



■ Made
■ in
■ Germany



FRANKEN

Alu-Cut

Volumenzerspanung in Aluminiumwerkstoffen
High-Volume Machining in Aluminium Materials



Nahezu 100 Jahre Präzision und Innovation. Nearly 100 years of precision and innovation.

FRANKEN als Teil der EMUGE-FRANKEN Unternehmensgruppe beschäftigt sich seit seiner Gründung mit der Entwicklung und Produktion von Fräswerkzeugen. Präzision und Innovation prägen das breite Angebot von Fräsern aus Hartmetall und HSS sowie PKD-, CBN- oder wendepplattenbestückten Fräskörpern.

Die Fertigung am deutschen Produktionsstandort in Rückersdorf reicht von Standard-Schaft- und Bohrungsfräsern bis hin zu hochgenauen Form- und Profil-Sonderfräsern. Mit seiner Typen- und Schneidstoffvielfalt, dem hohen Standard und der kompromisslosen Präzision entspricht das Fräserprogramm den höchsten Qualitätsanforderungen.

Als Ergänzung zu den Fräswerkzeugen führen wir ein durchgängiges Programm an Fräsespannmitteln und Zubehör für die verschiedensten Adaptierungsmöglichkeiten.

Ever since its foundation FRANKEN as part of the EMUGE-FRANKEN company association has been developing and manufacturing milling tools. The wide range of end mills of solid carbide and HSS as well as PCD and CBN inserts or milling cutters with indexable inserts is characterised by precision and innovation.

The production in our German manufacturing plant in Rückersdorf includes standard end mills and bore cutters as well as highly precise special form and profile milling tools. With its large variety of tool types and cutting materials, the consistently high standards and uncompromising precision, our product range of milling cutters meets even the highest quality requirements.

In addition to our selection of milling tools, we also offer a comprehensive range of clamping systems, tool holders and accessories.

**EMUGE-FRANKEN ist nach
ISO 9001:2015 zertifiziert**







EMUGE-FRANKEN is certified
according ISO 9001:2015

















www.sgs-tuev-saar.com

Certification ID
DE/819944190



| Alu-Cut „Aerospace“ | | | | | | Bestell-Code Order code | Seite Page |
|--|-----------|------------------|------|---|---|----------------------------|---------------|
| Hartmetall-Schaftfräser Solid carbide end mills | WR | Z3 (Flutes) | ICRA |  |  | 2888 / 2881 | 6 - 7 |
| | WR | Z3 (Flutes) | ICRA |  |  | 2890 / 2883 | 8 - 9 |
| | W | Z3-4 (Flutes) | ICRA |  |  | 2889 / 2882 | 10 - 11 |
| | W | Z4 (Flutes) | ICRA |  |  | 2891 / 2884 | 12 - 13 |

| Alu-Cut | | | | | | Bestell-Code Order code | Seite Page |
|---|-----------|------------------|--|---|---|----------------------------|---------------|
| Hartmetall-Schaftfräser Solid carbide end mills | WR | Z3 (Flutes) | |  |  | 2548 / 2549 | 14 - 15 |
| | W | Z2-3 (Flutes) | |  |  | 2544 / 2545 | 16 - 17 |
| | W | Z3 (Flutes) | |  |  | 2546 / 2547 | 18 - 19 |
| Hartmetall-Kugelfräser Solid carbide ball nose end mills | W | Z2 (Flutes) | |  |  | 1921 / 2830 / 1943 | 20 - 23 |
| Hartmetall-Torusfräser Solid carbide torus end mills | W | Z2 (Flutes) | |  |  | 1942 / 2838 / 1941 | 24 - 27 |

| Alu-Cut HSS | | | | | | Bestell-Code Order code | Seite Page |
|-----------------------------------|-----------|----------------|------|---|---|----------------------------|---------------|
| HSS-Schaftfräser HSS end mills | WR | Z3 (Flutes) | ICRA |  |  | 1092 / 1093 | 28 - 29 |
| | W | Z4 (Flutes) | ICRA |  |  | 1034 / 1035 | 30 - 31 |

| Wendeschneidplattenfräser und PKD-Fräser für die Aluminiumbearbeitung Indexable milling cutters and PCD end mills for the machining of aluminium | | | | | | Seite Page |
|---|--|--|--|--|--|---------------|
| Rhombische Wendeschneidplattenfräser Rhombic indexable milling cutters | | | | | | 32 - 37 |
| PKD-Plan- und Eckfräser PCD side and face milling cutters | | | | | | 38 - 39 |

Alu-Cut Eine neue Dimension bei der Volumenzerspanung in Aluminiumwerkstoffen

Mit der Typenreihe Alu-Cut stellt FRANKEN eine technisch neuartige Fräser-Familie aus Hartmetall und HSSE-PM für die Volumenzerspanung in Aluminiumwerkstoffen. Durch die Kombination von optimalem Schneidstoff, komplett neu entwickelter Schneidengeometrie und Optimierung des Schleifprozesses wurden mit den Werkzeugen der Typenreihe Alu-Cut noch nie da gewesene Zerspanraten erreicht.

Einer der Zielmärkte ist die Luft- und Raumfahrtindustrie. Diese fertigt Bauteile, bei denen bis zu 95% des ursprünglichen Werkstückvolumens zerspannt werden müssen. Hier ist Zeit einer der wichtigsten Faktoren, der maßgeblich durch das erzeugte Spanvolumen, gemessen in Litern pro Minute, beeinflusst wird.

Bei umfangreichen Versuchen wurden Zerspanraten erreicht, welche neue Maßstäbe setzen. Wichtig ist die Spanabfuhr, welche bisher die Grenze des Zeitspanvolumens darstellte. Nun liegt die Grenze bei optimalen Bedingungen bei der Maschinenspindleleistung. Hier ist das zur Verfügung stehende Drehmoment im höheren Drehzahlbereich relevant.

Ergänzt wird die Typenreihe Alu-Cut um rhombische Wendeschneidplatten mit an die Aluminiumbearbeitung angepasster Schneidengeometrie und dazu passenden Einschraub- und Aufsteckfräskörpern.

Alu-Cut A new dimension in high-volume machining in aluminium materials

FRANKEN introduces the new Alu-Cut, a tool line of radically new solid carbide and HSSE-PM milling cutters for the high-volume machining of aluminium materials. Due to the combination of an optimum cutting material with a newly developed cutting geometry and optimized grinding processes, machining volumes which would have been considered impossible until now can be achieved with the Alu-Cut.

One of the target markets for this new tool type is the aircraft and space industry. Some of the components which are produced in this industry lose up to 95% of their original weight, all through machining processes. Time is one of the most important factors under such circumstances, and it is defined by the machining volume produced, and measured in litres per minute.

In the course of extensive tests, machining volumes were achieved which will set new standards. Especially important is chip evacuation which until now decided the limits of the possible machining volume. Now, the limits are defined only by the performance of the machine spindle, provided that work conditions are otherwise as good as they can be. The available torque in the higher speed ranges is the relevant factor here.

The Alu-Cut line is supplemented both with rhombic inserts with a cutting geometry fitted to the machining of aluminium and suitable indexable screw-in end mills and shell type milling cutters.

Alu-Cut „Aerospace“ Für die Volumenzerspanung

- ICRA (Kühlschmierstoffaustritt radial und axial)
- Polierte Funktionsflächen

Die Alu-Cut-Serie besteht aus Hartmetall- und HSS-Werkzeugen, die gezielt für die prozesssichere Volumenzerspanung von Aluminium-Knetlegierungen bis 5% Siliziumgehalt entwickelt wurden.

Werkstoffe mit höherem Siliziumgehalt sollten ausschließlich mit beschichteten Werkzeugen bearbeitet werden.

Besonderheiten:

- Ungleiche Teilung
- Schruppverzahnung mit grobem WR-Profil
- Spezielle Geometrie zur Aluminium-Bearbeitung
- Optional mit innerer Kühlschmierstoff-Zufuhr mit radialem und axialem Austritt (ICRA)

Hauptmerkmal:

Hohes Zeitspanvolumen.

Alu-Cut "Aerospace" For volume machining

- ICRA (internal coolant supply, axial exit)
- Polished chip gash

The Alu-Cut series includes tools made from solid carbide and HSS particularly developed for the process-reliable volume machining of wrought aluminum alloys with up to 5% silicon content.

Materials with higher silicon content should preferably be machined with coated tools.

Characteristics:

- Variable spacing
- Available with WR profile for roughing
- Special geometry for machining aluminium
- Optionally available with internal coolant supply, radial and axial exit (ICRA)

Main feature:

Highest metal removal rate.

Alu-Cut Die universelle Lösung zur Aluminium-Bearbeitung

Diese neuen Werkzeuge wurden gezielt für die Bearbeitung von Aluminium und Nichteisenmetallen entwickelt. Durch die neue, sehr glatte Beschichtung wird das Werkzeug gegen Aufbauschnittenbildung und Verschleiß geschützt.

Besonderheiten:

- Ungleiche Teilung
- Schruppverzahnung mit grobem WR-Profil
- Spezielle Geometrie zur Aluminium-Bearbeitung
- Werkzeuge mit und ohne Eckenradius

Hauptmerkmal:

Geeignet zum Fräsen von Aluminium-Knetlegierungen von bis 7% Siliziumgehalt.

Alu-Cut The versatile solution for machining aluminium

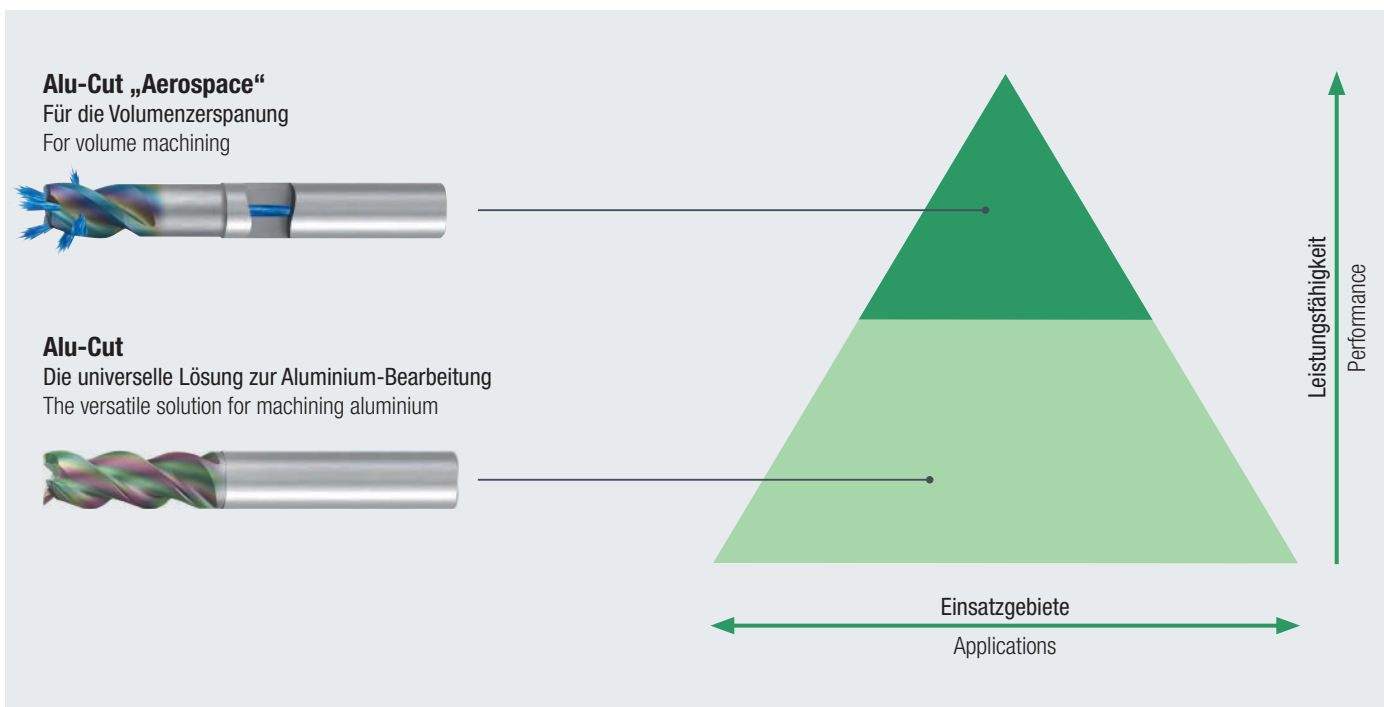
These new tools have been developed for machining aluminium and non-ferrous metals. The new, very smooth coating protects the tool against built-up edge and wear.

Characteristics:

- Variable spacing
- Available with WR profile for roughing
- Special geometry for machining aluminium
- Tools with and without corner radii

Main feature:

Suitable for milling of Aluminium-alloys with up to 7% Silicon.

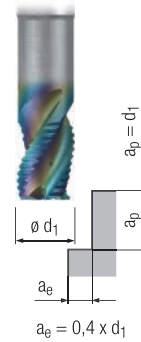
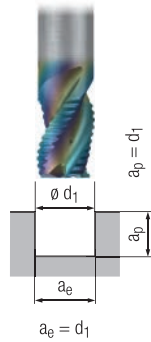


| | | Einsatzgebiete – Material Applications – material | | Material-Beispiele Material examples | Material-Nummern Material numbers | |
|----------|---|--|--------------------------|---|--------------------------------------|-------------|
| N | Nichteisenwerkstoffe | Non-ferrous materials | | | | |
| | Aluminium-Legierungen | Aluminium alloys | | | | |
| | 1.1 | Aluminium-Knetlegierungen | Wrought aluminium alloys | ≤ 200 N/mm ² | EN AW-AlMn1Cu | EN AW-3103 |
| | | | | | EN AW-Al99,5 | EN AW-1050A |
| | | | | EN AW-AlMg1 | EN AW-5005A | |
| | | | | EN AW-AlMgSi0,5 | EN AW-6060 | |
| | 1.2 | | | ≤ 350 N/mm ² | EN AW-AlMgSi | EN-AW-6060 |
| | | | | | EN AW-AlMg3 | EN-AW-5754 |
| | | EN AW-AlMg2Mn0,8 | EN-AW-5049 | | | |
| | 1.3 | ≤ 550 N/mm ² | | EN AW-AlMgSi1 | EN-AW-6082 | |
| | | | | EN AW-AlZn5Mg3Cu | EN AW-7022 | |
| | | | | EN AW-AlMg4,5Mn | EN AW-5083 | |
| | | | | EN AW-AlZn4,5Mg1 | EN AW-7020 | |
| | 1.4 | Aluminium-Gusslegierungen | Aluminium cast alloys | Si ≤ 7% | En AW-AlZnMgCu1,5 | EN AW-7075 |
| | | | | | EN AC-AlMg5 | EN AC-51300 |
| | | | | EN AC-AlSi5Cu3Mg | EN AC-45100 | |
| | | | | EN AC-AlMg3 | EN AC-51100 | |
| | | | | EN AC-AlSi7Mg0,3 | EN AC-42100 | |
| | 1.5 | | | 7% < Si ≤ 12% | EN AC-AlSi9Cu3 | EN AC-46500 |
| | | | | | EN AC-AlSi10Mg(Cu) | EN AC-43000 |
| | EN AC-AlSi12(Fe) | EN AC-44300 | | | | |
| 1.6 | 12% < Si ≤ 17% | EN AC-AlSi7Cu2 | EN AC-46600 | | | |
| | | EN AC-AlSi17Cu4Mg | EN AC-48100 | | | |
| | GD-AlSi17Cu4FeMg | | | | | |
| | Kupfer-Legierungen | Copper alloys | | | | |
| 2.1 | Reinkupfer, niedriglegiertes Kupfer | Pure copper, low-alloyed copper | ≤ 400 N/mm ² | E-Cu 57 | EN CW 004 A | |
| 2.2 | Kupfer-Zink-Legierungen (Messing, langspanend) | Copper-zinc alloys (brass, long-chipping) | ≤ 550 N/mm ² | CuZn37 (Ms63) | EN CW 508 L | |
| 2.3 | Kupfer-Zink-Legierungen (Messing, kurzspanend) | Copper-zinc alloys (brass, short-chipping) | ≤ 550 N/mm ² | CuZn36Pb3 (Ms58) | EN CW 603 N | |
| 2.4 | Kupfer-Aluminium-Legierungen (Alubronze, langspanend) | Copper-aluminium alloys (alu bronze, long-chipping) | ≤ 800 N/mm ² | CuAl10Ni5Fe4 | EN CW 307 G | |
| 2.5 | Kupfer-Zinn-Legierungen (Zinnbronze, langspanend) | Copper-tin alloys (tin bronze, long-chipping) | ≤ 700 N/mm ² | CuSn8P | EN CW 459 K | |
| 2.6 | Kupfer-Zinn-Legierungen (Zinnbronze, kurzspanend) | Copper-tin alloys (tin bronze, short-chipping) | ≤ 400 N/mm ² | CuSn7ZnPb (Rg7) | 2.1090 | |
| 2.7 | Kupfer-Sonderlegierungen | Special copper alloys | ≤ 600 N/mm ² | (AMPCO® 8) | | |
| 2.8 | | | ≤ 1400 N/mm ² | (AMPCO® 45) | | |
| | Magnesium-Legierungen | Magnesium alloys | | | | |
| 3.1 | Magnesium-Knetlegierungen | Magnesium wrought alloys | ≤ 500 N/mm ² | MgAl6Zn | 3.5612 | |
| 3.2 | Magnesium-Gusslegierungen | Magnesium cast alloys | ≤ 500 N/mm ² | EN MCMgAl9Zn1 | EN MC21120 | |
| | Kunststoffe | Synthetics | | | | |
| 4.1 | Duroplaste (kurzspanend) | Duroplastics (short-chipping) | | Bakelit, Pertinax | | |
| 4.2 | Thermoplaste (langspanend) | Thermoplastics (long-chipping) | | PMMA, POM, PVC | | |
| 4.3 | Faserverstärkte Kunststoffe (Faseranteil ≤ 30%) | Fibre-reinforced synthetics (fibre content ≤ 30%) | | GFK, CFK, AFK | | |
| 4.4 | Faserverstärkte Kunststoffe (Faseranteil > 30%) | Fibre-reinforced synthetics (fibre content > 30%) | | GFK, CFK, AFK | | |
| | Besondere Werkstoffe | Special materials | | | | |
| 5.1 | Grafit | Graphite | | C 8000 | | |
| 5.2 | Wolfram-Kupfer-Legierungen | Tungsten-copper alloys | | W-Cu 80/20 | | |
| 5.3 | Verbundwerkstoffe | Composite materials | | Hylite, Alucobond | | |



Hartmetall-Schaftfräser „Aerospace“ – lange Ausführung
Solid carbide end mills “Aerospace” – long design

WR



Gültig für · Valid for

- 2881_Z
- 2881RZ
- 2888_T
- 2888_Z
- 2888RT
- 2888RZ

Achtung:
Bei unbeschichteter Ausführung ist die Schnittgeschwindigkeit v_c um 30% zu reduzieren!

