_1$ | XS                                                                                   | extra kurz extra short                                           |
|                                                                                                                     | S                                                                                    | kurz short                                                       |
|                                                                                                                     | L                                                                                    | lang long                                                        |
|                                                                                                                     | XL                                                                                   | extra lang extra long                                            |
|                                                                                                                     | <b>Einteilung Ausführungslängen</b><br><b>Classification design length</b>           |                                                                  |
|                                                                                                                     |   | <b>Verhältnis Relation</b><br><b>l<sub>3</sub>/d<sub>1</sub></b> |
|                                                                                                                     | XS                                                                                   | extra kurz extra short                                           |
|                                                                                                                     | S                                                                                    | kurz short                                                       |
|                                                                                                                     | L                                                                                    | lang long                                                        |
|                                                                                                                     | XL                                                                                   | extra lang extra long                                            |
| <b>Kopierfräsen</b><br><b>Copy milling</b>                                                                          |  |                                                                  |
|                                                                                                                     |                                                                                      |                                                                  |

a<sub>e</sub> = Schnittbreite Width of cut in mm  
a<sub>p</sub> = Schnitttiefe Depth of cut in mm  
d<sub>1</sub> = Durchmesser Cutter diameter in mm  
f<sub>1</sub> = Korrekturfaktor für Correction factor v<sub>f</sub>  
f<sub>z</sub> = Vorschub pro Zahn Feed per tooth in mm  
n = Drehzahl Speed in min<sup>-1</sup>  
v<sub>f</sub> = Vorschubgeschwindigkeit Feed rate in mm/min  
z = Anzahl der Schneiden No. of teeth

|  | Fräserdurchmesser Cutting diameter (mm)                                   |       |       |       |       |       |       |       | Schruppen<br>Roughing |                | Vorschlichten<br>Semi finishing |                | Schlichten<br>Finishing |                |
|--|---------------------------------------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-----------------------|----------------|---------------------------------|----------------|-------------------------|----------------|
|  | Vorschub pro Zahn f <sub>z</sub> Feed per tooth f <sub>z</sub><br>(mm/z.) |       |       |       |       |       |       |       |                       |                |                                 |                |                         |                |
|  | Ø 0,5                                                                     | Ø 0,6 | Ø 0,8 | Ø 1   | Ø 1,5 | Ø 2   | Ø 2,5 | Ø 3   | a <sub>p</sub>        | a <sub>e</sub> | a <sub>p</sub>                  | a <sub>e</sub> | a <sub>p</sub>          | a <sub>e</sub> |
|  | 0,004                                                                     | 0,004 | 0,006 | 0,008 | 0,011 | 0,015 | 0,019 | 0,023 | 0,2 x D               | 0,1 x D        |                                 |                |                         |                |
|  | 0,008                                                                     | 0,010 | 0,013 | 0,017 | 0,025 | 0,034 | 0,043 | 0,052 |                       |                | 0,1 x D                         | 0,05 x D       |                         |                |
|  | 0,013                                                                     | 0,015 | 0,020 | 0,026 | 0,039 | 0,052 | 0,066 | 0,080 |                       |                |                                 |                | 0,04 x D                | 0,04 x D       |
|  | 0,004                                                                     | 0,004 | 0,006 | 0,007 | 0,011 | 0,014 | 0,018 | 0,021 | 0,2 x D               | 0,1 x D        |                                 |                |                         |                |
|  | 0,008                                                                     | 0,009 | 0,012 | 0,016 | 0,024 | 0,031 | 0,040 | 0,048 |                       |                | 0,1 x D                         | 0,05 x D       |                         |                |
|  | 0,012                                                                     | 0,014 | 0,019 | 0,024 | 0,036 | 0,048 | 0,061 | 0,073 |                       |                |                                 |                | 0,04 x D                | 0,04 x D       |
|  | 0,006                                                                     | 0,007 | 0,009 | 0,012 | 0,018 | 0,024 | 0,030 | 0,036 | 0,1 x D               | 0,075 x D      |                                 |                |                         |                |
|  | 0,008                                                                     | 0,010 | 0,014 | 0,017 | 0,026 | 0,034 | 0,043 | 0,052 |                       |                | 0,05 x D                        | 0,04 x D       |                         |                |
|  | 0,010                                                                     | 0,012 | 0,015 | 0,019 | 0,029 | 0,039 | 0,049 | 0,059 |                       |                |                                 |                | 0,03 x D                | 0,03 x D       |
|  | 0,007                                                                     | 0,008 | 0,011 | 0,013 | 0,020 | 0,027 | 0,034 | 0,041 | 0,05 x D              | 0,05 x D       |                                 |                |                         |                |
|  | 0,008                                                                     | 0,009 | 0,012 | 0,015 | 0,023 | 0,031 | 0,039 | 0,047 |                       |                | 0,03 x D                        | 0,03 x D       |                         |                |
|  | 0,008                                                                     | 0,010 | 0,013 | 0,016 | 0,025 | 0,033 | 0,041 | 0,050 |                       |                |                                 |                | 0,02 x D                | 0,02 x D       |
|  | 0,004                                                                     | 0,005 | 0,007 | 0,009 | 0,013 | 0,018 | 0,023 | 0,027 | 0,05 x D              | 0,05 x D       |                                 |                |                         |                |
|  | 0,005                                                                     | 0,006 | 0,008 | 0,010 | 0,015 | 0,021 | 0,026 | 0,031 |                       |                | 0,03 x D                        | 0,03 x D       |                         |                |
|  | 0,005                                                                     | 0,007 | 0,009 | 0,011 | 0,016 | 0,022 | 0,028 | 0,033 |                       |                |                                 |                | 0,02 x D                | 0,02 x D       |



Trockenbearbeitung, Pressluftkühlung ist vorteilhaft  
Dry machining, Compressed air cooling is advantageous