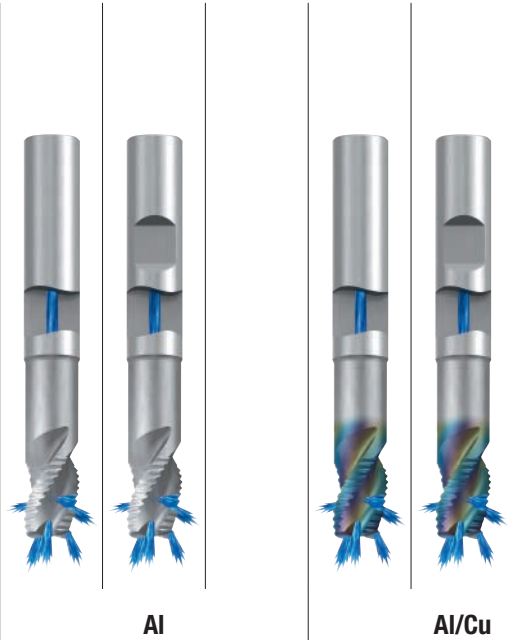
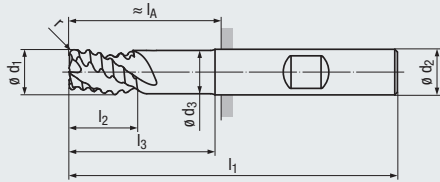
Please note:
For uncoated design, please reduce cutting speed v_c by 30%!

| | v_c [m/min] | f_z [mm] | v_c [m/min] | f_z [mm] | | | MMS MQL | |
|---|------------------|---------------|------------------|---------------|--|--------------------------|--------------------------|-------------------------------------|
| Nichteisenwerkstoffe · Non-ferrous materials | | | | | | | | |
| Aluminium-Legierungen · Aluminium alloys | | | | | | | | |
| 1.1 | 420 | 0,009 x d_1 | 630 | 0,011 x d_1 | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.2 | 620 | 0,008 x d_1 | 930 | 0,010 x d_1 | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.3 | 550 | 0,007 x d_1 | 830 | 0,008 x d_1 | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.4 | 380 | 0,008 x d_1 | 570 | 0,010 x d_1 | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.5 | | | | | | | | |
| 1.6 | | | | | | | | |
| Kupfer-Legierungen · Copper alloys | | | | | | | | |
| 2.1 | 120 | 0,005 x d_1 | 180 | 0,006 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.2 | 120 | 0,005 x d_1 | 180 | 0,006 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.3 | 120 | 0,005 x d_1 | 180 | 0,006 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.4 | 110 | 0,004 x d_1 | 170 | 0,005 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.5 | 110 | 0,004 x d_1 | 170 | 0,005 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.6 | 110 | 0,004 x d_1 | 170 | 0,005 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.7 | 70 | 0,003 x d_1 | 110 | 0,004 x d_1 | | | | <input checked="" type="checkbox"/> |
| 2.8 | | | | | | | | |
| Magnesium-Legierungen · Magnesium alloys | | | | | | | | |
| 3.1 | | | | | | | | |
| 3.2 | | | | | | | | |
| Kunststoffe · Synthetics | | | | | | | | |
| 4.1 | | | | | | | | |
| 4.2 | | | | | | | | |
| 4.3 | | | | | | | | |
| 4.4 | | | | | | | | |
| Besondere Werkstoffe · Special materials | | | | | | | | |
| 5.1 | | | | | | | | |
| 5.2 | | | | | | | | |
| 5.3 | | | | | | | | |

■ = sehr gut geeignet · very suitable
□ = gut geeignet · suitable

v_c = Schnittgeschwindigkeit · Cutting speed
 f_z = Vorschub pro Zahn · Feed per tooth

- Hochleistungswerkzeug
 - Spezielle Geometrie für die Volumenzerspanung von Aluminium
 - Vibrationsarme Bearbeitung
 - Sehr glatte CRN-Beschichtung
 - Verschiedene Eckenradien pro Schneidendurchmesser
 - Innere Kühlschmierstoff-Zufuhr, Austritt radial und axial (ICRA)
 - Kurze Schneidenlänge
- High performance tool
 - Special geometry for high-volume machining of aluminium
 - Low-vibration machining
 - Very smooth CRN coating
 - Several corner radii per cutting diameter
 - Internal coolant supply, radial and axial exit (ICRA)
 - Short flute length



Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 5)

- Für Aluminium-Knetlegierungen
- Für Aluminium-Legierungen mit einem Siliziumgehalt bis 7%
- Mit CRN-Beschichtung auch in Kupfer-Legierungen einsetzbar

Applications – material (see page 5)

- For wrought aluminium alloys
- For aluminium alloys with a silicon content of up to 7%
- With CRN coating also for copper alloys

N 1.1-1.3 1.4

CRN

N 1.1-1.4 2.1-2.7

Lange Ausführung · Long design

Eckenradius · Corner radius

| Bestell-Code · Order code | | | | | | | | | | | 2890_Z | 2883_Z | 2890RZ | 2883RZ |
|---------------------------|-----|-------|-------|-------|-------------------|-------------------------|-------|--------------------------------------|---------------|------------------|--------|--------|--------|--------|
| $\varnothing d_1$ h11 | r | l_2 | l_3 | l_1 | $\varnothing d_3$ | $\varnothing d_2$ h5 | l_A | $n_{max.}^{2)}$ min ⁻¹ | Z (Flutes) | Dimens.- Code | | | | |
| 12 | 2 | 15 | 35 | 83 | 11,4 | 12 | 38 | 15000 | 3 | .012020 | ● | ● | ● | ● |
| 12 | 2,5 | 15 | 35 | 83 | 11,4 | 12 | 38 | 15000 | 3 | .012025 | ● | ● | ● | ● |
| 12 | 3 | 15 | 35 | 83 | 11,4 | 12 | 38 | 15000 | 3 | .012030 | ● | ● | ● | ● |
| 12 | 4 | 15 | 35 | 83 | 11,4 | 12 | 38 | 15000 | 3 | .012040 | ● | ● | ● | ● |
| 16 | 2 | 20 | 46 | 96 | 15,2 | 16 | 48 | 12500 | 3 | .016020 | ● | ● | ● | ● |
| 16 | 2,5 | 20 | 46 | 96 | 15,2 | 16 | 48 | 12500 | 3 | .016025 | ● | ● | ● | ● |
| 16 | 3 | 20 | 46 | 96 | 15,2 | 16 | 48 | 12500 | 3 | .016030 | ● | ● | ● | ● |
| 16 | 4 | 20 | 46 | 96 | 15,2 | 16 | 48 | 12500 | 3 | .016040 | ● | ● | ● | ● |
| 20 | 2 | 25 | 58 | 110 | 19 | 20 | 60 | 10000 | 3 | .020020 | ● | ● | ● | ● |
| 20 | 2,5 | 25 | 58 | 110 | 19 | 20 | 60 | 10000 | 3 | .020025 | ● | ● | ● | ● |
| 20 | 3 | 25 | 58 | 110 | 19 | 20 | 60 | 10000 | 3 | .020030 | ● | ● | ● | ● |
| 20 | 4 | 25 | 58 | 110 | 19 | 20 | 60 | 10000 | 3 | .020040 | ● | ● | ● | ● |
| 25 | 2 | 30 | 73 | 125 | 24 | 25 ³⁾ | 75 | 8000 | 3 | .025020 | ● | ● | ● | ● |
| 25 | 2,5 | 30 | 73 | 125 | 24 | 25 ³⁾ | 75 | 8000 | 3 | .025025 | ● | ● | ● | ● |
| 25 | 3 | 30 | 73 | 125 | 24 | 25 ³⁾ | 75 | 8000 | 3 | .025030 | ● | ● | ● | ● |
| 25 | 4 | 30 | 73 | 125 | 24 | 25 ³⁾ | 75 | 8000 | 3 | .025040 | ● | ● | ● | ● |

Andere Eckenradien auf Anfrage lieferbar
Other corner radii available on request

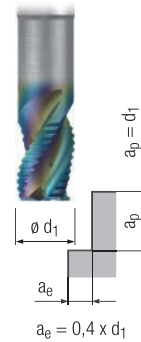
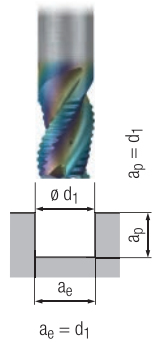
²⁾ Maximal zulässige Drehzahl für Hartmetall-Schaftfräser mit seitlicher Mitnahmefläche nach DIN 6535 HB
Maximum permissible revolution of solid carbide end mills with clamping flat according to DIN 6535 HB

³⁾ Schaftlänge 50 mm
Shank length 50 mm



Hartmetall-Schaftfräser „Aerospace“ – lange Ausführung
Solid carbide end mills “Aerospace” – long design

WR



Gültig für · Valid for

- 2883_Z
- 2883RZ
- 2890_Z
- 2890RZ

Achtung:
Bei unbeschichteter Ausführung ist die Schnittgeschwindigkeit v_c um 30% zu reduzieren!

Please note:
For uncoated design, please reduce cutting speed v_c by 30%!

| v_c [m/min] | f_z [mm] | v_c [m/min] | f_z [mm] | | | MMS MQL | |
|------------------|---------------|------------------|---------------|--|--|------------|--|
|------------------|---------------|------------------|---------------|--|--|------------|--|

| Nichteisenwerkstoffe · Non-ferrous materials | | | | | | | |
|--|-----|---------------|-----|---------------|--|---|---|
| Aluminium-Legierungen · Aluminium alloys | | | | | | | |
| 1.1 | 420 | 0,009 x d_1 | 630 | 0,011 x d_1 | | | ■ |
| 1.2 | 620 | 0,008 x d_1 | 930 | 0,010 x d_1 | | | ■ |
| 1.3 | 550 | 0,007 x d_1 | 830 | 0,008 x d_1 | | | ■ |
| 1.4 | 380 | 0,008 x d_1 | 570 | 0,010 x d_1 | | | ■ |
| 1.5 | | | | | | | |
| 1.6 | | | | | | | |
| Kupfer-Legierungen · Copper alloys | | | | | | | |
| 2.1 | 120 | 0,005 x d_1 | 180 | 0,006 x d_1 | | □ | ■ |
| 2.2 | 120 | 0,005 x d_1 | 180 | 0,006 x d_1 | | □ | ■ |
| 2.3 | 120 | 0,005 x d_1 | 180 | 0,006 x d_1 | | □ | ■ |
| 2.4 | 110 | 0,004 x d_1 | 170 | 0,005 x d_1 | | □ | ■ |
| 2.5 | 110 | 0,004 x d_1 | 170 | 0,005 x d_1 | | □ | ■ |
| 2.6 | 110 | 0,004 x d_1 | 170 | 0,005 x d_1 | | □ | ■ |
| 2.7 | 70 | 0,003 x d_1 | 110 | 0,004 x d_1 | | | ■ |
| 2.8 | | | | | | | |
| Magnesium-Legierungen · Magnesium alloys | | | | | | | |
| 3.1 | | | | | | | |
| 3.2 | | | | | | | |
| Kunststoffe · Synthetics | | | | | | | |
| 4.1 | | | | | | | |
| 4.2 | | | | | | | |
| 4.3 | | | | | | | |
| 4.4 | | | | | | | |
| Besondere Werkstoffe · Special materials | | | | | | | |
| 5.1 | | | | | | | |
| 5.2 | | | | | | | |
| 5.3 | | | | | | | |

■ = sehr gut geeignet · very suitable
□ = gut geeignet · suitable

v_c = Schnittgeschwindigkeit · Cutting speed
 f_z = Vorschub pro Zahn · Feed per tooth

- Hochleistungswerkzeug
- Spezielle Geometrie für die Volumenzerspanung von Aluminium
- Vibrationsarme Bearbeitung
- Sehr glatte CRN-Beschichtung
- Innere Kühlschmierstoff-Zufuhr, Austritt radial und axial (ICRA)
- Kurze Schneidenlänge

- High performance tool
- Special geometry for high-volume machining of aluminium
- Low-vibration machining
- Very smooth CRN coating
- Internal coolant supply, radial and axial exit (ICRA)
- Short flute length

W

ICRA

HM

DIN 6535
HA
HB

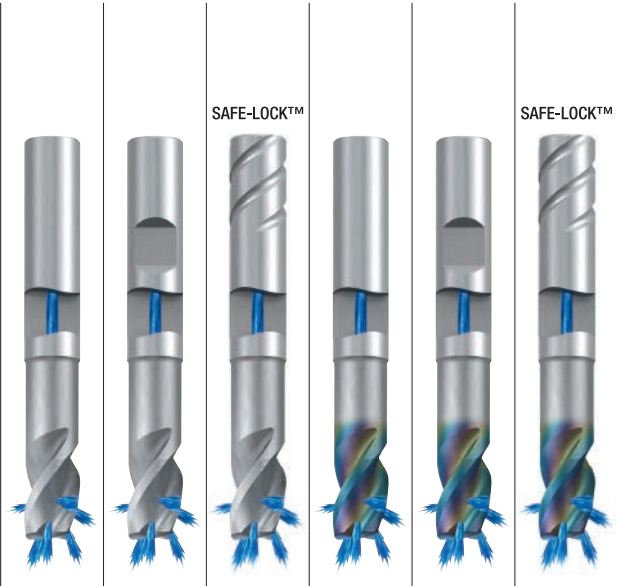
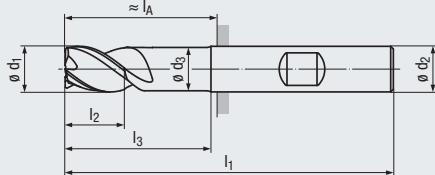
40°

KB x 45°

n max.

3-5°

V_c/f_z
11



Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 5)

- Für Aluminium-Knetlegierungen
- Für Aluminium-Legierungen mit einem Siliziumgehalt bis 7%
- Mit CRN-Beschichtung auch in Kupfer-Legierungen einsetzbar

Applications – material (see page 5)

- For wrought aluminium alloys
- For aluminium alloys with a silicon content of up to 7%
- With CRN coating also for copper alloys

CRN

N 1.1-1.3 1.4

N 1.1-1.4 2.1-2.7

Lange Ausführung · Long design

| Bestell-Code · Order code | | | | | | | | | | | 2889_Z | 2882_Z | 2889_T | 2889RZ | 2882RZ | 2889RT |
|---------------------------|----------------|----------------|----------------|------------------|------------------------|----------------|--|------|---------------|------------------|--------|--------|--------|--------|--------|--------|
| ø d ₁ | l ₂ | l ₃ | l ₁ | ø d ₃ | ø d ₂ h5 | l _A | n _{max.} ²⁾ min ⁻¹ | KB | Z (Flutes) | Dimens.- Code | | | | | | |
| 6 1) -0,02 | 8 | 20 | 57 | 5,6 | 6 | 21 | 30000 | 0,12 | 3 | .006 | ● | ● | ○ | ● | ● | ○ |
| 8 -0,04 | 10 | 25 | 63 | 7,6 | 8 | 27 | 25000 | 0,12 | 3 | .008 | ● | ● | ○ | ● | ● | ○ |
| 10 -0,04 | 13 | 30 | 72 | 9,5 | 10 | 32 | 20000 | 0,2 | 3 | .010 | ● | ● | ○ | ● | ● | ○ |
| 12 -0,04 | 15 | 35 | 83 | 11,4 | 12 | 38 | 15000 | 0,2 | 4 | .012 | ● | ● | ○ | ● | ● | ○ |
| 16 -0,04 | 20 | 46 | 96 | 15,2 | 16 | 48 | 12500 | 0,2 | 4 | .016 | ● | ● | ○ | ● | ● | ○ |
| 20 -0,04 | 25 | 58 | 110 | 19 | 20 | 60 | 10000 | 0,3 | 4 | .020 | ● | ● | ○ | ● | ● | ○ |
| 25 -0,04 | 30 | 73 | 125 | 24 | 25 ³⁾ | 75 | 8000 | 0,3 | 4 | .025 | ● | ● | ○ | ● | ● | ○ |

1) Kühlschmierstoffaustritt axial (ICA)
Internal coolant supply, axial exit (ICA)

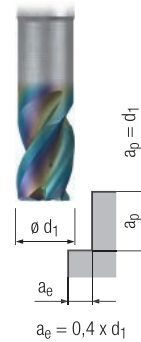
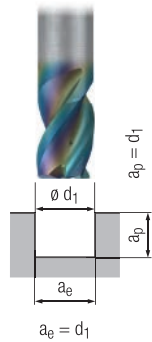
2) Maximal zulässige Drehzahl für Hartmetall-Schaftfräser mit seitlicher Mitnahmefläche nach DIN 6535 HB
Maximum permissible revolution of solid carbide end mills with clamping flat according to DIN 6535 HB

3) Schaftlänge 50 mm
Shank length 50 mm



Hartmetall-Schaftfräser „Aerospace“ – lange Ausführung
Solid carbide end mills “Aerospace” – long design

W



Gültig für · Valid for

- 2882_Z
- 2882RZ
- 2889_T
- 2889_Z
- 2889RT
- 2889RZ

Achtung:
Bei unbeschichteter Ausführung ist die Schnittgeschwindigkeit v_c um 30% zu reduzieren!

Please note:
For uncoated design, please reduce cutting speed v_c by 30%!

| | v_c [m/min] | f_z [mm] | v_c [m/min] | f_z [mm] | | | MMS MQL | |
|---|------------------|---------------|------------------|---------------|--|--------------------------|--------------------------|-------------------------------------|
| Nichteisenwerkstoffe · Non-ferrous materials | | | | | | | | |
| Aluminium-Legierungen · Aluminium alloys | | | | | | | | |
| 1.1 | 420 | 0,008 x d_1 | 760 | 0,011 x d_1 | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.2 | 620 | 0,007 x d_1 | 1120 | 0,010 x d_1 | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.3 | 550 | 0,006 x d_1 | 990 | 0,008 x d_1 | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.4 | 380 | 0,007 x d_1 | 680 | 0,010 x d_1 | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.5 | | | | | | | | |
| 1.6 | | | | | | | | |
| Kupfer-Legierungen · Copper alloys | | | | | | | | |
| 2.1 | 120 | 0,005 x d_1 | 220 | 0,006 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.2 | 120 | 0,005 x d_1 | 220 | 0,006 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.3 | 120 | 0,005 x d_1 | 220 | 0,006 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.4 | 110 | 0,004 x d_1 | 200 | 0,005 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.5 | 110 | 0,004 x d_1 | 200 | 0,005 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.6 | 110 | 0,004 x d_1 | 200 | 0,005 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.7 | 70 | 0,003 x d_1 | 130 | 0,004 x d_1 | | | | <input checked="" type="checkbox"/> |
| 2.8 | | | | | | | | |
| Magnesium-Legierungen · Magnesium alloys | | | | | | | | |
| 3.1 | | | | | | | | |
| 3.2 | | | | | | | | |
| Kunststoffe · Synthetics | | | | | | | | |
| 4.1 | | | | | | | | |
| 4.2 | | | | | | | | |
| 4.3 | | | | | | | | |
| 4.4 | | | | | | | | |
| Besondere Werkstoffe · Special materials | | | | | | | | |
| 5.1 | | | | | | | | |
| 5.2 | | | | | | | | |
| 5.3 | | | | | | | | |

■ = sehr gut geeignet · very suitable
□ = gut geeignet · suitable

v_c = Schnittgeschwindigkeit · Cutting speed
 f_z = Vorschub pro Zahn · Feed per tooth

- Hochleistungswerkzeug
- Spezielle Geometrie für die Volumenzerspanung von Aluminium
- Vibrationsarme Bearbeitung
- Sehr glatte CRN-Beschichtung
- Verschiedene Eckenradien pro Schneidendurchmesser
- Innere Kühlschmierstoff-Zufuhr, Austritt radial und axial (ICRA)
- Kurze Schneidenlänge

- High performance tool
- Special geometry for high-volume machining of aluminium
- Low-vibration machining
- Very smooth CRN coating
- Several corner radii per cutting diameter
- Internal coolant supply, radial and axial exit (ICRA)
- Short flute length

W

ICRA

HM

DIN 6535
HA
HB

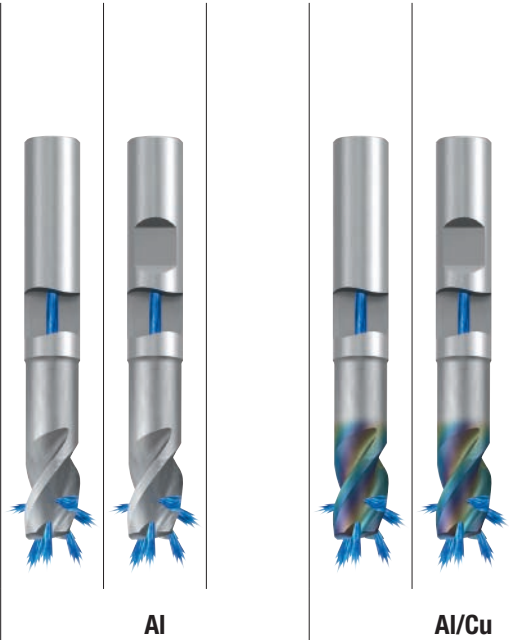
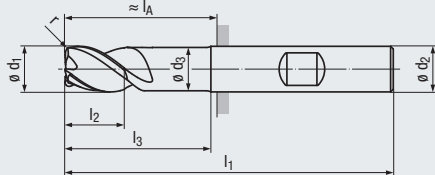
40°

ER

n max.

3-5°

V_c/f_z
13



Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 5)

- Für Aluminium-Knetlegierungen
- Für Aluminium-Legierungen mit einem Siliziumgehalt bis 7%
- Mit CRN-Beschichtung auch in Kupfer-Legierungen einsetzbar

Applications – material (see page 5)

- For wrought aluminium alloys
- For aluminium alloys with a silicon content of up to 7%
- With CRN coating also for copper alloys

N 1.1-1.3 1.4

CRN

N 1.1-1.4 2.1-2.7

Lange Ausführung · Long design

Eckenradius · Corner radius

| Bestell-Code · Order code | | | | | | | | | | | 2891_Z | 2884_Z | 2891RZ | 2884RZ |
|---------------------------|-----|----------------|----------------|----------------|------------------|------------------------------------|----------------|--|---------------|------------------|--------|--------|--------|--------|
| ∅ d ₁ -0,04 | r | l ₂ | l ₃ | l ₁ | ∅ d ₃ | ∅ d ₂ h ₅ | l _A | n _{max.} ²⁾ min ⁻¹ | Z (Flutes) | Dimens.- Code | | | | |
| 12 | 2 | 15 | 35 | 83 | 11,4 | 12 | 38 | 15000 | 4 | .012020 | ● | ● | ● | ● |
| 12 | 2,5 | 15 | 35 | 83 | 11,4 | 12 | 38 | 15000 | 4 | .012025 | ● | ● | ● | ● |
| 12 | 3 | 15 | 35 | 83 | 11,4 | 12 | 38 | 15000 | 4 | .012030 | ● | ● | ● | ● |
| 12 | 4 | 15 | 35 | 83 | 11,4 | 12 | 38 | 15000 | 4 | .012040 | ● | ● | ● | ● |
| 16 | 2 | 20 | 46 | 96 | 15,2 | 16 | 48 | 12500 | 4 | .016020 | ● | ● | ● | ● |
| 16 | 2,5 | 20 | 46 | 96 | 15,2 | 16 | 48 | 12500 | 4 | .016025 | ● | ● | ● | ● |
| 16 | 3 | 20 | 46 | 96 | 15,2 | 16 | 48 | 12500 | 4 | .016030 | ● | ● | ● | ● |
| 16 | 4 | 20 | 46 | 96 | 15,2 | 16 | 48 | 12500 | 4 | .016040 | ● | ● | ● | ● |
| 20 | 2 | 25 | 58 | 110 | 19 | 20 | 60 | 10000 | 4 | .020020 | ● | ● | ● | ● |
| 20 | 2,5 | 25 | 58 | 110 | 19 | 20 | 60 | 10000 | 4 | .020025 | ● | ● | ● | ● |
| 20 | 3 | 25 | 58 | 110 | 19 | 20 | 60 | 10000 | 4 | .020030 | ● | ● | ● | ● |
| 20 | 4 | 25 | 58 | 110 | 19 | 20 | 60 | 10000 | 4 | .020040 | ● | ● | ● | ● |
| 25 | 2 | 30 | 73 | 125 | 24 | 25 ³⁾ | 75 | 8000 | 4 | .025020 | ● | ● | ● | ● |
| 25 | 2,5 | 30 | 73 | 125 | 24 | 25 ³⁾ | 75 | 8000 | 4 | .025025 | ● | ● | ● | ● |
| 25 | 3 | 30 | 73 | 125 | 24 | 25 ³⁾ | 75 | 8000 | 4 | .025030 | ● | ● | ● | ● |
| 25 | 4 | 30 | 73 | 125 | 24 | 25 ³⁾ | 75 | 8000 | 4 | .025040 | ● | ● | ● | ● |

Andere Eckenradien auf Anfrage lieferbar
Other corner radii available on request

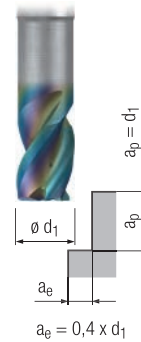
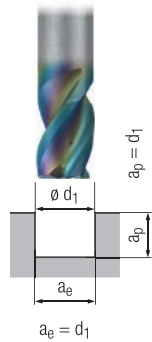
²⁾ Maximal zulässige Drehzahl für Hartmetall-Schaftfräser mit seitlicher Mitnahmefläche nach DIN 6535 HB
Maximum permissible revolution of solid carbide end mills with clamping flat according to DIN 6535 HB

³⁾ Schaftlänge 50 mm
Shank length 50 mm



Hartmetall-Schaftfräser „Aerospace“ – lange Ausführung
Solid carbide end mills “Aerospace” – long design

W



Gültig für · Valid for

- 2884_Z
- 2884RZ
- 2891_Z
- 2891RZ

Achtung:
Bei unbeschichteter Ausführung ist die Schnittgeschwindigkeit v_c um 30% zu reduzieren!

Please note:
For uncoated design, please reduce cutting speed v_c by 30%!

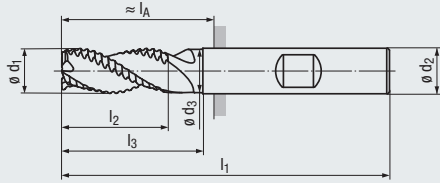
| | v_c [m/min] | f_z [mm] | v_c [m/min] | f_z [mm] | | | MMS MQL | |
|---|------------------|---------------|------------------|---------------|--|--------------------------|--------------------------|-------------------------------------|
| Nichteisenwerkstoffe · Non-ferrous materials | | | | | | | | |
| Aluminium-Legierungen · Aluminium alloys | | | | | | | | |
| 1.1 | 420 | 0,008 x d_1 | 760 | 0,011 x d_1 | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.2 | 620 | 0,007 x d_1 | 1120 | 0,010 x d_1 | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.3 | 550 | 0,006 x d_1 | 990 | 0,008 x d_1 | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.4 | 380 | 0,007 x d_1 | 680 | 0,010 x d_1 | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.5 | | | | | | | | |
| 1.6 | | | | | | | | |
| Kupfer-Legierungen · Copper alloys | | | | | | | | |
| 2.1 | 120 | 0,005 x d_1 | 220 | 0,006 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.2 | 120 | 0,005 x d_1 | 220 | 0,006 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.3 | 120 | 0,005 x d_1 | 220 | 0,006 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.4 | 110 | 0,004 x d_1 | 200 | 0,005 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.5 | 110 | 0,004 x d_1 | 200 | 0,005 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.6 | 110 | 0,004 x d_1 | 200 | 0,005 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.7 | 70 | 0,003 x d_1 | 130 | 0,004 x d_1 | | | | <input checked="" type="checkbox"/> |
| 2.8 | | | | | | | | |
| Magnesium-Legierungen · Magnesium alloys | | | | | | | | |
| 3.1 | | | | | | | | |
| 3.2 | | | | | | | | |
| Kunststoffe · Synthetics | | | | | | | | |
| 4.1 | | | | | | | | |
| 4.2 | | | | | | | | |
| 4.3 | | | | | | | | |
| 4.4 | | | | | | | | |
| Besondere Werkstoffe · Special materials | | | | | | | | |
| 5.1 | | | | | | | | |
| 5.2 | | | | | | | | |
| 5.3 | | | | | | | | |

■ = sehr gut geeignet · very suitable
□ = gut geeignet · suitable

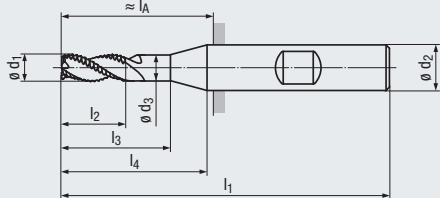
v_c = Schnittgeschwindigkeit · Cutting speed
 f_z = Vorschub pro Zahn · Feed per tooth

- Hochleistungswerkzeug
- Spezielle Geometrie für die Aluminiumzerspanung
- Schneiden zur Mitte

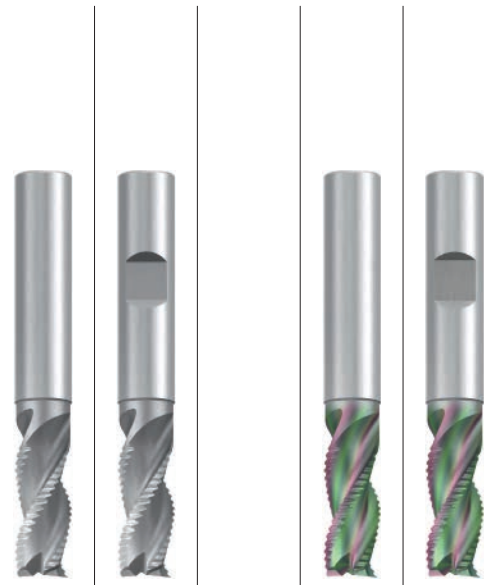
- High performance tool
- Special geometry for the machining of aluminium
- Centre cutting



Design l_4 :



- WR** (Werkzeugradius)
- grob coarse** (Coarse geometry)
- HM** (Hartmetall)
- DIN 6535** (Standards)
 - HA (Hochleistungs-Alu)
 - HB (Hochleistungs-Edelstahl)
- 40°** (Flute angle)
- 45°** (Flute angle)
- 3-5°** (Flute angle)
- v_c/f_z** (Cutting speed/Feed rate)
 - 15 (Value)



AI

Al/Cu

Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 5)

- Für Aluminium-Knetlegierungen
- Für Aluminium-Legierungen mit einem Siliziumgehalt bis 7%
- Mit GLT-Beschichtung auch in Kupfer-Legierungen einsetzbar

Applications – material (see page 5)

- For wrought aluminium alloys
- For aluminium alloys with a silicon content of up to 7%
- With GLT coating also for copper alloys

GLT

N 1.1-1.3 1.4

N 1.1-1.4 2.1-2.7

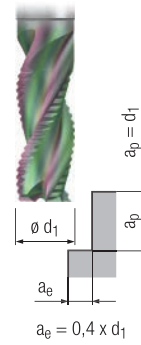
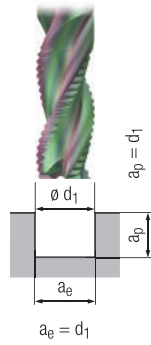
DIN 6527 – Lange Ausführung · Long design

| Bestell-Code · Order code | | | | | | | | | | 2548 | 2549 | 2548K | 2549K |
|---------------------------|-------|-------|-------|-------------------|-------|-------------------------|-------|---------------|------------------|------|------|-------|-------|
| $\varnothing d_1$ h11 | l_2 | l_3 | l_1 | $\varnothing d_3$ | l_4 | $\varnothing d_2$ h6 | l_A | Z (Flutes) | Dimens.- Code | | | | |
| 3 | 7 | 14 | 57 | 2,9 | 20 | 6 | 21 | 3 | .003 | ● | ● | ● | ● |
| 4 | 8 | 18 | 57 | 3,8 | 20 | 6 | 21 | 3 | .004 | ● | ● | ● | ● |
| 5 | 10 | 19 | 57 | 4,8 | 20 | 6 | 21 | 3 | .005 | ● | ● | ● | ● |
| 6 | 13 | 20 | 57 | 5,8 | – | 6 | 21 | 3 | .006 | ● | ● | ● | ● |
| 8 | 19 | 25 | 63 | 7,7 | – | 8 | 34 | 3 | .008 | ● | ● | ● | ● |
| 10 | 22 | 30 | 72 | 9,5 | – | 10 | 32 | 3 | .010 | ● | ● | ● | ● |
| 12 | 26 | 35 | 83 | 11,5 | – | 12 | 38 | 3 | .012 | ● | ● | ● | ● |
| 16 | 32 | 40 | 92 | 15,5 | – | 16 | 44 | 3 | .016 | ● | ● | ● | ● |
| 20 | 38 | 50 | 104 | 19,5 | – | 20 | 54 | 3 | .020 | ● | ● | ● | ● |



Hartmetall-Schaftfräser – lange Ausführung
Solid carbide end mills – long design

WR



Gültig für · Valid for

- 2548
- 2548K
- 2549
- 2549K

Achtung:
Bei unbeschichteter Ausführung ist die Schnittgeschwindigkeit v_c um 30% zu reduzieren!

Please note:
For uncoated design, please reduce cutting speed v_c by 30%!

| v_c [m/min] | f_z [mm] | v_c [m/min] | f_z [mm] | | | MMS MQL | |
|------------------|---------------|------------------|---------------|--|--|------------|--|
|------------------|---------------|------------------|---------------|--|--|------------|--|

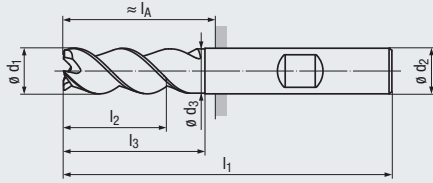
| Nichteisenwerkstoffe · Non-ferrous materials | | | | | | | |
|--|-----|---------------|-----|---------------|--|--------------------------|--------------------------|
| Aluminium-Legierungen · Aluminium alloys | | | | | | | |
| 1.1 | 300 | 0,009 x d_1 | 420 | 0,011 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.2 | 430 | 0,008 x d_1 | 620 | 0,010 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.3 | 385 | 0,007 x d_1 | 550 | 0,008 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.4 | 270 | 0,008 x d_1 | 380 | 0,010 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> |
| 1.5 | | | | | | | |
| 1.6 | | | | | | | |
| Kupfer-Legierungen · Copper alloys | | | | | | | |
| 2.1 | 100 | 0,005 x d_1 | 160 | 0,006 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.2 | 100 | 0,005 x d_1 | 160 | 0,006 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.3 | 100 | 0,005 x d_1 | 160 | 0,006 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.4 | 80 | 0,004 x d_1 | 140 | 0,005 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.5 | 80 | 0,004 x d_1 | 140 | 0,005 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.6 | 80 | 0,004 x d_1 | 140 | 0,005 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.7 | 60 | 0,003 x d_1 | 100 | 0,004 x d_1 | | <input type="checkbox"/> | <input type="checkbox"/> |
| 2.8 | | | | | | | |
| Magnesium-Legierungen · Magnesium alloys | | | | | | | |
| 3.1 | | | | | | | |
| 3.2 | | | | | | | |
| Kunststoffe · Synthetics | | | | | | | |
| 4.1 | | | | | | | |
| 4.2 | | | | | | | |
| 4.3 | | | | | | | |
| 4.4 | | | | | | | |
| Besondere Werkstoffe · Special materials | | | | | | | |
| 5.1 | | | | | | | |
| 5.2 | | | | | | | |
| 5.3 | | | | | | | |

■ = sehr gut geeignet · very suitable
□ = gut geeignet · suitable

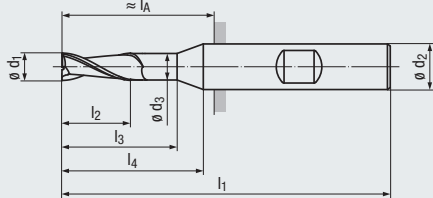
v_c = Schnittgeschwindigkeit · Cutting speed
 f_z = Vorschub pro Zahn · Feed per tooth

- Hochleistungswerkzeug
- Spezielle Geometrie für die Aluminiumzerspanung
- Vibrationsarme Bearbeitung
- Mit 2 und 3 Schneiden
- Schneiden zur Mitte

- High performance tool
- Special geometry for the machining of aluminium
- Low-vibration machining
- With 2 and 3 flutes
- Centre cutting



Design l_4 :



W

HM

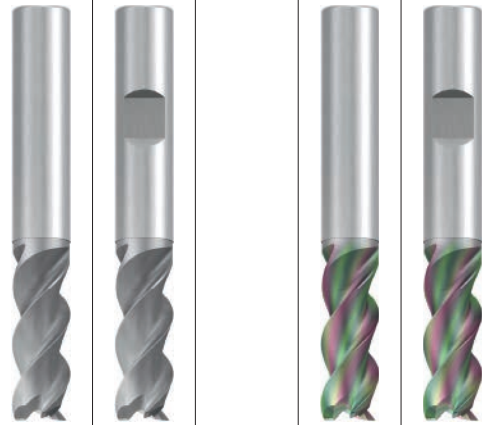
DIN 6535
HA
HB

Z2
45°

Z3
38-40°

KB x 45°

v_c/f_z
17



AI

AI/Cu

Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 5)

- Für Aluminium-Knetlegierungen
- Für Aluminium-Legierungen mit einem Siliziumgehalt bis 7%
- Mit GLT-Beschichtung auch in Kupfer-Legierungen einsetzbar
- Zum Bohrfräsen geeignet
- Zum Schruppen und Schlichten geeignet

Applications – material (see page 5)

- For wrought aluminium alloys
- For aluminium alloys with a silicon content of up to 7%
- With GLT coating also for copper alloys
- Suitable for z-axis milling
- Suitable for roughing and finishing

GLT

N 1.1-1.3 1.4

N 1.1-1.4 2.1-2.7

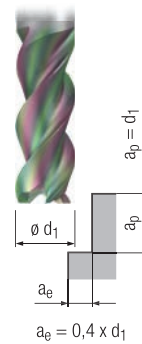
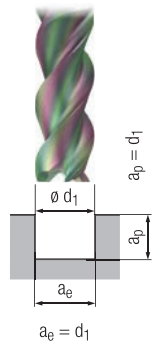
DIN 6527 – Lange Ausführung · Long design

| Bestell-Code · Order code | | | | | | | | | | | 2544 | 2545 | 2544K | 2545K |
|---------------------------|-------|-------|-------|-------------------|-------|-------------------------|-------------|-------|---------------|------------------|------|------|-------|-------|
| $\varnothing d_1$ h10 | l_2 | l_3 | l_1 | $\varnothing d_3$ | l_4 | $\varnothing d_2$ h6 | l_A h6 | KB | Z (Flutes) | Dimens.- Code | | | | |
| 2 | 6 | 10 | 57 | 1,9 | 20 | 6 | 21 | 0,06 | 2 | .002 | ● | ● | ● | ● |
| 3 | 7 | 14 | 57 | 2,9 | 20 | 6 | 21 | 0,1 | 2 | .003 | ● | ● | ● | ● |
| 4 | 8 | 18 | 57 | 3,8 | 20 | 6 | 21 | 0,1 | 2 | .004 | ● | ● | ● | ● |
| 5 | 10 | 19 | 57 | 4,8 | 20 | 6 | 21 | 0,15 | 2 | .005 | ● | ● | ● | ● |
| 6 | 13 | 20 | 57 | 5,8 | – | 6 | 21 | 0,125 | 3 | .006 | ● | ● | ● | ● |
| 8 | 19 | 25 | 63 | 7,7 | – | 8 | 34 | 0,125 | 3 | .008 | ● | ● | ● | ● |
| 10 | 22 | 30 | 72 | 9,5 | – | 10 | 32 | 0,2 | 3 | .010 | ● | ● | ● | ● |
| 12 | 26 | 35 | 83 | 11,5 | – | 12 | 38 | 0,2 | 3 | .012 | ● | ● | ● | ● |
| 16 | 32 | 40 | 92 | 15,5 | – | 16 | 44 | 0,2 | 3 | .016 | ● | ● | ● | ● |
| 20 | 38 | 50 | 104 | 19,5 | – | 20 | 54 | 0,3 | 3 | .020 | ● | ● | ● | ● |



Hartmetall-Schaftfräser – lange Ausführung
Solid carbide end mills – long design

W



Gültig für · Valid for

- 2544
- 2544K
- 2545
- 2545K

Achtung:
Bei unbeschichteter Ausführung ist die Schnittgeschwindigkeit v_c um 30% zu reduzieren!

Please note:
For uncoated design, please reduce cutting speed v_c by 30%!

| v_c [m/min] | f_z [mm] | v_c [m/min] | f_z [mm] | | | MMS MQL | |
|------------------|---------------|------------------|---------------|--|--|------------|--|
|------------------|---------------|------------------|---------------|--|--|------------|--|

| Nichteisenwerkstoffe · Non-ferrous materials | | | | | | | |
|--|-----|--------------------|-----|--------------------|--|---|-----|
| Aluminium-Legierungen · Aluminium alloys | | | | | | | |
| 1.1 | 300 | $0,006 \times d_1$ | 420 | $0,011 \times d_1$ | | | □ ■ |
| 1.2 | 430 | $0,005 \times d_1$ | 620 | $0,010 \times d_1$ | | | □ ■ |
| 1.3 | 385 | $0,005 \times d_1$ | 550 | $0,008 \times d_1$ | | | □ ■ |
| 1.4 | 270 | $0,005 \times d_1$ | 380 | $0,010 \times d_1$ | | | □ ■ |
| 1.5 | | | | | | | |
| 1.6 | | | | | | | |
| Kupfer-Legierungen · Copper alloys | | | | | | | |
| 2.1 | 100 | $0,005 \times d_1$ | 160 | $0,006 \times d_1$ | | □ | □ ■ |
| 2.2 | 100 | $0,005 \times d_1$ | 160 | $0,006 \times d_1$ | | □ | □ ■ |
| 2.3 | 100 | $0,005 \times d_1$ | 160 | $0,006 \times d_1$ | | □ | □ ■ |
| 2.4 | 80 | $0,004 \times d_1$ | 140 | $0,005 \times d_1$ | | □ | □ ■ |
| 2.5 | 80 | $0,004 \times d_1$ | 140 | $0,005 \times d_1$ | | □ | □ ■ |
| 2.6 | 80 | $0,004 \times d_1$ | 140 | $0,005 \times d_1$ | | □ | □ ■ |
| 2.7 | 60 | $0,003 \times d_1$ | 100 | $0,004 \times d_1$ | | | □ ■ |
| 2.8 | | | | | | | |
| Magnesium-Legierungen · Magnesium alloys | | | | | | | |
| 3.1 | | | | | | | |
| 3.2 | | | | | | | |
| Kunststoffe · Synthetics | | | | | | | |
| 4.1 | | | | | | | |
| 4.2 | | | | | | | |
| 4.3 | | | | | | | |
| 4.4 | | | | | | | |
| Besondere Werkstoffe · Special materials | | | | | | | |
| 5.1 | | | | | | | |
| 5.2 | | | | | | | |
| 5.3 | | | | | | | |

■ = sehr gut geeignet · very suitable
□ = gut geeignet · suitable

v_c = Schnittgeschwindigkeit · Cutting speed
 f_z = Vorschub pro Zahn · Feed per tooth

- Hochleistungswerkzeug
- Spezielle Geometrie für die Aluminiumzerspanung
- Vibrationsarme Bearbeitung
- Verschiedene Eckenradien pro Schneidendurchmesser
- Schneiden zur Mitte

- High performance tool
- Special geometry for the machining of aluminium
- Low-vibration machining
- Several corner radii per cutting diameter
- Centre cutting

W

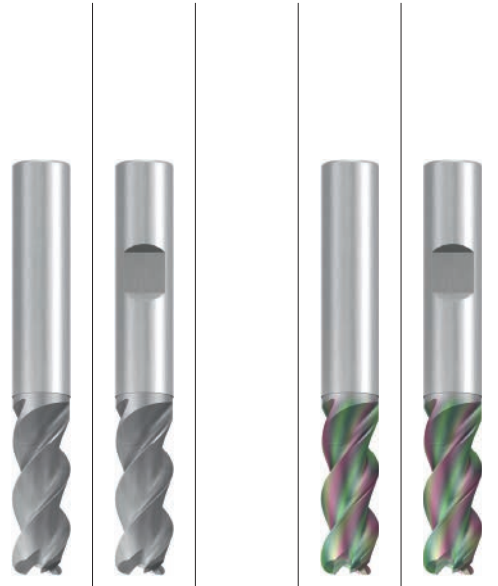
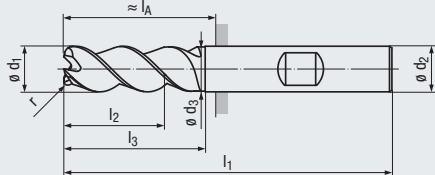
HM