**Vergleichstabelle: Werkstoffe**  
**Comparison chart: materials**

| Werkstoff | Material                                                            | Werkstoff-Nr.<br>Material No. | DIN<br>Bezeichnung Alt<br>DIN<br>Description Old | R <sub>m</sub> /UTS<br>(N/mm <sup>2</sup> ) | DIN<br>Bezeichnung Neu<br>DIN<br>Description New |
|-----------|---------------------------------------------------------------------|-------------------------------|--------------------------------------------------|---------------------------------------------|--------------------------------------------------|
| <b>P</b>  | Unlegierter Baustahl<br>+ Automatenstahl                            | 1.0570                        | St52-3                                           | -700                                        | S355J2G3                                         |
|           |                                                                     | 1.1730                        | C45                                              | -800                                        | C45U                                             |
|           |                                                                     | 1.0715                        | 9SMn28                                           | -700                                        | 11SMn30                                          |
|           |                                                                     | 1.1191                        | Ck45                                             | 500-950                                     | C45E                                             |
|           | Vergütungsstahl,<br>mittelfest                                      | 1.7219                        | 26CrMo4                                          |                                             | 26CrMo4-2                                        |
|           |                                                                     | 1.7225                        | 42CrMo4                                          | 500-950                                     | 42CrMo4                                          |
|           | Stahlguss                                                           | 1.8159                        | 51CrV4                                           |                                             | 51CrV4                                           |
|           | Einsatzstahl                                                        | 1.0416                        | GS40                                             | -950                                        | GS40                                             |
|           |                                                                     | 1.7131                        | 16MnCr5                                          | -950                                        | 16MnCr5                                          |
|           |                                                                     | 1.4006                        | X10Cr13                                          | 500-950                                     | X12Cr13                                          |
|           | Rost- und säurebe-<br>ständiger Stahl,<br>ferritisch, martensitisch | 1.4104                        | X12CrMoS17                                       |                                             | X14CrMoS17                                       |
|           |                                                                     | 1.4122                        | X35CrMo17                                        |                                             | X39CrMo17-1                                      |
|           |                                                                     | 1.7225                        | 42CrMo4                                          | 950-1400                                    | 42CrMo4                                          |
|           | Vergütungsstahl,<br>hochfest                                        | 1.6580                        | 30CrNiMo8                                        |                                             | 30CrNiMo8                                        |
|           | Nitrierstahl,<br>vergütet                                           | 1.8504                        | 34CrAl6                                          | 950-1400                                    | 34CrAl6                                          |
|           |                                                                     | 1.2344                        | X40CrMoV5.1                                      | -900                                        | X40CrMoV5-1                                      |
|           | Werkzeugstahl                                                       | 1.2343                        | X38CrMoV5 1                                      | 950-1400                                    | X37CrMoV5-1                                      |
|           |                                                                     | 1.2379                        | X155CrVMo12 1                                    | -950                                        | X153CrMoV12-1                                    |
|           |                                                                     | 1.2358                        | 60CrMoV18-5                                      | 850-1000                                    | 60CrMoV18-5                                      |
|           |                                                                     | 1.2080                        | X210Cr12                                         | 950-1400                                    | X210Cr12                                         |
|           |                                                                     | 1.2714                        | 55NiCrMoV7                                       | 1100-1350                                   | 55NiCrMoV7                                       |
|           |                                                                     | 1.2311                        | 40CrMnMo7                                        | -1100                                       | 40CrMnMo7                                        |
|           |                                                                     | 1.2312                        | 40CrMnNiMoS8.6                                   | -1150                                       | 40CrMnNiMoS8-6                                   |
|           |                                                                     | 1.2316                        | X38CrMo16                                        | -1100                                       | X38CrMo16                                        |
| <b>M</b>  | Rost- und säurebe-<br>ständiger Stahl,<br>austenitisch              | 1.4301                        | X2CrNiMo17-12-2                                  | 500-950                                     | X5CrNiMo18-10                                    |
|           |                                                                     | 1.4404                        | X6CrNiMoTi17-12-2                                |                                             | X2CrNiMo17-12-2                                  |
|           |                                                                     | 1.4571                        | X10CrNiMoTi18                                    |                                             | X10CrNiMoTi18                                    |
|           | Rost- und säurebe-<br>ständiger Stahl,<br>martensitisch aushärtbar  | 1.2709                        | X3NiCoMoTi18-9-5                                 | 800-1000                                    | X3NiCoMoTi18-9-5                                 |
|           |                                                                     | 1.4542                        | X5CrNiCuNb16-4                                   |                                             | X5CrNiCuNb16-4                                   |
| <b>K</b>  | Grauguss                                                            | 1.4568                        | X7CrNiAl17-7                                     |                                             | X7CrNiAl17-7                                     |
|           |                                                                     | 0.6025                        | GG25                                             | 100-400<br>(120-260 HB)                     | EN-GJ1-250                                       |
|           | Legierter Grauguss                                                  | 0.6678                        | GGL-NiCr35 2                                     | 150-250<br>(160-230 HB)                     | EN-GJLA-XNiCr35-2                                |
|           | Sphäroguss                                                          | 0.7060                        | GGG60                                            | 400-800                                     | EN-GJS-600-3                                     |
|           | Temperguss                                                          | 0.7070                        | GGG70L                                           | (120-310 HB)                                | EN-GJS-700-2U                                    |
| <b>N</b>  | Aluminium-Legierungen,<br>kurzspanend                               | 0.8155                        | GTS55                                            | 350-700<br>(150-280 HB)                     | EN-GJMB-550-4                                    |
|           |                                                                     | 3.2581                        | G-AlSi12                                         | -400                                        | G-IGK-AlSi12                                     |
|           | Aluminium-Legierungen,<br>langspanend                               | 3.3535                        | AlMg3                                            | -550                                        | AlMg3                                            |
|           | Kupfer-Legierungen,<br>kurzspanend                                  | 3.4365                        | AlZnMgCu1,5                                      |                                             | AlZnMgCu1,5                                      |
|           | Kupfer-Legierungen,<br>langspanend                                  | 2.0402                        | MS58                                             | -500                                        | CuZn40Pb2                                        |
|           | Thermoplaste                                                        | 2.0320                        | MS63                                             | 300-500                                     | CuZn37                                           |
|           | Duroplaste                                                          | 2.0975                        | CuAl10Ni                                         | 40-70                                       | CuAl10Fe5Ni5-C                                   |
|           | Graphit                                                             |                               | PVC                                              | 20-40                                       | PVC                                              |
| <b>S</b>  | Titan-Legierungen,<br>mittelfest                                    |                               | Bakelit, Melamin                                 |                                             | Bakelit, Melamin                                 |
|           |                                                                     | 3.7115                        | TiAl5Sn2,5                                       | -950                                        | TiAl5Sn2-5                                       |
|           | Titan-Legierungen,<br>hochfest                                      | 3.7164                        | TiAl6V4                                          |                                             | TiAl6V4                                          |
|           | Nickelbasis-Legierungen,<br>mittelfest                              | 3.7174                        | TiAl6Sn2                                         | 900-1400                                    | TiAl6V6Sn2                                       |
|           | Nickelbasis-Legierungen,<br>hochwarmfest                            | 2.4670                        | NiCr12Al6MoNb                                    | -950                                        | NiCr12Al6MoNb                                    |
| <b>H</b>  | Hartguss                                                            | 2.4668                        | NiCr19Fe19NbMo                                   | 900-1400                                    | Inconel 718                                      |
|           |                                                                     |                               |                                                  |                                             | NiCr19Fe19Nb5Mo3                                 |
|           |                                                                     |                               |                                                  |                                             |                                                  |
|           | Gehärteter Stahl                                                    |                               | Ni-hard, Ampco                                   | 300-600 HB                                  | Ni-hard, Ampco                                   |
|           |                                                                     |                               |                                                  | 45-52 HRC                                   |                                                  |
|           |                                                                     |                               |                                                  | 53-59 HRC                                   |                                                  |
|           |                                                                     |                               |                                                  | 60-65 HRC                                   |                                                  |



|      | Spez.<br>Schnittkraft<br>Specific<br>cutting<br>force<br>kc 1.1<br>(N/mm²) | Schnitt-<br>kraft-<br>Exponent<br>Cutting<br>Force<br>exponent<br>m <sub>c</sub> | Großbritannien<br>Great Britain |           | Frankreich<br>France                           | Italien<br>Italy                                  | Schweden<br>Sweden         | Spanien<br>France                   | Japan<br>Japan                  | USA<br>USA                    | Russland<br>Russia        | Leistungs-<br>faktor<br>Efficiency<br>factor<br><br>LF = $\frac{\text{cm}^3}{\text{min} \cdot \text{kW}}$ |
|------|----------------------------------------------------------------------------|----------------------------------------------------------------------------------|---------------------------------|-----------|------------------------------------------------|---------------------------------------------------|----------------------------|-------------------------------------|---------------------------------|-------------------------------|---------------------------|-----------------------------------------------------------------------------------------------------------|
|      |                                                                            |                                                                                  | BS                              | EN        | AFNOR                                          | UNI                                               | SS                         | UNE                                 | JIS                             | AISI/SAE                      | GOST                      |                                                                                                           |
|      | 1700                                                                       | 0,24                                                                             | 4360-50 B                       | EN43B     | E 36-3; E 36-4<br>Y3 42                        | Fe 510 B; C; D<br>C45                             | 2132<br>1672               |                                     | SM 50 YA<br>S45C                |                               | 17 GS                     | 24                                                                                                        |
|      |                                                                            | 0,24                                                                             | 230 M 07                        | 1A        | S 250                                          | CF 9 SMn 28                                       | 1912                       | F.2111                              | SUM 22                          | 1045                          |                           | 22                                                                                                        |
|      |                                                                            | 0,24                                                                             | 080 M46                         |           | XC 45                                          | C 45                                              | 1672                       | C45K                                | S 45 C                          | 1045                          | 45                        | 20                                                                                                        |
|      |                                                                            | 0,24                                                                             | 708 M 40<br>735 A 50            | 19A<br>47 | 42 CD 4<br>50 CV4                              | 42 CrMo 4<br>51 CrV 4                             | 2244<br>2230               | 42CrMo4<br>50CrV4                   | SCM 440 (H)<br>SUP 10           | 4242; 4140<br>6150            | G 41400<br>50ChGFA        | 18                                                                                                        |
|      |                                                                            | 0,24                                                                             |                                 |           |                                                |                                                   |                            |                                     |                                 |                               |                           | 18                                                                                                        |
|      |                                                                            | 0,24                                                                             | S27 M 17                        |           | 16 MC 4                                        | 16 MnCr 5                                         | 2511                       | 16MnCr5                             | SCR 415                         | 5115                          | 18ChG                     | 18                                                                                                        |
|      |                                                                            | 0,24                                                                             | 410 S 21<br>441S29              | 56A       | Z 12 C 13<br>Z 12 CF17                         | X 12 Cr 13<br>X 10 CrS 17                         | 2302<br>2383               | F.3401<br>F.3117                    | SUS 410<br>SUS 430 F            | 410; CA-15<br>430 F           | 12Ch13                    | 16                                                                                                        |
|      |                                                                            | 0,24                                                                             | 708 M 40                        | 19A       | 42 CD 4                                        | 42 CrMo 4                                         | 2244                       | 42CrMo4                             | SCM 440 (H)                     | 4242; 4140                    | G 41400                   | 16                                                                                                        |
|      |                                                                            | 0,24                                                                             |                                 |           |                                                |                                                   |                            |                                     |                                 |                               |                           | 16                                                                                                        |
| 2000 |                                                                            |                                                                                  | BH13                            |           | Z40CFV5                                        | X40CrMoV511KU                                     | 2242                       | F.5318                              | SKD61                           | H13                           |                           |                                                                                                           |
| 2000 | 0,24                                                                       |                                                                                  | BH11<br>BD2                     |           | Z38CDV5<br>Z160CDV12                           | X37CrMoV51KU<br>X155CrVMo121KU                    | X37CrMoV5-1<br>2310        | F.5317<br>F.5211                    | SKD6<br>SKD11                   | H11<br>D2                     | 4Ch5MFS                   | 14                                                                                                        |
| 2000 |                                                                            |                                                                                  | BD3                             |           | Z200Cr12                                       | X210Cr13KU                                        | 2710                       | F.5212                              | SKD1                            | D3                            |                           |                                                                                                           |
| 2000 |                                                                            |                                                                                  | P20<br>P20+S                    |           | 40CMD8<br>40CMD8+S<br>Z35CD17                  | 35CrMo8KU<br>X38CrMo161KU                         | 2541                       | F.5263<br>X210CrW12<br>F.5267       | SKT3<br>SKT3+S<br>SUS42J2+Mo    | P20<br>P20+S<br>422           |                           |                                                                                                           |
| 2000 |                                                                            |                                                                                  | P20+Ni                          |           | 40CMND8                                        |                                                   | 2541                       |                                     | SKT3+Ni                         | P20+Ni                        |                           |                                                                                                           |
| 1900 | 0,2                                                                        |                                                                                  | 304 S 15<br>416 S 11<br>320S31  | 58E<br>58 | Z 6 CN 18.09<br>Z 2 CND 17.12<br>Z 6 CNT 17.12 | X 5 CrNi 18 10<br>X 2 CrNiMo 17 12<br>X6CrNiTi811 | 2332; 2333<br>2348<br>2350 | F.314<br>F3535-X6CrNiMo-<br>Ti17122 | SUS 304<br>SUS 316 L<br>SUS 347 | 304; 304 H<br>316 L<br>316 Ti | 08Ch18N10<br>10Ch17N13M2T | 18                                                                                                        |
| 2000 | 0,2                                                                        |                                                                                  | 316S111                         |           | Z2NKD18-09<br>Z 7 CNU 17-04<br>Z8CNA17-07      | NiCrMo<br>X2CrNiMo1712<br>(1.4568)                |                            |                                     | SCS 24; SUS<br>630              | 630<br>17-7PH                 |                           | 18                                                                                                        |
| 1225 | 0,25                                                                       |                                                                                  | Grade 260                       |           | FT25D                                          | G25                                               | 125                        | FG25                                | FC250                           | No35B                         |                           | 30                                                                                                        |
|      | 0,22                                                                       |                                                                                  |                                 |           |                                                |                                                   |                            |                                     |                                 |                               |                           | 22                                                                                                        |
| 1100 | 0,28                                                                       |                                                                                  | SNG 600/3<br>SNG 700/2          | FGS 700-2 | FGS 600-3<br>FGS 700-2                         | GS 600-3<br>GS 700-2                              | 07 32-03<br>07 37-01       | FGE 60-2<br>FGS 70-2                | FCD600<br>FCD700                | 80-55-06<br>100-70-03         |                           | 24                                                                                                        |
| 1050 | 0,28                                                                       |                                                                                  | P 510/4                         |           | MP50-5                                         | GMN55                                             | 08 54                      |                                     |                                 |                               |                           | 24                                                                                                        |
| 500  | 0,25                                                                       |                                                                                  | LM 6                            |           | A-S13                                          | 4514                                              | 4261                       | L-2520                              | AC3A                            | A413.0                        |                           | 55                                                                                                        |
|      | 0,25                                                                       |                                                                                  | A-G3C<br>A-Z5GU                 |           | NS<br>DTD5074                                  |                                                   |                            |                                     |                                 | 5754<br>7075                  |                           | 60                                                                                                        |
|      | 0,2                                                                        |                                                                                  | CZ122                           |           | CuZn39Pb2                                      | P-CuZn3940Pb2                                     |                            |                                     |                                 | C37700                        |                           | 35                                                                                                        |
|      | 0,2                                                                        |                                                                                  | AB2                             |           | CuAl11Ni5Fe                                    | G-CuAl1 1Fe4Ni4                                   |                            |                                     |                                 | B-148-52                      |                           | 50                                                                                                        |
|      | 0,15                                                                       |                                                                                  |                                 |           |                                                |                                                   |                            |                                     |                                 |                               |                           | 70                                                                                                        |
|      | 0,15                                                                       |                                                                                  |                                 |           |                                                |                                                   |                            |                                     |                                 | Phenolic                      |                           | 35                                                                                                        |
|      |                                                                            |                                                                                  |                                 |           |                                                |                                                   |                            |                                     |                                 |                               |                           | 90                                                                                                        |
| 1450 | 0,23                                                                       |                                                                                  | TA10-13<br>TA28                 |           | T-A6V                                          |                                                   |                            | Ti-P63                              |                                 | AMS5640<br>4911               |                           | 20                                                                                                        |
| 1450 | 0,23                                                                       |                                                                                  |                                 |           |                                                |                                                   |                            |                                     |                                 |                               |                           | 16                                                                                                        |
|      | 0,23                                                                       |                                                                                  |                                 |           |                                                |                                                   |                            |                                     |                                 |                               |                           | 18                                                                                                        |
|      | 0,23                                                                       |                                                                                  | HR 8                            |           | NC 19 FeNb                                     | Inconel 718                                       |                            |                                     |                                 | N07718                        |                           | 15                                                                                                        |
| 2900 | 0,22                                                                       |                                                                                  |                                 |           |                                                |                                                   |                            |                                     |                                 |                               |                           |                                                                                                           |
| 3100 |                                                                            |                                                                                  |                                 |           |                                                |                                                   |                            |                                     |                                 |                               |                           |                                                                                                           |
| 3300 |                                                                            |                                                                                  |                                 |           |                                                |                                                   |                            |                                     |                                 |                               |                           |                                                                                                           |