DIN 6535
HA
HB

38-40°

ER

V_c/f_z
19



AI

Al/Cu

Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 5)

- Für Aluminium-Knetlegierungen
- Für Aluminium-Legierungen mit einem Siliziumgehalt bis 7%
- Mit GLT-Beschichtung auch in Kupfer-Legierungen einsetzbar
- Zum Bohrfräsen geeignet
- Zum Schruppen und Schlichten geeignet

Applications – material (see page 5)

- For wrought aluminium alloys
- For aluminium alloys with a silicon content of up to 7%
- With GLT coating also for copper alloys
- Suitable for z-axis milling
- Suitable for roughing and finishing

GLT

N 1.1-1.3 1.4

N 1.1-1.4 2.1-2.7

DIN 6527 – Lange Ausführung · Long design

Eckenradius · Corner radius

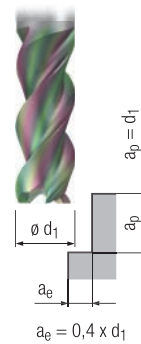
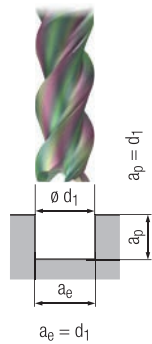
| Bestell-Code · Order code | | | | | | | | | | 2546 | 2547 | 2546K | 2547K |
|---------------------------|------------|----------------|----------------|----------------|------------------|------------------------|----------------|---------------|------------------|------|------|-------|-------|
| ∅ d ₁ h10 | r ±0,02 | l ₂ | l ₃ | l ₁ | ∅ d ₃ | ∅ d ₂ h6 | l _A | Z (Flutes) | Dimens.- Code | | | | |
| 6 | 0,5 | 13 | 20 | 57 | 5,8 | 6 | 21 | 3 | .006005 | ● | ● | ● | ● |
| 6 | 1 | 13 | 20 | 57 | 5,8 | 6 | 21 | 3 | .006010 | ● | ● | ● | ● |
| 8 | 1 | 19 | 25 | 63 | 7,7 | 8 | 27 | 3 | .008010 | ● | ● | ● | ● |
| 8 | 1,5 | 19 | 25 | 63 | 7,7 | 8 | 27 | 3 | .008015 | ● | ● | ● | ● |
| 8 | 2 | 19 | 25 | 63 | 7,7 | 8 | 27 | 3 | .008020 | ● | ● | ● | ● |
| 10 | 1 | 22 | 30 | 72 | 9,5 | 10 | 32 | 3 | .010010 | ● | ● | ● | ● |
| 10 | 1,5 | 22 | 30 | 72 | 9,5 | 10 | 32 | 3 | .010015 | ● | ● | ● | ● |
| 10 | 2 | 22 | 30 | 72 | 9,5 | 10 | 32 | 3 | .010020 | ● | ● | ● | ● |
| 12 | 1 | 26 | 35 | 83 | 11,5 | 12 | 38 | 3 | .012010 | ● | ● | ● | ● |
| 12 | 1,5 | 26 | 35 | 83 | 11,5 | 12 | 38 | 3 | .012015 | ● | ● | ● | ● |
| 12 | 2 | 26 | 35 | 83 | 11,5 | 12 | 38 | 3 | .012020 | ● | ● | ● | ● |
| 12 | 2,5 | 26 | 35 | 83 | 11,5 | 12 | 38 | 3 | .012025 | ● | ● | ● | ● |
| 12 | 3 | 26 | 35 | 83 | 11,5 | 12 | 38 | 3 | .012030 | ● | ● | ● | ● |
| 12 | 4 | 26 | 35 | 83 | 11,5 | 12 | 38 | 3 | .012040 | ● | ● | ● | ● |
| 16 | 1 | 32 | 40 | 92 | 15,5 | 16 | 44 | 3 | .016010 | ● | ● | ● | ● |
| 16 | 1,5 | 32 | 40 | 92 | 15,5 | 16 | 44 | 3 | .016015 | ● | ● | ● | ● |
| 16 | 2 | 32 | 40 | 92 | 15,5 | 16 | 44 | 3 | .016020 | ● | ● | ● | ● |
| 16 | 2,5 | 32 | 40 | 92 | 15,5 | 16 | 44 | 3 | .016025 | ● | ● | ● | ● |
| 16 | 3 | 32 | 40 | 92 | 15,5 | 16 | 44 | 3 | .016030 | ● | ● | ● | ● |
| 16 | 4 | 32 | 40 | 92 | 15,5 | 16 | 44 | 3 | .016040 | ● | ● | ● | ● |
| 20 | 1 | 38 | 50 | 104 | 19,5 | 20 | 54 | 3 | .020010 | ● | ● | ● | ● |
| 20 | 1,5 | 38 | 50 | 104 | 19,5 | 20 | 54 | 3 | .020015 | ● | ● | ● | ● |
| 20 | 2 | 38 | 50 | 104 | 19,5 | 20 | 54 | 3 | .020020 | ● | ● | ● | ● |
| 20 | 2,5 | 38 | 50 | 104 | 19,5 | 20 | 54 | 3 | .020025 | ● | ● | ● | ● |
| 20 | 3 | 38 | 50 | 104 | 19,5 | 20 | 54 | 3 | .020030 | ● | ● | ● | ● |
| 20 | 4 | 38 | 50 | 104 | 19,5 | 20 | 54 | 3 | .020040 | ● | ● | ● | ● |

Andere Eckenradien auf Anfrage lieferbar
Other corner radii available on request



Hartmetall-Schaftfräser – lange Ausführung
Solid carbide end mills – long design

W



Gültig für · Valid for

- 2546
- 2546K
- 2547
- 2547K

Achtung:
Bei unbeschichteter Ausführung ist die Schnittgeschwindigkeit v_c um 30% zu reduzieren!

Please note:
For uncoated design, please reduce cutting speed v_c by 30%!

| v_c [m/min] | f_z [mm] | v_c [m/min] | f_z [mm] | | | MMS MQL | |
|------------------|---------------|------------------|---------------|--|--|------------|--|
|------------------|---------------|------------------|---------------|--|--|------------|--|

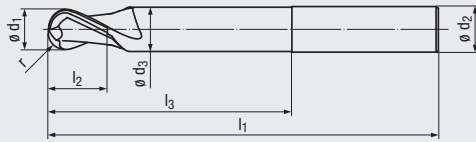
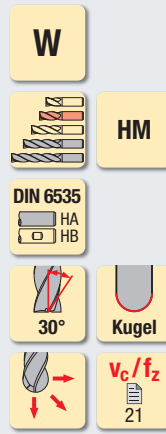
| Nichteisenwerkstoffe · Non-ferrous materials | | | | | | | |
|--|-----|--------------------|-----|--------------------|--|---|-----|
| Aluminium-Legierungen · Aluminium alloys | | | | | | | |
| 1.1 | 300 | $0,006 \times d_1$ | 420 | $0,011 \times d_1$ | | | □ ■ |
| 1.2 | 430 | $0,005 \times d_1$ | 620 | $0,010 \times d_1$ | | | □ ■ |
| 1.3 | 385 | $0,005 \times d_1$ | 550 | $0,008 \times d_1$ | | | □ ■ |
| 1.4 | 270 | $0,005 \times d_1$ | 380 | $0,010 \times d_1$ | | | □ ■ |
| 1.5 | | | | | | | |
| 1.6 | | | | | | | |
| Kupfer-Legierungen · Copper alloys | | | | | | | |
| 2.1 | 100 | $0,005 \times d_1$ | 160 | $0,006 \times d_1$ | | □ | □ ■ |
| 2.2 | 100 | $0,005 \times d_1$ | 160 | $0,006 \times d_1$ | | □ | □ ■ |
| 2.3 | 100 | $0,005 \times d_1$ | 160 | $0,006 \times d_1$ | | □ | □ ■ |
| 2.4 | 80 | $0,004 \times d_1$ | 140 | $0,005 \times d_1$ | | □ | □ ■ |
| 2.5 | 80 | $0,004 \times d_1$ | 140 | $0,005 \times d_1$ | | □ | □ ■ |
| 2.6 | 80 | $0,004 \times d_1$ | 140 | $0,005 \times d_1$ | | □ | □ ■ |
| 2.7 | 60 | $0,003 \times d_1$ | 100 | $0,004 \times d_1$ | | | □ ■ |
| 2.8 | | | | | | | |
| Magnesium-Legierungen · Magnesium alloys | | | | | | | |
| 3.1 | | | | | | | |
| 3.2 | | | | | | | |
| Kunststoffe · Synthetics | | | | | | | |
| 4.1 | | | | | | | |
| 4.2 | | | | | | | |
| 4.3 | | | | | | | |
| 4.4 | | | | | | | |
| Besondere Werkstoffe · Special materials | | | | | | | |
| 5.1 | | | | | | | |
| 5.2 | | | | | | | |
| 5.3 | | | | | | | |

■ = sehr gut geeignet · very suitable
□ = gut geeignet · suitable

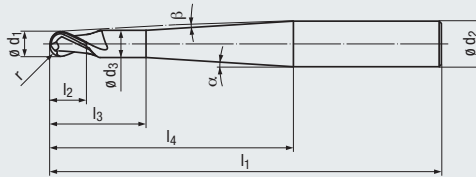
v_c = Schnittgeschwindigkeit · Cutting speed
 f_z = Vorschub pro Zahn · Feed per tooth

- Hochleistungswerkzeug
- Patentierte Querschneide
- Scharfe Schneidkanten
- Sehr glatte CRN-Beschichtung
- 3 Baulängen verfügbar

- High performance tool
- Patented chisel edge
- Sharp cutting edges
- Very smooth CRN coating
- 3 lengths available



Design I₄:



Al



Al/Cu

Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 5)

- Für Aluminium-Knetlegierungen
- Für Aluminium-Legierungen mit einem Siliziumgehalt bis 7%
- Mit CRN-Beschichtung auch in Kupfer-Legierungen einsetzbar

Applications – material (see page 5)

- For wrought aluminium alloys
- For aluminium alloys with a silicon content of up to 7%
- With CRN coating also for copper alloys

CRN

N 1.1-1.3
N 4.1-4.2 5.3

N 1.1-1.4
N 2.1-2.3 2.4-2.8
N 3.1-4.4, 5.3

Kurze Ausführung · Short design

Bestell-Code · Order code

| $\varnothing d_1$ $\pm 0,01$ | r $\pm 0,005$ | l_2 | l_3 | l_1 | $\varnothing d_3$ | l_4 | $\varnothing d_2$ h5 | α | β | Z (Flutes) | Dimens.- Code | 1921 | 1921R |
|---------------------------------|------------------|-------|-------|-------|-------------------|-------|-------------------------|----------|---------|---------------|------------------|------|-------|
| 0,5 | 0,25 | 1 | 2 | 38 | 0,45 | 9 | 3 | 10° | 8° | 2 | .0005 | ● | ● |
| 0,5 | 0,25 | 1 | 2 | 57 | 0,45 | 20 | 6 | 10° | 8,5° | 2 | .000506 | ● | ● |
| 1 | 0,5 | 2 | 4 | 38 | 0,95 | 9 | 3 | 12,5° | 6,5° | 2 | .001 | ● | ● |
| 1 | 0,5 | 2 | 4 | 57 | 0,95 | 20 | 6 | 10° | 8° | 2 | .00106 | ● | ● |
| 1,5 | 0,75 | 2,5 | 7,5 | 38 | 1,4 | 9 | 3 | 32° | 5° | 2 | .0015 | ● | ● |
| 1,5 | 0,75 | 2,5 | 7,5 | 57 | 1,4 | 20 | 6 | 12,5° | 7° | 2 | .001506 | ● | ● |
| 2 | 1 | 3 | 8 | 38 | 1,8 | 9 | 3 | 31° | 3,5° | 2 | .002 | ● | ● |
| 2 | 1 | 3 | 8 | 57 | 1,8 | 20 | 6 | 12° | 6,5° | 2 | .00206 | ● | ● |
| 3 | 1,5 | 3,5 | 10 | 57 | 2,8 | 20 | 6 | 11,5° | 5° | 2 | .003 | ● | ● |
| 4 | 2 | 4 | 12 | 57 | 3,8 | 20 | 6 | 11° | 3,5° | 2 | .004 | ● | ● |
| 5 | 2,5 | 5 | 14 | 57 | 4,7 | 20 | 6 | 10° | 2° | 2 | .005 | ● | ● |
| 6 | 3 | 6 | 20 | 57 | 5,6 | – | 6 | – | – | 2 | .006 | ● | ● |
| 8 | 4 | 7 | 25 | 63 | 7,6 | – | 8 | – | – | 2 | .008 | ● | ● |
| 10 | 5 | 8 | 30 | 72 | 9,6 | – | 10 | – | – | 2 | .010 | ● | ● |
| 12 | 6 | 10 | 35 | 83 | 11,5 | – | 12 | – | – | 2 | .012 | ● | ● |

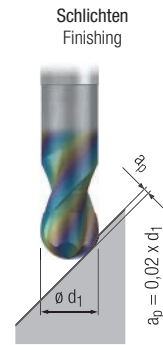
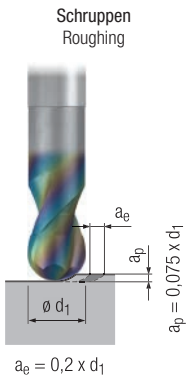


Werkzeug mit seitlicher Mitnahmefläche: Bestell-Code 1922/1922R
Tool with side-lock clamping: order code 1922/1922R



Hartmetall-Kugelfräser – kurze, lange und extra lange Ausführung
Solid carbide ball nose end mills – short, long and extra long design

W



Gültig für · Valid for
1921
1921R

Achtung:
Bei unbeschichteter Ausführung ist die Schnittgeschwindigkeit v_c um 30% zu reduzieren!

Please note:
For uncoated design, please reduce cutting speed v_c by 30%!



| | v_c [m/min] | f_z [mm] | v_c [m/min] | f_z [mm] | | | | |
|---|------------------|--------------------|------------------|--------------------|--------------------------|-------------------------------------|--------------------------|-------------------------------------|
| Nichteisenwerkstoffe · Non-ferrous materials | | | | | | | | |
| Aluminium-Legierungen · Aluminium alloys | | | | | | | | |
| 1.1 | 900 | $0,022 \times d_1$ | 1200 | $0,016 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.2 | 900 | $0,020 \times d_1$ | 1200 | $0,014 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.3 | 900 | $0,017 \times d_1$ | 1200 | $0,012 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.4 | 600 | $0,020 \times d_1$ | 800 | $0,014 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.5 | | | | | | | | |
| 1.6 | | | | | | | | |
| Kupfer-Legierungen · Copper alloys | | | | | | | | |
| 2.1 | 200 | $0,014 \times d_1$ | 260 | $0,010 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.2 | 200 | $0,014 \times d_1$ | 260 | $0,010 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.3 | 200 | $0,014 \times d_1$ | 260 | $0,010 \times d_1$ | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.4 | 160 | $0,011 \times d_1$ | 220 | $0,008 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.5 | 160 | $0,011 \times d_1$ | 220 | $0,008 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.6 | 160 | $0,011 \times d_1$ | 220 | $0,008 \times d_1$ | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.7 | 100 | $0,008 \times d_1$ | 140 | $0,006 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.8 | 100 | $0,008 \times d_1$ | 140 | $0,006 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Magnesium-Legierungen · Magnesium alloys | | | | | | | | |
| 3.1 | 450 | $0,025 \times d_1$ | 600 | $0,018 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 3.2 | 450 | $0,020 \times d_1$ | 600 | $0,014 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Kunststoffe · Synthetics | | | | | | | | |
| 4.1 | 350 | $0,021 \times d_1$ | 450 | $0,015 \times d_1$ | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 4.2 | 500 | $0,021 \times d_1$ | 650 | $0,015 \times d_1$ | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 4.3 | 200 | $0,017 \times d_1$ | 250 | $0,012 \times d_1$ | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 4.4 | 140 | $0,017 \times d_1$ | 180 | $0,012 \times d_1$ | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Besondere Werkstoffe · Special materials | | | | | | | | |
| 5.1 | | | | | | | | |
| 5.2 | | | | | | | | |
| 5.3 | 220 | $0,017 \times d_1$ | 300 | $0,012 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | | <input checked="" type="checkbox"/> |

■ = sehr gut geeignet · very suitable
□ = gut geeignet · suitable

v_c = Schnittgeschwindigkeit · Cutting speed
 f_z = Vorschub pro Zahn · Feed per tooth

- Hochleistungswerkzeug
- Patentierte Querschnitte
- Scharfe Schneidkanten
- Sehr glatte CRN-Beschichtung
- 3 Baulängen verfügbar

- High performance tool
- Patented chisel edge
- Sharp cutting edges
- Very smooth CRN coating
- 3 lengths available

W

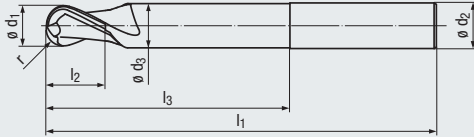
HM

DIN 6535
HA
HB

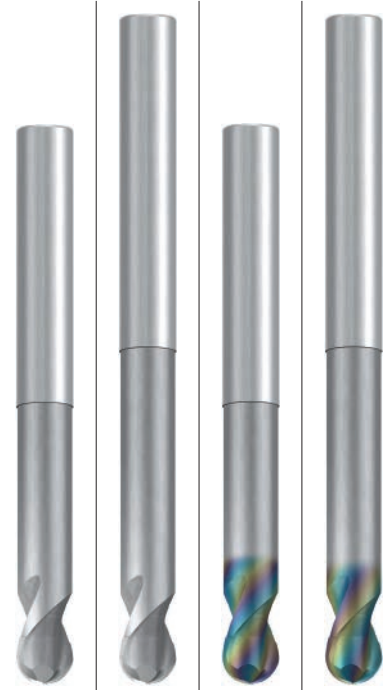
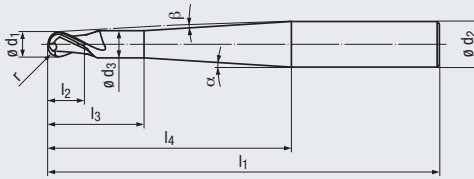
30°

Kugel

v_c / f_z
23



Design I₄:



Al

Al/Cu

Beschichtung · Coating

CRN

Einsatzgebiete – Material (siehe Seite 5)

- Für Aluminium-Knetlegierungen
- Für Aluminium-Legierungen mit einem Siliziumgehalt bis 7%
- Mit CRN-Beschichtung auch in Kupfer-Legierungen einsetzbar

Applications – material (see page 5)

- For wrought aluminium alloys
- For aluminium alloys with a silicon content of up to 7%
- With CRN coating also for copper alloys

| | | | |
|---|--------------|-----|-------------------|
| N | 1.1-1.3 | N | 1.1-1.4 |
| N | 4.1-4.2 | 5.3 | N 2.1-2.3 2.4-2.8 |
| N | 3.1-4.4, 5.3 | | |

Lange Ausführung · Long design

Bestell-Code · Order code

2830

2830R

| $\varnothing d_1$ $\pm 0,01$ | r $\pm 0,005$ | l_2 | l_3 | l_1 | $\varnothing d_3$ | l_4 | $\varnothing d_2$ h5 | α | β | Z (Flutes) | Dimens.- Code | | | |
|---------------------------------|------------------|-------|-------|-------|-------------------|-------|-------------------------|----------|---------|---------------|------------------|---|--|---|
| 8 | 4 | 7 | 40 | 90 | 7,6 | – | 8 | – | – | 2 | .008 | ● | | ● |
| 10 | 5 | 8 | 50 | 100 | 9,6 | – | 10 | – | – | 2 | .010 | ● | | ● |
| 12 | 6 | 10 | 65 | 120 | 11,5 | – | 12 | – | – | 2 | .012 | ● | | ● |
| 16 | 8 | 12 | 80 | 140 | 15,5 | – | 16 | – | – | 2 | .016 | ● | | ● |

Extra lange Ausführung · Extra long design

Bestell-Code · Order code

1943

1943R

| $\varnothing d_1$ $\pm 0,01$ | r $\pm 0,005$ | l_2 | l_3 | l_1 | $\varnothing d_3$ | l_4 | $\varnothing d_2$ h5 | α | β | Z (Flutes) | Dimens.- Code | | | |
|---------------------------------|------------------|-------|-------|-------|-------------------|-------|-------------------------|----------|---------|---------------|------------------|---|--|---|
| 3 | 1,5 | 3,5 | 12 | 80 | 2,8 | 40 | 6 | 3,5° | 2,5° | 2 | .003 | ● | | ● |
| 4 | 2 | 4 | 20 | 80 | 3,8 | 40 | 6 | 4° | 1,5° | 2 | .004 | ● | | ● |
| 5 | 2,5 | 5 | 10 | 100 | 4,7 | 40 | 6 | 1,5° | 1° | 2 | .005 | ● | | ● |
| 6 | 3 | 6 | 40 | 100 | 5,6 | – | 6 | – | – | 2 | .006 | ● | | ● |
| 8 | 4 | 7 | 60 | 120 | 7,6 | – | 8 | – | – | 2 | .008 | ● | | ● |
| 10 | 5 | 8 | 60 | 120 | 9,6 | – | 10 | – | – | 2 | .010 | ● | | ● |
| 12 | 6 | 10 | 70 | 160 | 11,5 | – | 12 | – | – | 2 | .012 | ● | | ● |

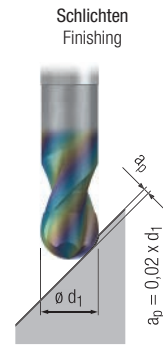
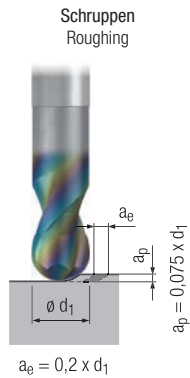


Werkzeug mit seitlicher Mitnahmefläche: Bestell-Code 2831/2831R (lange Ausführung) und 1843/1843R (extra lange Ausführung)
Tool with side-lock clamping: order code 2831/2831R (long design) and 1843/1843R (extra long design)



Hartmetall-Kugelfräser – kurze, lange und extra lange Ausführung
Solid carbide ball nose end mills – short, long and extra long design

W



Gültig für · Valid for

- 1943
- 1943R
- 2830
- 2830R

Achtung:
Bei unbeschichteter Ausführung ist die Schnittgeschwindigkeit v_c um 30% zu reduzieren!