| Zugfestigkeit<br>R <sub>m</sub><br>Tensile<br>strength R <sub>m</sub><br>N/mm <sup>2</sup> | Vickers-<br>härte<br>Vickers<br>hardness<br>HV | Brinell-<br>härte<br>Brinell<br>hardness<br>HB | Rockwell-<br>härte<br>Rockwell<br>hardness<br>HRC |
|--------------------------------------------------------------------------------------------|------------------------------------------------|------------------------------------------------|---------------------------------------------------|
| 255                                                                                        | 80                                             | 76                                             |                                                   |
| 270                                                                                        | 85                                             | 80,7                                           |                                                   |
| 285                                                                                        | 90                                             | 85,5                                           |                                                   |
| 305                                                                                        | 95                                             | 90,2                                           |                                                   |
| 320                                                                                        | 100                                            | 95                                             |                                                   |
| 335                                                                                        | 105                                            | 99,8                                           |                                                   |
| 350                                                                                        | 110                                            | 105                                            |                                                   |
| 370                                                                                        | 115                                            | 109                                            |                                                   |
| 385                                                                                        | 120                                            | 114                                            |                                                   |
| 400                                                                                        | 125                                            | 119                                            |                                                   |
| 415                                                                                        | 130                                            | 124                                            |                                                   |
| 430                                                                                        | 135                                            | 128                                            |                                                   |
| 450                                                                                        | 140                                            | 133                                            |                                                   |
| 465                                                                                        | 145                                            | 138                                            |                                                   |
| 480                                                                                        | 150                                            | 143                                            |                                                   |
| 495                                                                                        | 155                                            | 147                                            |                                                   |
| 510                                                                                        | 160                                            | 152                                            |                                                   |
| 530                                                                                        | 165                                            | 156                                            |                                                   |
| 545                                                                                        | 170                                            | 162                                            |                                                   |
| 560                                                                                        | 175                                            | 166                                            |                                                   |
| 575                                                                                        | 180                                            | 171                                            |                                                   |
| 595                                                                                        | 185                                            | 176                                            |                                                   |
| 610                                                                                        | 190                                            | 181                                            |                                                   |
| 625                                                                                        | 195                                            | 185                                            |                                                   |
| 640                                                                                        | 200                                            | 190                                            |                                                   |
| 660                                                                                        | 205                                            | 195                                            |                                                   |
| 675                                                                                        | 210                                            | 199                                            |                                                   |
| 690                                                                                        | 215                                            | 204                                            |                                                   |
| 705                                                                                        | 220                                            | 209                                            |                                                   |
| 720                                                                                        | 225                                            | 214                                            |                                                   |
| 740                                                                                        | 230                                            | 219                                            |                                                   |
| 755                                                                                        | 235                                            | 223                                            |                                                   |
| 770                                                                                        | 240                                            | 228                                            | 20,3                                              |
| 785                                                                                        | 245                                            | 233                                            | 21,3                                              |
| 800                                                                                        | 250                                            | 238                                            | 22,2                                              |
| 820                                                                                        | 255                                            | 242                                            | 23,1                                              |
| 835                                                                                        | 260                                            | 247                                            | 24                                                |
| 850                                                                                        | 265                                            | 252                                            | 24,8                                              |
| 865                                                                                        | 270                                            | 257                                            | 25,6                                              |
| 880                                                                                        | 275                                            | 261                                            | 26,4                                              |
| 900                                                                                        | 280                                            | 266                                            | 27,1                                              |
| 915                                                                                        | 285                                            | 271                                            | 27,8                                              |
| 930                                                                                        | 290                                            | 276                                            | 28,5                                              |
| 950                                                                                        | 295                                            | 280                                            | 29,2                                              |
| 965                                                                                        | 300                                            | 285                                            | 29,8                                              |
| 995                                                                                        | 310                                            | 295                                            | 31                                                |
| 1030                                                                                       | 320                                            | 304                                            | 32,2                                              |
| 1060                                                                                       | 330                                            | 314                                            | 33,3                                              |
| 1095                                                                                       | 340                                            | 323                                            | 34,4                                              |