Please note:
For uncoated design, please reduce cutting speed v_c by 30%!



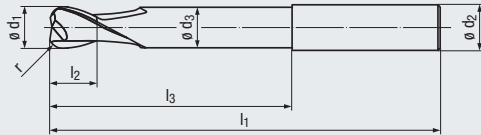
| | v_c [m/min] | f_z [mm] | v_c [m/min] | f_z [mm] | | | MMS MQL | |
|---|------------------|--------------------|------------------|--------------------|--------------------------|-------------------------------------|--------------------------|-------------------------------------|
| Nichteisenwerkstoffe · Non-ferrous materials | | | | | | | | |
| Aluminium-Legierungen · Aluminium alloys | | | | | | | | |
| 1.1 | 900 | $0,022 \times d_1$ | 1200 | $0,016 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.2 | 900 | $0,020 \times d_1$ | 1200 | $0,014 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.3 | 900 | $0,017 \times d_1$ | 1200 | $0,012 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.4 | 600 | $0,020 \times d_1$ | 800 | $0,014 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.5 | | | | | | | | |
| 1.6 | | | | | | | | |
| Kupfer-Legierungen · Copper alloys | | | | | | | | |
| 2.1 | 200 | $0,014 \times d_1$ | 260 | $0,010 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.2 | 200 | $0,014 \times d_1$ | 260 | $0,010 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.3 | 200 | $0,014 \times d_1$ | 260 | $0,010 \times d_1$ | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.4 | 160 | $0,011 \times d_1$ | 220 | $0,008 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.5 | 160 | $0,011 \times d_1$ | 220 | $0,008 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.6 | 160 | $0,011 \times d_1$ | 220 | $0,008 \times d_1$ | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.7 | 100 | $0,008 \times d_1$ | 140 | $0,006 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.8 | 100 | $0,008 \times d_1$ | 140 | $0,006 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Magnesium-Legierungen · Magnesium alloys | | | | | | | | |
| 3.1 | 450 | $0,025 \times d_1$ | 600 | $0,018 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 3.2 | 450 | $0,020 \times d_1$ | 600 | $0,014 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Kunststoffe · Synthetics | | | | | | | | |
| 4.1 | 350 | $0,021 \times d_1$ | 450 | $0,015 \times d_1$ | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 4.2 | 500 | $0,021 \times d_1$ | 650 | $0,015 \times d_1$ | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 4.3 | 200 | $0,017 \times d_1$ | 250 | $0,012 \times d_1$ | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 4.4 | 140 | $0,017 \times d_1$ | 180 | $0,012 \times d_1$ | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Besondere Werkstoffe · Special materials | | | | | | | | |
| 5.1 | | | | | | | | |
| 5.2 | | | | | | | | |
| 5.3 | 220 | $0,017 \times d_1$ | 300 | $0,012 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | | <input checked="" type="checkbox"/> |

■ = sehr gut geeignet · very suitable
□ = gut geeignet · suitable

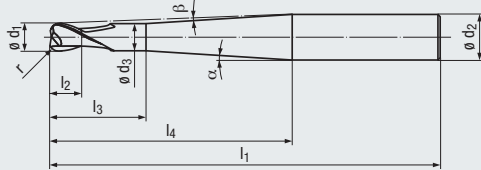
v_c = Schnittgeschwindigkeit · Cutting speed
 f_z = Vorschub pro Zahn · Feed per tooth

- Hochleistungswerkzeug
- Scharfe Schneidkanten
- Hochgenauer Eckenradius
- Sehr glatte CRN-Beschichtung
- 3 Baulängen verfügbar

- High performance tool
- Sharp cutting edges
- High-precision corner radius
- Very smooth CRN coating
- 3 lengths available



Design I₄:



Al



Al/Cu

Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 5)

- Für Aluminium-Knetlegierungen
- Für Aluminium-Legierungen mit einem Siliziumgehalt bis 7%
- Mit CRN-Beschichtung auch in Kupfer-Legierungen einsetzbar

Applications – material (see page 5)

- For wrought aluminium alloys
- For aluminium alloys with a silicon content of up to 7%
- With CRN coating also for copper alloys

N 1.1-1.3
N 4.1-4.2 5.3

CRN

N 1.1-1.4
N 2.1-2.3 2.4-2.8
N 3.1-4.4, 5.3

Kurze Ausführung · Short design

Bestell-Code · Order code

| ϕd_1 $\pm 0,01$ | r $\pm 0,005$ | l_2 | l_3 | l_1 | ϕd_3 | l_4 | ϕd_2 h5 | α | β | Z (Flutes) | Dimens.- Code | 1942 | 1942R |
|--------------------------|------------------|-------|-------|-------|------------|-------|------------------|----------|---------|---------------|------------------|------|-------|
| 0,5 | 0,1 | 1 | 2 | 38 | 0,45 | 9 | 3 | 10° | 8° | 2 | .0005 | ● | ● |
| 0,5 | 0,1 | 1 | 2 | 57 | 0,45 | 20 | 6 | 10° | 8,5° | 2 | .000506 | ● | ● |
| 1 | 0,25 | 2 | 4 | 38 | 0,95 | 9 | 3 | 12,5° | 6,5° | 2 | .001 | ● | ● |
| 1 | 0,25 | 2 | 4 | 57 | 0,95 | 20 | 6 | 10° | 8° | 2 | .00106 | ● | ● |
| 1,5 | 0,25 | 2,5 | 7,5 | 38 | 1,4 | 9 | 3 | 32° | 5° | 2 | .0015 | ● | ● |
| 1,5 | 0,25 | 2,5 | 7,5 | 57 | 1,4 | 20 | 6 | 12,5° | 7° | 2 | .001506 | ● | ● |
| 2 | 0,5 | 3 | 8 | 38 | 1,8 | 9 | 3 | 31° | 3,5° | 2 | .002 | ● | ● |
| 2 | 0,5 | 3 | 8 | 57 | 1,8 | 20 | 6 | 12° | 6,5° | 2 | .00206 | ● | ● |
| 3 | 0,5 | 3,5 | 10 | 57 | 2,8 | 20 | 6 | 11,5° | 5° | 2 | .003 | ● | ● |
| 4 | 0,5 | 4 | 12 | 57 | 3,8 | 20 | 6 | 11° | 3,5° | 2 | .004 | ● | ● |
| 5 | 0,5 | 5 | 14 | 57 | 4,7 | 20 | 6 | 10° | 2° | 2 | .005 | ● | ● |
| 6 | 0,8 | 6 | 20 | 57 | 5,6 | – | 6 | – | – | 2 | .006 | ● | ● |
| 8 | 1 | 7 | 25 | 63 | 7,6 | – | 8 | – | – | 2 | .008 | ● | ● |
| 10 | 1 | 8 | 30 | 72 | 9,6 | – | 10 | – | – | 2 | .010 | ● | ● |
| 12 | 1,5 | 10 | 35 | 83 | 11,5 | – | 12 | – | – | 2 | .012 | ● | ● |



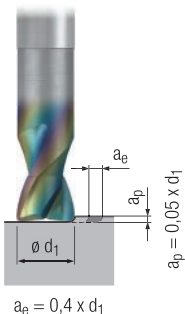
Werkzeug mit seitlicher Mitnahmefläche: Bestell-Code 1944/1944R
Tool with side-lock clamping: order code 1944/1944R



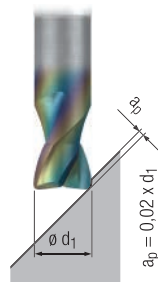
Hartmetall-Torusfräser – kurze, lange und extra lange Ausführung
Solid carbide torus end mills – short, long and extra long design

W

Schruppen
Roughing



Schlichten
Finishing



Gültig für · Valid for

1942
1942R

Achtung:
Bei unbeschichteter Ausführung ist die Schnittgeschwindigkeit v_c um 30% zu reduzieren!

Please note:
For uncoated design, please reduce cutting speed v_c by 30%!



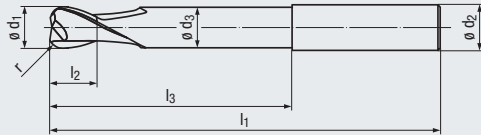
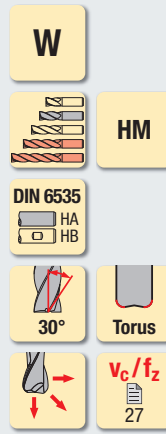
| | v_c [m/min] | f_z [mm] | v_c [m/min] | f_z [mm] | | | MMS MQL | |
|---|------------------|--------------------|------------------|--------------------|--------------------------|-------------------------------------|--------------------------|-------------------------------------|
| Nichteisenwerkstoffe · Non-ferrous materials | | | | | | | | |
| Aluminium-Legierungen · Aluminium alloys | | | | | | | | |
| 1.1 | 900 | $0,022 \times d_1$ | 1200 | $0,016 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.2 | 900 | $0,020 \times d_1$ | 1200 | $0,014 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.3 | 900 | $0,017 \times d_1$ | 1200 | $0,012 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.4 | 600 | $0,020 \times d_1$ | 800 | $0,014 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.5 | | | | | | | | |
| 1.6 | | | | | | | | |
| Kupfer-Legierungen · Copper alloys | | | | | | | | |
| 2.1 | 200 | $0,014 \times d_1$ | 260 | $0,010 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.2 | 200 | $0,014 \times d_1$ | 260 | $0,010 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.3 | 200 | $0,014 \times d_1$ | 260 | $0,010 \times d_1$ | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.4 | 160 | $0,011 \times d_1$ | 220 | $0,008 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.5 | 160 | $0,011 \times d_1$ | 220 | $0,008 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.6 | 160 | $0,011 \times d_1$ | 220 | $0,008 \times d_1$ | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.7 | 100 | $0,008 \times d_1$ | 140 | $0,006 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.8 | 100 | $0,008 \times d_1$ | 140 | $0,006 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Magnesium-Legierungen · Magnesium alloys | | | | | | | | |
| 3.1 | 450 | $0,025 \times d_1$ | 600 | $0,018 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 3.2 | 450 | $0,020 \times d_1$ | 600 | $0,014 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Kunststoffe · Synthetics | | | | | | | | |
| 4.1 | 350 | $0,021 \times d_1$ | 450 | $0,015 \times d_1$ | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 4.2 | 500 | $0,021 \times d_1$ | 650 | $0,015 \times d_1$ | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 4.3 | 200 | $0,017 \times d_1$ | 250 | $0,012 \times d_1$ | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 4.4 | 140 | $0,017 \times d_1$ | 180 | $0,012 \times d_1$ | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Besondere Werkstoffe · Special materials | | | | | | | | |
| 5.1 | | | | | | | | |
| 5.2 | | | | | | | | |
| 5.3 | 220 | $0,017 \times d_1$ | 300 | $0,012 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | | <input checked="" type="checkbox"/> |

■ = sehr gut geeignet · very suitable
□ = gut geeignet · suitable

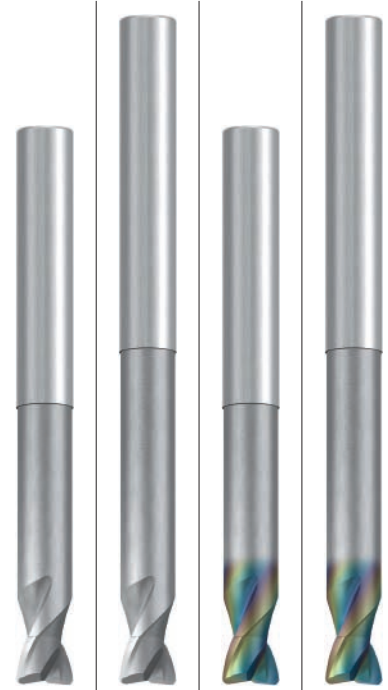
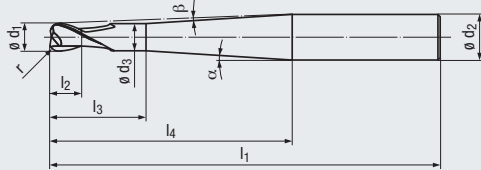
v_c = Schnittgeschwindigkeit · Cutting speed
 f_z = Vorschub pro Zahn · Feed per tooth

- Hochleistungswerkzeug
- Scharfe Schneidkanten
- Hochgenauer Eckenradius
- Sehr glatte CRN-Beschichtung
- 3 Baulängen verfügbar

- High performance tool
- Sharp cutting edges
- High-precision corner radius
- Very smooth CRN coating
- 3 lengths available



Design I₄:



Al

Al/Cu

Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 5)

- Für Aluminium-Knetlegierungen
- Für Aluminium-Legierungen mit einem Siliziumgehalt bis 7%
- Mit CRN-Beschichtung auch in Kupfer-Legierungen einsetzbar

Applications – material (see page 5)

- For wrought aluminium alloys
- For aluminium alloys with a silicon content of up to 7%
- With CRN coating also for copper alloys

| | | | |
|---|--------------|------------|-------------------|
| | | CRN | |
| N | 1.1-1.3 | N | 1.1-1.4 |
| N | 4.1-4.2 | 5.3 | N 2.1-2.3 2.4-2.8 |
| N | 3.1-4.4, 5.3 | | |

Lange Ausführung · Long design

Bestell-Code · Order code

| ϕd_1 $\pm 0,01$ | r $\pm 0,005$ | l_2 | l_3 | l_1 | ϕd_3 | l_4 | ϕd_2 h5 | α | β | Z (Flutes) | Dimens.- Code | 2838 | 2838R |
|--------------------------|------------------|-------|-------|-------|------------|-------|------------------|----------|---------|---------------|------------------|------|-------|
| 8 | 1 | 7 | 40 | 90 | 7,6 | – | 8 | – | – | 2 | .008 | ● | ● |
| 10 | 1 | 8 | 50 | 100 | 9,6 | – | 10 | – | – | 2 | .010 | ● | ● |
| 12 | 1,5 | 10 | 65 | 120 | 11,5 | – | 12 | – | – | 2 | .012 | ● | ● |
| 16 | 2 | 12 | 80 | 140 | 15,5 | – | 16 | – | – | 2 | .016 | ● | ● |

Extra lange Ausführung · Extra long design

Bestell-Code · Order code

| ϕd_1 $\pm 0,01$ | r $\pm 0,005$ | l_2 | l_3 | l_1 | ϕd_3 | l_4 | ϕd_2 h5 | α | β | Z (Flutes) | Dimens.- Code | 1941 | 1941R |
|--------------------------|------------------|-------|-------|-------|------------|-------|------------------|----------|---------|---------------|------------------|------|-------|
| 3 | 0,5 | 3,5 | 12 | 80 | 2,8 | 40 | 6 | 3,5° | 2,5° | 2 | .003 | ● | ● |
| 4 | 0,5 | 4 | 20 | 80 | 3,8 | 40 | 6 | 4° | 1,5° | 2 | .004 | ● | ● |
| 5 | 0,5 | 5 | 10 | 100 | 4,7 | 40 | 6 | 1,5° | 1° | 2 | .005 | ● | ● |
| 6 | 0,8 | 6 | 40 | 100 | 5,6 | – | 6 | – | – | 2 | .006 | ● | ● |
| 8 | 1 | 7 | 60 | 120 | 7,6 | – | 8 | – | – | 2 | .008 | ● | ● |
| 10 | 1 | 8 | 60 | 120 | 9,6 | – | 10 | – | – | 2 | .010 | ● | ● |
| 12 | 1,5 | 10 | 70 | 160 | 11,5 | – | 12 | – | – | 2 | .012 | ● | ● |

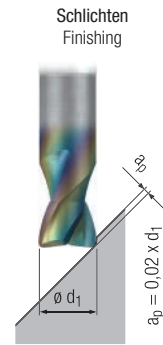
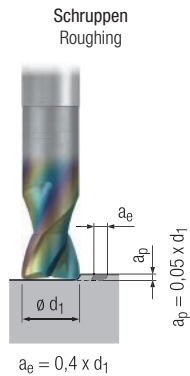


Werkzeug mit seitlicher Mitnahmefläche: Bestell-Code 2839/2839R (lange Ausführung) und 1841/1841R (extra lange Ausführung)
Tool with side-lock clamping: order code 2839/2839R (long design) and 1841/1841R (extra long design)



Hartmetall-Torusfräser – kurze, lange und extra lange Ausführung
Solid carbide torus end mills – short, long and extra long design

W



Gültig für · Valid for

- 1941
- 1941R
- 2838
- 2838R

Achtung:
Bei unbeschichteter Ausführung ist die Schnittgeschwindigkeit v_c um 30% zu reduzieren!

Please note:
For uncoated design, please reduce cutting speed v_c by 30%!










| | v_c [m/min] | f_z [mm] | v_c [m/min] | f_z [mm] | | | MMS MQL | |
|---|------------------|--------------------|------------------|--------------------|--------------------------|-------------------------------------|--------------------------|-------------------------------------|
| Nichteisenwerkstoffe · Non-ferrous materials | | | | | | | | |
| Aluminium-Legierungen · Aluminium alloys | | | | | | | | |
| 1.1 | 900 | $0,022 \times d_1$ | 1200 | $0,016 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.2 | 900 | $0,020 \times d_1$ | 1200 | $0,014 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.3 | 900 | $0,017 \times d_1$ | 1200 | $0,012 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.4 | 600 | $0,020 \times d_1$ | 800 | $0,014 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.5 | | | | | | | | |
| 1.6 | | | | | | | | |
| Kupfer-Legierungen · Copper alloys | | | | | | | | |
| 2.1 | 200 | $0,014 \times d_1$ | 260 | $0,010 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.2 | 200 | $0,014 \times d_1$ | 260 | $0,010 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.3 | 200 | $0,014 \times d_1$ | 260 | $0,010 \times d_1$ | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.4 | 160 | $0,011 \times d_1$ | 220 | $0,008 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.5 | 160 | $0,011 \times d_1$ | 220 | $0,008 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.6 | 160 | $0,011 \times d_1$ | 220 | $0,008 \times d_1$ | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.7 | 100 | $0,008 \times d_1$ | 140 | $0,006 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.8 | 100 | $0,008 \times d_1$ | 140 | $0,006 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Magnesium-Legierungen · Magnesium alloys | | | | | | | | |
| 3.1 | 450 | $0,025 \times d_1$ | 600 | $0,018 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 3.2 | 450 | $0,020 \times d_1$ | 600 | $0,014 \times d_1$ | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Kunststoffe · Synthetics | | | | | | | | |
| 4.1 | 350 | $0,021 \times d_1$ | 450 | $0,015 \times d_1$ | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 4.2 | 500 | $0,021 \times d_1$ | 650 | $0,015 \times d_1$ | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 4.3 | 200 | $0,017 \times d_1$ | 250 | $0,012 \times d_1$ | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 4.4 | 140 | $0,017 \times d_1$ | 180 | $0,012 \times d_1$ | | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Besondere Werkstoffe · Special materials | | | | | | | | |
| 5.1 | | | | | | | | |
| 5.2 | | | | | | | | |
| 5.3 | 220 | $0,017 \times d_1$ | 300 | $0,012 \times d_1$ | <input type="checkbox"/> | <input checked="" type="checkbox"/> | | <input checked="" type="checkbox"/> |

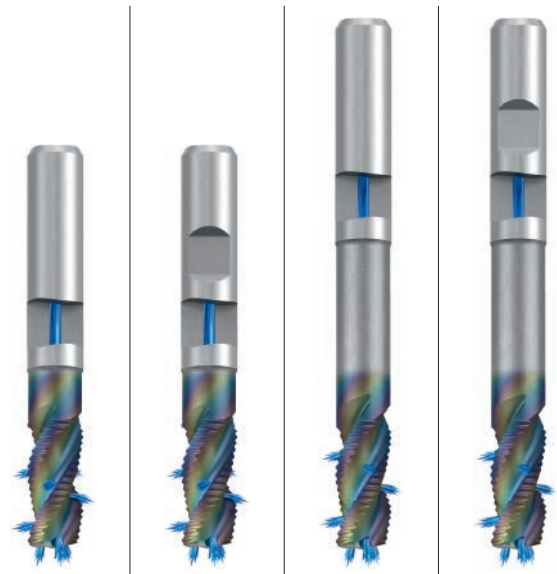
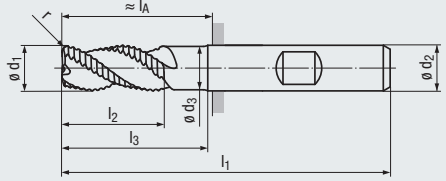
■ = sehr gut geeignet · very suitable
□ = gut geeignet · suitable

v_c = Schnittgeschwindigkeit · Cutting speed
 f_z = Vorschub pro Zahn · Feed per tooth

- Hochleistungs-Schrupfräser mit groben, runden Spanteilern
- Erzeugt deutliche Oberflächenmarkierungen
- Neuentwickelte Geometrie
- Zentrumschneidend
- Vibrationsarme Bearbeitung
- Große Spanräume
- Innere Kühlschmierstoff-Zufuhr, Austritt radial und axial (ICRA)
- Sehr gute Spanabfuhr
- Lange Ausführung mit kurzer Schneidenlänge

- High-performance roughing end mill with coarse, round chip breakers
- Generates significant milling marks
- Newly developed geometry
- Centre cutting
- Low-vibration machining
- Large chip space
- Internal coolant supply, radial and axial exit (ICRA)
- Excellent chip evacuation
- Long design with short flute length


- WR**  **grob coarse**
- ICRA** 
- HSSE-PM** 
- DIN 1835** 
- 40°** 
- ER** 
- v_c/f_z** 



| | | | |
|--|--|---------------------------|---------------------------|
| Beschichtung · Coating | | CRN | CRN |
| Einsatzgebiete – Material (siehe Seite 5) | Applications – material (see page 5) | N 1.1-1.4 1.5 | N 1.1-1.4 1.5 |
| <ul style="list-style-type: none"> - Sehr gut zum Schrumpfräsen von Leicht- und Buntmetallen mit einer Zugfestigkeit bis 500 N/mm² - Besonders leistungsfähig beim Bohrfräsen, Nuten- und Taschenfräsen - Zur HPC-Bearbeitung geeignet | <ul style="list-style-type: none"> - Very suitable for roughing light metals and non-ferrous metals with a tensile strength of up to 500 N/mm² - Particularly effective for z-axis milling, slot milling and pocket milling - Suitable for HPC machining | N 2.1-2.6, 3.1-3.2 | N 2.1-2.6, 3.1-3.2 |


DIN 844 – Kurze Ausführung · Short design

Eckenradius · Corner radius

| Bestell-Code · Order code | | | | | | | | | | 1092RZ | 1392RZ | | |
|----------------------------------|---|-------|-------|-------|-------------------|-------------------------|--|---------------|---------------------|---------------|---------------|--|--|
| $\varnothing d_1$ k10 | r | l_2 | l_3 | l_1 | $\varnothing d_3$ | $\varnothing d_2$ h6 | l_A  | Z (Flutes) | Dimens.-Code | | | | |
| 16 | 2 | 32 | 42 | 92 | 14,5 | 16 | 44 | 3 | .016020 | ● | ● | | |
| 16 | 4 | 32 | 42 | 92 | 14,5 | 16 | 44 | 3 | .016040 | ● | ● | | |
| 20 | 2 | 38 | 52 | 104 | 18 | 20 | 54 | 3 | .020020 | ● | ● | | |
| 20 | 4 | 38 | 52 | 104 | 18 | 20 | 54 | 3 | .020040 | ● | ● | | |
| 25 | 2 | 45 | 63 | 121 | 23 | 25 | 65 | 3 | .025020 | ● | ● | | |
| 25 | 4 | 45 | 63 | 121 | 23 | 25 | 65 | 3 | .025040 | ● | ● | | |
| 32 | 2 | 53 | 70 | 133 | 30 | 32 | 73 | 3 | .032020 | ● | ● | | |
| 32 | 4 | 53 | 70 | 133 | 30 | 32 | 73 | 3 | .032040 | ● | ● | | |

Lange Ausführung · Long design

Eckenradius · Corner radius

| Bestell-Code · Order code | | | | | | | | | | | | 1093RZ | 1393RZ |
|----------------------------------|---|-------|-------|-------|-------------------|-------------------------|--|---------------|---------------------|--|--|---------------|---------------|
| $\varnothing d_1$ k10 | r | l_2 | l_3 | l_1 | $\varnothing d_3$ | $\varnothing d_2$ h6 | l_A  | Z (Flutes) | Dimens.-Code | | | | |
| 16 | 2 | 32 | 73 | 123 | 14,5 | 16 | 75 | 3 | .016020 | | | ● | ● |
| 16 | 4 | 32 | 73 | 123 | 14,5 | 16 | 75 | 3 | .016040 | | | ● | ● |
| 20 | 2 | 38 | 89 | 141 | 18 | 20 | 91 | 3 | .020020 | | | ● | ● |
| 20 | 4 | 38 | 89 | 141 | 18 | 20 | 91 | 3 | .020040 | | | ● | ● |
| 25 | 2 | 45 | 108 | 166 | 23 | 25 | 110 | 3 | .025020 | | | ● | ● |
| 25 | 4 | 45 | 108 | 166 | 23 | 25 | 110 | 3 | .025040 | | | ● | ● |
| 32 | 2 | 53 | 123 | 186 | 30 | 32 | 126 | 3 | .032020 | | | ● | ● |
| 32 | 4 | 53 | 123 | 186 | 30 | 32 | 126 | 3 | .032040 | | | ● | ● |

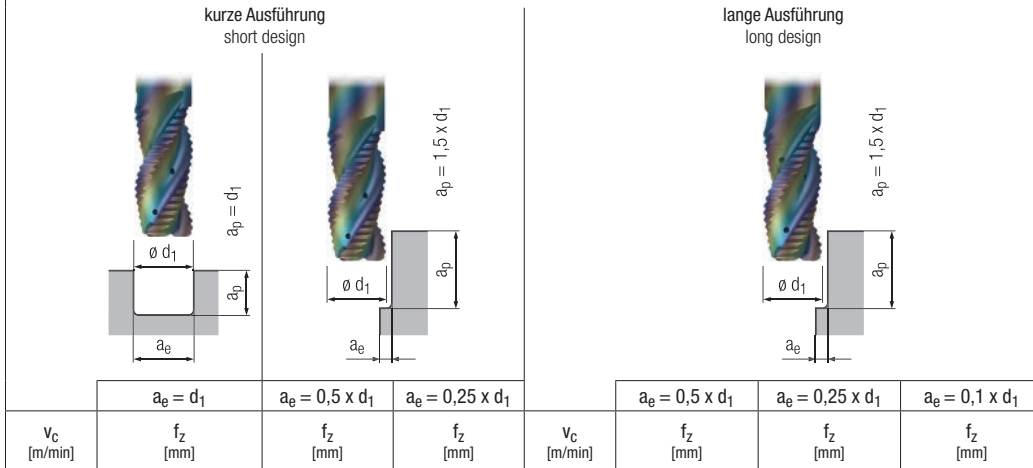


HSS-Schaftfräser – kurze und lange Ausführung
HSS end mills – short and long design

WR

Gültig für · Valid for

- 1092RZ
- 1093RZ
- 1392RZ
- 1393RZ



| Nichteisenwerkstoffe · Non-ferrous materials | | | | | | | | | | | | |
|--|------------------|---------------------|---------------------|---------------------|------------------|---------------------|---------------------|---------------------|---|---|---|---|
| Aluminium-Legierungen · Aluminium alloys | | | | | | | | | | | | |
| | V_c [m/min] | f_z [mm] | f_z [mm] | f_z [mm] | V_c [m/min] | f_z [mm] | f_z [mm] | f_z [mm] | | | | |
| 1.1 | 360 | $0,0048 \times d_1$ | $0,0062 \times d_1$ | $0,0077 \times d_1$ | 60 | $0,0046 \times d_1$ | $0,0053 \times d_1$ | $0,0066 \times d_1$ | | | | ■ |
| 1.2 | 320 | $0,0045 \times d_1$ | $0,0059 \times d_1$ | $0,0072 \times d_1$ | 60 | $0,0044 \times d_1$ | $0,0050 \times d_1$ | $0,0062 \times d_1$ | | | | ■ |
| 1.3 | 250 | $0,0042 \times d_1$ | $0,0055 \times d_1$ | $0,0067 \times d_1$ | 55 | $0,0041 \times d_1$ | $0,0046 \times d_1$ | $0,0057 \times d_1$ | | | | ■ |
| 1.4 | 200 | $0,0039 \times d_1$ | $0,0051 \times d_1$ | $0,0062 \times d_1$ | 60 | $0,0038 \times d_1$ | $0,0043 \times d_1$ | $0,0053 \times d_1$ | | | | ■ |
| 1.5 | 150 | $0,0036 \times d_1$ | $0,0047 \times d_1$ | $0,0058 \times d_1$ | 50 | $0,0035 \times d_1$ | $0,0040 \times d_1$ | $0,0049 \times d_1$ | | | | ■ |
| 1.6 | | | | | | | | | | | | |
| Kupfer-Legierungen · Copper alloys | | | | | | | | | | | | |
| 2.1 | 52 | $0,0058 \times d_1$ | $0,0047 \times d_1$ | $0,0036 \times d_1$ | 30 | $0,0049 \times d_1$ | $0,0040 \times d_1$ | $0,0035 \times d_1$ | | | □ | ■ |
| 2.2 | 56 | $0,0053 \times d_1$ | $0,0043 \times d_1$ | $0,0033 \times d_1$ | 34 | $0,0045 \times d_1$ | $0,0036 \times d_1$ | $0,0032 \times d_1$ | | | □ | ■ |
| 2.3 | 100 | $0,0058 \times d_1$ | $0,0047 \times d_1$ | $0,0036 \times d_1$ | 48 | $0,0049 \times d_1$ | $0,0040 \times d_1$ | $0,0035 \times d_1$ | | | □ | ■ |
| 2.4 | 50 | $0,0043 \times d_1$ | $0,0035 \times d_1$ | $0,0027 \times d_1$ | 32 | $0,0037 \times d_1$ | $0,0030 \times d_1$ | $0,0026 \times d_1$ | | | □ | ■ |
| 2.5 | 80 | $0,0048 \times d_1$ | $0,0039 \times d_1$ | $0,0030 \times d_1$ | 48 | $0,0041 \times d_1$ | $0,0033 \times d_1$ | $0,0029 \times d_1$ | | | □ | ■ |
| 2.6 | 90 | $0,0058 \times d_1$ | $0,0047 \times d_1$ | $0,0036 \times d_1$ | 48 | $0,0049 \times d_1$ | $0,0040 \times d_1$ | $0,0035 \times d_1$ | | | □ | ■ |
| 2.7 | | | | | | | | | | | | |
| 2.8 | | | | | | | | | | | | |
| Magnesium-Legierungen · Magnesium alloys | | | | | | | | | | | | |
| 3.1 | 200 | $0,0039 \times d_1$ | $0,0051 \times d_1$ | $0,0062 \times d_1$ | 70 | $0,0038 \times d_1$ | $0,0043 \times d_1$ | $0,0053 \times d_1$ | □ | ■ | | □ |
| 3.2 | 150 | $0,0045 \times d_1$ | $0,0059 \times d_1$ | $0,0072 \times d_1$ | 70 | $0,0044 \times d_1$ | $0,0050 \times d_1$ | $0,0062 \times d_1$ | □ | ■ | | □ |
| Kunststoffe · Synthetics | | | | | | | | | | | | |
| 4.1 | | | | | | | | | | | | |
| 4.2 | | | | | | | | | | | | |
| 4.3 | | | | | | | | | | | | |
| 4.4 | | | | | | | | | | | | |
| Besondere Werkstoffe · Special materials | | | | | | | | | | | | |
| 5.1 | | | | | | | | | | | | |
| 5.2 | | | | | | | | | | | | |
| 5.3 | | | | | | | | | | | | |

■ = sehr gut geeignet · very suitable
□ = gut geeignet · suitable

V_c = Schnittgeschwindigkeit · Cutting speed
 f_z = Vorschub pro Zahn · Feed per tooth

- Hochleistungs-Schlichtfräser
- Erzeugt glatte Oberflächen
- Neuentwickelte Geometrie mit ungleich geteilten Schneiden
- Zentrumschneidend
- Vibrationsarme Bearbeitung
- Große Spanräume
- Innere Kühlschmierstoff-Zufuhr, Austritt radial und axial (ICRA)
- Sehr gute Spanabfuhr
- Eingeschränkte Schneidendurchmesser-Toleranz

- High-performance finishing end mill
- Generates smooth surfaces
- Newly developed geometry with variable spacing of cutting edges
- Centre cutting
- Low-vibration machining
- Large chip space
- Internal coolant-lubricant supply, radial and axial exit (ICRA)
- Excellent chip evacuation
- Tighter cutting diameter tolerance

W

ICRA

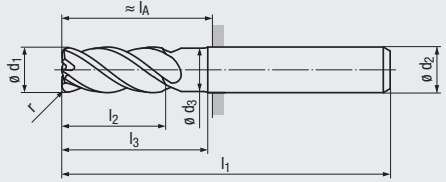
HSSE-PM

DIN 1835

40°

ER

v_c/f_z 31



Al



Al

Beschichtung · Coating

Einsatzgebiete – Material (siehe Seite 5)

- Besonders zum Schlichtfräsen von Leicht- und Buntmetallen mit einer Zugfestigkeit bis 500 N/mm² geeignet

Applications – material (see page 5)

- Especially suitable for finishing light metals and non-ferrous metals with a tensile strength of up to 500 N/mm²

CRN

N 1.2-1.4 1.1, 1.5-1.6

N 3.1-4.2

CRN

N 1.2-1.4 1.1, 1.5-1.6

N 3.1-4.2

DIN 844 – Kurze Ausführung · Short design

Eckenradius · Corner radius

| Bestell-Code · Order code | | | | | | | | | 1034RZ | |
|---------------------------|-----------|----------------|----------------|----------------|------------------|------------------------|---------------|--------------|--------|--|
| ø d ₁ h8 | r ±0,1 | l ₂ | l ₃ | l ₁ | ø d ₃ | ø d ₂ h6 | Z (Flutes) | Dimens.-Code | | |
| 16 | 2 | 32 | 42 | 92 | 14,5 | 16 | 4 | .016020 | ● | |
| 16 | 4 | 32 | 42 | 92 | 14,5 | 16 | 4 | .016040 | ● | |
| 20 | 2 | 38 | 52 | 104 | 18 | 20 | 4 | .020020 | ● | |
| 20 | 4 | 38 | 52 | 104 | 18 | 20 | 4 | .020040 | ● | |
| 25 | 2 | 45 | 63 | 121 | 23 | 25 | 4 | .025020 | ● | |
| 25 | 4 | 45 | 63 | 121 | 23 | 25 | 4 | .025040 | ● | |
| 32 | 2 | 53 | 70 | 133 | 30 | 32 | 4 | .032020 | ● | |
| 32 | 4 | 53 | 70 | 133 | 30 | 32 | 4 | .032040 | ● | |

DIN 844 – Lange Ausführung · Long design

Eckenradius · Corner radius

| Bestell-Code · Order code | | | | | | | | | 1035RZ | |
|---------------------------|-----------|----------------|----------------|----------------|------------------|------------------------|---------------|--------------|--------|--|
| ø d ₁ h8 | r ±0,1 | l ₂ | l ₃ | l ₁ | ø d ₃ | ø d ₂ h6 | Z (Flutes) | Dimens.-Code | | |
| 16 | 2 | 63 | 73 | 123 | 14,5 | 16 | 4 | .016020 | ● | |
| 16 | 4 | 63 | 73 | 123 | 14,5 | 16 | 4 | .016040 | ● | |
| 20 | 2 | 75 | 89 | 141 | 18 | 20 | 4 | .020020 | ● | |
| 20 | 4 | 75 | 89 | 141 | 18 | 20 | 4 | .020040 | ● | |
| 25 | 2 | 90 | 108 | 166 | 23 | 25 | 4 | .025020 | ● | |
| 25 | 4 | 90 | 108 | 166 | 23 | 25 | 4 | .025040 | ● | |
| 32 | 2 | 106 | 123 | 186 | 30 | 32 | 4 | .032020 | ● | |
| 32 | 4 | 106 | 123 | 186 | 30 | 32 | 4 | .032040 | ● | |



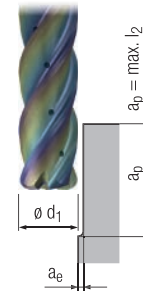
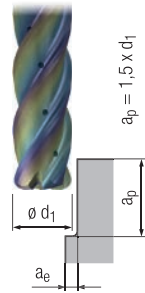
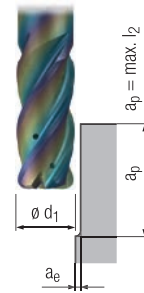
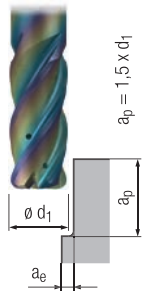
HSS-Schaftfräser – kurze und lange Ausführung
HSS end mills – short and long design

W

Gültig für · Valid for
1034RZ
1035RZ

kurze Ausführung
short design

lange Ausführung
long design



| | | | | | |
|-------------------------|------------------------|------------------------|-------------------------|------------------------|------------------------|
| $a_e = 0,25 \times d_1$ | $a_e = 0,1 \times d_1$ | $a_e = 0,2 \text{ mm}$ | $a_e = 0,25 \times d_1$ | $a_e = 0,1 \times d_1$ | $a_e = 0,2 \text{ mm}$ |
| V_C [m/min] | f_z [mm] | f_z [mm] | V_C [m/min] | f_z [mm] | f_z [mm] |



| Nichteisenwerkstoffe · Non-ferrous materials | | | | | | | | | | | | |
|--|-----|---------------------|---------------------|---------------------|-----|---------------------|---------------------|---------------------|---|---|---|---|
| Aluminium-Legierungen · Aluminium alloys | | | | | | | | | | | | |
| 1.1 | 360 | $0,0051 \times d_1$ | $0,0070 \times d_1$ | $0,0090 \times d_1$ | 60 | $0,0038 \times d_1$ | $0,0046 \times d_1$ | $0,0064 \times d_1$ | | | | ■ |
| 1.2 | 320 | $0,0048 \times d_1$ | $0,0066 \times d_1$ | $0,0084 \times d_1$ | 60 | $0,0036 \times d_1$ | $0,0044 \times d_1$ | $0,0060 \times d_1$ | | | | ■ |
| 1.3 | 250 | $0,0045 \times d_1$ | $0,0062 \times d_1$ | $0,0078 \times d_1$ | 55 | $0,0034 \times d_1$ | $0,0041 \times d_1$ | $0,0056 \times d_1$ | | | | ■ |
| 1.4 | 200 | $0,0042 \times d_1$ | $0,0057 \times d_1$ | $0,0073 \times d_1$ | 60 | $0,0031 \times d_1$ | $0,0038 \times d_1$ | $0,0052 \times d_1$ | | | | ■ |
| 1.5 | 150 | $0,0038 \times d_1$ | $0,0053 \times d_1$ | $0,0067 \times d_1$ | 50 | $0,0029 \times d_1$ | $0,0035 \times d_1$ | $0,0048 \times d_1$ | | | | ■ |
| 1.6 | 90 | $0,0035 \times d_1$ | $0,0048 \times d_1$ | $0,0062 \times d_1$ | 40 | $0,0026 \times d_1$ | $0,0032 \times d_1$ | $0,0044 \times d_1$ | | | | ■ |
| Kupfer-Legierungen · Copper alloys | | | | | | | | | | | | |
| 2.1 | | | | | | | | | | | | |
| 2.2 | | | | | | | | | | | | |
| 2.3 | | | | | | | | | | | | |
| 2.4 | | | | | | | | | | | | |
| 2.5 | | | | | | | | | | | | |
| 2.6 | | | | | | | | | | | | |
| 2.7 | | | | | | | | | | | | |
| 2.8 | | | | | | | | | | | | |
| Magnesium-Legierungen · Magnesium alloys | | | | | | | | | | | | |
| 3.1 | 200 | $0,0042 \times d_1$ | $0,0057 \times d_1$ | $0,0073 \times d_1$ | 100 | $0,0048 \times d_1$ | $0,0058 \times d_1$ | $0,0080 \times d_1$ | □ | ■ | | □ |
| 3.2 | 150 | $0,0048 \times d_1$ | $0,0066 \times d_1$ | $0,0084 \times d_1$ | 180 | $0,0048 \times d_1$ | $0,0058 \times d_1$ | $0,0080 \times d_1$ | □ | ■ | | □ |
| Kunststoffe · Synthetics | | | | | | | | | | | | |
| 4.1 | 200 | $0,0042 \times d_1$ | $0,0057 \times d_1$ | $0,0073 \times d_1$ | 100 | $0,0048 \times d_1$ | $0,0058 \times d_1$ | $0,0080 \times d_1$ | □ | □ | □ | ■ |
| 4.2 | 150 | $0,0048 \times d_1$ | $0,0066 \times d_1$ | $0,0084 \times d_1$ | 180 | $0,0048 \times d_1$ | $0,0058 \times d_1$ | $0,0080 \times d_1$ | □ | □ | □ | ■ |
| 4.3 | | | | | | | | | | | | |
| 4.4 | | | | | | | | | | | | |
| Besondere Werkstoffe · Special materials | | | | | | | | | | | | |
| 5.1 | | | | | | | | | | | | |
| 5.2 | | | | | | | | | | | | |
| 5.3 | | | | | | | | | | | | |