| Zugfestigkeit<br>R <sub>m</sub><br>Tensile<br>strength R <sub>m</sub><br>N/mm <sup>2</sup> | Vickers-<br>härte<br>Vickers<br>hardness<br>HV | Brinell-<br>härte<br>Brinell<br>hardness<br>HB | Rockwell-<br>härte<br>Rockwell<br>hardness<br>HRC |
|--------------------------------------------------------------------------------------------|------------------------------------------------|------------------------------------------------|---------------------------------------------------|
| 1125                                                                                       | 350                                            | 333                                            | 35,5                                              |
| 1155                                                                                       | 360                                            | 342                                            | 36,6                                              |
| 1190                                                                                       | 370                                            | 352                                            | 37,7                                              |
| 1220                                                                                       | 380                                            | 361                                            | 38,8                                              |
| 1255                                                                                       | 390                                            | 371                                            | 39,8                                              |
| 1290                                                                                       | 400                                            | 380                                            | 40,8                                              |
| 1320                                                                                       | 410                                            | 390                                            | 41,8                                              |
| 1350                                                                                       | 420                                            | 399                                            | 42,7                                              |
| 1385                                                                                       | 430                                            | 409                                            | 43,6                                              |
| 1420                                                                                       | 440                                            | 418                                            | 44,5                                              |
| 1455                                                                                       | 450                                            | 428                                            | 45,3                                              |
| 1485                                                                                       | 460                                            | 437                                            | 46,1                                              |
| 1520                                                                                       | 470                                            | 447                                            | 46,9                                              |
| 1555                                                                                       | 480                                            | (456)                                          | 47,7                                              |
| 1595                                                                                       | 490                                            | (466)                                          | 48,4                                              |
| 1630                                                                                       | 500                                            | (475)                                          | 49,1                                              |
| 1665                                                                                       | 510                                            | (485)                                          | 49,8                                              |
| 1700                                                                                       | 520                                            | (494)                                          | 50,5                                              |
| 1740                                                                                       | 530                                            | (504)                                          | 51,1                                              |
| 1775                                                                                       | 540                                            | (513)                                          | 51,7                                              |
| 1810                                                                                       | 550                                            | (523)                                          | 52,3                                              |
| 1845                                                                                       | 560                                            | (532)                                          | 53,0                                              |
| 1880                                                                                       | 570                                            | (542)                                          | 53,6                                              |
| 1920                                                                                       | 580                                            | (551)                                          | 54,1                                              |
| 1955                                                                                       | 590                                            | (561)                                          | 54,7                                              |
| 1995                                                                                       | 600                                            | (570)                                          | 55,2                                              |
| 2030                                                                                       | 610                                            | (580)                                          | 55,7                                              |
| 2070                                                                                       | 620                                            | (589)                                          | 56,3                                              |
| 2105                                                                                       | 630                                            | (599)                                          | 56,8                                              |
| 2145                                                                                       | 640                                            | (608)                                          | 57,3                                              |
| 2180                                                                                       | 650                                            | (618)                                          | 57,8                                              |
|                                                                                            | 660                                            |                                                | 58,3                                              |
|                                                                                            | 670                                            |                                                | 58,8                                              |
|                                                                                            | 680                                            |                                                | 59,2                                              |
|                                                                                            | 690                                            |                                                | 59,7                                              |
|                                                                                            | 700                                            |                                                | 60,1                                              |
|                                                                                            | 720                                            |                                                | 61                                                |
|                                                                                            | 740                                            |                                                | 61,8                                              |
|                                                                                            | 760                                            |                                                | 62,5                                              |
|                                                                                            | 780                                            |                                                | 63,3                                              |
|                                                                                            | 800                                            |                                                | 64                                                |
|                                                                                            | 820                                            |                                                | 64,7                                              |
|                                                                                            | 840                                            |                                                | 65,3                                              |
|                                                                                            | 860                                            |                                                | 65,9                                              |
|                                                                                            | 880                                            |                                                | 66,4                                              |
|                                                                                            | 900                                            |                                                | 67                                                |
|                                                                                            | 920                                            |                                                | 67,5                                              |
|                                                                                            | 940                                            |                                                | 68                                                |

|                                                                                    |                |                                                                                                                                                   |
|------------------------------------------------------------------------------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Zugfestigkeit Tensile strength                                                     | R <sub>m</sub> | N/mm <sup>2</sup>                                                                                                                                 |
| Vickershärte Vickers hardness                                                      | HV             | Diamantpyramide 136°, Prüfkraft F ≥ 98 N Diamond pyramid 136°, Test force F ≥ 98 N                                                                |
| Brinellhärte Brinell hardness<br>Kalkuliert mit calculated from:<br>HB = 0,95 × HV | HB             | 0,102 × F/D <sup>2</sup> = 30 N/mm <sup>2</sup><br>F = Prüfkraft in N, D = Kegeldurchmesser in mm<br>F = Test force in N, D = Ball diameter in mm |
| Härte Rockwell C Hardness Rockwell C                                               | HRC            | Diamantkegel 120°, Gesamtprüfkraft 1471 ± 9 N Diamond cone 120°, Total test force 1471 ± 9 N                                                      |