■ = sehr gut geeignet · very suitable
□ = gut geeignet · suitable

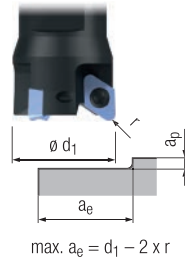
V_C = Schnittgeschwindigkeit · Cutting speed
 f_z = Vorschub pro Zahn · Feed per tooth

| | | | | | | | |
|--|-----|--|--------------|----------------------|---|---|--|
| - Spanleitstufe 20° - Polierte Ausführung für optimalen Spanfluss - Chip former 20° - Polished design for optimum chip removal | | | | | | | |
| HM 20° v_c/f_z 33 | | | | KC2 | | | |
| Schneidstoff · Cutting material | | | | | | | |
| Beschichtung · Coating | | | | | | | |
| Einsatzgebiete – Material (siehe Seite 5) - Zum Schrumpfen und Schlichten von Aluminium-Knetlegierungen - Für die Volumenzerspannung | | Applications – material (see page 5) - For roughing and finishing wrought aluminium alloys - For high-volume machining | | N 1.1-1.3 2.1-4.2 | | | |
| Bestell-Code · Order code | | | | 9635 | | | |
| IC | R | b | Dimens.-Code | | | | |
| 4,6 | 0,5 | 2,2 | .04605 | ● | | | |
| 4,6 | 1 | 2,2 | .04610 | ● | | | |
| 9,2 | 2 | 3,6 | .09220 | | ● | | |
| 9,2 | 2,5 | 3,6 | .09225 | | | ● | |

| | | | | | | | |
|--|-----|--|--------------|---|---|---|--|
| - Spanleitstufe 20° - Sehr glatte CRN-Beschichtung - Chip former 20° - Very smooth CRN coating | | | | | | | |
| HM 20° v_c/f_z 33 | | | | KC2 | | | |
| Schneidstoff · Cutting material | | | | | | | |
| Beschichtung · Coating | | | | CRN | | | |
| Einsatzgebiete – Material (siehe Seite 5) - Für Aluminium-Knetlegierungen - Für Aluminium-Legierungen mit einem Siliziumgehalt bis 7% - Für Kupfer-Legierungen - Zum Schrumpfen und Schlichten | | Applications – material (see page 5) - For wrought aluminium alloys - For aluminium alloys with a silicon content of up to 7% - For copper alloys - For roughing and finishing | | N 1.1-1.4 N 2.1-4.2 4.3-4.4 N 5.3 | | | |
| Bestell-Code · Order code | | | | 9635R | | | |
| IC | R | b | Dimens.-Code | | | | |
| 4,6 | 0,5 | 2,2 | .04605 | ● | | | |
| 4,6 | 1 | 2,2 | .04610 | ● | | | |
| 9,2 | 2 | 3,6 | .09220 | | ● | | |
| 9,2 | 2,5 | 3,6 | .09225 | | | ● | |

Rhombische Wendschneidplatten
Rhombic inserts

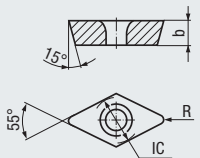

Gültig für · Valid for
9635
9635R



| | v_c [m/min] | f_z [mm] | a_p [mm] | v_c [m/min] | f_z [mm] | a_p [mm] | | | MMS MQL | |
|---|------------------|---------------|------------------|------------------|---------------|------------------|-------------------------------------|-------------------------------------|--------------------------|-------------------------------------|
| Nichteisenwerkstoffe · Non-ferrous materials | | | | | | | | | | |
| Aluminium-Legierungen · Aluminium alloys | | | | | | | | | | |
| 1.1 | 800 - 1000 | IC ÷ 30 | 0,10 - 0,20 x IC | 800 - 1000 | IC ÷ 30 | 0,10 - 0,20 x IC | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.2 | 800 - 1000 | IC ÷ 30 | 0,10 - 0,20 x IC | 800 - 1000 | IC ÷ 30 | 0,10 - 0,20 x IC | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.3 | 600 - 800 | IC ÷ 30 | 0,10 - 0,20 x IC | 600 - 800 | IC ÷ 30 | 0,10 - 0,20 x IC | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.4 | | | | 400 - 600 | IC ÷ 30 | 0,10 - 0,20 x IC | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.5 | | | | | | | | | | |
| 1.6 | | | | | | | | | | |
| Kupfer-Legierungen · Copper alloys | | | | | | | | | | |
| 2.1 | 300 - 350 | IC ÷ 60 | 0,05 - 0,10 x IC | 300 - 350 | IC ÷ 60 | 0,05 - 0,10 x IC | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.2 | 300 - 350 | IC ÷ 60 | 0,05 - 0,10 x IC | 300 - 350 | IC ÷ 60 | 0,05 - 0,10 x IC | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.3 | 280 - 320 | IC ÷ 60 | 0,05 - 0,10 x IC | 280 - 320 | IC ÷ 60 | 0,05 - 0,10 x IC | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.4 | 240 - 280 | IC ÷ 60 | 0,05 - 0,10 x IC | 240 - 280 | IC ÷ 60 | 0,05 - 0,10 x IC | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.5 | 240 - 280 | IC ÷ 60 | 0,05 - 0,10 x IC | 240 - 280 | IC ÷ 60 | 0,05 - 0,10 x IC | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.6 | 300 - 350 | IC ÷ 60 | 0,05 - 0,10 x IC | 300 - 350 | IC ÷ 60 | 0,05 - 0,10 x IC | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.7 | 80 - 120 | IC ÷ 60 | 0,05 - 0,10 x IC | 80 - 120 | IC ÷ 60 | 0,05 - 0,10 x IC | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 2.8 | 80 - 120 | IC ÷ 60 | 0,05 - 0,10 x IC | 80 - 120 | IC ÷ 60 | 0,05 - 0,10 x IC | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Magnesium-Legierungen · Magnesium alloys | | | | | | | | | | |
| 3.1 | 280 - 320 | IC ÷ 30 | 0,05 - 0,10 x IC | 280 - 320 | IC ÷ 30 | 0,05 - 0,10 x IC | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 3.2 | 250 - 300 | IC ÷ 30 | 0,05 - 0,10 x IC | 250 - 300 | IC ÷ 30 | 0,05 - 0,10 x IC | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Kunststoffe · Synthetics | | | | | | | | | | |
| 4.1 | 200 - 240 | IC ÷ 30 | 0,05 - 0,10 x IC | 200 - 240 | IC ÷ 30 | 0,05 - 0,10 x IC | <input checked="" type="checkbox"/> | <input type="checkbox"/> | | <input type="checkbox"/> |
| 4.2 | 80 - 120 | IC ÷ 30 | 0,05 - 0,10 x IC | 80 - 120 | IC ÷ 30 | 0,05 - 0,10 x IC | | <input type="checkbox"/> | | <input checked="" type="checkbox"/> |
| 4.3 | | | | 100 - 140 | IC ÷ 30 | 0,05 - 0,10 x IC | <input type="checkbox"/> | <input checked="" type="checkbox"/> | | <input checked="" type="checkbox"/> |
| 4.4 | | | | 80 - 120 | IC ÷ 30 | 0,05 - 0,10 x IC | <input type="checkbox"/> | <input checked="" type="checkbox"/> | | <input checked="" type="checkbox"/> |
| Besondere Werkstoffe · Special materials | | | | | | | | | | |
| 5.1 | | | | | | | | | | |
| 5.2 | | | | | | | | | | |
| 5.3 | | | | 100 - 140 | IC ÷ 30 | 0,05 - 0,10 x IC | | | | <input checked="" type="checkbox"/> |

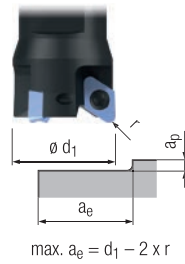
■ = sehr gut geeignet · very suitable
□ = gut geeignet · suitable

v_c = Schnittgeschwindigkeit · Cutting speed
 f_z = Vorschub pro Zahn · Feed per tooth

| | | | | | | | | | | | | | | | |
|--|--|--|------------|---|------------|---|---|---|--------------|-----|---------------|-----|---------------|---|----------------------------------|
| <ul style="list-style-type: none"> - PKD-bestückt - Ohne Spanleitstufe - Mit scharfen Schneidkanten  <ul style="list-style-type: none"> - PCD-tipped - Without chip former - Sharp cutting edges <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px; background-color: #fff9c4;">PKD</div> <div style="border: 1px solid black; padding: 2px; background-color: #fff9c4;">0°</div> </div> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px; background-color: #fff9c4;"></div> <div style="border: 1px solid black; padding: 2px; background-color: #fff9c4;"> v_c/f_z 35 </div> </div> |  <p style="text-align: center;">AI</p> | | | | | | | | | | | | | | |
| <p>Schneidstoff · Cutting material</p> | <div style="border: 1px solid black; border-radius: 5px; padding: 2px; background-color: #fff9c4; display: inline-block;">PKD</div> | | | | | | | | | | | | | | |
| <p>Beschichtung · Coating</p> | | | | | | | | | | | | | | | |
| <p>Einsatzgebiete – Material (siehe Seite 5)</p> <ul style="list-style-type: none"> - Zum Schruppen und Schlichten von Aluminium-Legierungen mit einem Siliziumgehalt bis 17% | <p>Applications – material (see page 5)</p> <ul style="list-style-type: none"> - For roughing and finishing aluminium alloys with a silicon content of up to 17% | <p>N 1.5-1.6 1.1-1.4</p> <p>N 5.1, 5.3</p> | | | | | | | | | | | | | |
| Bestell-Code · Order code | | | | | | | | | | | | | | | |
| <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">IC</td> <td style="width: 50%; text-align: center;">R</td> </tr> <tr> <td style="text-align: center;">4,6</td> <td style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">9,2</td> <td style="text-align: center;">2</td> </tr> </table> | IC | R | 4,6 | 1 | 9,2 | 2 | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">b</td> <td style="width: 50%; text-align: center;">Dimens.-Code</td> </tr> <tr> <td style="text-align: center;">2,2</td> <td style="text-align: center;">.04610</td> </tr> <tr> <td style="text-align: center;">3,6</td> <td style="text-align: center;">.09220</td> </tr> </table> | b | Dimens.-Code | 2,2 | .04610 | 3,6 | .09220 | <p>9679</p> <p style="font-size: 2em;">●</p> | <p style="font-size: 2em;">●</p> |
| IC | R | | | | | | | | | | | | | | |
| 4,6 | 1 | | | | | | | | | | | | | | |
| 9,2 | 2 | | | | | | | | | | | | | | |
| b | Dimens.-Code | | | | | | | | | | | | | | |
| 2,2 | .04610 | | | | | | | | | | | | | | |
| 3,6 | .09220 | | | | | | | | | | | | | | |

Rhombische PKD-Wechselschneidplatten
Rhombic PCD inserts

Gültig für · Valid for
9679



IC 4,6 / IC 9,2



9679



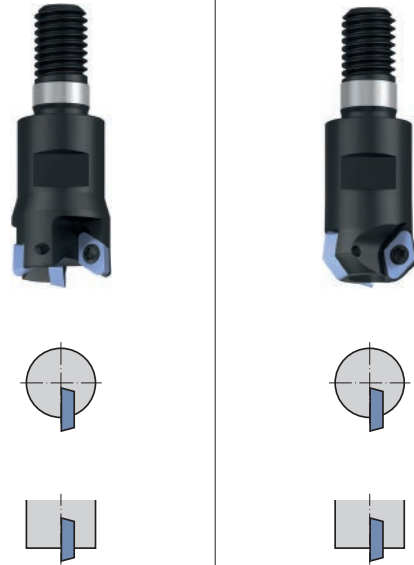
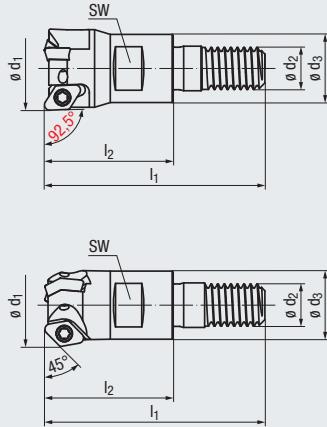
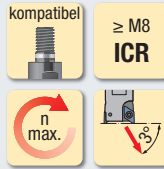
| | v_c [m/min] | f_z [mm] | a_p [mm] | | | | |
|---|------------------|---------------|------------------|--|--|--------------------------|-------------------------------------|
| Nichteisenwerkstoffe · Non-ferrous materials | | | | | | | |
| Aluminium-Legierungen · Aluminium alloys | | | | | | | |
| 1.1 | 800 - 1000 | IC ÷ 30 | 0,10 - 0,20 x IC | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.2 | 800 - 1000 | IC ÷ 30 | 0,10 - 0,20 x IC | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.3 | 600 - 800 | IC ÷ 30 | 0,10 - 0,20 x IC | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.4 | 400 - 600 | IC ÷ 30 | 0,10 - 0,20 x IC | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.5 | 400 - 600 | IC ÷ 30 | 0,10 - 0,20 x IC | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| 1.6 | 300 - 500 | IC ÷ 30 | 0,10 - 0,20 x IC | | | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| Kupfer-Legierungen · Copper alloys | | | | | | | |
| 2.1 | | | | | | | |
| 2.2 | | | | | | | |
| 2.3 | | | | | | | |
| 2.4 | | | | | | | |
| 2.5 | | | | | | | |
| 2.6 | | | | | | | |
| 2.7 | | | | | | | |
| 2.8 | | | | | | | |
| Magnesium-Legierungen · Magnesium alloys | | | | | | | |
| 3.1 | | | | | | | |
| 3.2 | | | | | | | |
| Kunststoffe · Synthetics | | | | | | | |
| 4.1 | | | | | | | |
| 4.2 | | | | | | | |
| 4.3 | | | | | | | |
| 4.4 | | | | | | | |
| Besondere Werkstoffe · Special materials | | | | | | | |
| 5.1 | 600 - 1000 | IC ÷ 30 | 0,20 - 0,30 x IC | | | | <input checked="" type="checkbox"/> |
| 5.2 | | | | | | | |
| 5.3 | 200 - 300 | IC ÷ 30 | 0,05 - 0,10 x IC | | | | <input checked="" type="checkbox"/> |

■ = sehr gut geeignet · very suitable
□ = gut geeignet · suitable

v_c = Schnittgeschwindigkeit · Cutting speed
 f_z = Vorschub pro Zahn · Feed per tooth

- Einschraubfräskörper
- Ab M8 innere Kühlschmierstoff-Zufuhr, Austritt radial (ICR)
- Mit 45° zum Fasfräsen geeignet
- Kompatibel zu marktüblichen Einschraub-Aufnahmen und Adaptern

- Indexable screw-in end mill
- From M8 internal coolant supply, radial exit (ICR)
- With 45° lead angle suitable for chamfering
- Compatible with commercially available screw-in holders and adapters



IC 4,6

| Bestell-Code · Order code | | | | | | | | | | 9180 | 9181 |
|---------------------------|-------|-------|----|-------------------|-------------------|-------------------------------------|----------------------------------|----------------|------------------|------|------|
| $\varnothing d_1$ | l_2 | l_1 | SW | $\varnothing d_3$ | $\varnothing d_2$ | M_d max. ($\varnothing d_2$) | n_{max} . min ⁻¹ | Z (Inserts) | Dimens.- Code | | |
| 10 | 20 | 35 | 8 | 10 | M 6 | 8 Nm | 40 000 | 2 | .100202 | • | |
| 12 | 20 | 35 | 8 | 10 | M 6 | 8 Nm | 35 000 | 2 | .120202 | • | |
| 16 | 25 | 43 | 10 | 13 | M 8 | 15 Nm | 28 000 | 3 | .160253 | • | • |
| 20 | 32 | 52 | 15 | 18 | M 10 | 30 Nm | 25 000 | 3 | .200323 | • | |

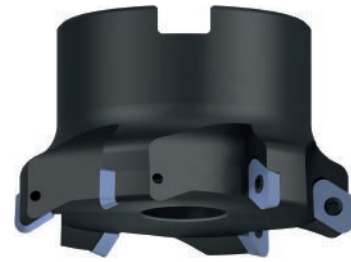
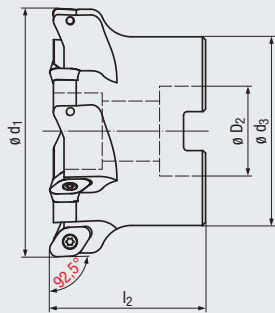
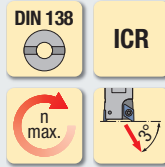
IC 9,2

| Bestell-Code · Order code | | | | | | | | | | 9185 | 9186 |
|---------------------------|-------|-------|----|-------------------|-------------------|-------------------------------------|----------------------------------|----------------|------------------|------|------|
| $\varnothing d_1$ | l_2 | l_1 | SW | $\varnothing d_3$ | $\varnothing d_2$ | M_d max. ($\varnothing d_2$) | n_{max} . min ⁻¹ | Z (Inserts) | Dimens.- Code | | |
| 20 | 32 | 52 | 15 | 18 | M 10 | 30 Nm | 35 000 | 2 | .200322 | • | |
| 25 | 36 | 58 | 17 | 21 | M 12 | 50 Nm | 30 000 | 3 | .250363 | • | |
| 32 | 40 | 64 | 22 | 29 | M 16 | 100 Nm | 25 000 | 3 | .320403 | • | • |
| 40 | 40 | 64 | 22 | 29 | M 16 | 100 Nm | 22 000 | 4 | .400424 | • | |

Lieferumfang: ohne Wendeschneidplatten, mit Torx-Schrauben
Delivery: without inserts, with Torx screws

Wendeschneidplatten siehe Seite 32 und 34
Inserts, see page 32 and 34

- Aufsteckfräskörper
- Innere Kühlschmierstoff-Zufuhr, Austritt radial (ICR)
- Indexable milling cutter
- Internal coolant supply, radial exit (ICR)



IC 9,2

| Bestell-Code · Order code | | | | | | | 9285 | |
|---------------------------|-------|-------------------|-------------------|---------------------------------|----------------|------------------|------|--|
| $\varnothing d_1$ | l_2 | $\varnothing d_3$ | $\varnothing D_2$ | $n_{max.}$ min ⁻¹ | Z (Inserts) | Dimens.- Code | | |
| 50 | 50 | 40 | 22 | 22 000 | 5 | .05005 | ● | |
| 63 | 50 | 50 | 27 | 20 000 | 6 | .06306 | ● | |
| 80 | 50 | 60 | 27 | 18 000 | 6 | .08006 | ● | |
| 100 | 56 | 78 | 32 | 15 000 | 7 | .10007 | ● | |
| 125 | 65 | 90 | 40 | 12 000 | 8 | .12508 | ● | |

Lieferumfang: ohne Wendeschneidplatten, mit Torx-Schrauben
Delivery: without inserts, with Torx screws

Wendeschneidplatten siehe Seite 32 und 34
Inserts, see page 32 and 34

Zubehör · Accessories

Schraubendreher · Screwdriver



| Bestell-Code · Order code | | | 9855 |
|---------------------------|------------------|---|------|
| Größe Size | Dimens.- Code | | |
| IC 4,6 Torx T7 | .07 | ● | |
| IC 9,2 Torx T9 | .09 | ● | |

Spannschraube · Clamping Screw



| Bestell-Code · Order code | | | | 9805 |
|--------------------------------|------------|------------------|---|------|
| Größe Size | M_d max. | Dimens.- Code | | |
| IC 4,6 M2,2 x 3,7 x Torx T7 | 1 Nm | .223707 | ● | |
| IC 9,2 M3 x 6,5 x Torx T9 | 2,25 Nm | .306509 | ● | |

Hochtemperatur-Schraubenpaste · High-Temperature Screw Paste



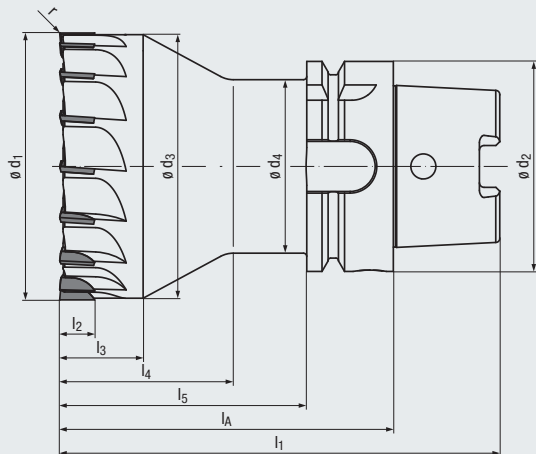
| Bestell-Code · Order code | | | 9000 |
|---------------------------|------------------|---|------|
| Menge Quantity | Dimens.- Code | | |
| 100 g | .000 | ● | |

Sicherstellung der Lösbarkeit von Torx-Schrauben für Wendeschneidplatten durch leichtes Einfetten von Gewinde und Senkkopf!

Applying a light coating of grease on thread and countersunk head ensures that the Torx screws for the inserts can be loosened again.