|                                                                                                                                                      |                                                                                                        |                                                                                                      |
|------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| $a_p$ = Spanungstiefe in mm<br>Depths of cut in mm                                                                                                   | <b>Umdrehungen pro Minute n [U/min]</b><br><b>Revolutions per minute n [rpm]</b>                       | <b>Mittlere Spanndicke <math>h_m</math> [mm]</b><br><b>Mean chip thickness <math>h_m</math> [mm]</b> |
| $a_e$ = Spanungsbreite in mm<br>Width of cut in mm                                                                                                   | $n = \frac{v_c \cdot 1000}{\pi \cdot d_e}$                                                             | $h_m = f_z \cdot \sqrt{\frac{a_e}{d_e}}$                                                             |
| $l$ = Bearbeitete Länge in mm<br>Machined length in mm                                                                                               |                                                                                                        | gültig nur bis $\frac{a_e}{d_e} < 0,3$<br>valid only up to                                           |
| $h_m$ = Mittenspanndicke in mm<br>Mean chip thickness                                                                                                | <b>Vorschubgeschwindigkeit <math>v_f</math> [mm/min]</b><br><b>Feed rate <math>v_f</math> [mm/min]</b> | bzw. 30 % oder or $w = 60^\circ$                                                                     |
| $v_c$ = Schnittgeschwindigkeit in m/min<br>Cutting speed in m/min                                                                                    | $v_f = f_z \cdot n \cdot z$                                                                            | sonst $h_m = \frac{360 \cdot f_z \cdot a_e \cdot \sin(k)}{\pi \cdot d_e \cdot w_s}$<br>otherwise     |
| $f_z$ = Vorschub pro Zahn in mm<br>Feed per tooth in mm                                                                                              | <b>Vorschub pro Umdrehung f [mm/U]</b><br><b>Feed per revolution f [mm/rev.]</b>                       | <b>Zerspanungsvolumen Q [cm³/min]</b><br><b>Chip removal rate Q [cm³/min]</b>                        |
| $d_1$ = Äußerer Werkzeugdurchmesser<br>Outside tool diameter                                                                                         | $f = \frac{v_f}{n}$                                                                                    | $Q = \frac{a_p \cdot a_e \cdot v_f}{1000}$                                                           |
| $S_d$ = Effektiver Durchmesser,<br>Schnittkreisdurchmesser in mm<br>Effective diameter with different<br>inserts and at specified cut depth<br>in mm | <b>Vorschub pro Zahn <math>f_z</math> [mm/z]</b><br><b>Feed per tooth <math>f_z</math> [mm/tooth]</b>  | <b>Effektiver Schnittkreisdurchmesser [mm]</b><br><b>Effective diameter of cutting</b>               |
| $d$ = Durchmesser der Platte in mm<br>Insert diameter in mm                                                                                          | $f_z = \frac{V_F}{n \cdot z}$                                                                          | <b>Werkzeuge mit Eckenradius</b><br><b>Milling cutter with corner radius</b>                         |
| $k$ = Einstellwinkel<br>Lead angle                                                                                                                   | gültig nur bis $\frac{a_e}{d_e} < 0,3$<br>valid only up to<br><br>bzw. 30 % oder or $w = 60^\circ$     | $S_d = 2 \cdot \sqrt{d_1} \cdot a_p - a_p^2$                                                         |
| $w_s$ = Eingriffswinkel<br>Approach angle                                                                                                            | Einstellwinkel k<br>Plunge angle                                                                       | <b>Kugel-Kopierfräser</b><br><b>Ball Nose cutter</b><br><br>$S_d = d_1 - d + 2 \cdot a_p (d - a_p)$  |
| $b_r$ = Zeilensprung<br>Horizontal skip                                                                                                              | 90°                                                                                                    |                                                                                                      |
| $R_{th}$ = Rauhtiefe<br>Roughness                                                                                                                    | 45°                                                                                                    |                                                                                                      |
| $M_c$ = Spindeldrehmoment in Nm<br>Spindle torque                                                                                                    | 30°                                                                                                    |                                                                                                      |
| $f_n$ = Vorschub pro Umdrehung<br>Feed per revolution                                                                                                | sonst<br>otherwise                                                                                     |                                                                                                      |
| $k_c$ = Spez. Schnittkraft in N/mm²<br>Cutting force in N/mm²                                                                                        | $f_z = \frac{h_m \cdot \pi \cdot d_e \cdot w_s}{360 \cdot a_e \cdot \sin(k)}$                          | <b>Theoretische Rauhtiefe</b><br><b>Theoretical roughness</b>                                        |
| $P$ = benötigte Maschinenleistung<br>required machine power                                                                                          | $R_{th} = \frac{d_1}{2} \cdot \sqrt{\frac{d_1^2 - b_r^2}{4}}$                                          | <b>Spindeldrehmoment</b><br><b>Spindle torque</b>                                                    |
| $LF$ = Leistungsfaktor<br>Efficiency factor                                                                                                          | <b>Zeilensprung</b><br><b>Horizontal skip</b>                                                          | $M_c = \frac{f_n \cdot \pi \cdot d_1^2 \cdot k_c}{4000}$                                             |
|                                                                                                                                                      | $b_r = 2 \cdot \sqrt{R_{th} \cdot (d_1 - R_{th})}$                                                     | <b>benötigte Maschinenleistung</b><br><b>required machine power</b>                                  |
|                                                                                                                                                      |                                                                                                        | $P = \frac{Q}{LF}$                                                                                   |

Gültigkeit der Diagramme

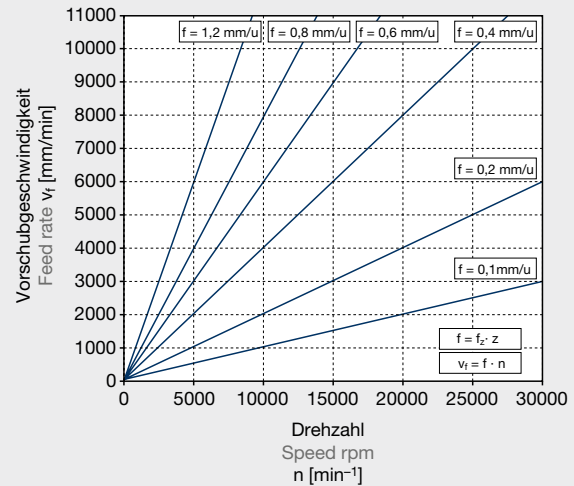
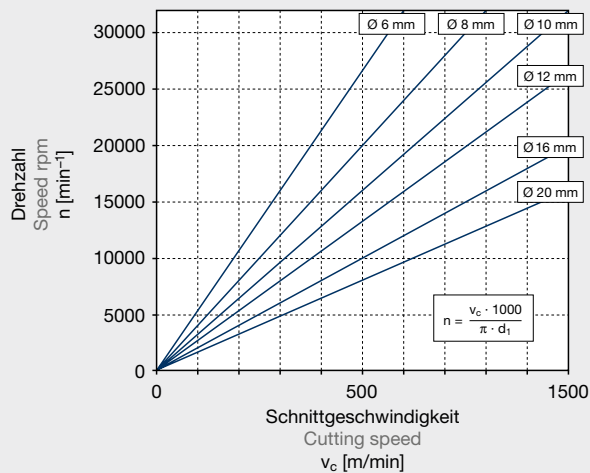
für  $a_p \geq 0,5 \cdot d_1$  bzw.  
 $a_p \geq 0,5 \cdot d_4$  sonst

Berechnungsformeln siehe unten

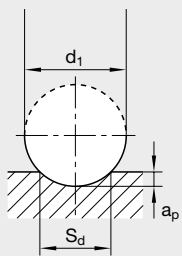
Diagrams are valid

for  $a_p \geq 0,5 \cdot d_1$  respectively  
 $a_p \geq 0,5 \cdot d_4$  otherwise

see formula below



### Kugel-Kopierfräser Ball nose end mill



Kugel-Kopierfräser mit einer  
Schnitttiefe von  
Ball nose end mill with depth  
of cut

$a_p < 0,5 \cdot d_1$

$$n = \frac{v_c \cdot 1000}{2 \cdot \pi \sqrt{d_1 \cdot a_p - a_p^2}} \quad [\text{min}^{-1}]$$

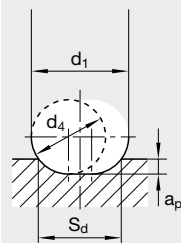
$a_p$  = Schnitttiefe  
Depth of cut [mm]

$S_d$  = Schnittkreis-Ø  
Cutting circle dia. [mm]

$d_1$  = Fräser-Ø  
Milling Cutter dia. [mm]

$$S_d = 2 \cdot \sqrt{d_1 \cdot a_p - a_p^2}$$

### Fräser mit Eckenradius Milling cutter with corner radius



Fräser mit einer Schnitttiefe von  
Cutter with depth of cut

$a_p < 0,5 \cdot d_4$

$$n = \frac{v_c \cdot 1000}{(d_1 - d_4 + 2 \cdot \sqrt{d_4 \cdot a_p - a_p^2}) \cdot \pi} \quad [\text{min}^{-1}]$$