● = Lagerwerkzeug, siehe Preisliste · Stock tool, see price list
○ = Kurzfristig lieferbar, Preis auf Anfrage · Available at short notice, price on request

- Eingelötete PKD-Schneiden
- Schwingungsgedämpft durch massiven Stahlgrundkörper
- hohe Wuchtgüte
- hohe Schneidanzahl ermöglicht hohe Vorschubwerte
- Kegel-Hohlschaft HSK-A nach DIN 69893-1
- Innere Kühlschmierstoff-Zufuhr, Austritt radial (ICR)
- PCD-tipped cutting edges
- Vibration absorbing due to solid steel base body
- High balance quality
- Large number of inserts enables high feed rates
- Hollow taper shank HSK-A acc. DIN 69893-1
- Internal coolant supply, axial exit (ICA)



N

ICR **PKD**

ER

n max.

1-3°

V_c/f_z
39



AI

Einsatzgebiete – Material (siehe Seite 5)

- Für Aluminium-Legierungen mit einem Siliziumgehalt bis 17%
- Auch für Verbundwerkstoffe und Grafitbearbeitung geeignet
- Zum HSC-Schruppen und -Schlichten geeignet
- Ermöglicht sehr hohe Oberflächengüten

Applications – material (see page 5)

- For aluminium alloys with a silicon content of up to 17%
- Also suitable for composites and graphite
- Suitable for HSC roughing and finishing
- Enables to achieve very high surface qualities

| | | |
|----------|---------------------|----------------|
| N | 1.1-1.6 | 2.1-2.8 |
| N | 3.1-3.2 | 4.1-4.2 |
| N | 4.3-5.1, 5.3 | 5.2 |

Monoblock-Ausführung · Monobloc design

| Bestell-Code · Order code | | | | | | | | | | | | | 2885_Z | |
|---------------------------|-----|----------------|----------------|------------------|----------------|------------------|----------------|----------------|------------------|----------------|--|---------------|------------------|---|
| ∅ d ₁ | r | l ₂ | l ₁ | ∅ d ₃ | l ₃ | ∅ d ₄ | l ₄ | l ₅ | ∅ d ₂ | l _A | n _{max.} ²⁾ min ⁻¹ | Z (Flutes) | Dimens.- Code | |
| 32 | 0,2 | 10 | 132 | 31 | 50 | 52 | 60 | 74 | HSK-A63 | 100 | 25 000 | 8 | .032 | ● |
| 40 | 0,2 | 10 | 132 | 39 | 50 | 52 | 60 | 74 | HSK-A63 | 100 | 25 000 | 10 | .040 | ● |
| 50 | 0,2 | 10 | 132 | 49 | 50 | 52 | 60 | 74 | HSK-A63 | 100 | 25 000 | 12 | .050 | ● |
| 63 | 0,2 | 10 | 132 | 62 | 25 | 52 | 51 | 74 | HSK-A63 | 100 | 25 000 | 14 | .063 | ● |
| 80 | 0,2 | 10 | 132 | 79 | 25 | 52 | 52 | 74 | HSK-A63 | 100 | 25 000 | 16 | .080 | ● |
| 100 | 0,2 | 10 | 132 | 99 | 22 | 52 | 40 | 74 | HSK-A63 | 100 | 25 000 | 18 | .100 | ● |
| 125 | 0,2 | 10 | 132 | 124 | 22 | 52 | 41 | 74 | HSK-A63 | 100 | 20 000 | 22 | .125 | ● |
| 160 | 0,2 | 10 | 132 | 159 | 22 | 52 | 41 | 74 | HSK-A63 | 100 | 15 000 | 28 | .160 | ● |

2) Maximal zulässige Drehzahl
Maximum permissible revolution

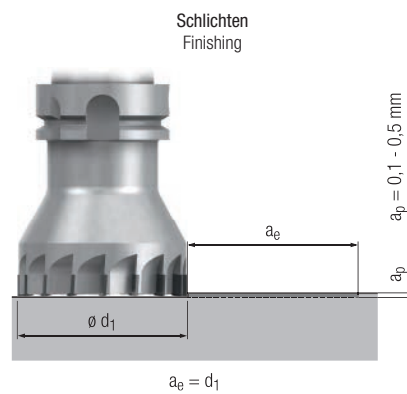
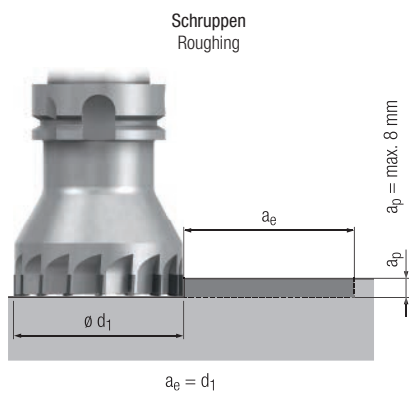
Auf Anfrage auch mit anderen Schaftausführungen lieferbar
Other shank designs available on request

Auf Anfrage auch mit reduzierter Zähnezahl lieferbar
Also available with a reduced number of inserts on request

PKD-Plan- und Eckfräser
PCD side and face milling cutters

N

Gültig für · Valid for
2885_Z



| | | V_c [m/min] | f_z [mm] | V_c [m/min] | f_z [mm] | | | MMS MQL | | |
|---|---|------------------|---------------|------------------|---------------|--|---|------------|---|--|
| Nichteisenwerkstoffe · Non-ferrous materials | | | | | | | | | | |
| Aluminium-Legierungen · Aluminium alloys | | | | | | | | | | |
| N | 1.1 | 2500 - 5000 | 0,08 - 0,12 | 2500 - 5000 | 0,03 - 0,12 | | ■ | □ | ■ | |
| | 1.2 | 2500 - 5000 | 0,08 - 0,12 | 2500 - 5000 | 0,03 - 0,12 | | ■ | □ | ■ | |
| | 1.3 | 2500 - 5000 | 0,08 - 0,12 | 2500 - 5000 | 0,03 - 0,12 | | ■ | □ | ■ | |
| | 1.4 | 2500 - 5000 | 0,08 - 0,12 | 2500 - 5000 | 0,03 - 0,12 | | ■ | □ | ■ | |
| | 1.5 | 2500 - 5000 | 0,08 - 0,12 | 2500 - 5000 | 0,03 - 0,12 | | ■ | □ | ■ | |
| | 1.6 | 1000 - 2000 | 0,08 - 0,12 | 1000 - 2000 | 0,03 - 0,12 | | ■ | □ | ■ | |
| | Kupfer-Legierungen · Copper alloys | | | | | | | | | |
| | 2.1 | 1000 - 2000 | 0,08 - 0,12 | 1000 - 2000 | 0,03 - 0,08 | | | □ | ■ | |
| | 2.2 | 1000 - 2000 | 0,08 - 0,12 | 1000 - 2000 | 0,03 - 0,08 | | | □ | ■ | |
| | 2.3 | 1000 - 2000 | 0,08 - 0,12 | 1000 - 2000 | 0,03 - 0,08 | | | □ | ■ | |
| | 2.4 | 1000 - 2000 | 0,08 - 0,12 | 1000 - 2000 | 0,03 - 0,08 | | | □ | ■ | |
| | 2.5 | 1000 - 2000 | 0,08 - 0,12 | 1000 - 2000 | 0,03 - 0,08 | | | □ | ■ | |
| | 2.6 | 1000 - 2000 | 0,08 - 0,12 | 1000 - 2000 | 0,03 - 0,08 | | | □ | ■ | |
| | 2.7 | 1000 - 2000 | 0,08 - 0,12 | 1000 - 2000 | 0,03 - 0,08 | | | □ | ■ | |
| | 2.8 | 1000 - 2000 | 0,08 - 0,12 | 1000 - 2000 | 0,03 - 0,08 | | | □ | ■ | |
| | Magnesium-Legierungen · Magnesium alloys | | | | | | | | | |
| 3.1 | 2500 - 5000 | 0,08 - 0,12 | 2500 - 5000 | 0,03 - 0,08 | | | □ | ■ | | |
| 3.2 | 2500 - 5000 | 0,08 - 0,12 | 2500 - 5000 | 0,03 - 0,08 | | | □ | ■ | | |
| Kunststoffe · Synthetics | | | | | | | | | | |
| 4.1 | 1500 - 3000 | 0,08 - 0,12 | 1500 - 3000 | 0,03 - 0,08 | | | □ | ■ | | |
| 4.2 | 1500 - 3000 | 0,08 - 0,12 | 1500 - 3000 | 0,03 - 0,08 | | | □ | ■ | | |
| 4.3 | 1500 - 3000 | 0,08 - 0,12 | 1500 - 3000 | 0,03 - 0,08 | | | □ | ■ | | |
| 4.4 | 1500 - 3000 | 0,08 - 0,12 | 1500 - 3000 | 0,03 - 0,08 | | | □ | ■ | | |
| Besondere Werkstoffe · Special materials | | | | | | | | | | |
| 5.1 | 1000 - 2000 | 0,08 - 0,12 | 1000 - 2000 | 0,03 - 0,08 | | | □ | ■ | | |
| 5.2 | 1000 - 2000 | 0,08 - 0,12 | 1000 - 2000 | 0,03 - 0,08 | | | □ | ■ | | |
| 5.3 | 1000 - 2000 | 0,08 - 0,12 | 1000 - 2000 | 0,03 - 0,08 | | | □ | ■ | | |

■ = sehr gut geeignet · very suitable
□ = gut geeignet · suitable

V_c = Schnittgeschwindigkeit · Cutting speed
 f_z = Vorschub pro Zahn · Feed per tooth

Bearbeitungsbeispiel

Machining example

Maschine:

DMC 80 U duoBLOCK®

Spindel:

 12.000 min⁻¹

130 Nm

SK 40

Kühlschmierstoff-Druck 40 bar

Emulsion 12%

Material:

Aluminiumlegierung

AlMg4,5Mn - F27

EN AW 5083


Machine:

DMC 80 U duoBLOCK®

Spindle:

12 000 rpm

130 Nm

ISO 40

Coolant-lubricant pressure 40 bar

Emulsion 12%

Material:

Aluminium alloy

AlMg4,5Mn - F27

EN AW 5083

Zielsetzung:

Reduzieren der Fertigungszeit durch Optimierung der Schruppoperation an einem Strukturbauteil für die Luftfahrtindustrie.

Objective:

Reducing production time by optimizing the roughing operation on a structural component for the aircraft industry.

Lösung:

Austausch des herkömmlichen Werkzeuges durch den FRANKEN Alu-Cut Hartmetall-Schaftfräser „Aerospace“ Typ WR, ø 20 mm (Art.-Nr. 2888_Z.020). Dadurch erfolgte nach einer Optimierung der Schnittdaten und Eingriffsverhältnisse eine Verdreifachung des Zeitspanvolumens.

Solution:

Replacing the conventional tool by the FRANKEN Alu-Cut solid carbide end mill “Aerospace” type WR, dia. 20 mm (art. no. 2888_Z.020). After optimizing the cutting data and the depth-of-cut values, the metal removal rate could be tripled.



| | | Schnittdaten Cutting data | |
|--|--------------------------|------------------------------|--------------------------------|
| | | herkömmlich conventional | FRANKEN Alu-Cut „Aerospace“ |
| Schnittgeschwindigkeit / Cutting speed | v_c [m/min] | 500 | 630 |
| Drehzahl / Speed/rpm | n [min ⁻¹] | 7 960 | 10 000 |
| Vorschub pro Zahn / Feed per tooth | f_z [mm] | 0,175 | 0,23 |
| Vorschub eff. / Feed eff. | v_f [mm/min] | 5 570 | 6 900 |
| Axiale Zustellung / Axial depth-of-cut | a_p [mm] | 8 | 20 |
| Radiale Zustellung / Radial depth-of-cut | a_e [mm] | 10-20 | 10-20 |
| Spanvolumen / Machining volume | Q [l/min] | 0,67 | 2,07 |

Bearbeitungsbeispiel

Machining example

Maschine:

Alzmetall GS 1000 5T

Spindel:

18 000 min⁻¹
138 Nm
HSK-A63
Kühlschmierstoff-Druck 40 bar
Emulsion 10%

Material:

Aluminiumlegierung
AlZnMgCu1,5 - F53
EN AW 7075



Machine:

Alzmetall GS 1000 5T

Spindle:

18 000 rpm
138 Nm
HSK-A63
Coolant-lubricant pressure 40 bar
Emulsion 10%

Material:

Aluminium alloy
AlZnMgCu1.5 - F53
EN AW 7075

Zielsetzung:

Reduzierung der Bearbeitungszeit bei einem Integralbauteil für die Luftfahrtindustrie.

Lösung:

Austausch des herkömmlichen Werkzeuges durch den FRANKEN Alu-Cut Hartmetall-Schaftfräser „Aerospace“ Typ WR, ø 20 mm mit Eckenradius 2 mm (Art.-Nr. 2890_Z.020020).

Nach einer Optimierung der Schnittdaten und Eingriffsverhältnisse konnte das Zeitspanvolumen fast versechsfacht werden. Die Standzeit des Alu-Cut „Aerospace“ lag gegenüber dem konventionellen Werkzeug um ca. 75% höher.

Objective:

Reducing the machining time for an integral component for the aircraft industry.








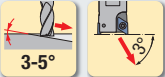

Solution:

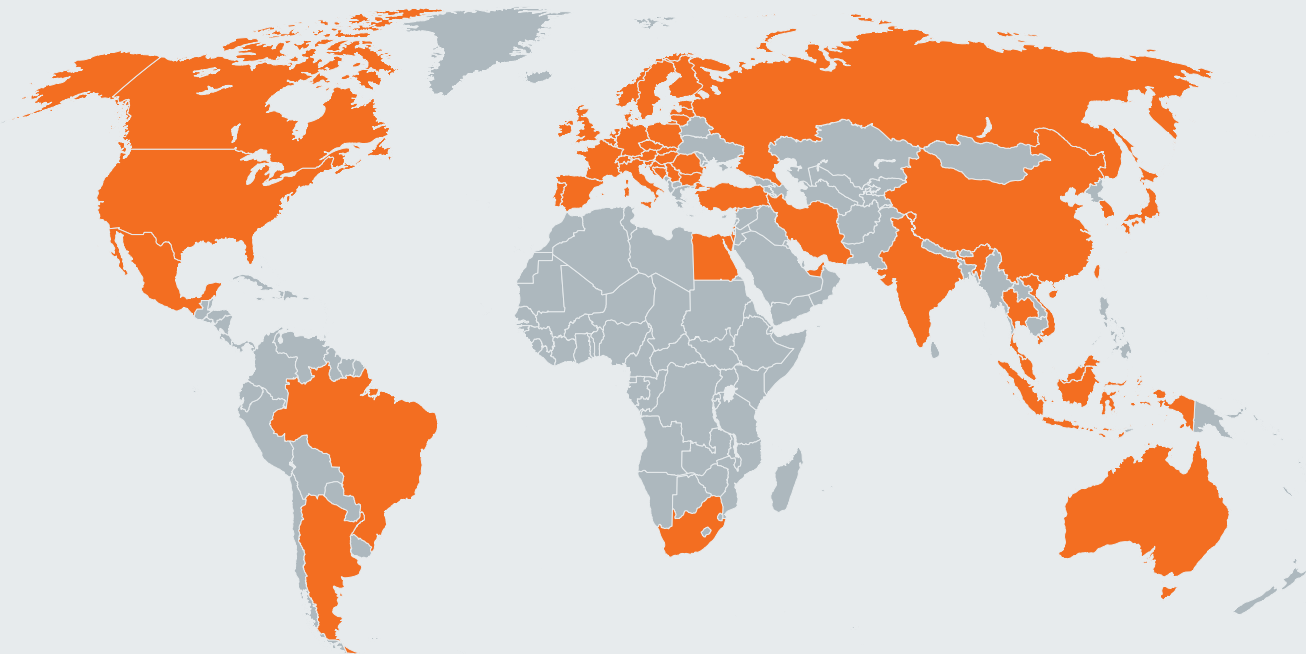
Replacing the conventional tool by the FRANKEN Alu-Cut solid carbide end mill “Aerospace” type WR, dia 20 mm with corner radius 2 mm (art. no. 2890_Z.020020). After optimizing cutting data and depth-of-cut values, the metal removal rates could be increased to almost six times the former volume. The tool life of the Alu-Cut “Aerospace” was approximately 75% higher than that of the conventional tool.



| | | Schnittdaten Cutting data | |
|--|--------------------------|------------------------------|--------------------------------|
| | | herkömmlich conventional | FRANKEN Alu-Cut „Aerospace“ |
| Schnittgeschwindigkeit / Cutting speed | v_c [m/min] | 300 | 578 |
| Drehzahl / Speed/rpm | n [min ⁻¹] | 4780 | 9200 |
| Vorschub pro Zahn / Feed per tooth | f_z [mm] | 0,10 | 0,20 |
| Vorschub eff. / Feed eff. | v_f [mm/min] | 1912 | 5520 |
| Axiale Zustellung / Axial depth-of-cut | a_p [mm] | 10 | 20 |
| Radiale Zustellung / Radial depth-of-cut | a_e [mm] | 20 | 20 |
| Spanvolumen / Machining volume | Q [l/min] | 0,38 | 2,21 |

| | | |
|---|---|---|
|  | <p>Baulänge</p> <p>extra kurz kurz mittellang lang extra lang</p> <p>Die entsprechende Baulänge ist rot hervorgehoben. Alternativ-Baulängen des gleichen Typs sind grau unterlegt. Nicht gekennzeichnete Baulängen sind im Lieferprogramm nicht enthalten.</p> | <p>Constructional length</p> <p>extra short short medium length long extra long</p> <p>The relevant length is marked in red. Alternative lengths of the same type are marked in grey. Lengths without any marking are not available as catalogue products.</p> |
|  | <p>Schaftausführung</p> <p>Die auf der jeweiligen Seite befindlichen Schaftausführungen sind grau unterlegt.</p> | <p>Shank design</p> <p>The shank designs to be found on the respective page are marked in grey.</p> |
|  | <p>Einschraubgewinde</p> <p>Das Einschraubgewinde dieser Fräser ist kompatibel zu marktüblichen Einschraub-Aufnahmen und Adaptern.</p> | <p>Screw-in thread</p> <p>The screw-in thread of these end mills is compatible with commercially available screw-in holders and adapters.</p> |
|  | <p>Bohrungsausführung</p> <p>Zylindrische Bohrung mit Quernut</p> | <p>Bore design</p> <p>Straight bore with driving slot</p> |
|  | <p>Drallwinkel</p> <p>Angegeben ist der Drallwinkel dieser Werkzeuge. Bei unterschiedlichen Drallwinkeln sind alle Winkel aufgeführt.</p> | <p>Helix angle</p> <p>The helix angle of these tools is shown. If there are variable helix angles, these are all shown.</p> |
|  | <p>Spanteiler</p> <p>Diese Fräser erzeugen entsprechende Oberflächenmarkierungen.</p> | <p>Chip breaker</p> <p>These end mills generate appropriate milling marks.</p> |
|  | <p>Schneidstoff</p> <p>HM Hartmetall</p> <p>HSSE-PM Pulvermetallurgischer Hochleistungs-Schnellarbeitsstahl</p> <p>PKD Polykristalliner Diamant</p> | <p>Cutting material</p> <p>Solid carbide</p> <p>Powder metal high speed steel</p> <p>Polycrystalline diamond</p> |
|  | <p>Schneideckenausführung und Stirnkontur</p> <p>Scharfkantig</p> <p>Schutzeckenfase (Kantenbruch)</p> <p>Eckenradius</p> <p>Kugel (Vollradius)</p> <p>Torus</p> | <p>Cutting edge design and face geometry</p> <p>Sharp-edged</p> <p>Bevelled edge</p> <p>Corner radius</p> <p>Ball nose</p> <p>Torus</p> |

| | | |
|---|--|---|
|  | Innere Kühlschmierstoff-Zufuhr | Internal coolant supply |
| | ICR = Kühlschmierstoffaustritt radial | ICR = Internal coolant supply, radial exit |
|  | ICRA = Kühlschmierstoffaustritt radial und axial | ICRA = Internal coolant supply, radial and axial exit |
|  | Kühlung und Schmierung | Coolant and lubrication |
| | Trockenbearbeitung | Dry machining |
|  | Kaltluftdüse | Cold-air nozzle |
|  | Minimalmengenschmierung (MMS) | Minimum-quantity lubrication (MQL) |
|  | Emulsion | Emulsion |
|  | Vorschubrichtung | Feed direction |
| | Die roten Pfeile beschreiben die empfohlenen Vorschubrichtungen der abgebildeten Fräser. | The red arrows mark the recommended feed directions of the respective cutters. |
|  | Rampenwinkel | Ramping angle |
| | Der Rampenwinkel ist der empfohlene Winkel beim Eintauchen in das Werkstück. | The specified angle is the recommended angle for ramping applications. |
|  | Maximal zulässige Drehzahl | Maximum permissible revolution |
| | Die max. zulässige Drehzahl des Fräskörpers in Verbindung mit Wendeschneidplatten ist ein Sicherheitswert und darf keinesfalls überschritten werden. | The maximum permissible revolution of an indexable milling cutter is a safety value, please not to be exceeded. |
| | Dieser Wert ist keine Schnittwertangabe! | Do not use this value as cutting condition recommendation! |



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EMUGE-FRANKEN sales partners, please see www.emuge-franken.com/sales

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