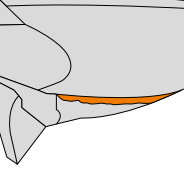
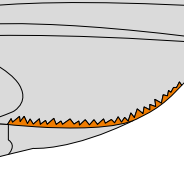
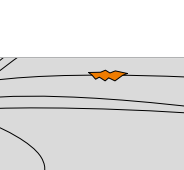
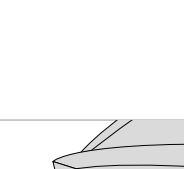
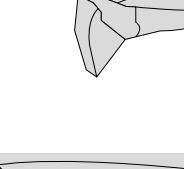
$d_4 = 2 \cdot \text{Eckenradius}$   
 $2 \cdot \text{Corner radius}$  [mm]

$$S_d = d_1 - d_4 + 2 \cdot \sqrt{d_4 \cdot a_p - a_p^2}$$

$z$  = Zähnezahl  
No. of teeth

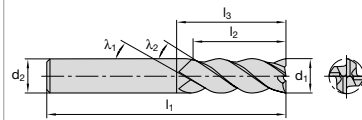
$f_z$  = Vorschub/Zahn  
Feed/Tooth [mm]

$f$  = Vorschub/Umdrehung  
Feed/Revolution [mm/u]

| Art<br>Type                                                                                                                                                                                                                                                                               | Beschreibung<br>Description                                                                                                                                                                                                                                  | Maßnahmen<br>Measures                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  <p><b>Freiflächenverschleiß</b><br/>Abrieb an der Freifläche</p> <p><b>Flank wear</b><br/>Abrasion on the clearance</p>                                                                                 | <p>Freiflächenverschleiß entsteht durch Abrasion zwischen Werkstück und Schneidkante, also an der Freifläche.</p> <p>Flank wear is caused by abrasion between the workpiece and flank.</p>                                                                   | <ul style="list-style-type: none"> <li>■ Schnittgeschwindigkeit verringern</li> <li>■ Verschleißfesteren Schneidstoff verwenden</li> <li>■ Vorschub erhöhen</li> <li>■ Kühlmitteldruck erhöhen</li> <li>■ Reduce cutting speed</li> <li>■ Use more wear-resistant cutting material</li> <li>■ Increase feed rate</li> <li>■ Increase coolant pressure</li> </ul>                                                           |
|  <p><b>Kolkverschleiß</b><br/>Aufbau an der Schneide und Auswaschung an der Spanfläche</p> <p><b>Crater wear</b><br/>Washout or build up at the rake face</p>                                            | <p>Kolkverschleiß wird durch Diffusion und Abrasion auf der Spanfläche verursacht.</p> <p>Crater wear is caused by diffusion and abrasion of the cutting face.</p>                                                                                           | <ul style="list-style-type: none"> <li>■ Schnittgeschwindigkeit verringern</li> <li>■ Härteren Schneidstoff verwenden</li> <li>■ Vorschub erhöhen</li> <li>■ Kühlmitteldruck erhöhen</li> <li>■ Reduce cutting speed</li> <li>■ Use harder cutting material</li> <li>■ Increase feed rate</li> <li>■ Increase coolant pressure</li> </ul>                                                                                  |
|  <p><b>Aufbauschneide</b><br/>Aufklebung von Material auf der Spanfläche</p> <p><b>Built-up edge</b><br/>Adhesion of material along the cutting edge at the rake face</p>                                | <p>Aufgrund von Adhäsion (Anhaftung) bleiben Teile des Materials auf der Schneidkante kleben und eine Aufbauschneide bildet sich.</p> <p>Due to micro-cold welding, parts of the workpiece material adhere to the cutting edge, forming a build-up edge.</p> | <ul style="list-style-type: none"> <li>■ Schnittgeschwindigkeit erhöhen</li> <li>■ Spanwinkel vergrößern</li> <li>■ Werkzeuge mit schärferer Schneide verwenden</li> <li>■ Vorschub verringern</li> <li>■ Kühlmitteldruck erhöhen</li> <li>■ Increase cutting speed</li> <li>■ Increase cutting angle</li> <li>■ Use tools with a sharper edge</li> <li>■ Reduce feed rate</li> <li>■ Increase coolant pressure</li> </ul> |
|  <p><b>Ausbrüche</b><br/>Ausbrüche entlang der Schneidkante</p> <p><b>Chipping</b><br/>Chipping along the cutting edge</p>                                                                             | <p>Ausbrüche entstehen aufgrund von Vibrationen, Späneschlag, Kammrisen und zu geringer Zähigkeit des Schneidstoffes.</p> <p>Chipping is caused by vibrations, impact of chips, thermal cracks and too less toughness of the carbide grade.</p>              | <ul style="list-style-type: none"> <li>■ Schnittgeschwindigkeit verringern</li> <li>■ Weniger scharfes Werkzeug verwenden</li> <li>■ Zäheren Schneidstoff verwenden</li> <li>■ Vorschub erhöhen</li> <li>■ Kühlmitteldruck erhöhen</li> <li>■ Reduce cutting speed</li> <li>■ Use less sharp tools</li> <li>■ Use tougher cutting material</li> <li>■ Increase feed rate</li> <li>■ Increase coolant pressure</li> </ul>   |
|  <p><b>Plastische Deformation</b><br/>Deformation an der Schneidkante (oft am Eckenradius)</p> <p><b>Plastic deformation</b><br/>Deformation on the cutting edge (especially at the corner radius)</p> | <p>Plastische Deformation wird durch hohe Wärmeeinwirkung in Kombination mit mechanischer Wechselbelastung verursacht.</p> <p>Plastic deformation is caused by excessive heat combined with mechanical stress.</p>                                           | <ul style="list-style-type: none"> <li>■ Vorschub verringern</li> <li>■ Verschleißfesteren Schneidstoff verwenden</li> <li>■ Weniger scharfes Werkzeug verwenden</li> <li>■ Kühlmitteldruck erhöhen</li> <li>■ Reduce feed rate</li> <li>■ Use more wear-resistant cutting material</li> <li>■ Use less sharp tools</li> <li>■ Increase coolant pressure</li> </ul>                                                        |
|  <p><b>Kammrisse</b><br/>Gleichmäßige Risse im Werkzeug 90° zur Schneidkante</p> <p><b>Thermal cracks</b><br/>Uniform cracks in the tool orthogonal to the cutting edge</p>                            | <p>Kammrisse (Thermoschock) werden durch zu hohe thermische Wechsel verursacht.</p> <p>Thermal cracks are caused by thermal alternating stress (Thermal shock)</p>                                                                                           | <ul style="list-style-type: none"> <li>■ Schnittgeschwindigkeit verringern</li> <li>■ Vorschub verringern</li> <li>■ Kühlmitteldruck verringern</li> <li>■ Reduce cutting speed</li> <li>■ Reduce feed rate</li> <li>■ Reduce coolant pressure</li> </ul>                                                                                                                                                                  |

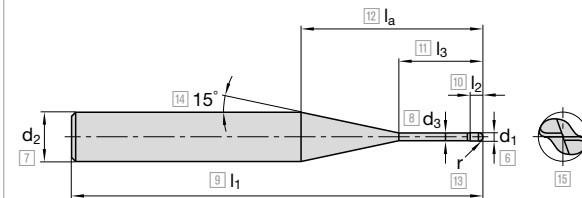
## Fräsen mit Schaftfräsern Milling with end mills

- 1 Abmessung nach  
Dimension according
- 2 Ausführung Schneidkante  
Cutting edge design
- 3 Drallwinkel  
Helix angle
- 4 Toleranzklasse  
Tolerance
- 5 Anwendung  
Application



## Fräsen mit Schaftfräsern Milling with end mills

- 1 Abmessung nach  
Dimension according
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Tolerance
- 5 Anwendung  
Application
- 6 Schneidendurchmesser  
Cutting edge diameter
- 7 Schaftdurchmesser  
Shank diameter
- 8 Halsdurchmesser  
Neck diameter
- 9 Gesamtlänge  
Total length
- 10 Schneidenlänge  
Cutting length
- 11 Nutzbare Länge  
Operable length
- 12 Auskraglänge  
Extension length
- 13 Eckenradius  
Corner radius
- 14 Kegelwinkel  
Cone angle
- 15 Zähnezahl  
Number of teeth



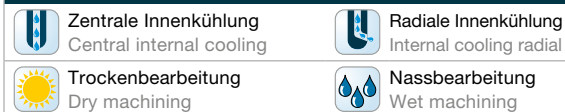
**Normen für Schäfte und Schneiden**  
Standards for shanks and cutting edges



**Kantenprofile, Drall, Drallwinkel**  
Edge profiles, spiral, spiral angle



**Besonderheiten**  
Special features



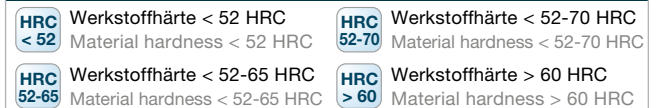
**Schneidstoffsorten**  
Cutting material grades



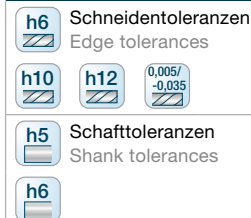
**Besonderheiten**  
Special features



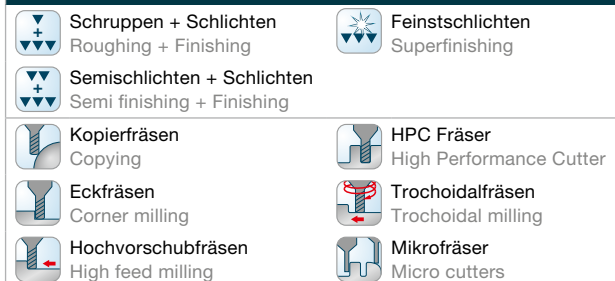
**Anwendungen**  
Applications



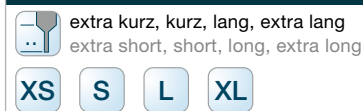
**Toleranzklassen**  
Tolerance classes



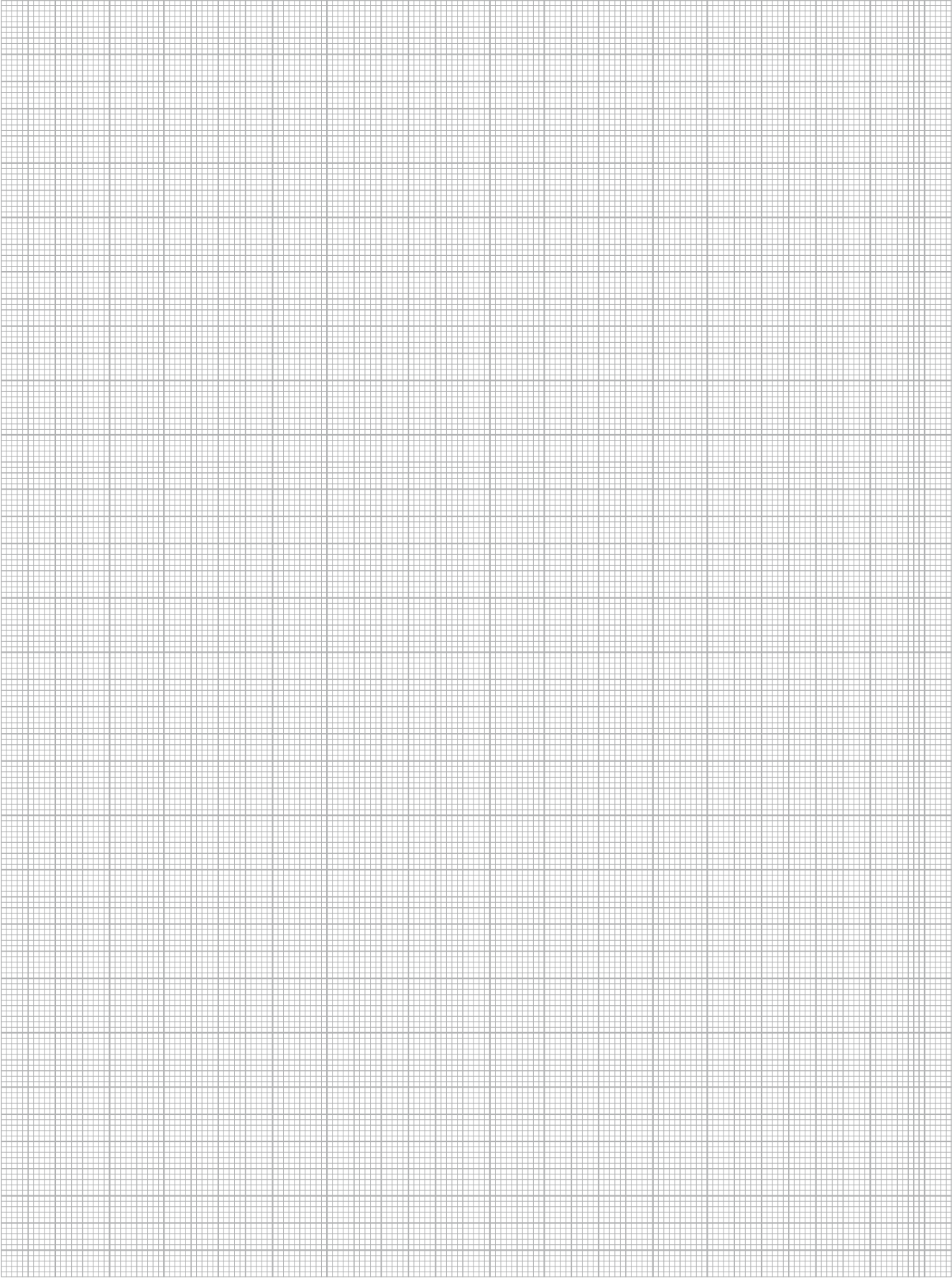
**Prozesse**  
Processes



**Schneidenlängen**  
Cutting length







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## Examples

### Beispiele



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